VOLUME II - ECM / COST SUBMISSION

Response to Request for Quotes for a Guaranteed Energy Savings Project for the Commonwealth of Pennsylvania Department of General Services at

Pennsylvania Fish & Boat Commission

Headquarters and Hatcheries in Pennsylvania

Project No. GESA 2019-3

Contract No. DGS GESA 2019-3

Tony Prelec, Account Executive
Phone: 724.996.7970

April 14, 2020

energy systems group

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Electronic Copy (USB Flash Drive) Includes:
Full Copy of ECM / Cost Submission
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- Energy Calculations including Line by Line
- Equipment Cut Sheets
- Utility Baseline Data

April 14, 2020

Becky Tomlinson
403 North Office Building
401 North Street
Harrisburg, Pennsylvania 17120

Subject: Response to Request for Quotes for a Guaranteed Energy Savings Project at Pennsylvania Fish & Boat Commission (PFBC), Project No. GESA 2019-3

Dear Selection Committee Members:

Energy Systems Group, LLC, (ESG) is pleased to provide our response to the above referenced Energy Savings Improvement Program to assist The Department of General Services and the Pennsylvania Fish & Boat Commission (PFBC) Headquarters and Hatcheries in Pennsylvania. Vectren's State of Pennsylvania Vendor Number is **406674**. As a comprehensive and NAESCO accredited Energy Service Provider, ESG designs, develops, implements, operates, maintains and verifies innovative, customer focused energy and operation solutions that enhance our client partners' facilities, productivity, comfort and finances so they can focus on meeting their core mission. ESG possesses all of the resources necessary to implement an energy performance contract project with the PFBC.

The ESG team offers a complete complement of staff members to develop and implement comprehensive energy efficient and guaranteed savings programs to assist various agencies in achieving mandated reductions in energy consumption. To ensure the strongest value and responsiveness, subcontractors such as mechanical, lighting and water conservation will be selected/bid for specific jobs.

The primary point of contact for questions or notification regarding the submitted response is:

Tony Prelec, Account Executive
tprelec@energysystemsgroup.com
Phone Number: 724-996-7970
Fax Number: 812-492-8541

The primary person(s) authorized to bind the company and conduct contract negotiations:

Steven D. Pride, Senior Vice President or
Dan Shell, VP and General Counsel
Phone Number: 812-471-5000
Fax Number: 812-475-2544

Thank you for your time and consideration. We look forward to your acceptance of our proposal.

Sincerely,

DocuSigned by:
Steven D. Pride
D1096AA836054DC...

Steven D. Pride
Senior Vice President

Bid Bond

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF GENERAL SERVICES
GSBPSAS-147 (2009 Ed.) Bond No. 43982-Liberty-19-25

CONSTRUCTION BID BOND
(Please Complete All Blanks)

KNOW ALL MEN BY PRESENTS, that we, Energy Systems Group, LLC (hereinafter called the "Principal") as Principal and Liberty Mutual Insurance Company a corporation duly organized under the laws of the State of Massachusetts (hereinafter called the "Surety") as Surety, are held and firmly bound unto The Department of General Services, Harrisburg, Pennsylvania (hereinafter called the "Obligee"), in the sum of Ten (10%) Percent of the ECM/Cost Submittal Amount for the payment of which sum, well and truly to be made, we, the said Principal, and the said Surety, bind ourselves, our heirs, our administrators, successors, and assigns, jointly and severally firmly by these presents.

Sealed with our seals and dated this 13th day of March A.D.

Two Thousand and Twenty (2020).

WHEREAS the Principal has submitted a bid upon Contract
No. Project No. GESA 2019-3
For Guaranteed Energy Savings Project for the PA Fish & Boat Commission

NOW, THEREFORE, the conditions of these obligations are such that if the Principal shall not withdraw its bid prior to the expiration of the award period after the opening of the bids; and shall comply with all requirements set forth in the "Quote" and the "Instructions to Bidders;" and if the said contract be awarded to the Principal and the Principal shall, within such time as may be specified, enter into the contract in writing, and give bond, with Surety acceptable to the Obligee, covering the faithful performance of the said contract and payment of claims for labor, material, and equipment rental, all of which shall be supplied on the forms as specified by said Obligee; or if the Principal shall fail to do so, pay to the Obligee the lesser of the following amounts: 1) the amount of this bond as herein above set forth, or 2) the difference between the amount specified in the Principal's bid and such larger amount for which the Obligee may in good faith contract with another party to perform the work covered by said bid, then this obligation shall be void; otherwise to remain in full force and effect.

WITNESS (OR ATTEST IF A CORPORATION)

PRINCIPAL Energy Systems Group, LLC

BY

Steven D. Pride, Senior Vice President
(CORPORATE SEAL)

SURETY - Liberty Mutual Insurance Company

BY

Linda M. Howard, Attorney-In-Fact

This Power of Attorney limits the acts of those named herein, and they have no authority to bind the Company except in the manner and to the extent herein stated.

Liberty Mutual Insurance Company
The Ohio Casualty Insurance Company
West American Insurance Company

Certificate No: **8203216 - 969358**

POWER OF ATTORNEY

KNOWN ALL PERSONS BY THESE PRESENTS: That The Ohio Casualty Insurance Company is a corporation duly organized under the laws of the State of New Hampshire, that Liberty Mutual Insurance Company is a corporation duly organized under the laws of the State of Massachusetts, and West American Insurance Company is a corporation duly organized under the laws of the State of Indiana (herein collectively called the "Companies"), pursuant to and by authority herein set forth, does hereby name, constitute and appoint, Andrea Allman, Rachel A. Chaveriat, Jessica Frederick, Lisa Frye, Linda M. Howard, Loretta M. Jones, Julie Karnes, Sandra King, Thelma M. Lett, Michelle Lute-Heatherly, Sandy McElhaney, Vicki Nobinger, Bonnie Rice, Mary Y. Volmar, Carolyn E. Wheeler, Joy M. Williams

all of the city of Knoxville state of TN each individually if there be more than one named, its true and lawful attorney-in-fact to make, execute, seal, acknowledge and deliver, for and on its behalf as surety and as its act and deed, any and all undertakings, bonds, recognizances and other surety obligations, in pursuance of these presents and shall be as binding upon the Companies as if they have been duly signed by the president and attested by the secretary of the Companies in their own proper persons.

IN WITNESS WHEREOF, this Power of Attorney has been subscribed by an authorized officer or official of the Companies and the corporate seals of the Companies have been affixed thereto this 3rd day of March, 2020.

Liberty Mutual Insurance Company
The Ohio Casualty Insurance Company
West American Insurance Company

By: _____
David M. Carey, Assistant Secretary

State of PENNSYLVANIA
County of MONTGOMERY ss

On this 3rd day of March, 2020 before me personally appeared David M. Carey, who acknowledged himself to be the Assistant Secretary of Liberty Mutual Insurance Company, The Ohio Casualty Company, and West American Insurance Company, and that he, as such, being authorized so to do, execute the foregoing instrument for the purposes therein contained by signing on behalf of the corporations by himself as a duly authorized officer.

IN WITNESS WHEREOF, I have hereunto subscribed my name and affixed my notarial seal at King of Prussia, Pennsylvania, on the day and year first above written.

COMMONWEALTH OF PENNSYLVANIA
Notarial Seal
Teresa Pastella, Notary Public
Upper Merion Twp., Montgomery County
My Commission Expires March 28, 2021
Member, Pennsylvania Association of Notaries

By: _____
Teresa Pastella, Notary Public

This Power of Attorney is made and executed pursuant to and by authority of the following By-laws and Authorizations of The Ohio Casualty Insurance Company, Liberty Mutual Insurance Company, and West American Insurance Company which resolutions are now in full force and effect reading as follows:

ARTICLE IV – OFFICERS: Section 12. Power of Attorney.
Any officer or other official of the Corporation authorized for that purpose in writing by the Chairman or the President, and subject to such limitation as the Chairman or the President may prescribe, shall appoint such attorneys-in-fact, as may be necessary to act in behalf of the Corporation to make, execute, seal, acknowledge and deliver as surety any and all undertakings, bonds, recognizances and other surety obligations. Such attorneys-in-fact, subject to the limitations set forth in their respective powers of attorney, shall have full power to bind the Corporation by their signature and execution of any such instruments and to attach thereto the seal of the Corporation. When so executed, such instruments shall be as binding as if signed by the President and attested to by the Secretary. Any power or authority granted to any representative or attorney-in-fact under the provisions of this article may be revoked at any time by the Board, the Chairman, the President or by the officer or officers granting such power or authority.

ARTICLE XIII – Execution of Contracts: Section 5. Surety Bonds and Undertakings.
Any officer of the Company authorized for that purpose in writing by the chairman or the president, and subject to such limitations as the chairman or the president may prescribe, shall appoint such attorneys-in-fact, as may be necessary to act in behalf of the Company to make, execute, seal, acknowledge and deliver as surety any and all undertakings, bonds, recognizances and other surety obligations. Such attorneys-in-fact subject to the limitations set forth in their respective powers of attorney, shall have full power to bind the Company by their signature and execution of any such instruments and to attach thereto the seal of the Company. When so executed such instruments shall be as binding as if signed by the president and attested by the secretary.

Certificate of Designation – The President of the Company, acting pursuant to the Bylaws of the Company, authorizes David M. Carey, Assistant Secretary to appoint such attorneys-in-fact as may be necessary to act on behalf of the Company to make, execute, seal, acknowledge and deliver as surety any and all undertakings, bonds, recognizances and other surety obligations.

Authorization – By unanimous consent of the Company's Board of Directors, the Company consents that facsimile or mechanically reproduced signature of any assistant secretary of the Company, wherever appearing upon a certified copy of any power of attorney issued by the Company in connection with surety bonds, shall be valid and binding upon the Company with the same force and effect as though manually affixed.

I, Renee C. Llewellyn, the undersigned, Assistant Secretary, The Ohio Casualty Insurance Company, Liberty Mutual Insurance Company, and West American Insurance Company do hereby certify that the original power of attorney of which the foregoing is a full, true and correct copy of the Power of Attorney executed by said Companies, is in full force and effect and has not been revoked.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed the seals of said Companies this 13th day of March, 2020.

By: _____
Renee C. Llewellyn, Assistant Secretary

Not valid for mortgage, note, loan, letter of credit, currency rate, interest rate or residual value guarantees.

To confirm the validity of this Power of Attorney call 1-610-832-8240 between 9:00 am and 4:30 pm EST on any business day.

Liberty Mutual SURETY

LIBERTY MUTUAL INSURANCE COMPANY

FINANCIAL STATEMENT — DECEMBER 31, 2018

Assets

Cash and Bank Deposits	$464,341,712
*Bonds — U.S Government	2,259,714,810
*Other Bonds	11,864,776,740
*Stocks	16,527,715,226
Real Estate	255,809,551
Agents' Balances or Uncollected Premiums	5,817,927,234
Accrued Interest and Rents	108,139,840
Other Admitted Assets	11,532,139,744
Total Admitted Assets	**$48,830,564,857**

Liabilities

Unearned Premiums		$7,851,429,449
Reserve for Claims and Claims Expense		20,165,209,300
Funds Held Under Reinsurance Treaties		384,795,327
Reserve for Dividends to Policyholders		1,111,529
Additional Statutory Reserve		62,866,000
Reserve for Commissions, Taxes and Other Liabilities		3,999,822,802
Total		**$32,465,234,407**
Special Surplus Funds	$43,108,583	
Capital Stock	10,000,000	
Paid in Surplus	10,044,912,727	
Unassigned Surplus	6,267,309,139	
Surplus to Policyholders		**16,365,330,449**
Total Liabilities and Surplus		**$48,830,564,856**

LIBERTY MUTUAL INSURANCE COMPANY INCORPORATED 1912 MASSACHUSETTS

* Bonds are stated at amortized or investment value; Stocks at Association Market Values.
The foregoing financial information is taken from Liberty Mutual Insurance Company's financial statement filed with the state of Massachusetts Department of Insurance.

I, TIM MIKOLAJEWSKI, Assistant Secretary of Liberty Mutual Insurance Company, do hereby certify that the foregoing is a true, and correct statement of the Assets and Liabilities of said Corporation, as of December 31, 2018, to the best of my knowledge and belief.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the seal of said Corporation at Seattle, Washington, this 22nd day of March, 2019.

T A Mikolajewski

Assistant Secretary

EXECUTIVE SUMMARY

Executive Summary

Energy Systems Group (ESG) is pleased to submit this proposal in response to the Department of General Services Fish and Boat Commission GESA 2019-3, Request for Quotes issued on Dec. 30, 2019

Since 1994, ESG has implemented over 730 energy efficiency and facility infrastructure improvement projects totaling over $3.3 Billion for more than 428 Customers in 38 States and the U.S. Virgin Islands.

The information in this proposal will show "why" Energy Systems Group is the leader in customer satisfaction and how we set ourselves apart from all others. Our value is manifested in having the best expertise, financial strength, and long-term dependability; but most importantly, our track record shows our commitment to forming long-term partnerships with our customers, helping them meet infrastructure and environmental goals and standing behind our projects 100%.

For the PA Fish and Boat Commission GESA, our ESG Team was able to include all but four (4) Appendix "S" ECMs in our Preliminary Cash Flow Neutral project and could probably include two of those four with some additional research and input from PFBC. We also developed twenty-four (24) ESG ECMs some of which are included in the Preliminary Cash Flow Neutral project and many more are included in the 2nd Cash-Flow Project utilizing Energy Related Cost Savings.

The RFQ states, "Interest Rates are to be assumed to be 4.0%, however, assumption of interest rates should also be based on the Offeror's research of current financial market rates", therefore, based on our ESG Financing Manager's market research, we believe a 4% interest rate closely reflects current market conditions.

STATEMENTS REGARDING RFQ REQUIREMENTS:

- Energy Systems Group (ESG) has received and acknowledged all six (6) bulletins released by PA DGS pertaining to the PA Fish and Boat Commission GESA 2019-3 RFQ.
- ESG has not included any cost information in the Technical Submission.
- With the exception of our Financial Statements ESG has not labeled any portion of our proposal as proprietary or confidential.
- The total energy savings projected in our ESG final scope of work will be at least 95% of the savings projected in the Quote, and the actual ECM costs shall be within 10% of the costs listed in the CEA/IGA and the project will be self-funded from energy savings over the term of the project (maximum 18 years).
- Our sample RFQ Project schedule should not be construed as the final CPM schedule.

- ESG can meet the required insurance coverage limits through a combination of primary and excess policies and will provide evidence of insurance in the form of an industry standard ACORD certificate.
- Energy Consultants service fees are included in our project cash flow.
- Measurement and Verification Services are included in the first three years of the project.
- Construction period interest is included in our project cash flow.

Energy Systems Group (ESG) is very pleased that we were able to develop a very attractive preliminary cash flow neutral project for the PA Fish and Boat Commission and an even more appealing 2nd Cash-Flow Project utilizing Energy Related Savings contributions.

Note: Itemizations for the Energy Related Cost Savings contributions are listed in the Appendix section.

Thank you for this opportunity to, once again, serve the Commonwealth of Pennsylvania, and PA Department of General Services and we are hopeful that ESG will be selected as the ESCO of choice for this high profile project within the PA Fish and Boat Commission.

2.6. Energy Conservation Measures and Cost Submission

INVESTMENT GRADE AUDIT

a. Scope of the Investment Grade Audit (IGA) including systems covered, personnel, methodology, and milestones

ESG's comprehensive IGA will compile results from the facility audits and comprehensive cost savings analysis and will include a careful evaluation of the most cost-effective Energy Conservation Measures (ECMs) in conjunction with any specific facility needs and/or goals to be included in the final list of recommended ECMs. ESG's final report will also include ECMs that were excluded due to poor economics or customer operational concerns, so PFBC will understand all of the evaluated measures.

ESG's systematic approach to project development includes a preliminary site visit to evaluate baseline equipment operation and conditions. Following the preliminary survey, a list of deficiencies or upgrades is identified and a measurement/metering plan is devised. Short-term measurements, in combination with drawings, manufacturer's data and ESG facilities expertise, are utilized to develop baseline energy budgeting for various building systems, such as lighting, cooling, heating, pumps, and fans. The baseline energy budgeting is a critical step to establishing boundaries for realizable energy savings through various ECMs. The total building energy use (utility bills or, in the absence of utility bills, calculated from benchmark data for similar facilities or systems) is then compared to the aggregate energy budget number to validate the baseline values further. As an example, ESG measures those motors that are part of the IGA and that are rated at five horsepower or above, while smaller motors may be estimated based on demand (load).

ESG's calculation methodology is based on standard engineering principles from ASHRAE, AEE or approved Building Simulation software. The spreadsheet calculations are based on hourly calculations and hourly BIN data with weather data based on Typical Meteorological Year-3 (TMY-3) information. When warranted, we employ computer models, such as eQUEST, to calculate the energy savings.

ESG has the required expertise in all aspects of developing, designing, installing, maintaining and verifying Guaranteed Energy Savings Agreement (GESA) projects in multi-site settings. Over the years, we have sought out and retained professionals that possess the specific skillsets to be a highly capable GESA provider. **The ESG Northeast Region team has more than two hundred and thirteen years' worth of combined experience in GESA contracting**.

The ESG team has expertise in:

- Identifying energy conservation measures
- Identifying reliable and proven equipment and materials
- Preparing detailed engineering feasibility studies
- Developing preliminary plans and specifications
- Site investigation, including analysis of:
  - existing HVAC
  - chilled water systems including existing distribution systems
  - fuel switching
  - operations and utility costs
  - load calculations
  - current system operation practices
  - maintenance
  - renewables including solar, geothermal
- Maximizing energy and cost savings to provide a program that is fully funded with energy savings
- Performing "Building Simulation Software" to establish a baseline and propose energy savings measures
- Providing definitive cost and savings estimates for proposed ECMs
- Guaranteeing results

ESG will assemble a team of in-house licensed professional engineers and lighting specialists to audit identified facilities to evaluate existing components and systems and generate recommended solutions. Key ESG personnel that will have varied roles in the audit phase are Dan Khuu, Tony Prelec, Mark Winters, Kanwar Bajaj, Michael Lowery, Karthik Dandu, Stephen Richmond, and Scott Gracely. The subcontractors ultimately selected to assist with the facility audits and analysis will depend on the project size, energy systems involved, and any preferences identified by PA DGS and the PFBC while maximizing Small Diverse Business (SDB) and Veteran Business Enterprises (VBE) participation.

Our approach to performing detailed audits, identification and design of improvement measures, and selection process for energy savings and operating cost measures includes a detailed analysis of your objectives, facilities, and cost of operations. Most importantly, it includes your team's input at every step of the process.

ESG will schedule workshop meetings with key department heads, facility personnel, and other parties desired by the PFBC. The purpose of the workshops will be to review all of the PFBC's goals and priorities, planned engineering approaches, and key process and timeline plans. The goal for these meetings will be to understand your expectations fully. We expect the outcome of this effort to be a high level of satisfaction with ESG's process and a final project that delivers exceptional value. Understanding your objectives is essential for measuring project success. Our goal is to co-author a plan that addresses current and long-range objectives. Specific emphasis will be placed on:

Maximized Savings	Installation Excellence	Long-Term Results
• Minimize utility expenditures • Increase operating efficiency • Reduce service issues • Reduce maintenance costs • Upgrade controls & utility monitoring technology	• Consistent communication • Security upgrading • Document expectations • Meet expectations • No change-order construction • Best quality and best value solutions	• Guarantee energy savings to protect the PFBC's investment • Improvements without raising tax rates • Better working and/or living learning environments • Ongoing staff training to maximize savings impacts

Once on-site, ESG's development team will analyze the facility, reviewing major building systems, control sequences, and overall operations through field measurement and analysis equipment. As previously mentioned, when appropriate, ESG may also use energy analysis and facility modeling software to examine your utility consumption, identify indications of current operational inefficiencies, and determine a facility's pattern of use. Advanced building modeling software may also be utilized to predict the impact that various changes to a building's envelope, mechanical, controls, and electrical systems will have on utility consumption. Our audit process also includes the placement of data loggers or permanent metering to accurately establish baseline information such as occupancy and hours of operation.

ENERGY CONSERVATION MEASURES

b. Proposed ECMs in the RFQ. If there is a reason a proposed ECM listed in the Core ECMs Appendix to this RFQ by the Commonwealth is not included in the scope of the Quote, the Offeror must provide a detailed explanation as to why the ECM was excluded from the scope.

A list of proposed ECMs and reasons certain Appendix S ECMs were not included in our preliminary proposal are described in section 'c' below.

c. A preliminary listing of ECMs both included and NOT included in the project

Our list can be found on the following pages.

			ECMs Evaluated and Considered by Site													
ECM ID	ECM Type (Core/ESCO)	ECM Description	Bellefonte SFH	Benner Spring SFH	Corry SFH	Fairview SFH	Huntsdale SFH	Linesville SFH	Oswayo SFH	PFBC HQ Harrisburg	Pleasant Gap SFH	Pleasant Mount SFH	Reynoldsdale SFH	Tionesta SFH	Tylersville SFH	Union City SFH
ECM #01	Core	Exterior and interior light conversion to LED	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ECM #02	Core	Add lighting controls to interior & exterior lighting	✓		✓	✓	✓	✓	✓		✓		✓	✓	✓	✓
ECM #03	Core	Building weatherization and insulation improvements	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
ECM #04	Core	Remove and replace window A/C units with multi-zone heat pump ductless systems. Repair walls as	✓	✓	✓	✓	✓				✓		✓	✓	✓	✓
ECM #05	Core	Add controls to existing pump VFDs to maintain proper flow.	✓		✓				✓		✓		✓	✓		
ECM #07	Core	Electric to Gas DHW Heater Conversion						✓			✓			✓		
ECM #08	Core	Evaluate roofing and underfloor plenum systems for inadequate insulation or integrity								✓						
ECM #09	Core	Retro commissioning of building air and control systems								✓						
ECM #10	Core	Replace unit heaters with gas fired radiant heaters in hatch house and maintenance buildings		✓							✓					
ECM #11	Core	Hot water boiler replacement in hatch house #2, fuel switch.										✓				
ECM #12	Core	Reclaiming energy from heated water										✓				
ECM #13	Core	Replace gas fired boilers and hot water heaters with condensing units.							✓							
ECM #14	Core	Replace gas fired boilers and hot water heaters with condensing units.												✓		
ECM #16	Core	Convert electric heaters to Natural Gas Heater			✓											
ECM #17	Core	Add holding sediment pond/tank to eliminate flow of fish excrement to public sewer			✓											
ECM #18	Core	Convert electric water heater to gas.														✓
ECM #19	Core	Replace non functional unit heater in production room														✓
ECM #20	Core	Convert main office from electric heat and window A/C units to multizone heat pump system						✓								
ECM #21	Core	Add filtration/UV system to clean lake water for use/to prevent heating water in the summer						✓								
ECM #22	Core	Rework system controls/flow in hatch house to optimize boiler heat exchanges						✓								
ECM #23	Core	Add level controls to upper fishpond to control pump VFD to keep from overflowing system.						✓								
ECM #24	Core	Hot water boiler replacement in office space/hatch house and possible fuel conversion (propane or													✓	

			ECMs Evaluated and Considered by Site													
ECM ID	ECM Type (Core/ESCO)	ECM Description	Bellefonte SFH	Benner Spring SFH	Corry SFH	Fairview SFH	Huntsdale SFH	Linesville SFH	Oswayo SFH	PFBC HQ Harrisburg	Pleasant Gap SFH	Pleasant Mount SFH	Reynoldsdale SFH	Tionesta SFH	Tylersville SFH	Union City SFH
ESCO #01	ESCO	Replace Process Water Heaters to Propane Heaters										✓				
ESCO #02	ESCO	Transformer Replacement	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
ESCO #03	ESCO	Convert Gas/Oil Unit Heaters to Radiant Heat				✓	✓	✓	✓			✓		✓		
ESCO #04	ESCO	Spring/Well Pump VFDs	✓	✓	✓		✓	✓	✓			✓	✓			
ESCO #05	ESCO	Solar PV	!	!	!	!	!	!	!	!	!	!	!	!	!	!
ESCO #06	ESCO	Generator Heat Pump Block Heater	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
ESCO #07	ESCO	Replace non functional flowmeter	✓											✓		
ESCO #08	ESCO	Retrocommissioning	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
ESCO #09	ESCO	Programmable Thermostats	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
ESCO #10	ESCO	BERT Plug Load Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ESCO #11	ESCO	Truck Advertising Revenue for all Trucks owned by PFBC								✓						
ESCO #12	ESCO	Demand Based Oxygen Injection	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
ESCO #13	ESCO	Boiler Replacement		✓								✓				
ESCO #14	ESCO	Chilled Water Pump VFD								✓						
ESCO #15	ESCO	Cancel Zero use electric account				✓										
ESCO #16	ESCO	Replace Gas Fired Water Heaters with High Eff. Water Heaters				✓		✓		✓						
ESCO #17	ESCO	Convert electric DHW heaters to heat pump					✓					✓	✓		✓	
ESCO #18	ESCO	Electric Vehicle Charging Station								✓						
ESCO #19	ESCO	Fish Food Vending Machines at Hatcheries	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
ESCO #20	ESCO	Onsite/Central Oxygen Generator	!	!	!	!	!	!	!		!	!	!	!	!	!

✓	ECM evaluated and included
✓	ECM considered & will be evaluated in IGA
!	ECM evaluated/considered but not included

Appendix S, ECMs not included in our proposed project:

ECM #	Location	ECM Description	Explanation
6	All Sites	Consider fuel switches from electric to propane/oil and/or CNG, if feasible.	Note 1
15	Tionesta SFH	Add gas-fired radiant heaters for hatch house	Note 1
17	Corry SFH	Sediment holding tank/pond	Note 2
21	Linesville SFH	Lake water filtration/UV system	Note 2

Note 1: Detailed explanations of why ECMs #6 and #15 have not been included are addressed in the subsection below with header: Base Energy Conservation Measures (from Appendix S) considered but not included within the ESG's Preliminary Cash-Flow Neutral Project.

Note 2: ESG's 2nd Cash-Flow Project (with O&M savings and Energy-Related Cost Savings) includes $2,994,438 of excess cash that can be used to fund ECMs #17 and #21.

Base Energy Conservation Measures (from Appendix S)

ECM #1 – Exterior and Interior Light Conversion to LED - Project Wide - (Included in ESG's Preliminary Cash-Flow Neutral Project)

Present Conditions
The existing lighting at PFBC facilities is a mix of different technologies such as fluorescent T5, T8 with electronic ballast & T12 with magnetic ballasts, Metal Halide Fixtures, and High-Pressure Sodium, along with some newer LED lighting at select facilities.

ESG Proposed Solution
ESG has included LED replacement and/or retrofits for all PFBC locations. LED technology benefits the PFBC facilities by reducing energy consumption used by lighting as much as 70% and reduces peak demand. Lighting represents a significant portion of the PFBC's electricity use. In addition, lighting retrofit projects often improve the aesthetic appeal by providing a higher quality light and operating more quietly than older lighting systems. Maintenance costs are also reduced due to the longer life of the LED equipment. Improvements to lighting will reduce electrical use while meeting or exceeding existing light levels. The costs of material to maintain the current systems will also be reduced since these renovations replace items (i.e., lamps and ballasts) that are near the end of their life cycle with components capable of a significantly longer life cycle.

Interior - The interior lighting design ESG proposes for the PFBC buildings is to replace or retrofit the predominantly 32-watt T8 lamps to LEDs (with a small amount of 28 watt T8 and T12 lamps to LEDs as well). Existing linear 4' and 8' T8/T12 fixtures are to be retrofitted from fluorescent lamps and electronic ballast, to direct wire LED T8 lamps with an L70 of 50,000 hours (L70 is defined as when the light bulb produces 70% of its initial lumen or how long one can expect an LED to provide an acceptable level of intensity relative to initial levels). This system will eliminate the ballast and have the power wired directly to the socket to power the LED lamps. This will result in a wattage reduction of approximately 70% and will eliminate the ballast as a maintenance concern by disconnecting the ballast from the fixture.

Incandescent and compact fluorescent light (CFL) screw-in fixtures will be re-lamped with new LED screw-in lamps that are a suitable replacement for the existing lamp wattage and the fixture/area application. These lamps will result in wattage reductions ranging from 23% - 93% based on the existing technology being replaced. With a rated life of 1,500 hours for incandescent and 10,000 hours for CFL, the 25,000+ hour rated life of LED screw-in lamps will also result in significant material maintenance savings. CFL plug-in lamps will be replaced with LED plug-in lamps with similar energy and maintenance savings.

Much of the existing high bay lighting system across the PFBC buildings are made up of High Intensity Discharge (HID) Metal-halide lamps or fluorescent high bay type lighting fixtures. High bay fixtures will be replaced with new LED fixtures that provide equal or better light levels, attractive return on investment (ROI) and significant material maintenance reductions. These fixtures are rated for over 100,000 hours of relatively maintenance-free operation.

Exterior - The existing exterior lighting system across all of the PFBC buildings are made up of HID fixtures as well as some CFL and incandescent fixtures. HID fixtures will be replaced with new LED fixtures that provide equal or better light levels, attractive ROI, and material maintenance reductions. CFL and incandescent fixtures will be re-lamped with LED screw-in lamps. Wattage reductions from these lamp replacements will range from roughly 50% to well over 70% across all fixture types. With a rated life of 100,000+ hours compared to the 10,000 hours of an HID lamp, these fixture replacements will see the most significant material maintenance savings of any replacements or retrofits on the project. The color consistency and even distribution of light from LED compared to HID technology will also result in a much more secure and visually appealing environment for each exterior space.

Assumptions

- ESG specifies a superior product to maximize energy savings, reduce material maintenance requirements and provide the greatest warranty.
- ESG specifies a superior product to maximize Utility Rebate Incentives and provide the highest life expectancy.
- This is a complete LED upgrade, with an exception to some places which already have LED retrofits.
- Standardized products are utilized wherever possible to reduce inventory and ongoing material maintenance costs.
- RFP specifications: Lighting levels shall be Illuminating Engineering Society (IES) recommendations as maximum; and, 80% of IES standards as a minimum. New fixtures shall be Energy Star rated.
- The existing electrical wiring, grounding, existing circuit breakers, and lighting fixtures are in good operating condition and in compliance with current building and electrical codes. Ungrounded conditions outside of the light fixture or immediate conduit are excluded from the scope of work and are to be corrected by others.
- Any major components or wiring discovered in need of repair shall be noted and submitted to the customer. Any such repairs will be the responsibility of the customer to remedy in a timely manner;
- A detailed lighting line-by-line scope of work, assumptions and detailed savings calculations can be found in the Appendix.

ECM Costs & Savings Breakdown

Cost	Savings	Rebate	O&M Savings	Useful Life
$694,412	$41,800	$0	$5,336	70,000 Hrs

ECM #2 – Add Lighting Controls to Interior & Exterior Lighting - Project Wide - (Included in ESG's Preliminary Cash-Flow Neutral Project)

Present Conditions

During our surveys, ESG Engineers noted the lighting in individual spaces was fairly well controlled, but that savings could be generated by controlling the lighting with occupancy sensors in the common areas.

ESG Proposed Solution

The ESG energy analysis team has developed an occupancy sensor program for this proposal based on "Dual Technology" sensors, which senses both motion and heat. In addition, to control for interior lighting, ESG has included photocell based control for exterior lighting that is currently controlled with switches. Photocells are electronic devices commonly used to manage outdoor lighting, these are also called Dusk to Dawn sensors, which automatically turn on the lights at sunset, and they save energy by turning the lights off when extra light is unnecessary. Because they sense ambient light levels, photocells automatically adjust to seasonal changes in the day/night cycle and are unaffected by daylight saving time.

Assumptions

- The existing electrical wiring, grounding, existing circuit breakers, and lighting fixtures are in good operating condition and in compliance with existing building and electrical codes. Ungrounded conditions outside of the light fixture or immediate conduit are excluded from the scope of work and are to be corrected by others.
- Any major components or wiring discovered in need of repair shall be noted and submitted to the customer. Any such repairs will be the responsibility of the customer to remedy in a timely manner;
- A detailed scope of work for lighting controls, assumptions and detailed savings calculations can be found in the Appendix along with the lighting line-by-line scope.

ECM Costs & Savings Breakdown

Cost	Savings	Rebate	O&M Savings	Useful Life
$22,143	$351	$0	$0	15 Years

ECM #3 Building Weatherization and Insulation Improvements – Project-Wide - (Included in ESG's Preliminary Cash-Flow Neutral Project)

Appendix S asks the proposer for an ECM for Building Weatherization and Insulation Improvements at all sites included in the project. ESG team has surveyed and included weatherization improvements for all PFBC locations.

Present Conditions

In buildings that are heated or cooled, significant energy losses can occur via air infiltration/exfiltration through poorly insulated walls, ceilings, and floors and through failing or missing seals around doors and windows. Included within the Appendix, ESG has noted locations at each PFBC building where seals and insulation can be improved.

ESG Proposed Solution

For locations where the spaces are heated and/or cooled, the following scope of work will be implemented where our survey team observed opportunities for improvement:

1. Roof Edge and Roof/Wall Air Seal:
   - Protect building finishes and contents typically with plastic. Move any furnishing necessary to perform work
   - Remove perimeter ceiling tiles to access roof/wall joint
   - Fill joint with closed-cell, spray polyurethane foam
   - Remove protection, replace furnishings and clean work area
2. Door Weather-stripping:
   - Inspect doors. Notify client of any damaged or missing hardware or doors that do not latch
   - Install weather-stripping under compression, door jambs, and head
   - Install door bottom sweeps
   - Install double door astragal sweeps
   - Inspect door latching, adjust closers if necessary.
3. Sheath and Foam Overhangs:
   - Protect building finishes and contents typically with plastic. Move any furnishings to perform work
   - Remove perimeter tiles to access overhang
   - Install Johns Manville AP foil-faced insulation board (sheathing) to connect the top of the exterior wall to the roof deck
   - Foam seal all joints and edges of sheathing board with 2-part polyurethane fire retardant foam
   - Remove protection, replace furnishings, and clean work area.

This measure results in minimized leakage of outside air which must heated and/or cooled using expensive electric and thermal utilities and results in a comfortable environment for building occupants as well as energy cost savings.

Assumptions - The savings calculations are performed using ASHRAE prescribed measures and local weather data, also known as degree day data.

ECM Costs & Savings Breakdown

Cost	Savings	Rebate	O&M Savings	Useful Life
$561,416	$33,635	$0	$0	20 Years

ECM #4 Remove and replace window A/C units with multi-zone heat pump ductless systems. Repair walls as needed - (Partially included in ESG's Preliminary Cash-Flow Neutral Project)

Present Conditions - Currently, most of the sites still utilize "window" type air conditioning units for cooling. While the direct costs of individual units are significantly less than multi-zone units, they are not as efficient in terms of electrical consumption or overall cooling effectiveness. These individual units are often not sealed properly in windows, resulting in additional warm air entering the space during air conditioning months and cold air during the non-air conditioning months, increasing the cooling or heating load of the building/space. When installed in a window, the air conditioner takes away the visual effect of having a window.

ESG Proposed Solution
As part of this ECM, ESG has included the replacement of the Reynoldsdale Administration Building window air conditioning units with a multi-zone heat pump system. Multi-zone heat pump systems can reduce the electrical consumption of the air conditioning system and provide better, more effective cooling of a building/space. Additionally, with the heat pump technology, heat can be transferred from the outside air reducing the building's heat costs. Lastly, the ASHRAE useful life of an air source heat pump is 15 years – considerably longer than the life of a traditional window air conditioning unit. The proposed ECM replaces aged equipment avoiding the future cost to PFBC. Additionally, the increased efficiency decreases PFBC operating costs.

In addition to the Reynoldsdale Administration, ESG's ***alternate cash flow*** includes the replacement of the window units at the following sites:

Site	Building
Bellefonte	Administration
Benner Spring	Administration & Maintenance Garage
Corry	Administration & Maintenance Garage
Fairview	Administration
Huntsdale	Administration
Pleasant Gap	Administration, Garage & Upper Garage
Tionesta	Administration & Fish Management House
Tylersville	Administration, Hatchery & Maintenance Garage
Union City	Administration

Assumptions

- Sufficient electrical service is available at each building for the installation of the proposed heat pump system.

ECM Costs & Savings Breakdown

Cost	Savings	Rebate	O&M Savings	Useful Life
$2,192,188	$17,022	$0	$0	15 Years

ECM #5 Add controls to existing pump VFDs to maintain proper flow - (Included in ESG's Preliminary Cash-Flow Neutral Project)

Present Conditions - Although many of the spring/well pumps at the various sites utilize variable frequency drives (VFDs), they rely on manual operation based on the experience of the Staff. VFDs allow the Staff the ability to change the water flow produced by the pumps depending on the season, life stage of the produce, and removal of the fish excrement. Although VFDs are in place on many of the pumps, there is no automatic control of the VFD resulting in increased electrical consumption by not only the pump but the fish waste handling equipment.

ESG Proposed Solution
ESG proposes the installation of programmable controls to automatically vary the speed of the pumps reducing the electrical consumption of the pump(s) and waste handling equipment. ESG, during commissioning of these controls, will work with the facilities managers to program any fish excrement removal scenarios as preferred by PFBC staff. The proposed controls would monitor the dissolved oxygen (DO) content of the water leaving the raceways and provide a wireless signal to the VFD for the following:

Site	Pump Horsepowers (HP)
Bellefonte	(1) – 10 hp, (2) – 15 hp & (1) – 20 hp
Corry	(2) – 20 hp & (1) 60 hp
Oswayo	(1) – 20 hp
Pleasant Gap	(1) – 7½, (2) – 15, (1) – 20 & (1) – 40 hp
Reynoldsdale	(1) – 10 hp, (2) – 15 hp & (1) – 20 hp
Tionesta	(1) – 10 hp, (2) – 20 hp & (1) – 40 hp

Assumptions

- A wireless network is available for the operation of the controls.
- One (1) DO sensor is included and will be installed at the end of the last raceway prior to the treatment of the water.

ECM Costs & Savings Breakdown

Cost	Savings	Rebate	O&M Savings	Useful Life
$215,625	$3,537	$0	$0	15 Years

ECM #7 Electric to Gas Domestic Water Heater Conversion - (Included in ESG's Preliminary Cash-Flow Neutral Project)

Present Conditions - Several of the buildings surveyed by ESG's Engineers utilize electric resistance type domestic water heaters. Electric resistance water heaters have low recovery rates and higher utility costs as opposed to natural gas types, which have high recovery rates and lower utility costs.

ESG Proposed Solution - A water heater's efficiency is the water heater's overall efficiency based on the amount of hot water produced per unit of fuel consumed over a typical day. The water heater energy factor is determined by its recovery efficiency, standby losses, and cycling losses. The higher the energy factor, the more efficient the water heater.

However, when fuel costs are taken into account, natural gas-fired water heaters can be significantly more cost-effective. ESG proposes the replacement of the following domestic water heaters with natural gas-fired water heaters. The proposed ECM replaces aged equipment avoiding the future cost to PFBC. Additionally, increased efficiency decreases PFBC operating costs.

Site	Building
Linesville	Administration
Pleasant Gap	Garage/Fab
Tionesta	Fish Management House

Assumptions

- The existing domestic water heater represents realistic domestic hot water demands of the respective building/space.
- The site natural gas system is sufficient for the addition of the proposed domestic hot water heater.

ECM Costs & Savings Breakdown

Cost	Savings	Rebate	O&M Savings	Useful Life
$115,000	$1,050	$0	$0	15 Years

ECM #8 Evaluate Roofing and Underfloor Plenum Systems for Inadequate Insulation or Integrity – PFBC Harrisburg Headquarters - (Included in ESG's Preliminary Cash-Flow Neutral Project)

Present Conditions - As noted in the Appendix S of the RFQ, the ESG team surveyed the Headquarters Building Server Room for air sealing and insulation effectiveness.

This room is a temperature and humidity sensitive space which should be thermally insulated from adjacent areas for efficient and effective control of indoor air quality. The Server room is currently thermally continuous to the adjacent areas via ceiling and floor plenum walls. The insulation and air sealing was observed to be deficient. The server room is conditioned by a 5 Ton Liebert Computer Room Air Conditioning (CRAC) Unit.

ESG Proposed Solution
As a part of this project ESG proposes to implement the following improvements:

1. Install ¼" thick radiant sheathing above and below the four walls of the room
    a. 36" High sheathing within the ceiling plenum
    b. 12" High sheathing below the walls in the floor plenum
2. Install door weather-stripping around the entry doors

These measures will result in more effective thermal isolation of this room from the adjacent areas in the building and allow for the CRAC Unit to condition the server room space efficiently as originally designed and intended.

Assumptions - The savings calculations are performed using ASHRAE prescribed measures and using local weather data also known as degree day data.

ECM Costs & Savings Breakdown

Cost	Savings	Rebate	O&M Savings	Useful Life
$6,383	$321	$0	$0	20 Years

ECM #9 Retro-commissioning of building air and control systems – PFBC Harrisburg Headquarters - (Included in ESG's Preliminary Cash-Flow Neutral Project)

Present Conditions - Building performance often deteriorates steadily over time as system setpoints are misadjusted or control sequences no longer match the changing use and occupancy patterns of the building.

ESG Proposed Solution - Retro-commissioning analyzes a building's current performance and sequences of operation and implements measures to reduce the operating costs while improving the functionality of the building's systems. While commissioning is the term used to describe this process when it is applied to new constructions, 'retro-commissioning' evolved as the term for when the building has been in use. Retro-commissioning includes engineering analysis designed to increase efficiency, lower operating cost, improve occupant comfort and decrease maintenance costs, spanning the spectrum from optimizing controls of the HVAC systems to physically analyzing the functionality of the mechanical systems.

This ECM recommissions the primary HVAC equipment such as air handling units, pumps, boilers, and chillers, at the PFBC's Headquarters building. Terminal equipment and air balancing is not included. Following Retro-commissioning, the building operates more smoothly, occupants are more comfortable, and equipment maintenance problems and utility expenses are reduced.

Assumptions - It is assumed that the ESG team will be able to access the building automation system and associated instrumentation and devices to test and program optimal sequences for the building occupants' comfort and energy efficiency.

ECM Costs & Savings Breakdown

Cost	Savings	Rebate	O&M Savings	Useful Life
$50,313	$16,681	$0	$0	N/A

ECM #10 Replace unit heaters with gas-fired radiant heaters in hatch house and maintenance buildings – Benner Spring & Pleasant Gap SFH - (Partially included in ESG's Preliminary Cash-Flow Neutral Project)

Present Conditions - Benner Spring utilizes fuel oil and Pleasant Gap utilizes natural gas unit heaters to heat the respective building.

ESG Proposed Solution - Natural gas or propane infrared heat can be utilized for general heating purposes reducing both the cost of electricity and natural gas or fuel oil. Infrared radiant heat reduces the consumption of natural gas or fuel-fired heaters along with the electricity utilized by the respective unit heaters by focusing warmth where it is needed, rather than the entire space. The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) has found that infrared heaters can reduce the required heat needed to maintain a comfortable temperature in a building (heat load), by at least 15 percent. Studies of similar buildings as those at PFBC show saving upwards of 30%. Due to the different modes in which the heat is transferred (radiation vs. convection), infrared systems are always sized at lower input capacities, further reducing fuel consumption costs. The proposed ECM replaces aged equipment avoiding the future cost to PFBC. Additionally, increased efficiency decreases PFBC operating costs.

Site	Applicable Building	Included In	Proposed Fuel
Benner Spring	Maintenance Garage	Cash Flow Neutral Project	Propane
Pleasant Gap	Garage & Maintenance Fab & Upper Garage	Alternate Project	Natural Gas

Assumptions

- The existing heating equipment represents the realistic heating demands of the respective building/space.
- Propane fuel tank location and/or set-up is not included and will be evaluated during the IGA. An evaluation as to the most cost-effective procurement method will be investigated. This may involve the option of individual tanks or a tank farm and the possibility of owning or renting the tanks.

ECM Costs & Savings Breakdown (includes Benner Spring and Pleasant Gap)

Cost	Savings	Rebate	O&M Savings	Useful Life
$265,938	$3,911	$0	$0	15 Years

ECM #11 Hot water boiler replacement in hatch house #2, fuel switch – Pleasant Mount SFH - (Included in ESG's Preliminary Cash-Flow Neutral Project)

Present Conditions - The existing Hatch House #2 building heat is provided through a single Thermal Dynamics oil-fired boiler.

ESG Proposed Solution - ESG proposes the replacement of the existing fuel oil-fired non-condensing boiler with a propane-fired condensing boiler. Heating loads are directly related to the outside air temperature. The lower the outside air temperature, the more heat is required. This heat comes from the water temperature produced by the hydronic boiler. Condensing boilers automatically reset the boiler water temperature to the outside air temperature lowering the water temperature as the outside air temperature increases. Not only does this decrease the wear and tear on the equipment, extending its life but condensing boilers are up to 99% efficient whereas non-condensing boilers are only up to 82% efficient, reducing the costs of fuel. The proposed ECM replaces aged equipment avoiding the future cost to PFBC. Additionally, increased efficiency decreases PFBC operating costs.

Assumptions

- The existing heating equipment represents the realistic heating demands of the respective building/space.
- Propane fuel tank location and/or set-up is not included and will be evaluated during the IGA. An evaluation as to the most cost-effective procurement method will be investigated. This may involve the option of individual tanks or a tank farm and the possibility of owning or renting the tanks.

ECM Costs & Savings Breakdown

Cost	Savings	Rebate	O&M Savings	Useful Life
$50,313	$3,091	$0	$0	20 Years

ECM #12 Reclaiming energy from heated water - Pleasant Mount SFH - (Included in ESG's Preliminary Cash-Flow Neutral Project)

Present Conditions - Pleasant Mount is a warm water hatchery that utilizes three (3) fuel oil-fired water heaters. The water that is heated then passes through the raceways before being treated and discharged. Any heat remaining in that water is lost. The annual fuel oil cost for Pleasant Mount is almost 16% higher than the combined cost of fuel oil at the other four sites that utilize fuel oil.

ESG Proposed Solution - ESG is proposing the reclamation of that heat remaining by installing a heat exchanger in the common discharge of the waste handling equipment prior to the release of that treated water from the building. This heat would then be transferred to the incoming water prior to the water heaters increasing the incoming water temperature and decreasing the fuel oil consumption required of the water heaters.

Assumptions - The proposed reclaim water flows match those utilized by the current water heaters.

ECM Costs & Savings Breakdown

Cost	Savings	Rebate	O&M Savings	Useful Life
$71,875	$2,274	$0	$0	20 Years

ECM #13 Replace gas fired boilers and hot water heaters with condensing units – Oswayo SFH - (Included in ESG's Preliminary Cash-Flow Neutral Project)

Present Conditions - The Administration Building hydronic heat is provided through two (2) older Weil McLain boilers manufactured in 1992. Domestic hot water is provided from an American water heater installed in 2007. Both the hydronic heating boiler and domestic hot water are approaching the end of their useful lives.

ESG Proposed Solution - ESG proposes the replacement of the existing non-condensing boilers with a natural gas-fired condensing boiler, which would incorporate an internal heat exchanger to provide domestic hot water as well. Heating loads are directly related to the outside air temperature. The lower the outside air temperature, the more heat is required. This heat comes from the water temperature produced by the hydronic boiler. Condensing boilers automatically reset the boiler water temperature to the outside air temperature lowering the water temperature as the outside air temperature increases. Not only does this decrease the wear and tear on the equipment extending its life, but condensing boilers are up to 99% efficient whereas non-condensing boilers are only up to 82% efficient, reducing the costs of fuel. The proposed ECM replaces aged equipment avoiding the future cost to PFBC. Additionally, increased efficiency decreases PFBC operating costs.

Assumptions - The existing heating and domestic hot water equipment represent realistic heating/domestic demands of the respective building/space.

ECM Costs & Savings Breakdown

Cost	Savings	Rebate	O&M Savings	Useful Life
$129,375	$1,293	$0	$0	20 Years

ECM #14 Replace gas-fired boilers and hot water heaters with condensing units – Tionesta SFH - (Included in ESG's Preliminary Cash-Flow Neutral Project)

Present Conditions - The Administration Building hydronic heat is provided through an older Hydrotherm cast iron boiler manufactured in 1990. The hydronic heating boiler is approaching the end of its useful life.

ESG Proposed Solution - ESG proposes the replacement of the existing non-condensing boilers with a natural gas-fired condensing boiler. Heating loads are directly related to the outside air temperature. The lower the outside air temperature the more heat is required. This heat comes from the water temperature produced by the hydronic boiler. Condensing boilers automatically reset the boiler water temperature to the outside air temperature lowering the water temperature as the outside air temperature increases. Not only does this decrease the wear and tear on the equipment extending its life, but condensing boilers are up to 99% efficient whereas non-condensing boilers are only up to 82% efficient, reducing the costs of fuel. The proposed ECM replaces aged equipment avoiding the future cost to PFBC. Additionally, increased efficiency decreases PFBC operating costs.

Assumptions - The existing heating and domestic hot water equipment represent realistic heating/domestic demands of the respective building/space.

ECM Costs & Savings Breakdown

Cost	Savings	Rebate	O&M Savings	Useful Life
$34,500	$493	$0	$0	20 Years

ECM #16 Convert Electric Heaters to Propane Heaters – Corry SFH - (Included in ESG's Preliminary Cash-Flow Neutral Project)

Present Conditions - Corry's Administration Building utilizes electric unit heaters in the Garage even though there is natural gas available at the site.

ESG Proposed Solution - Natural gas infrared heat can be utilized for general heating purposes, thus reducing the overall cost of utilities. Infrared radiant heat is a much more cost effective solution since it utilizes less expensive natural gas (vs. electricity) and by focusing warmth where it is needed rather than the entire space. The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) has found that infrared heaters can reduce the required heat needed to maintain a comfortable temperature in a building (heat load), by at least 15 percent. Studies of similar buildings as those at PFBC show saving upwards of 30%. Due to the different modes in which the heat is transferred (radiation vs. convection), infrared systems are always sized at lower input capacities, further reducing fuel consumption costs. The proposed ECM replaces aged equipment avoiding the future cost to PFBC. Additionally, increased efficiency decreases PFBC operating costs.

Assumptions

- The existing heating equipment represents the realistic heating demands of the respective building/space.
- The site natural gas system is sufficient for the addition of the proposed infrared heaters.

ECM Costs & Savings Breakdown

Cost	Savings	Rebate	O&M Savings	Useful Life
$25,875	$2,600	$0	$0	15 Years

ECM #18 Convert electric water heater to gas – Union SFH - (Included in ESG's Preliminary Cash-Flow Neutral Project)

Present Conditions - The Administration Building currently utilizes an older electric domestic hot water heater. Electric resistance water heaters have low recovery rates and higher utility costs as opposed to gas types, which have high recovery rates and lower utility costs.

ESG Proposed Solution - ESG proposes the replacement of the following domestic hot water heater with a natural gas-fired water heater. A water heater's efficiency is the water heater's overall efficiency based on the amount of hot water produced per unit of fuel consumed over a typical day. The water heater efficiency is determined by its recovery efficiency, standby losses, and cycling losses. The higher the energy factor, the more efficient the water heater. However, when fuel costs are taken into account, natural gas-fired water heaters can be significantly more cost-effective. The proposed ECM replaces aged equipment avoiding the future cost to PFBC. Additionally, increased efficiency decreases PFBC operating costs.

Assumptions

- The existing domestic hot water heater represents realistic domestic hot water demands of the respective building/space.
- The site natural gas system is sufficient for the addition of the proposed domestic hot water heater.

ECM Costs & Savings Breakdown

Cost	Savings	Rebate	O&M Savings	Useful Life
$14,375	$519	$0	$0	20 Years

ECM #19 Add Radiant Heat to Production Room – Union City SFH - (Included - replacement in-kind)

Present Conditions - The RFQ Appendix S asks the proposer to install radiant heaters in the production room at Union City State Fish Hatchery.

ESG Proposed Solution -The installation of radiant heaters in areas with cold water fish is not recommended as the fish are in direct line of sight to these heaters and, therefore, will receive a significant amount of heat. This can be harmful to fish health as the fish raised here are predominantly cold water fish whose body temperature needs to be the same as the water temperature they normally swim in. Installing radiant heaters can have negative impacts on the health of fish. Therefore, the ESG team has included an in-kind high-efficiency gas-fired unit heater replacement in the scope of work to address the facility's need of replacement of the existing non-functional unit heater.

ECM Costs & Savings Breakdown

Cost	Savings	Rebate	O&M Savings	Useful Life
$50,313	$963	$0	$0	15 Years

ECM #20 Convert main office from electric heat and window A/C units to multizone heat pump system – Linesville SFH - (Included in ESG's Preliminary Cash-Flow Neutral Project)

Present Conditions - Currently, the Administration Building at Linesville still utilizes "window" type air conditioning units for cooling. While the direct costs of individual units are significantly less than multi-zone zone units, they are not as efficient in terms of electrical consumption or overall cooling effectiveness. Individual units can result in additional warm air entering the space during air conditioning months and cold air during the non-air conditioning months, increasing the cooling or heating load of the building/space. When installed in a window, the air conditioner takes away the visual effect of having a window.

ESG Proposed Solution - ESG has included the replacement of the Linesville Administration Building window air conditioning units with a multi-zone heat pump system. Multi-zone heat pump systems can reduce the electrical consumption of the air conditioning system and provide better, more effective cooling of a building/space.

Additionally, with the heat pump technology, heat can be transferred from the outside air reducing the building's heat costs. Lastly, the ASHRAE useful life of an air source heat pump is 15 years – considerably longer than the life of a traditional window air conditioning unit. The proposed ECM replaces aged equipment avoiding the future cost to PFBC. Additionally, increased efficiency decreases PFBC operating costs.

Assumptions - Sufficient electrical service is available at each building for the installation of the proposed heat pump system.

ECM Costs & Savings Breakdown

Cost	Savings	Rebate	O&M Savings	Useful Life
$179,688	$5,649	$0	$0	15 Years

ECM #22 Rework system controls/flow in hatch house to optimize boiler heat exchanges - Linesville SFH - (Included in ESG's Preliminary Cash-Flow Neutral Project)

Present Conditions - Although the process heating boiler at Linesville is relatively new, there is an insufficient transfer of heat between the boiler and the process water.

ESG Proposed Solution - ESG's Engineers have examined the heat exchange process between the boiler water and the process water. The current system does not allow for sufficient heat transfer from the boiler water to the shell and tube heat exchanger. Such heat exchangers are prone to heat transfer losses as a result of fouling. Fouling is resistance to heat transfer due to the build-up of layers or dirt or other substances on the tube surfaces of the heat exchanger. Increased fouling results in lower heat transfer like those seen at Linesville. ESG proposes that the heat exchanger be taken out of service, cleaned and replaced, and a cyclonic separator be installed on the inlet side of the heat exchanger. Cyclonic separation removes particulate matter without the use of filters, through vortex separation. Those separated particulates are then discharged into the sewer system, reducing the foul of the heat exchanger.

Assumptions - The water flows of the proposed system are equal to those currently being pumped through the heat exchanger.

ECM Costs & Savings Breakdown

Cost	Savings	Rebate	O&M Savings	Useful Life
$21,563	$7,155	$0	$0	15 Years

ECM #23 Add level controls to upper fishpond to control pump VFD to keep from overflowing the system - Linesville SFH - (Included in ESG's Preliminary Cash-Flow Neutral Project)

Present Conditions - As a result of excessive pumping, the upper fishpond routinely overflows, resulting in the overflowing of other areas of the process.

ESG Proposed Solution - Although the pumps currently have variable frequency drives, they are not under any type of automatic control. As a result, the Staff must manually adjust the flows based on experience instead of demand, resulting in increased electrical and utility consumption from not only the pumps but the waste handling equipment and the overflowing of the upper fishpond and other areas of the process. ESG proposes the installation of level controls in the upper fishpond to control and minimize the overflows. The proposed controls would provide a wireless signal to the VFD. Additionally, PFBC will see electrical savings from not only the pumps but the waste handling equipment.

Assumptions - A wireless network is available for the operation of the controls. The level sensor would be installed before the discharge of the upper fishpond.

ECM Costs & Savings Breakdown

Cost	Savings	Rebate	O&M Savings	Useful Life
$28,750	$4,086	$0	$0	15 Years

ECM #24 Hot water boiler replacement in office space/hatch house and possible fuel conversion (propane or CNG) - Tylersville SFH - (Included in ESG's Preliminary Cash-Flow Neutral Project)

Present Conditions - Currently, the Hatchery Building is heated by an older Weil McLain fuel oil-fired boiler.

ESG Proposed Solution - ESG proposes the replacement of this boiler with a new, higher efficiency model. The existing piping and flue will be reconnected to the new boiler. Lastly, this proposed ECM replaces older equipment that is at or beyond its useful life. ESG evaluated conversion of fuel from Fuel Oil to Propane, however, the cost of Propane compared to Fuel Oil in the area does not allow for an economically feasible fuel switch.

Assumptions - The existing heating equipment represents the realistic heating demands of the respective building/space.

ECM Costs & Savings Breakdown

Cost	Savings	Rebate	O&M Savings	Useful Life
$21,563	$926	$0	$0	20 Years

Base Energy Conservation Measures (from Appendix S) considered but not included within the proposed cash-flow neutral project:

The following Appendix S ECMs did not fit into our proposed project as a result of relatively low energy savings compared to costs, or significant scope questions. ESG's proposed alternate project generates excess cash flow that could support approximately $3M (including energy-related cost savings) of additional scope without the need for additional savings. Upon determination of a workable scope with the PFBC, DGS, and the end-users, it is possible that much of this work could be completed within the project scope. Still, it has not been included for reasons addressed hereinafter.

During the IGA, when additional locations are included, we expect more ECMs to fit into the budget neutral cash flow. Additionally, Energy-Related Cost Savings at up to $300,000 per ECM per building could make these ECMs more cost-effective. These ECMs will be reconsidered and reevaluated during the Investment Grade Audit (IGA). It is essential to recognize that any of the ECMs can be included in the project at the sacrifice of all or part of another ECM that is currently included within the proposed project. If any of the ECMs listed in Appendix S is high on the PFBC priority list, ESG will work with the PFBC and DGS staff to try to include them in the project.

ECM #6 Consider fuel switches from electric to propane/oil and/or CNG, if feasible. – Project-Wide - (Included this scope as a part of other ECMs in ESG's Preliminary Cash-Flow Neutral Project)

ECM #6, project-wide, is not included as part of ESG's cash flow neutral project. However, the following Appendix "S" ECMs directly address fuel switches and have been included in our cash flow neutral project:

- ECM #7, Convert electric water heaters to gas, if available;
- ECM #11, Pleasant Mount - hot water boiler replacement in hatch house #2, fuel switch;
- ECM #16, Corry – convert electric heaters to propane heaters

- ECM #18, Union City – convert electric water heater to gas;
- ECM #24, Tylersville – hot water boiler replacement in office space/hatch house and possible fuel conversion (propane or CNG)

ECM #15 Add Gas Fired Radiant Heaters for Hatch House – Tionesta SFH - (Not included in ESG's Preliminary Cash-Flow Neutral Project)

The RFQ Appendix S asks the proposer to install Radiant Heaters to Hatch House at Tionesta State Fish Hatchery. During our surveys and in talking to Hatchery Managers as well as a reputable Radiant Heater manufacturer's engineering support, the installation of Radiant heaters in a hatch house is not recommended. As the fish are in direct line of sight to these heaters and therefore, will receive a significant amount of heat. This can be harmful to fish health as the fish raised here is predominantly cold water fish whose body temperature needs to be the same as the water temperature they normally swim in. Installing radiant heaters can have negative impacts on the health of fish. Therefore, ESG has not included this ECM for hatch houses. However, other ECMs in our proposal include radiant heaters in other areas at various hatcheries such as Maintenance Garages.

Reason Not Included In Self-Funded Cash-flow - Infrared heaters not recommended for hatch house where fish health can be adversely impacted.

ECM #17 Add holding sediment pond/tank to eliminate the flow of fish excrement to the public sewer - Corry SFH - (Not included in ESG's Preliminary Cash-Flow Neutral Project)

Present Conditions - Currently, the water quality standards of the site's wastewater discharge permit limit the discharge from the product. Consequently, Corry SFH is not able to operate at full capacity. The actual discharge permit requires an analysis of that permitted versus that produced and means and methods to mitigate the discharge. The additional sediment pond/tank will require a large footprint by the discharge area. There are a variety of means that a reduction in waste could occur, including the addition of a sediment pond/tank; however, at this time, there is not sufficient information to determine the size or complexion of an acceptable solution. However, ESG's alternate project includes almost $3M in net positive cash flow that could be used to address this particular measure.

Reason Not Included In Self-Funded Cashflow - Energy and operational savings cannot be determined at this time.

ECM #21 Add filtration/UV system to clean lake water for use / to prevent heating water in the summer – Linesville SFH - (Not included in ESG's Preliminary Cash-Flow Neutral Project)

Present Conditions - Linesville SFH produces warm water products. Off all PFBC hatchery sites, Linesville has the highest natural gas consumption and cost. During the warmer months, less, if any, heat would be required utilizing lake water. However, insufficient information is available at this time to evaluate the quantity of lake water and the temperature rise required for the product. However, ESG's alternate project includes roughly $3M in net positive cash flow that could be used to address this particular measure.

Reason Not Included In Self-Funded Cashflow - Energy and operational savings cannot be determined at this time.

d. The degree to which the Quote demonstrates the technical feasibility, suitability, reasonableness, comprehensiveness, and acceptability of the proposed ECMs, including the proposed equipment and quality of said equipment for the proposed savings.

All of the ECMs developed for this project were either taken from the core ECM listing in Appendix S or developed through knowledge gained by ESG's site visits. All the ESG developed ECMs for the PFBC project have been implemented by ESG at other facilities throughout the country with great success. A complete detailed description of each ECM has been provided in the previous ECM listing or is included in section 2.6.g of this proposal.

e. Training to be provided to funding agency staff with scope and personnel who will be providing same.

ESG fully understands the importance of training for each of our customers. We can provide a variety of owner education and training services. The following specifically describes the approach that ESG takes concerning customer training on newly installed equipment and is ready to implement, based on the final ECM development and selection.

Program Description - Training on the operation/maintenance of newly installed equipment is customized based on the specific needs and skill level of the end-user. Once the final scope is determined, ESG will assess the skills of existing staff with the PFBC leadership in determining the exact level of training required. When making an investment of this magnitude, an effective training plan must be implemented that realizes the full benefits of the systems installed. All training is facilitated by the ESG project managers and engineers, with factory representatives brought in to provide additional education and training resources when deemed necessary. Training is typically held on-site and caters solely to the equipment installed.

Types of Training - ESG provides customized training on all newly installed equipment, based on the specific needs and skill level of the customer. The PFBC's operating and maintenance staff will be trained to understand the design intent, operating parameters, maintenance requirements, and overall description and configuration of each ECM installed on the project. ESG will design a training program for each ECM installed. The program will detail the subjects to be covered, the amount of time expected for completion, and the number of staff recommended attending (typically a minimum of a mechanic, an electrician, and a programmer, plus back-up personnel).

Training materials will be provided, including printed manufacturer literature, control diagrams, O&M manuals, instructions on start-up and shut-down modes of operation, preventative maintenance procedures and identification of safety requirements. Less-experienced personnel will be given additional training, which will enable them to understand, operate, and maintain the systems and equipment. More experienced personnel may receive high-level training allowing them, in many cases, to make system changes without incurring fees for calling in outside contractors.

Types of Training Media - Training media is provided in a variety of formats to accommodate the learning needs and preferences of the audience. Typically, topic-specific handouts are provided, accompanied by hands-on tutorials that are supplemented with a wide range of multimedia tools including but not limited to PowerPoints, videos, and training simulations. At the end of all training sessions, any nonproprietary media used in training is the property of the PFBC and available for future reference.

f. Degree to which the methodology for the proposed ECMs was explained.

ESG's methodology is based on standard engineering principles from ASHRAE or AEE or approved Building Simulation software. ESG has the required expertise in all aspects of developing, designing, installing, maintaining, and verifying a Guaranteed Energy Savings Agreement (GESA) project. Over the years, we have sought out and retained professionals that possess the specific skillsets to be a highly capable GESA provider. **The ESG Northeast Region team has more than two hundred and thirteen years' worth of combined experience in GESA contracting**. In order to clearly evaluate sound engineering principles and the reasonableness of the proposed savings, ESG has provided detailed energy calculations as well as material cut sheets in our Appendix.

g. Additional ECMs developed by ESG and included in the project

As a result of our extensive site visits of the 14 facilities, ESG has included ***18 ESCO developed ECMs*** in the initial proposal. Additional ECMs will be explored during the Investment Grade Audit.

ESCO #01 Replace Process Water Heaters with Propane Heaters – Pleasant Mount - (Included in ESG's 2nd Cash-Flow Project)

Present Conditions - Pleasant Mount is a warm water hatchery that utilizes three (3) fuel oil-fired water heaters. The annual fuel oil cost for Pleasant Mount is almost 16% higher than the combined cost of fuel oil at the other four sites that utilize fuel oil.

ESG Proposed Solution - ESG proposes the replacement of the three (3) existing fuel oil-fired non-condensing water heaters with two (2) propane-fired condensing water heaters. Fuel oil-fired boilers produce constant temperature water with efficiencies of only roughly 80%. Condensing boilers are up to 99% efficient, especially with the low water temperatures required by warm water hatcheries.

Assumptions

- The existing heating equipment represents the realistic heating demands of the respective building/space.
- Propane fuel tank location and/or set-up is not included and will be evaluated during the IGA. An evaluation as to the most cost-effective procurement method will be investigated. This may involve the option of individual tanks or a tank farm and the possibility of owning or renting the tanks.

ECM Costs & Savings Breakdown

Cost	Savings	Rebate	O&M Savings	Useful Life
$158,125	$271	$0	$0	20 Years

ESCO ECM #02 Transformer Replacement – Various Facilities - (Included in ESG's 2nd Cash-Flow Project)

Present Conditions - This measure proposes to replace old and end of life, inefficient transformers with new, ultra-high efficiency transformers. During our site surveys, the ESG engineering team noticed that a significant number of onsite transformers were well past their useful life and showing signs of impending failure. Therefore, ESG has included the replacement of this critical equipment with new transformers appropriately selected for the particular application.

ESG Proposed Solution - The high-efficiency transformers scope includes the following:

- Disconnect and remove old transformer (electric shutdowns will be required)
- Furnish and install appropriate replacement transformer

- Reuse existing conductors and conduits
- Clean-up of the work area
- Training for facility staff on proper maintenance

The proposed transformers, Powersmiths E-Saver line of products is the ideal transformer for institutional and commercial environments where energy efficiency and reliability is a priority. The following facilities are included within the scope of work of this ECM:

Facility	Transformer kVA	# of Transformers
Bellefonte SFH	37.5	2
Bellefonte SFH	25	1
Benner SFH	25	1
Benner SFH	300	1
Fairview SFH	25	1
Fairview SFH	30	1
Fairview SFH	50	1
PFBC Headquarters	25	1
PFBC Headquarters	30	1
PFBC Headquarters	45	1
PFBC Headquarters	75	1
PFBC Headquarters	112.5	1
Huntsdale SFH	15	1
Huntsdale SFH	25	2
Linesville SFH	15	1

Facility	Transformer kVA	# of Transformers
Oswayo SFH	15	1
Oswayo SFH	75	1
Pleasant Gap SFH	15	1
Pleasant Gap SFH	25	1
Pleasant Mount State SFH	30	1
Pleasant Mount State SFH	75	1
Reynoldsdale SFH	25	1
Tionesta SFH	10	2
Tionesta SFH	30	2
Tylersville SFH	75	1
Tylersville SFH	100	1
Tylersville SFH	500	1

ECM Costs & Savings Breakdown

Cost	Savings	Rebate	O&M Savings	Useful Life
$264,297	$13,126	$0	$0	20 Years

ESCO ECM #03 Convert Gas/Oil Unit Heaters to Radiant Heat - (Included in ESG's 2nd Cash-Flow Project)

Present Conditions - The following sites use natural gas or fuel oil-fired unit heaters to heat the respective buildings.

ESG Proposed Solution - Infrared heat, though not recommended for the process areas within the hatchery, can be utilized for general heating purposes reducing utility costs. Natural gas infrared heat can be utilized for general heating purposes, thus reducing the overall cost of utilities. Infrared radiant heat is a much more cost effective solution since it utilizes less expensive natural gas (vs. fuel oil) and by focusing warmth where it is needed rather than the entire space. The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) has found that infrared heaters can reduce the required heat needed to maintain a comfortable temperature in a building (heat load), by at least 15 percent. Studies of similar buildings as those at PFBC show saving upwards of 30%. Due to the different modes in which the heat is transferred (radiation vs. convection), infrared systems are always sized at lower input capacities, further reducing fuel consumption costs. Lastly, this proposed ECM replaces older equipment that is at or beyond its useful life.

Site	Applicable Building	Current Fuel
Fairview	Garage	Natural Gas
Huntsdale	Administration/Garage	Fuel Oil
Linesville	Chemical Room & Garage	Natural Gas
Oswayo	Carpenter Shop & Garage	Natural Gas
Pleasant Mount	Maintenance, Upper Garage & Storage	Fuel Oil
Tionesta	Lower Garage	Natural Gas

Assumptions

- The existing heating equipment represents the realistic heating demands of the respective building/space.
- The site natural gas system is sufficient for the addition of the proposed domestic hot water heater.
- Huntsdale & Pleasant Mount only - Propane fuel tank location and/or set-up is not included and will be evaluated during the IGA. An evaluation as to the most cost-effective procurement method will be investigated. This may involve the option of individual tanks or a tank farm and the possibility of owning or renting the tanks.

ECM Costs & Savings Breakdown

Cost	Savings	Rebate	O&M Savings	Useful Life
$330,625	$14,625	$0	$0	15 Years

ESCO ECM #04 Spring/Well Pump VFDs - (Included in ESG's Preliminary Cash-Flow Neutral Project)

Present Conditions - A number of well/spring pumps at the various sites do not have variable frequency drives nor controls. As a result, the Staff must manually adjust the flows based on experience instead of demand resulting in increased electrical and utility consumption from not only the pumps but the waste handling equipment.

Site	Pump Horsepowers (HP)
Bellefonte	(1) – 30
Benner Springs	(1) – 50
Corry	(1) – 15 & (1) – 20
Huntsdale	(1) – 7½
Linesville	(1) - 7½, (1) – 15 & (1) - 25
Oswayo	(2) – 5
Pleasant Mount	(1) – 5
Reynoldsville	(1) – 7½ & (1) - 20

ESG Proposed Solution - ESG proposes the replacement of the existing across-the-line motor starters with variable frequency drives (VFDs) and flow controls to reduce the electrical consumptions to meet the required flows instead of the presumed flows. This includes, as applicable, the replacement of the respective pump motors.

Assumptions - The existing wiring is in good working order. Existing flow control devices are operational and can be programmed to operate the proposed VFDs.

ECM Costs & Savings Breakdown

Cost	Savings	Rebate	O&M Savings	Useful Life
$343,563	$42,626	$0	$0	15 Years

ESCO ECM #06 Generator Heat Pump Block Heater – Various Facilities - (Included in ESG's Preliminary Cash-Flow Neutral Project)

Present Conditions - All stand-by Diesel Generators must be kept hot at all times so that they can start quickly during a power outage. This heating process uses electricity and costs money.

ESG Proposed Solution - Using Heat Pump heating instead of electric resistance block heaters is a cost-effective way to heat emergency diesel generators. For PFBC generators, the ESG team will install GTS Heat Pumps within the emergency generators.

The facilities save approximately 84% of energy compared to traditional electric resistance block heaters that come installed with emergency diesel generators as standard equipment.

The GTS Heat Pumps will be installed in series with the existing block heaters. This adds extra redundancy further to prevent cold start wear or failure of the generator. Resistance block heaters have a useful life of 5 years, while the life expectancy of proposed GTS heat pumps is over 20 years. This ECM will increase the reliability of the critical backup generators and provide a quick return on investment. The following table notes the sites and generators which will receive this upgrade:

Building	Make	Model	Engine Size (kW)
Bellefonte SFH	Kohler	180REOZJG	180
Bellefonte SFH	Kohler	180REOZJG	180
Benner Spring SFH	Kohler	250REOZJE	250
Benner Spring SFH	Kohler	150REOZJF	150
Corry SFH	Kohler	Unreadable	180
Fairview SFH	Kohler	175	175
Huntsdale SFH	Kohler	100R0ZJ	100
Huntsdale SFH	Kohler	100R0ZJ	100
Huntsdale SFH	Kohler	100R0ZJ	100
Huntsdale SFH	Generac	10775590200	350
Building	**Make**	**Model**	**Engine Size (kW)**
PFBC HQ Harrisburg	CAT	No Tag Pic	250
Linesville SFH	Kohler	80REZGD	80
Oswayo SFH	Kohler	180R0ZJ71	180
Pleasant Gap SFH	Kohler	300R0Z71	300
Pleasant Mount SFH	Kohler	260R0Z71	260
Reynoldsdale SFH	Kohler	175R0Z71	175
Tionesta SFH	Kohler	80	80
Tionesta SFH	Kohler	150R0ZJT1	150
Tylersville SFH	Generac	6521530100	600

ECM Costs & Savings Breakdown

Cost	Savings	Rebate	O&M Savings	Useful Life
$371,055	$34,318	$0	$0	20 Years

ESCO ECM #07 Replace Non-Functional Process Water Flowmeters - (Included in ESG's 2nd Cash-Flow Project)

Present Conditions - During ESG's survey, the PFBC staff advised that at the Bellefonte and Tionesta sites, the existing process water flowmeters were no longer working. Proper flow is desired to maintain the health of the product and to reduce the consumption of not only electricity but the water required from the wells and the oxygen and food used.

ESG Proposed Solution - ESG proposes the replacement of the instrumentation flow measuring instrumentation for each of these process water flowmeters at the two (2) sites. This will not only decrease the amount of water required, reducing the electrical consumption of the well pumps but also reduce the oxygen used as a result of the correct flows.

Assumptions

- The flows will be reduced as a result of the Staff knowing the actual flows instead of running the pumps at unknown flows.
- The existing flow meter's instrumentation can be replaced and repaired.

ECM Costs & Savings Breakdown

Cost	Savings	Rebate	O&M Savings	Useful Life
$38,813	$0	$0	$0	15 Years

ESCO ECM #08 Retro-commissioning – All Hatcheries - (Included in ESG's 2nd Cash-Flow Project)

Present Conditions - Energy consuming systems' performance often deteriorates steadily over time as system setpoints are misadjusted, or control sequences no longer match the changing use and occupancy patterns of the building.

ESG Proposed Solution - Retro-commissioning analyzes a building's current performance and sequences of operation and implements measures to reduce the operating costs while improving the functionality of the building's systems. While commissioning is the term used to describe this process when it is applied to new constructions, 'retro-commissioning' evolved as the term for when the building has been in use. Retro-commissioning includes engineering analysis designed to increase efficiency, lower operating cost, improve occupant comfort and decrease maintenance costs, spanning the spectrum from optimizing controls of the HVAC systems to physically analyzing the functionality of the mechanical systems.

As a result, the building operates more smoothly, occupants are more comfortable, equipment maintenance problems are reduced, and the utility expenses are reduced. To maximize the benefits, retro-commissioning is a process that should be repeated every 5 to 10 years to maintain optimal performance. This ECM proposes that all the sites' HVAC systems be retro-commissioned, including tuning of boilers and furnaces, servicing air conditioners, and optimizing temperature set points.

Assumptions - It is assumed that the ESG team will be able to access the building automation system and associated instrumentation and devices to test and program optimal sequences for the building occupants' comfort and energy efficiency.

ECM Costs & Savings Breakdown

Cost	Savings	Rebate	O&M Savings	Useful Life
$263,063	$13,730	$0	$0	N/A

ESCO ECM #09 Programmable Thermostats - (Included in ESG's Preliminary Cash-Flow Neutral Project)

Present Conditions - During ESG's survey of the site, very few programmable thermostats were observed. Instead, non-programmable thermostats, many in bad condition, were observed.

ESG Proposed Solution - Usually, the sites are occupied less than 50 hours of the 168 hour workweek. Upwards of 10% energy savings can be achieved simply from setting back a heating/cooling unit's thermostat. Programmable thermostats allow temperatures to return to normal prior to occupancy while providing significant energy savings. Equipment wear and tear is decreased as a result of the thermostat not cycling the equipment as much. Finally, this ECM replaces damaged existing thermostats avoiding future costs to PFBC.

Assumptions - Existing wiring sufficient for proposed programmable thermostats. Existing thermostats to remain in place

ECM Costs & Savings Breakdown

Cost	Savings	Rebate	O&M Savings	Useful Life
$86,250	$19,989	$0	$0	15 Years

ESCO ECM #10 BERT Plug Load Controls – Various Facilities - (Included in ESG's Preliminary Cash-Flow Neutral Project)

Present Conditions - Office equipment is regularly left in the "on" state at all times allowing their individual machine to revert to "sleep" mode based on an internal timer.

ESG Proposed Solution - The measure proposes to plug in office/plugged-in equipment into networkable devices that will allow for scheduling of the equipment where currently the said equipment is not controlled. This measure will plug the office equipment into a networkable device that will allow for the scheduling of plugged-in equipment. ESG will utilize specialty wall receptacles from BERT (or equal) that have software to track real-time electrical usage of PFBC's equipment. The software will also be used to view this usage an automatically turn on/off any and all equipment plugged-in to these outlets.

The Plug Load controls scope includes the following:

1. Furnish and install BERT network outlet controllers to control plug load throughout the buildings.
2. Equipment including but not limited to: Copiers, Vending Machine, Hot/Cold Water Dispensers, etc.
3. Utilize PFBC facilities' existing internet and WiFi networks to connect new controllers.
4. Coordinate with IT staff to implement successful installation.

Assumptions - The proposed plug load controls will turn off power to the equipment when not in use, thereby eliminating the phantom power drain.

ECM Costs & Savings Breakdown

Cost	Savings	Rebate	O&M Savings	Useful Life
$5,750	$720	$0	$0	15 Years

ESCO ECM #11 Advertising on PFBC Stocking Trucks - (Included in ESG's 2nd Cash-Flow Project)

Present Conditions - The PFBC trucks are currently not advertising on their sticking vehicles.

ESG Proposed Solution - The measure takes the strategy and revenue estimates from PFBC Hatchery Cost Savings Work Group Report dated 08/31/2011. Advertising on PFBC Stocking Trucks was identified as an opportunity to increase revenue while having minimal operating and maintenance expenses. The scenario defined in the report for PFBC identifies additional revenue of $130,000 annually. ESG proposal assumes a very conservative $65,000 as the anticipated revenue from the implementation of this ECM. During the IGA phase, ESG team will work with PFBC to further develop this measure with a goal to maximize the revenue from advertising on PFBC trucks, we will:

1. Research other agencies to gather best practice information
2. Contact advertising companies to confirm the market viability of this measure
3. Provide information to PFBC to obtain legal approvals
4. Assist PFBC in developing and implementing the process for bidding to vendors for advertising sales and for signs' production

Assumptions - Legal Approvals as required to implement this project will be obtained by PFBC.

ECM Costs & Savings Breakdown

O&M Savings	$65,000

Costs and savings will be finalized during the IGA.

ESCO ECM #12 Demand-Based Oxygen Injection – All Sites Except PFBC Harrisburg Headquarters - (Included in ESG's 2nd Cash-Flow Project)

Present Conditions - Following the degassing of the water used in the process, liquid oxygen is vaporized and injected, increasing the oxygen content of the water. However, there is no automatic control of how much oxygen is injected.

ESG Proposed Solution - The concentration of dissolved oxygen in the surface water is affected by temperature and has both a seasonal and a daily cycle. Cold water can hold more dissolved oxygen than warm water. In winter and early spring, when the water temperature is low, the dissolved oxygen concentration is high. In summer and fall, when the water temperature is high, the dissolved-oxygen concentration is often lower. Without some means of monitoring and controlling the amount of oxygen injected into the water, that excess oxygen is lost to the atmosphere.

ESG proposes the installation of dissolved oxygen (DO) sensors in the raceways to control the amount of oxygen injected into the process water. This will automatically control the amount of oxygen injected into the process water. The result will be lower oxygen costs to PFBC.

Assumptions - As there are currently no controls on the oxygen, the oxygen usage is maximized. There is no penalty for PFBC from reduced oxygen demand.

ECM Costs & Savings Breakdown

Cost	Savings	Rebate	O&M Savings	Useful Life
$373,750	$0	$0	$78,000	15 Years

ESCO ECM #13 Boiler Replacement – Benner Spring Administration Building & Pleasant Mount Administration and Storage Buildings - (Included in ESG's 2nd Cash-Flow Project)

Present Conditions - Currently, the buildings identified above are heated by older, oil-fired boilers.

ESG Proposed Solution - ESG proposes the replacement of these boilers with a new, higher efficiency model. The existing piping and flue will be reconnected to the proposed boiler. Lastly, this proposed ECM replaces older equipment that is at or beyond its useful life.

Site	Applicable Building	Year Boiler Installed
Benner Spring	Administration	2004
Pleasant Mount	Administration	2004
Pleasant Mount	Old Manager's House	Unknown

Assumptions - The existing heating equipment represents the realistic heating demands of the respective building/space.

ECM Costs & Savings Breakdown

Cost	Savings	Rebate	O&M Savings	Useful Life
$28,750	$4,794	$0	$0	20 Years

ESCO ECM #14 Chilled Water Pump VFD - (Included in ESG's 2nd Cash-Flow Project)

Present Conditions - The existing cooling system at the PFBC Headquarters building in Harrisburg consists of an air cooled chiller paired with chilled water pumps which supply chilled water to air handlers within the building. The existing 15 HP chilled water pumps are constant speed and run continuously during the cooling season.

ESG Proposed Solution - ESG proposes the installation of variable speed drives on the existing pump motors to allow the pumps to operate at lower speeds during the period of low demand. New control sequences will be programmed, which will utilize a differential temperature flow modulation scheme to gauge the chilled water load within the building and determining if the real-time loads allow for the flowrate to reduce. The pump speed will reduce on a reduction in temperature differential and increase on the rise in differential temperature. The programming will also ensure the flowrate never drops below the minimum required flow rate of the chiller.

Assumptions - This assumes that the loads in the building have little diversity (all air handler coils have a similar percentage of peak load demands at all times).

ECM Costs & Savings Breakdown

Cost	Savings	Rebate	O&M Savings	Useful Life
$28,750	$1,482	$0	$0	15 Years

ESCO ECM #15 Cancel Zero Usage Electric Account – Fairview State Fish Hatchery - (Included in ESG's 2nd Cash-Flow Project)

Present Conditions - ESG's review of the utility data revealed no electric energy consumption associated with Penelec Account # 100058570332. ESG reviewed several other near-zero consumption electric accounts but determined that, if there is usage, these accounts are important to the respective facilities' operation.

ESG Proposed Solution - While the cost savings from the noted closure of this account at Fairview will result in limited savings, during the Investment Grade Audit, ESG will evaluate all accounts for opportunities of consolidation and elimination with a goal maximize utility bill savings from non-use related charges.

Assumptions - It is assumed that if an account has had zero electric kWh usage per the historical bills provided, the account can be closed and the electric loads connected to the said account service are not operational and can be disconnected without affecting the facility operations.

ECM Costs & Savings Breakdown

Cost	Savings	Rebate	O&M Savings	Useful Life
$719	$437	$0	$0	N/A

ESCO ECM #16 Replace Gas Fired Water Heaters with High-Efficiency Condensing Water Heaters – Fairview & Linesville SFH & PFBC Harrisburg Headquarters - (Included in ESG's 2nd Cash-Flow Project)

Present Conditions - The existing domestic water heaters are low efficiency natural gas-fired units.

ESG Proposed Solution - ESG proposes the replacement of the following domestic water heaters with high efficiency, condensing type domestic water heaters. This proposed ECM replaces older equipment that is at or beyond its useful life.

Site	Applicable Building	Size
Fairview	Administration	30 mbh
Linesville	Maintenance	25 mbh
PFBC Headquarters	Main Headquarters	200 mbh

Assumptions - The routings of the existing flues can be reused for the new domestic hot water heater intake and exhaust.

ECM Costs & Savings Breakdown

Cost	Savings	Rebate	O&M Savings	Useful Life
$115,000	$300	$0	$0	20 Years

ESCO ECM #17 Convert electric domestic water heaters to heat pump - (Included in ESG's 2nd Cash-Flow Project)

Present Conditions - Although ASHRAE does not identify the median useful life for domestic water heaters, the U.S. Department of Housing and Urban Development statistics indicates a median life of tank-type heaters as 10 years. During its survey, ESG's Engineers identified the following electric domestic water heaters that have exceeded 10 years:

Site	Location
Huntsdale	Cold Water Hatch House
Pleasant Mount	Garage
Reynoldsdale	Administration
Tylersdale	Administration & Hatchery

Additionally, these electric domestic water heaters operate at lower efficiencies, as determined by the U.S. Department of Energy (DOE) than current models.

ESG Proposed Solution - The proposed ECM replaces aged equipment avoiding the future cost to PFBC. Additionally, increased efficiency decreases PFBC operating costs.

In 2015, DOE efficiency standards required an increase in the overall efficiency of domestic water heaters resulting in decreased utility bills by one-fourth to one-half depending on the technology. Heat pump water heaters transfer heat from the surrounding air to the water. Only when hot water demand is very high, or the ambient air temperature drops below a threshold temperature not seen at the PFBC facilities, does a heat pump domestic water heater switch entirely to electric resistance heat. In addition, if placed in moist areas, the cool evaporator coil can dehumidify the space as it heats the water. In warm mechanical rooms, a heat pump domestic water heater operates at very high efficiencies resulting in cooler mechanical rooms.

Assumptions

- The existing electrical service to each domestic hot water heater is sufficiently sized for the proposed heat pump domestic hot water heaters.
- The size of the existing domestic hot water heaters is sufficient for the demand.
- Proper ventilation exists within the space for the transference of heat between the proposed heat pump domestic hot water heater(s) and the area exist.

ECM Costs & Savings Breakdown

Cost	Savings	Rebate	O&M Savings	Useful Life
$92,000	$514	$0	$0	20 Years

ESCO ECM #18 Electric Vehicle Charging Station at PFBC Headquarters Harrisburg - (Included in ESG's 2nd Cash-Flow Project)

Present Conditions - With the tremendous growth of Electric Vehicle sales, there is an increased demand by employees of various agencies to have designated sections in parking lots for Electric Vehicle (EV) charging. Placing EC charging stations at the PFBC Headquarters will demonstrate PFBC's acknowledgment of the significant role that EVs will play in PA's transportation future as is being recognized by PA DEP and other agencies in the State. Additionally, it will demonstrate support of the Governor's Executive Order 2019-01 directing replacement of 25 percent of the state passenger car fleet with battery electric and plug-in electric hybrid cars by 2025.

ESG Proposed Solution - ESG proposes to install two (2) Level 2 EV charging stations at the PFBC Headquarters. During the IGA phase, the ESG team will work with PFBC on the exact location selection in compliance with the prevalent standards.

No energy savings have been assumed for the purposes of this proposal. However, additional revenue can be generated for PFBC by charging the consumers for the use of these stations.

ECM Costs & Savings Breakdown

Cost	Savings	Rebate	O&M Savings	Useful Life
$115,000	$0	$0	$0	20 Years

ESCO ECM #19 Fish Food Vending Machines at Hatcheries - (Included in ESG's 2nd Cash-Flow Project)

Present Conditions - No fish food vending machines exist at the Hatcheries/Visitors center for patrons to purchase fish food.

ESG Proposed Solution - This was another revenue generation measure proposed within the PFBC Hatchery Cost Savings Work Group Report dated August 31, 2011. The report identified similar measures in place at many US Fish & Wildlife Service hatcheries. The measure proposes the installation of fish food vending machines at ten (10) PFBC hatcheries and generates an annual revenue of $15,000 - $25,000 at the cost of just $1,000.

ESG carried the low end estimated revenue of $15,000 in our proposed cashflow.

Assumptions - As a part of the IGA and Implementation phases, the ESG team will assist PFBC staff with the selection and procurement of vending machines for this purpose and provide information about the machines as required for approvals by the Commission.

Costs & Savings Breakdown

O&M Savings	$15,000

Costs and savings will be finalized during the IGA.

Lastly, there is a list of additional ECMs in the appendix that were not included in the preliminary scope that can be considered during the Investment Grade Audit should DGS or the PA PFBC desire to include any of them in the final project.

h. Provide annual financial projections for the length of the GESA Contract, to a maximum of 18 years, The Offeror should assume an interest rate of 3%, however, assumption of interest rates should also be based on the Offertory's research of current financial market rates. Also, assume payments will be made annually at the end of the period.

Please see the Energy Guarantee & Costs Savings Chart as well as the Performance Contract Cash Flow on the following pages.

ESG would note the following:

- ESG has used a 3.00% interest rate. Part 2, section 2.6 D h of the RFP asks the Offeror to use an interest rate of 3%.
- The cash flow does not include rebates as there is uncertainty by some utility companies such as PPL about when the incentive program will be available to new projects again. However, ESG will explore every possible rebate as the project develops.
- ESG's proposed project provides significant positive cash-flows that can be used to address Appendix S ECMs 17 and 21, pending the development of their scopes in cooperation with the PFBC and DGS staff.
- ESG has utilized the following Revenues and Operating and Maintenance (O&M) cost as calculated and described in ECM write-ups above:
    - Lighting (Material only) O&M Savings = $5,336
    - Oxygen savings = $78,000
    - Truck Advertising Revenue = $65,000
    - Fish Food Vending Machines = $ 15,000

  The provided O&M costs have not been escalated per RFP Part A, paragraph 5.3.A.17.

- Construction savings are carried to Year 1 per RFP Part 2, paragraph 2.6.D.h(9).
- As a result of the ESG proposed project, the PFBC will avoid significant capital expenditures that have not been defined in our cash-flow. However, applying $299,923 of annual capital cost avoidance savings, as shown in our Appendix, increases our project's net present value (NPV) to $2,994,438 that can be used without further savings to fund Appendix S ECMs #17 and 21.

Cashflow for ESG's Preliminary Cash-Flow Neutral Project (Self-Funded)

Energy Performance Contract Cash Flow

Project Cost	$ 3,207,908		Interest Rate	3.00%	**Estimated Annual Revenue/Oxygen Savings*	
Rebates/ Incentives	*No Act 129 rebates available until 2022*		Utility Escalation Rate	1.0%	*Demand Based Oxygen Injection*	*$0*
Client Contingency	$ 64,158	2%	Construction Period (Months)	12	*Fish Food Vending Machines*	*$0*
Design/Consultant Fee	$ 224,554	7%	Payment Frequency	Annual	*Truck Advertising Revenue*	*$0*
Net Project Cost to be Financed	$ 3,496,619				*Lighting O&M Savings*	*$0*
First Year Energy Savings	$ 336,516	(Includes construction year savings)			Total	$0

	A	B	C	D	E	F	G	H	I	J	K
	Annual Energy Costs without Improvement	Annual Energy Costs with Improvement	Annual Energy Cost Savings (A-B)	O&M Savings (Provided)*	Total Savings (C + D)	Payments for Financing Equipment	Energy Related Cost Savings	Payments for Monitoring & Maintenance Services	Net Annual Benefits	Cumulative Cash Flow	Net Present Value of Cash Flow
0	$824,826	$716,866	$107,961	$0	$107,961	$0	$0	$0	$0	$0	
1	$833,075	$604,519	$228,556	$0	$228,556	$321,330	$0	$15,086	$100	$100	
2	$841,405	$610,564	$230,841	$0	$230,841	$215,655	$0	$15,086	$100	$200	
3	$849,819	$616,670	$233,150	$0	$233,150	$217,963	$0	$15,086	$100	$300	
4	$858,318	$622,837	$235,481	$0	$235,481	$235,381	$0	$0	$100	$400	
5	$866,901	$629,065	$237,836	$0	$237,836	$237,736	$0	$0	$100	$500	
6	$875,570	$635,356	$240,214	$0	$240,214	$240,114	$0	$0	$100	$600	
7	$884,326	$641,709	$242,616	$0	$242,616	$242,516	$0	$0	$100	$700	
8	$893,169	$648,126	$245,043	$0	$245,043	$244,943	$0	$0	$100	$800	
9	$902,100	$654,608	$247,493	$0	$247,493	$247,393	$0	$0	$100	$900	
10	$911,122	$661,154	$249,968	$0	$249,968	$249,868	$0	$0	$100	$1,000	
11	$920,233	$667,765	$252,468	$0	$252,468	$252,368	$0	$0	$100	$1,100	
12	$929,435	$674,443	$254,992	$0	$254,992	$254,892	$0	$0	$100	$1,200	
13	$938,729	$681,187	$257,542	$0	$257,542	$257,442	$0	$0	$100	$1,300	
14	$948,117	$687,999	$260,118	$0	$260,118	$260,018	$0	$0	$100	$1,400	
15	$957,598	$694,879	$262,719	$0	$262,719	$262,619	$0	$0	$100	$1,500	
16	$967,174	$701,828	$265,346	$0	$265,346	$265,246	$0	$0	$100	$1,600	
17	$976,846	$708,846	$267,999	$0	$267,999	$267,899	$0	$0	$100	$1,700	
18	$986,614	$715,935	$270,679	$0	$270,679	$220,598	$0	$0	$50,082	$51,782	$30,734
Total	$16,340,549	$11,857,489	$4,483,060	$0	$4,483,060	$4,493,981	$0	$45,259	$51,782	$51,782	$30,734

ECM Chart for ESG's Preliminary Cash-Flow Neutral Project (Self-Funded)

Self Funded Project (18 year payback)

ECM #	ECM Description	A Construction Cost	B Utility Rebates	C Annual Energy Savings	D O&M Savings	E Total Energy and O&M Savings	F Simple Payback	G Annual Utility Savings					H
								Natural Gas (MCF)	Electric (kwh)	Water Sewer (Kgal)	Coal (MMBTU)	Oil (Kgal)	Annual SPB Shortfall*
ECM #01	Exterior and interior light conversion to LED	$ 694,412	$ -	$ 41,800	$ -	$ 41,800	16.6	-	521,530	-		-	
ECM #02	Add lighting controls to interior & exterior lighting	$ 22,143	$ -	$ 351	$ -	$ 351	63.1	-	4,940	-		-	
ECM #03	Building weatherization and insulation improvements	$ 561,416	$ -	$ 33,635	$ -	$ 33,635	16.7	1,622	117,694	-		5,656	
ECM #04	Remove and replace window A/C units with multi-zone heat pump ductless systems. Repair walls as needed.	$ 43,125	$ -	$ 59	$ -	$ 59	726.2	-	675	-		-	
ECM #05	Add controls to existing pump VFDs to maintain proper flow.	$ 215,625	$ -	$ 3,537	$ -	$ 3,537	61.0	-	44,720	-		-	
ECM #07	Electric to Gas DHW Heater Conversion	$ 115,000	$ -	$ 1,050	$ -	$ 1,050	109.5	(14)	4,190	-		-	
ECM #08	Evaluate roofing and underfloor plenum systems for inadequate insulation or integrity	$ 6,383	$ -	$ 321	$ -	$ 321	19.9	27	1,185	-		-	
ECM #09	Retro commissioning of building air and control systems	$ 50,313	$ -	$ 16,681	$ -	$ 16,681	3.0	807	132,012	-		-	
ECM #10	Replace unit heaters with gas fired radiant heaters in hatch house and maintenance buildings	$ 64,688	$ -	$ 2,158	$ -	$ 2,158	30.0	-	-	-		863	
ECM #11	Hot water boiler replacement in hatch house #2, fuel switch.	$ 50,313	$ -	$ 3,091	$ -	$ 3,091	16.3	-	-	-		1,527	
ECM #12	Reclaiming energy from heated water	$ 71,875	$ -	$ 2,274	$ -	$ 2,274	31.6	-	(22,810)	-		1,656	
ECM #13	Replace gas fired boilers and hot water heaters with condensing units.	$ 129,375	$ -	$ 1,293	$ -	$ 1,293	100.1	160	-	-		-	
ECM #14	Replace gas fired boilers and hot water heaters with condensing units.	$ 34,500	$ -	$ 493	$ -	$ 493	70.0	61	-	-		-	
ECM #16	Convert electric heaters to Natural Gas Heater	$ 25,875	$ -	$ 2,600	$ -	$ 2,600	10.0	(142)	39,200	-		-	
ECM #18	Convert electric water heater to gas.	$ 14,375	$ -	$ 519	$ -	$ 519	27.7	7	2,006	-		-	
ECM #19	Replace non functional unit heater in production room	$ 50,313	$ -	$ 963	$ -	$ 963	52.3	148	-	-		-	
ECM #20	Convert main office from electric heat and window A/C units to multizone heat pump system	$ 179,688	$ -	$ 5,649	$ -	$ 5,649	31.8	-	67,667	-		-	
ECM #22	Rework system controls/flow in hatch house to optimize boiler heat exchanges	$ 21,563	$ -	$ 7,155	$ -	$ 7,155	3.0	1,192	-	-		-	
ECM #23	Add level controls to upper fishpond to control pump VFD to keep from overflowing system.	$ 28,750	$ -	$ 4,086	$ -	$ 4,086	7.0	-	56,398	-		-	
ECM #24	Hot water boiler replacement in office space/hatch house and possible fuel conversion (propane or CNG).	$ 21,563	$ -	$ 926	$ -	$ 926	23.3	-	-	-		353	
ESCO #04	Spring/Well Pump VFDs	$ 343,563	$ -	$ 42,626	$ -	$ 42,626	8.1	-	576,424	-		-	
ESCO #06	Generator Heat Pump Block Heater	$ 371,055	$ -	$ 34,318	$ -	$ 34,318	10.8	-	476,607	-		-	
ESCO #09	Programmable Thermostats	$ 86,250	$ -	$ 19,989	$ -	$ 19,989	4.3	1,237	4,029	-		4,257	
ESCO #10	BERT Plug Load Controls	$ 5,750	$ -	$ 720	$ -	$ 720	8.0	-	10,086	-		-	
	Client Contingency (2%)	$ 64,158											
	Energy Consultant Fee (7%)	$ 224,554											
	Totals	$ 3,496,619	$ -	$ 226,293	$ -	$ 226,293	15.5	5,105	2,036,554	-	-	14,312	-

Utility Rebates	$0
Energy Related Cost Savings	$0
Financed Amount	$3,496,619

Cashflow for ESG's 2nd Cash-Flow Project (Project Including Energy Related Cost Savings_

Energy Performance Contract Cash Flow

Project Cost	$ 7,368,111		Interest Rate	3.00%	**Estimated Annual Revenue/Oxygen Savings*
Rebates/ Incentives	*No Act 129 rebates available until 2022*		Utility Escalation Rate	1.0%	*Demand Based Oxygen Injection* $78,000
Client Contingency	$ 147,362	2%	Construction Period (Months)	12	*Fish Food Vending Machines* $15,000
Design/Consultant Fee	$ 515,768	7%	Payment Frequency	Annual	*Truck Advertising Revenue* $65,000
Net Project Cost to be Financed	$ 8,031,241				*Lighting O&M Savings* $5,336
First Year Energy Savings	$ 438,163	(Includes construction year savings)			Total $163,336

	A	B	C	D	E	F	G	H	I	J	K
	Annual Energy Costs without Improvement	Annual Energy Costs with Improvement	Annual Energy Cost Savings (A-B)	O&M Savings (Provided)*	Total Savings (C + D)	Payments for Financing Equipment	Energy Related Cost Savings	Payments for Monitoring & Maintenance Services	Net Annual Benefits	Cumulative Cash Flow	Net Present Value of Cash Flow
0	$824,826	$683,896	$140,931	$0	$140,931	$0	$0	$0	$0	$0	
1	$833,075	$535,843	$297,232	$163,336	$460,568	$881,703	$299,923	$19,619	$100	$100	
2	$841,405	$541,201	$300,204	$163,336	$463,540	$743,744	$299,923	$19,619	$100	$200	
3	$849,819	$546,613	$303,206	$163,336	$466,542	$746,746	$299,923	$19,619	$100	$300	
4	$858,318	$552,079	$306,238	$163,336	$469,574	$769,398	$299,923	$0	$100	$400	
5	$866,901	$557,600	$309,301	$163,336	$472,637	$772,460	$299,923	$0	$100	$500	
6	$875,570	$563,176	$312,394	$163,336	$475,730	$775,553	$299,923	$0	$100	$600	
7	$884,326	$568,808	$315,518	$163,336	$478,854	$778,677	$299,923	$0	$100	$700	
8	$893,169	$574,496	$318,673	$163,336	$482,009	$781,832	$299,923	$0	$100	$800	
9	$902,100	$580,241	$321,860	$163,336	$485,196	$785,019	$299,923	$0	$100	$900	
10	$911,122	$586,043	$325,078	$163,336	$488,414	$788,238	$299,923	$0	$100	$1,000	
11	$920,233	$591,904	$328,329	$163,336	$491,665	$791,488	$299,923	$0	$100	$1,100	
12	$929,435	$597,823	$331,612	$163,336	$494,948	$794,772	$299,923	$0	$100	$1,200	
13	$938,729	$603,801	$334,928	$163,336	$498,264	$103,389	$299,923	$0	$694,799	$695,999	
14	$948,117	$609,839	$338,278	$163,336	$501,614	$0	$299,923	$0	$801,537	$1,497,536	
15	$957,598	$615,937	$341,661	$163,336	$504,997	$0	$299,923	$0	$804,920	$2,302,456	
16	$967,174	$622,097	$345,077	$163,336	$508,413	$0	$299,923	$0	$808,336	$3,110,793	
17	$976,846	$628,318	$348,528	$163,336	$511,864	$0	$299,923	$0	$811,787	$3,922,580	
18	$986,614	$634,601	$352,013	$163,336	$515,349	$0	$299,923	$0	$815,273	$4,737,853	$2,994,438
Total	$16,340,549	$10,510,419	$5,830,130	$2,940,048	$8,770,178	$9,513,020	$5,398,621	$58,858	$4,737,853	$4,737,853	$2,994,438

ECM Chart for ESG's 2nd Cash-Flow Project (Project Including Energy Related Cost Savings)

Proposed Project with Energy Related Cost Savings

		A	B	C	D	E	F	G Annual Utility Savings					H
ECM #	ECM Descrition	Construction Cost	Utility Rebates	Annual Energy Savings	O&M Savings	Total Energy and O&M Savings	Simple Payback	Natural Gas (MCF)	Electric (kwh)	Water Sewer (Kgal)	Coal (MMBTU)	Oil (Kgal)	Annual SPB Shortfall*
ECM #01	Exterior and interior light conversion to LED	$ 694,412	$ -	$ 41,800	$ 5,336	$ 47,136	14.7	-	521,530	-		-	
ECM #02	Add lighting controls to interior & exterior lighting	$ 22,143	$ -	$ 351	$ -	$ 351	63.1	-	4,940	-		-	
ECM #03	Building weatherization and insulation improvements	$ 561,416	$ -	$ 33,635	$ -	$ 33,635	16.7	1,622	117,694	-		5,656	
ECM #04	Remove and replace window A/C units with multi-zone heat pump ductless systems. Repair walls as needed.	$ 2,192,188	$ -	$ 17,022	$ -	$ 17,022	128.8	126	130,472	-		2,428	
ECM #05	Add controls to existing pump VFDs to maintain proper flow.	$ 215,625	$ -	$ 3,537	$ -	$ 3,537	61.0	-	44,720	-		-	
ECM #07	Electric to Gas DHW Heater Conversion	$ 115,000	$ -	$ 1,050	$ -	$ 1,050	109.5	(14)	4,190	-		-	
ECM #08	Evaluate roofing and underfloor plenum systems for inadequate insulation or integrity	$ 6,383	$ -	$ 321	$ -	$ 321	19.9	27	1,185	-		-	
ECM #09	Retro commissioning of building air and control systems	$ 50,313	$ -	$ 16,681	$ -	$ 16,681	3.0	807	132,012	-		-	
ECM #10	Replace unit heaters with gas fired radiant heaters in hatch house and maintenance buildings	$ 265,938	$ -	$ 3,911	$ -	$ 3,911	68.0	197	-	-		863	
ECM #11	Hot water boiler replacement in hatch house #2, fuel switch.	$ 50,313	$ -	$ 3,091	$ -	$ 3,091	16.3	-	-	-		1,527	
ECM #12	Reclaiming energy from heated water	$ 71,875	$ -	$ 2,274	$ -	$ 2,274	31.6	-	(22,810)	-		1,656	
ECM #13	Replace gas fired boilers and hot water heaters with condensing units.	$ 129,375	$ -	$ 1,293	$ -	$ 1,293	100.1	160	-	-		-	
ECM #14	Replace gas fired boilers and hot water heaters with condensing units.	$ 34,500	$ -	$ 493	$ -	$ 493	70.0	61	-	-		-	
ECM #16	Convert electric heaters to Natural Gas Heater	$ 25,875	$ -	$ 2,600	$ -	$ 2,600	10.0	(142)	39,200	-		-	
ECM #18	Convert electric water heater to gas.	$ 14,375	$ -	$ 519	$ -	$ 519	27.7	7	2,006	-		-	
ECM #19	Replace non functional unit heater in production room	$ 50,313	$ -	$ 963	$ -	$ 963	52.3	148	-	-		-	
ECM #20	Convert main office from electric heat and window A/C units to multizone heat pump system	$ 179,688	$ -	$ 5,649	$ -	$ 5,649	31.8	-	67,667	-		-	
ECM #22	Rework system controls/flow in hatch house to optimize boiler heat exchanges	$ 21,563	$ -	$ 7,155	$ -	$ 7,155	3.0	1,192	-	-		-	
ECM #23	Add level controls to upper fishpond to control pump VFD to keep from overflowing system.	$ 28,750	$ -	$ 4,086	$ -	$ 4,086	7.0	-	56,398	-		-	
ECM #24	Hot water boiler replacement in office space/hatch house and possible fuel conversion (propane or CNG).	$ 21,563	$ -	$ 926	$ -	$ 926	23.3	-	-	-		353	
ESCO #01	Replace Process Water Heaters to Propane Heaters	$ 158,125	$ -	$ 271	$ -	$ 271	582.8	-	-	-		3,153	
ESCO #02	Transformer Replacement	$ 264,297	$ -	$ 13,126	$ -	$ 13,126	20.13	-	174,129	-		-	
ESCO #03	Convert Gas/Oil Unit Heaters to Radiant Heat	$ 330,625	$ -	$ 14,625	$ -	$ 14,625	22.6	736	-	-		3,937	
ESCO #04	Spring/Well Pump VFDs	$ 343,563	$ -	$ 42,626	$ -	$ 42,626	8.1	-	576,424	-		-	
ESCO #06	Generator Heat Pump Block Heater	$ 371,055	$ -	$ 34,318	$ -	$ 34,318	10.8	-	476,607	-		-	
ESCO #07	Replace non functional flowmeter	$ 38,813	$ -	$ -	$ -	$ -		-	-	-		-	
ESCO #08	Retrocommissioning	$ 263,063	$ -	$ 13,730	$ -	$ 13,730	19.2	265	140,631	-		784	
ESCO #09	Programmable Thermostats	$ 86,250	$ -	$ 19,989	$ -	$ 19,989	4.3	1,237	4,029	-		4,257	
ESCO #10	BERT Plug Load Controls	$ 5,750	$ -	$ 720	$ -	$ 720	8.0	-	10,086	-		-	
ESCO #11	Truck Advertising Revenue for all Trucks owned by PFBC	$ -	$ -	$ -	$ 65,000	$ 65,000	0.0	-	-	-		-	
ESCO #12	Demand Based Oxygen Injection	$ 373,750	$ -	$ -	$ 78,000	$ 78,000	4.8	-	-	-		-	
ESCO #13	Boiler Replacement	$ 28,750	$ -	$ 4,794	$ -	$ 4,794	6.0	-	-	-		1,914	
ESCO #14	Chilled Water Pump VFD	$ 28,750	$ -	$ 1,482	$ -	$ 1,482	19.4	-	20,333	-		-	
ESCO #15	Cancel Zero use electric account	$ 719	$ -	$ 437	$ -	$ 437	1.6	-	-	-		-	
ESCO #16	Replace Gas Fired Water Heaters with High Eff. Water Heaters	$ 115,000	$ -	$ 300	$ -	$ 300	383.2	38	-	-		-	
ESCO #17	Convert electric DHW heaters to heat pump	$ 92,000	$ -	$ 514	$ -	$ 514	179.0	-	3,755	-		-	
ESCO #18	Electric Vehicle Charging Station	$ 115,000	$ -	$ -	$ -	$ -		-	-	-		-	
ESCO #19	Fish Food Vending Machines at Hatcheries	$ 1,000	$ -	$ -	$ 15,000	$ 15,000	0.1	-	-	-		-	
	Client Contingency (2%)	$ 147,362											
	Energy Consultant Fee (7%)	$ 515,768											
	Totals	$ 8,031,241	$ -	$ 294,289	$ 163,336	$ 457,625	17.5	6,466	2,505,198	0	0	26,527	

Utility Rebates	$0
Energy Related Cost Savings	$5,398,621
Financed Amount	$8,031,241

ECMs Evaluated but not Included

ECM #	ECM Description	A	B	C	D	E	F	G Annual Utility Savings					H
		Construction Cost	Utility Rebates	Annual Energy Savings	O&M Savings	Total Energy and O&M Savings	Simple Payback	Natural Gas (MCF)	Electric (kwh)	Water Sewer (Kgal)	Coal (MMBTU)	Oil (Kgal)	Annual SPB Shortfall
ECM #15	Add gas fired radiant heaters for hatch house	$0	$0	$0	$0	$0		-	-	-		-	$0
ECM #17	Add holding sediment pond/tank to eliminate flow of fish excrement to pub	$0	$0	$0	$0	$0		-	-	-		-	$0
ECM #21	Add filtration/UV system to clean lake water for use/to prevent heating wa	$0	$0	$0	$0	$0		-	-	-		-	$0
ESCO #21	Central Oxygen Generator	$0	$0	$0	$0	$0		-	-	-		-	$0
ESCO #22	Solar Thermal Water Heating System	$0	$0	$0	$0	$0		-	-	-		-	$0

i. Proposed energy analysis demonstrates sound engineering principles and the reasonableness of the proposed savings.

In order to clearly evaluate the proposed project's energy analysis, sound engineering principles and the reasonableness of the proposed savings, ESG has provided detailed energy and savings calculations as well as material cut sheets in the Appendix.

ESG has implemented over 685 projects totaling more than $3.2B, and we feel confident that our energy analysis for this PFBC project reflects that level of experience.

j. Monitoring and Maintenance Services provided

ESG guarantees energy savings without the requirement of a defined, specific maintenance contract. ESG's approach to equipment maintenance is designed to meet the specific needs of the customer in a cost-effective, customer-driven manner and clearly defines the required service work on all installed equipment, trains the customer's in-house staff as required, and identifies any service programs specifically needed to maintain factory warranties.

Based on our proposed project, ESG does not anticipate a need for any further outside maintenance agreements. The current PFBC staff will be trained by ESG to facilitate any necessary Preventive Maintenance on installed equipment. ESG is willing and has the capability to provide both maintenance and energy management services. These services are available to PFBC at their discretion. The terms and conditions for any maintenance services would be aligned with your current purchasing requirements and tailored to meet your specific needs.

k. Description of Measurement & Verification Plan

Measurement & Verification (M&V) must be accurate, cost-effective, and part of a process that helps our customers build a culture of energy efficiency. M&V is essential to validating guaranteed savings for our customers. ESG's M&V personnel will be involved with the project from conception to commissioning, throughout the contract term. The ESG Project Engineers dedicated to the PFBC will serve as your point of contact for M&V information, and will use the corporate resources of our M&V team to provide documentation that the installed systems are performing at guaranteed levels. ESG's methodologies are in full compliance with those defined by International Performance Measurement and Verification Protocol (IPMVP) standards (shown in the table below). ESG is well versed and has significant experience with each of these M&V protocols. ESG will evaluate the best protocol based on your goals, as well as the appropriateness of the M&V option for the specific measures installed.

M&V Option	Performance and Operational Factors	Savings Calculations
Option A Stipulated and measured factors	Based on a combination of measured and stipulated factors. Measurements are a spot or short-term taken at the component or system level. The stipulated factor is supported by historical or manufacturer's data.	Engineering calculations, component or system models.
Option B Measured factors	Based on the spot or short-term measurements were taken at the component or system level when variations in factors are not expected. Based on continuous measurements taken at the component or system level when variations are expected.	Engineering calculations, component or system models.
Option C Utility billing data analysis	Based on long-term, whole-building utility meter, facility level, or sub-meter data.	Based on regression analysis of utility billing meter data.
Option D Calibrated computer simulation	Computer simulation inputs may be based on several of the following: engineering estimates; spot, short-, or long-term measurements of system components; and long-term, whole-building utility meter data.	Based on the computer simulation model calibrated with whole-building and end-use data.

ESG guarantees all energy savings using the most appropriate methodology for accuracy and cost-effectiveness. The factors that determine the appropriate M&V option include the complexity of the ECM, minimizing the risk of savings being achieved, and the potential for changes in key factors between the baseline period and the performance period.

Savings results for our customers have an average positive deviation of more than 10%. We believe this is the strongest evidence of our company's ability to accurately calculate savings and then follow up with our customers to help them achieve the savings they expect and more. ESG will work with the PFBC personnel to define a customized approach for M&V that best reflects your goals. ESG is comfortable working in partnership to customize an M&V process that is accurate and helpful in maximizing savings results for the term of this project.

M&V option selection may vary depending on the ECM and building location. ESG includes the use of either calculated savings, or option A to verify and measure energy savings for this project. However, the final selection is dependent upon your requests and/or measures installed. It is important that a balance is achieved between the cost of the installed ECMs and the costs of the M&V methodology selected.

In this proposal, the majority of our guarantees utilize IPMVP Option A, which strikes the best balance between the accuracy of savings measurement with cost of proving said savings. ESG will evaluate the best protocol based on your goals, as well as the appropriateness of the M&V option for the specific measures installed. ESG guarantees energy savings using the most appropriate methodology for accuracy and cost-effectiveness.

After a solution is installed, energy savings are determined at a single occurrence, continuously, or at regular intervals as outlined in the contract. Baseline energy use, post-installation energy use, and utility savings will be determined using the agreed upon M&V option. Our guarantee ensures that ESG will pay any savings shortfalls, in full, directly to the customer. Any shortfall will be reconciled annually by ESG in an amount equal to the shortfall as calculated by the annual energy audit and accepted by our customer and their designated facilities' representatives.

ECM ID	Energy Conservation Measure "ECM" Description	M&V Option				Measured Variable/Calculated Value
		Electric	Fuel	Water / Sewer	Revenue / Other Cost	
ECM #01	Exterior and interior light conversion to LED	A	N/A	N/A	N/A	Pre/Post Sample Wattage; Calculated Burn Hours
ECM #02	Add lighting controls to interior & exterior lighting	A	N/A	N/A	N/A	Pre/Post Sample Wattage; Calculated Burn Hours
ECM #03	Building weatherization and insulation improvements	A	A	N/A	N/A	Not all components of the building are being affected. Spot measurements and/or assumed variables will be used to accurately determine savings.
ECM #04	Remove and replace window A/C units with multi-zone heat pump ductless systems. Repair walls as needed.	A	A	N/A	N/A	Pre/Post Sample Electric Use; Pre/Post Sample Short-Term Trends or Snap Shot Measurement
ECM #05	Add controls to existing pump VFDs to maintain proper flow.	A	A	A	N/A	Pre/Post Sample Electric; Pre/Post Sample Short-Term Trends or Snap Shot Measurement
ECM #07	Electric to Gas DHW Heater Conversion	A	A	N/A	N/A	Pre/Post Sample kW use of Electric Units. Spot measurements and/or assumed variables will be used to accurately determine savings.
ECM #08	Evaluate roofing and underfloor plenum systems for inadequate insulation or integrity	A	N/A	N/A	N/A	Not all components of the building are being affected. Spot measurements and/or assumed variables will be used to accurately determine savings.
ECM #09	Retro commissioning of building air and control systems	A	A	N/A	N/A	Pre/Post Sample Snap Shot Measurements and/or Sample EMS Trends
ECM #10	Replace unit heaters with gas fired radiant heaters in hatch house and maintenance buildings	N/A	A	N/A	N/A	Pre/Post Sample Electric Use; Spot measurements and/or assumed variables will be used to accurately determine savings.
ECM #11	Hot water boiler replacement in hatch house #2, fuel switch.	N/A	A	N/A	N/A	Pre/Post Sample Combustion Efficiency Measurements.
ECM #12	Reclaiming energy from heated water	A	A	N/A	N/A	Pre/Post Sample Short-Term Trends or Snap Shot Measurement.
ECM #13	Replace gas fired boilers and hot water heaters with condensing units.	N/A	A	N/A	N/A	Pre/Post Sample Combustion Efficiency Measurements
ECM #14	Replace gas fired boilers and hot water heaters with condensing units.	N/A	A	N/A	N/A	Pre/Post Sample Combustion Efficiency Measurements
ECM #16	Convert electric heaters to Natural Gas Heater	A	A	N/A	N/A	Pre/Post Sample kW use of Electric Units. Spot measurements and/or assumed variables will be used to accurately determine savings.

ECM ID	Energy Conservation Measure "ECM" Description	M&V Option				Measured Variable/Calculated Value
		Electric	Fuel	Water / Sewer	Revenue / Other Cost	
ECM #18	Convert electric water heater to gas.	A	A	N/A	N/A	Pre/Post Sample Electric & Fuel Use; Spot measurements and/or assumed variables will be used to accurately determine savings.
ECM #19	Replace nonfunctional unit heater in production room	N/A	A	N/A	N/A	Spot measurements and/or assumed variables will be used to accurately determine savings.
ECM #20	Convert the main office from electric heat and window A/C units to the multi-zone heat pump system	A	A	N/A	N/A	Pre/Post Sample Electric Use; Pre/Post Sample Short-Term Trends or Snap Shot Measurement
ECM #22	Rework system controls/flow in hatch house to optimize boiler heat exchanges	A	A	N/A	N/A	Not all components of the building are being affected. Spot measurements and/or assumed variables will be used to accurately determine savings.
ECM #23	Add level controls to upper fishpond to control pump VFD to keep from the overflowing system.	A	N/A	N/A	N/A	Not all components of the building are being affected. Spot measurements and/or assumed variables will be used to accurately determine savings.
ECM #24	Hot water boiler replacement in office space/hatch house and possible fuel conversion (propane or CNG).	N/A	A	N/A	N/A	Pre/Post Sample Combustion Efficiency Measurements
ESCO #01	Replace Process Water Heaters to Propane Heaters	A	A	A	N/A	Pre Sample Combustion Efficiency Measurements. Spot measurements and/or assumed variables will be used to accurately determine savings.
ESCO #02	Transformer Replacement	A	N/A	N/A	N/A	Pre/Post measurement of representative transformer loading & losses.
ESCO #03	Convert Gas/Oil Unit Heaters to Radiant Heat	N/A	A	N/A	N/A	Pre Sample Combustion Efficiency Measurements. Spot measurements and/or assumed variables will be used to accurately determine savings.
ESCO #04	Spring/Well Pump VFDs	A	N/A	N/A	N/A	Not all components of the building are being affected. Spot measurements and/or assumed variables will be used to accurately determine savings.
ESCO #06	Generator Heat Pump Block Heater	A	N/A	N/A	N/A	Pre/Post Sample kW use of Electric Units
ESCO #07	Replace nonfunctional flowmeter	N/A	N/A	N/A	N/A	N/A as no savings estimated from this measure
ESCO #08	Retro-commissioning	A	A	N/A	N/A	Pre/Post Sample Snap Shot Measurements and/or Sample EMS Trends

ECM ID	Energy Conservation Measure "ECM" Description	M&V Option				Measured Variable/Calculated Value
		Electric	Fuel	Water / Sewer	Revenue / Other Cost	
ESCO #09	Programmable Thermostats	A	A	N/A	N/A	Spot measurements and/or assumed variables will be used to accurately determine savings.
ESCO #10	BERT Plug Load Controls	A	N/A	N/A	N/A	Pre/Post Sample kWh use of Electric Units
ESCO #11	Truck Advertising Revenue for all Trucks owned by PFBC	N/A	N/A	N/A	Calculated	Report from advertising revenue generation
ESCO #12	Demand-Based Oxygen Injection	N/A	N/A	N/A	Calculated	Compare pre/post third party oxygen bills
ESCO #13	Boiler Replacement	N/A	A	N/A	N/A	Pre/Post Sample Combustion Efficiency Measurements
ESCO #14	Chilled Water Pump VFD	A	N/A	N/A	N/A	Spot measurements and/or assumed variables will be used to accurately determine savings.
ESCO #15	Cancel Zero use the electric account	Calculated	N/A	N/A	N/A	Compare pre/post electric utility bills. One time comparison only as there will be no bill in future.
ESCO #16	Replace Gas Fired Water Heaters with High Eff. Water Heaters	N/A	A	N/A	N/A	Pre/Post Sample Electric Use; Spot measurements and/or assumed variables will be used to accurately determine savings
ESCO #17	Convert electric DHW heaters to heat pump	A	N/A	N/A	N/A	Pre/Post Sample Electric Use; Spot measurements and/or assumed variables will be used to accurately determine savings
ESCO #18	Electric Vehicle Charging Station	N/A	N/A	N/A	N/A	N/A as no savings estimated from this measure
ESCO #19	Fish Food Vending Machines at Hatcheries	N/A	N/A	N/A	Calculated	Calculate revenue from food sales from vending machines.

Energy Conservation Measures Considered but not Included at this time

During our initial evaluation of the facilities and potential ECMs, several opportunities were identified for various facilities as noted below in this section, these opportunities, however, were not fully assigned costs and/or savings as further evaluation and design is necessary before costs and benefits can be determined.
ESG's comprehensive IGA will include a careful evaluation of these opportunities and will be included in the final list of recommended ECMs.

Solar PV Renewable Energy Generation – Various Facilities

Present Conditions
No Solar PV systems exist at any of the sites included within this project. However, there are areas available on site to add Solar PV systems.

ESG Proposed Solution
Solar Photovoltaic (PV) systems convert sunlight into electricity. Solar electric panels can be either roof or ground-mounted and connect to your existing electrical service. As long as your solar electrical system is connected to the utility grid, its clean electricity can be used in your facilities, or "banked" into the utility grid for later use. Through a process known as net metering, your utility will accept your excess solar power when you are producing more than you are using and will supply you with reliable grid power when the sun is not shining. Your utility company will base your bill on the difference between your solar production and electric use.

In addition, the support of renewable, Pennsylvania Act 213 The Alternative Energy Portfolio Standards Act of 2004 (AEPS) was enacted to provide economic development opportunities by increasing the mix of alternative electricity generation in Pennsylvania.

AEPS requires that 18 percent of the electricity supplied by Pennsylvania's electric distribution companies (EDCs) and electric generation suppliers (EGSs) come from alternative energy resources by 2021.

EDCs and EGSs can comply with AEPS by procuring Alternative Energy Credits (AECs) from qualified alternative energy resource facilities. Each AEC issued represents a megawatt-hour (equal to 1,000 kilowatt-hours) of generation from a qualified alternative energy system.

An AEC is valid for three years after the date it was created. An AEC can be transferred to another owner or sold at any time by the AEC owner. ESG has utilized the AEC sale price of $31.58/AEC, which was the weighted average price of Solar PV AEC in 2019.

ESG Engineering team has developed preliminary designs and layouts for the Solar Panel installations at various PFBC facilities; these layouts can be found within this Appendix section.

ECM Costs & Savings Breakdown
At this time, ESG has not included this ECM's costs or savings within our proposal as the further evaluation is needed to ensure the roofs and land required for the arrays are indeed available, and there are not any technical or regulatory impediments. ESG team will verify these items during the IGA and include them in the project as applicable.

Onsite/Central Oxygen Generation

Present Conditions
All Hatcheries currently purchase oxygen from a 3rd party supplier. There is no functional equipment on any of the sites to generate oxygen.

ESG Proposed Solution
Prepackaged oxygen generation equipment is widely used for similar applications where significant quantities oxygen is used. During UGA, ESG team will evaluate the various types of equipment available and feasibility to install a central oxygen generation and distribution location where oxygen will be generated and distributed to all hatcheries. Consideration will be given to:

1. Equipment Operating Cost
2. Delivery Truck expenses
3. Staffing costs
4. PFBC propensity for self-generation and distribution of oxygen

Solar Thermal Hot Water System

Present Conditions
Some Hatcheries use large amounts of hot water for raising warm/cool water fish. The water is heated using oil/gas fired hot water heaters.

ESG Proposed Solution
Installing a domestic hot water solar heat system to supplement or preheat the hot water could reduce the amount of gas/oil needed to supply hot water.

The solar water heating system would preheat or supplement the existing hot water system. This would leave the facilities with a redundant hot water heating system which would reduce the load placed on the boilers and water heaters. This will reduce the operations and maintenance costs for the boilers. The existing water heaters will remain in place, or newer more efficient heaters installed, to be used during days of low or no solar availability.

APPENDIX

Energy Related Cost Savings Breakdown for #2 Cash Flow

PA Fish & Boat - Energy Related Cost Avoidance Listing by Proposed ECM

March 30, 2020

Building	Energy Conservation Measure "ECM" Description	ECM ID	ECM Cost	Yearly Financed Cost Avoidance	Total Cost Avoidance By ECM
Bellefonte SFH	Exterior and interior light conversion to LED	ECM #01	$29,854	$1,091	
Benner Spring SFH	Exterior and interior light conversion to LED	ECM #01	$4,392	$0	
Corry SFH	Exterior and interior light conversion to LED	ECM #01	$22,621	$727	
Fairview SFH	Exterior and interior light conversion to LED	ECM #01	$23,401	$727	
Huntsdale SFH	Exterior and interior light conversion to LED	ECM #01	$37,362	$1,454	
Linesville SFH	Exterior and interior light conversion to LED	ECM #01	$24,029	$727	
Oswayo SFH	Exterior and interior light conversion to LED	ECM #01	$23,825	$727	
PFBC HQ Harrisburg	Exterior and interior light conversion to LED	ECM #01	$204,556	$6,544	
Pleasant Gap SFH	Exterior and interior light conversion to LED	ECM #01	$142,773	$6,544	
Pleasant Mount SFH	Exterior and interior light conversion to LED	ECM #01	$72,571	$3,635	
Reynoldsdale SFH	Exterior and interior light conversion to LED	ECM #01	$22,150	$364	
Tionesta SFH	Exterior and interior light conversion to LED	ECM #01	$51,457	$1,818	
Tylersville SFH	Exterior and interior light conversion to LED	ECM #01	$21,854	$364	$25,085
Union City SFH	Exterior and interior light conversion to LED	ECM #01	$13,567	$364	
Bellefonte SFH	Add lighting controls to interior & exterior lighting	ECM #02	$2,025	$0	
Corry SFH	Add lighting controls to interior & exterior lighting	ECM #02	$1,964	$0	
Fairview SFH	Add lighting controls to interior & exterior lighting	ECM #02	$1,486	$0	
Huntsdale SFH	Add lighting controls to interior & exterior lighting	ECM #02	$1,246	$0	
Linesville SFH	Add lighting controls to interior & exterior lighting	ECM #02	$952	$0	
Oswayo SFH	Add lighting controls to interior & exterior lighting	ECM #02	$1,547	$0	
Pleasant Gap SFH	Add lighting controls to interior & exterior lighting	ECM #02	$6,496	$0	
Reynoldsdale SFH	Add lighting controls to interior & exterior lighting	ECM #02	$1,252	$0	
Tionesta SFH	Add lighting controls to interior & exterior lighting	ECM #02	$2,320	$0	
Tylersville SFH	Add lighting controls to interior & exterior lighting	ECM #02	$2,082	$0	
Union City SFH	Add lighting controls to interior & exterior lighting	ECM #02	$773	$0	
Bellefonte SFH	Building weatherization and insulation improvements	ECM #03	$105,616	$2,908	
Benner Spring SFH	Building weatherization and insulation improvements	ECM #03	$57,601	$2,908	
Corry SFH	Building weatherization and insulation improvements	ECM #03	$97,992	$2,908	
Fairview SFH	Building weatherization and insulation improvements	ECM #03	$12,406	$364	
Huntsdale SFH	Building weatherization and insulation improvements	ECM #03	$25,175	$727	
Linesville SFH	Building weatherization and insulation improvements	ECM #03	$26,117	$727	
PFBC HQ Harrisburg	Building weatherization and insulation improvements	ECM #03	$1,294	$0	$16,796
Pleasant Gap SFH	Building weatherization and insulation improvements	ECM #03	$35,559	$1,091	
Pleasant Mount SFH	Building weatherization and insulation improvements	ECM #03	$5,175	$73	
Reynoldsdale SFH	Building weatherization and insulation improvements	ECM #03	$22,738	$727	
Tionesta SFH	Building weatherization and insulation improvements	ECM #03	$83,821	$1,818	
Tylersville SFH	Building weatherization and insulation improvements	ECM #03	$67,298	$2,181	
Union City SFH	Building weatherization and insulation improvements	ECM #03	$20,625	$364	

PA Fish & Boat - Energy Related Cost Avoidance Listing by Proposed ECM

March 30, 2020

Building	Energy Conservation Measure "ECM" Description	ECM ID	ECM Cost	Yearly Financed Cost Avoidance	Total Cost Avoidance By ECM
Bellefonte SFH	Remove and replace window A/C units with multi-zone heat pump ductless systems. Repair walls as needed.	ECM #04	$215,625	$8,362	$88,377
Benner Spring SFH	Remove and replace window A/C units with multi-zone heat pump ductless systems. Repair walls as needed.	ECM #04	$409,688	$13,487	
Corry SFH	Remove and replace window A/C units with multi-zone heat pump ductless systems. Repair walls as needed.	ECM #04	$409,688	$13,487	
Fairview SFH	Remove and replace window A/C units with multi-zone heat pump ductless systems. Repair walls as needed.	ECM #04	$215,625	$8,362	
Huntsdale SFH	Remove and replace window A/C units with multi-zone heat pump ductless systems. Repair walls as needed.	ECM #04	$179,688	$6,544	
Pleasant Gap SFH	Remove and replace window A/C units with multi-zone heat pump ductless systems. Repair walls as needed.	ECM #04	$143,750	$6,544	
Reynoldsdale SFH	Remove and replace window A/C units with multi-zone heat pump ductless systems. Repair walls as needed.	ECM #04	$43,125	$1,818	
Tionesta SFH	Remove and replace window A/C units with multi-zone heat pump ductless systems. Repair walls as needed.	ECM #04	$395,313	$21,813	
Tylersville SFH	Remove and replace window A/C units with multi-zone heat pump ductless systems. Repair walls as needed.	ECM #04	$150,938	$6,544	
Union City SFH	Remove and replace window A/C units with multi-zone heat pump ductless systems. Repair walls as needed.	ECM #04	$28,750	$1,418	
Bellefonte SFH	Add controls to existing pump VFDs to maintain proper flow.	ECM #05	$43,125	$1,818	$9,307
Corry SFH	Add controls to existing pump VFDs to maintain proper flow.	ECM #05	$34,500	$1,454	
Oswayo SFH	Add controls to existing pump VFDs to maintain proper flow.	ECM #05	$11,500	$582	
Pleasant Gap SFH	Add controls to existing pump VFDs to maintain proper flow.	ECM #05	$46,000	$1,818	
Reynoldsdale SFH	Add controls to existing pump VFDs to maintain proper flow.	ECM #05	$40,250	$1,818	
Tionesta SFH	Add controls to existing pump VFDs to maintain proper flow.	ECM #05	$40,250	$1,818	
Linesville SFH	Electric to Gas DHW Heater Conversion	ECM #07	$28,750	$1,018	$4,653
Pleasant Gap SFH	Electric to Gas DHW Heater Conversion	ECM #07	$57,500	$2,908	
Tionesta SFH	Electric to Gas DHW Heater Conversion	ECM #07	$28,750	$727	
PFBC HQ Harrisburg	Evaluate roofing and underfloor plenum systems for inadequate insulation or integrity	ECM #08	$6,383	$0	$0
PFBC HQ Harrisburg	Retro commissioning of building air and control systems	ECM #09	$50,313	$0	$0
Benner Spring SFH	Replace unit heaters with gas fired radiant heaters in hatch house and maintenance buildings	ECM #10	$64,688	$2,181	$9,452
Pleasant Gap SFH	Replace unit heaters with gas fired radiant heaters in hatch house and maintenance buildings	ECM #10	$201,250	$7,271	
Pleasant Mount SFH	Hot water boiler replacement in hatch house #2, fuel switch.	ECM #11	$50,313	$2,545	$2,545
Pleasant Mount SFH	Reclaiming energy from heated water	ECM #12	$71,875	$0	$0
Oswayo SFH	Replace gas fired boilers and hot water heaters with condensing units.	ECM #13	$129,375	$4,363	$4,363
Tionesta SFH	Replace gas fired boilers and hot water heaters with condensing units.	ECM #14	$34,500	$1,818	$1,818
Corry SFH	Convert electric heaters to Natural Gas Heater	ECM #16	$25,875	$1,091	$1,091
Corry SFH	Add holding sediment pond/tank to eliminate flow of fish excrement to public sewer	ECM #17	$1,150,000	$21,813	$21,813

PA Fish & Boat - Energy Related Cost Avoidance Listing by Proposed ECM

March 30, 2020

Building	Energy Conservation Measure "ECM" Description	ECM ID	ECM Cost	Yearly Financed Cost Avoidance	Total Cost Avoidance By ECM
Union City SFH	Convert electric water heater to gas.	ECM #18	$14,375	$509	$509
Union City SFH	Replace non functional unit heater in production room	ECM #19	$50,313	$3,635	$3,635
Linesville SFH	Convert main office from electric heat and window A/C units to multizone heat pump system	ECM #20	$179,688	$6,544	$6,544
Linesville SFH	Add filtration/UV system to clean lake water for use/to prevent heating water in the summer	ECM #21	$1,437,500	$21,813	$21,813
Linesville SFH	Rework system controls/flow in hatch house to optimize boiler heat exchanges	ECM #22	$21,563	$1,309	$1,309
Linesville SFH	Add level controls to upper fishpond to control pump VFD to keep from overflowing system.	ECM #23	$28,750	$945	$945
Tylersville SFH	Hot water boiler replacement in office space/hatch house and possible fuel conversion (propane or CNG).	ECM #24	$21,563	$727	$727
Pleasant Mount SFH	Replace Process Water Heaters to Propane Heaters	ESCO #01	$158,125	$6,544	$6,544
Bellefonte SFH	Transformer Replacement	ESCO #02	$18,868	$0	$0
Benner Spring SFH	Transformer Replacement	ESCO #02	$30,275	$0	
Fairview SFH	Transformer Replacement	ESCO #02	$21,005	$0	
Huntsdale SFH	Transformer Replacement	ESCO #02	$17,357	$0	
Linesville SFH	Transformer Replacement	ESCO #02	$5,221	$0	
Oswayo SFH	Transformer Replacement	ESCO #02	$15,382	$0	
PFBC HQ Harrisburg	Transformer Replacement	ESCO #02	$43,286	$0	
Pleasant Gap SFH	Transformer Replacement	ESCO #02	$11,289	$0	
Pleasant Mount SFH	Transformer Replacement	ESCO #02	$16,276	$0	
Reynoldsdale SFH	Transformer Replacement	ESCO #02	$6,068	$0	
Tionesta SFH	Transformer Replacement	ESCO #02	$22,445	$0	
Tylersville SFH	Transformer Replacement	ESCO #02	$56,825	$0	
Fairview SFH	Convert Gas/Oil Unit Heaters to Radiant Heat	ESCO #03	$7,188	$182	$11,670
Huntsdale SFH	Convert Gas/Oil Unit Heaters to Radiant Heat	ESCO #03	$7,188	$145	
Linesville SFH	Convert Gas/Oil Unit Heaters to Radiant Heat	ESCO #03	$115,000	$3,635	
Oswayo SFH	Convert Gas/Oil Unit Heaters to Radiant Heat	ESCO #03	$43,125	$1,527	
Pleasant Mount SFH	Convert Gas/Oil Unit Heaters to Radiant Heat	ESCO #03	$107,813	$3,999	
Tionesta SFH	Convert Gas/Oil Unit Heaters to Radiant Heat	ESCO #03	$50,313	$2,181	
Bellefonte SFH	Spring/Well Pump VFDs	ESCO #04	$30,188	$1,091	$13,815
Benner Spring SFH	Spring/Well Pump VFDs	ESCO #04	$33,063	$1,091	
Corry SFH	Spring/Well Pump VFDs	ESCO #04	$51,750	$1,818	
Huntsdale SFH	Spring/Well Pump VFDs	ESCO #04	$25,875	$1,091	
Linesville SFH	Spring/Well Pump VFDs	ESCO #04	$77,625	$3,635	
Oswayo SFH	Spring/Well Pump VFDs	ESCO #04	$43,125	$1,818	
Pleasant Mount SFH	Spring/Well Pump VFDs	ESCO #04	$25,875	$1,091	
Reynoldsdale SFH	Spring/Well Pump VFDs	ESCO #04	$56,063	$2,181	

PA Fish & Boat - Energy Related Cost Avoidance Listing by Proposed ECM

March 30, 2020

Building	Energy Conservation Measure "ECM" Description	ECM ID	ECM Cost	Yearly Financed Cost Avoidance	Total Cost Avoidance By ECM
Bellefonte SFH	Solar PV	ESCO #05	$149,500	$0	$0
Corry SFH	Solar PV	ESCO #05	$2,035,500	$0	
Fairview SFH	Solar PV	ESCO #05	$213,900	$0	
Huntsdale SFH	Solar PV	ESCO #05	$1,803,488	$0	
Linesville SFH	Solar PV	ESCO #05	$233,450	$0	
Oswayo SFH	Solar PV	ESCO #05	$517,500	$0	
PFBC HQ Harrisburg	Solar PV	ESCO #05	$197,800	$0	
Pleasant Gap SFH	Solar PV	ESCO #05	$386,400	$0	
Reynoldsdale SFH	Solar PV	ESCO #05	$1,725,000	$0	
Tylersville SFH	Solar PV	ESCO #05	$641,700	$0	
Bellefonte SFH	Generator Heat Pump Block Heater	ESCO #06	$38,669	$364	$6,544
Benner Spring SFH	Generator Heat Pump Block Heater	ESCO #06	$38,669	$364	
Corry SFH	Generator Heat Pump Block Heater	ESCO #06	$19,334	$364	
Fairview SFH	Generator Heat Pump Block Heater	ESCO #06	$19,334	$727	
Huntsdale SFH	Generator Heat Pump Block Heater	ESCO #06	$77,338	$1,818	
Linesville SFH	Generator Heat Pump Block Heater	ESCO #06	$19,334	$364	
Oswayo SFH	Generator Heat Pump Block Heater	ESCO #06	$19,334	$364	
PFBC HQ Harrisburg	Generator Heat Pump Block Heater	ESCO #06	$23,036	$364	
Pleasant Gap SFH	Generator Heat Pump Block Heater	ESCO #06	$19,334	$364	
Pleasant Mount SFH	Generator Heat Pump Block Heater	ESCO #06	$19,334	$364	
Reynoldsdale SFH	Generator Heat Pump Block Heater	ESCO #06	$19,334	$364	
Tionesta SFH	Generator Heat Pump Block Heater	ESCO #06	$38,669	$364	
Tylersville SFH	Generator Heat Pump Block Heater	ESCO #06	$19,334	$364	
Bellefonte SFH	Replace non functional flowmeter	ESCO #07	$21,563	$1,454	$2,545
Tionesta SFH	Replace non functional flowmeter	ESCO #07	$17,250	$1,091	
Bellefonte SFH	Retrocommissioning	ESCO #08	$7,188	$0	$0
Benner Spring SFH	Retrocommissioning	ESCO #08	$21,563	$0	
Corry SFH	Retrocommissioning	ESCO #08	$7,188	$0	
Fairview SFH	Retrocommissioning	ESCO #08	$21,563	$0	
Huntsdale SFH	Retrocommissioning	ESCO #08	$35,938	$0	
Linesville SFH	Retrocommissioning	ESCO #08	$35,938	$0	
Oswayo SFH	Retrocommissioning	ESCO #08	$21,563	$0	
Pleasant Gap SFH	Retrocommissioning	ESCO #08	$28,750	$0	
Pleasant Mount SFH	Retrocommissioning	ESCO #08	$7,188	$0	
Reynoldsdale SFH	Retrocommissioning	ESCO #08	$21,563	$0	
Tionesta SFH	Retrocommissioning	ESCO #08	$21,563	$0	
Tylersville SFH	Retrocommissioning	ESCO #08	$21,563	$0	
Union City SFH	Retrocommissioning	ESCO #08	$11,500	$0	

PA Fish & Boat - Energy Related Cost Avoidance Listing by Proposed ECM

March 30, 2020

Building	Energy Conservation Measure "ECM" Description	ECM ID	ECM Cost	Yearly Financed Cost Avoidance	Total Cost Avoidance By ECM
Bellefonte SFH	Programmable Thermostats	ESCO #09	$4,313	$182	$2,181
Corry SFH	Programmable Thermostats	ESCO #09	$7,188	$182	
Fairview SFH	Programmable Thermostats	ESCO #09	$4,313	$145	
Huntsdale SFH	Programmable Thermostats	ESCO #09	$4,313	$109	
Linesville SFH	Programmable Thermostats	ESCO #09	$12,938	$254	
Oswayo SFH	Programmable Thermostats	ESCO #09	$7,188	$145	
Pleasant Gap SFH	Programmable Thermostats	ESCO #09	$7,188	$182	
Pleasant Mount SFH	Programmable Thermostats	ESCO #09	$14,375	$364	
Reynoldsdale SFH	Programmable Thermostats	ESCO #09	$4,313	$109	
Tionesta SFH	Programmable Thermostats	ESCO #09	$7,188	$218	
Tylersville SFH	Programmable Thermostats	ESCO #09	$7,188	$145	
Union City SFH	Programmable Thermostats	ESCO #09	$5,750	$145	
Bellefonte SFH	BERT Plug Load Controls	ESCO #10	$359	$0	$0
Benner Spring SFH	BERT Plug Load Controls	ESCO #10	$359	$0	
Corry SFH	BERT Plug Load Controls	ESCO #10	$359	$0	
Fairview SFH	BERT Plug Load Controls	ESCO #10	$359	$0	
Huntsdale SFH	BERT Plug Load Controls	ESCO #10	$359	$0	
Linesville SFH	BERT Plug Load Controls	ESCO #10	$359	$0	
Oswayo SFH	BERT Plug Load Controls	ESCO #10	$359	$0	
PFBC HQ Harrisburg	BERT Plug Load Controls	ESCO #10	$1,078	$0	
Pleasant Gap SFH	BERT Plug Load Controls	ESCO #10	$359	$0	
Pleasant Mount SFH	BERT Plug Load Controls	ESCO #10	$359	$0	
Reynoldsdale SFH	BERT Plug Load Controls	ESCO #10	$359	$0	
Tionesta SFH	BERT Plug Load Controls	ESCO #10	$359	$0	
Tylersville SFH	BERT Plug Load Controls	ESCO #10	$359	$0	
Union City SFH	BERT Plug Load Controls	ESCO #10	$359	$0	
PFBC HQ Harrisburg	Truck Advertising Revenue for all Trucks owned by PFBC	ESCO #11	$0	$0	
Bellefonte SFH	Demand Based Oxygen Injection	ESCO #12	$28,750	$1,454	$18,904
Benner Spring SFH	Demand Based Oxygen Injection	ESCO #12	$28,750	$1,454	
Corry SFH	Demand Based Oxygen Injection	ESCO #12	$28,750	$1,454	
Fairview SFH	Demand Based Oxygen Injection	ESCO #12	$28,750	$1,454	
Huntsdale SFH	Demand Based Oxygen Injection	ESCO #12	$28,750	$1,454	
Linesville SFH	Demand Based Oxygen Injection	ESCO #12	$28,750	$1,454	
Oswayo SFH	Demand Based Oxygen Injection	ESCO #12	$28,750	$1,454	
Pleasant Gap SFH	Demand Based Oxygen Injection	ESCO #12	$28,750	$1,454	
Pleasant Mount SFH	Demand Based Oxygen Injection	ESCO #12	$28,750	$1,454	
Reynoldsdale SFH	Demand Based Oxygen Injection	ESCO #12	$28,750	$1,454	
Tionesta SFH	Demand Based Oxygen Injection	ESCO #12	$28,750	$1,454	
Tylersville SFH	Demand Based Oxygen Injection	ESCO #12	$28,750	$1,454	
Union City SFH	Demand Based Oxygen Injection	ESCO #12	$28,750	$1,454	
Benner Spring SFH	Boiler Replacement	ESCO #13	$14,375	$727	$1,091
Pleasant Mount SFH	Boiler Replacement	ESCO #13	$14,375	$364	
PFBC HQ Harrisburg	Chilled Water Pump VFD	ESCO #14	$28,750	$0	$0
Fairview SFH	Cancel Zero use electric account	ESCO #15	$719	$0	$0

PA Fish & Boat - Energy Related Cost Avoidance Listing by Proposed ECM

March 30, 2020

Building	Energy Conservation Measure "ECM" Description	ECM ID	ECM Cost	Yearly Financed Cost Avoidance	Total Cost Avoidance By ECM
Fairview SFH	Replace Gas Fired Water Heaters with High Eff. Water Heaters	ESCO #16	$35,938	$1,091	$3,999
Linesville SFH	Replace Gas Fired Water Heaters with High Eff. Water Heaters	ESCO #16	$35,938	$1,091	
PFBC HQ Harrisburg	Replace Gas Fired Water Heaters with High Eff. Water Heaters	ESCO #16	$43,125	$1,818	
Huntsdale SFH	Convert electric DHW heaters to heat pump	ESCO #17	$17,250	$727	$3,490
Pleasant Mount SFH	Convert electric DHW heaters to heat pump	ESCO #17	$17,250	$727	
Reynoldsdale SFH	Convert electric DHW heaters to heat pump	ESCO #17	$17,250	$582	
Tylersville SFH	Convert electric DHW heaters to heat pump	ESCO #17	$40,250	$1,454	
PFBC HQ Harrisburg	Electric Vehicle Charging Station	ESCO #18	$115,000	$8,362	$8,362
PFBC HQ Harrisburg	Fish Food Vending Machines at Hatcheries	ESCO #19	$1,000	$0	$0
		TOTAL	**$17,859,849**	**$299,923**	**$299,923**

Energy Savings Calculations including Line by Line

Pennsylvania Fish & Boat Commission

Energy Saving Calculations

PA Fish & Boat Commission

Lighting Scope

Line x Line

ID #	Location					Existing Fixture				Proposed Fixture						PeakDemand			Usage			Controls	
	Building # : Name	Floor	Area	Sub Area / Room	Usage Group	Fixture	Quantity	Input Wattage	Hours of Operation	ECM	Quantity	Input Wattage	Hours of Operation	Occ Sensor Type	Occ Sensor Qty	Pre	Post	Savings	Pre	Post	Savings	Savings %	Savings
1	PFBC HQ Harrisburg	2nd Floor		Stairs A	Stairwell	4' Wall Bracket BP 2L 32W T8	2	59	8760	RT, 4' 10.5W SE LED 2L	2	21	8760	-	0	0.1	0.0	0.1	1,034	368	666	25%	0
2	PFBC HQ Harrisburg	2nd Floor		Law Enforcement 226	Open Office	2x2 Prism Rec 2L FT40	4	72	2860	RT, LED 17W 4P 2G11 2L	4	34	2860	-	0	0.2	0.1	0.1	824	389	435	15%	0
3	PFBC HQ Harrisburg	2nd Floor		Law Enforcement 226	Open Office	8' Direct/Indirect BP 6L 32W T8 DS	12	175	2860	RT, 4' 10.5W SE LED 6L	12	63	2860	-	0	1.7	0.6	1.1	6,006	2,162	3,844	15%	0
4	PFBC HQ Harrisburg	2nd Floor		Private Office 225	Private Office	4' Direct/Indirect BP 4L 32W T8 DS	2	118	1750	RT, 4' 10.5W SE LED 4L	2	42	1750	-	0	0.2	0.1	0.1	413	147	266	30%	0
5	PFBC HQ Harrisburg	2nd Floor		Private Office 224	Private Office	8' Direct/Indirect BP 6L 32W T8 DS	2	175	1750	RT, 4' 10.5W SE LED 6L	2	63	1750	-	0	0.3	0.1	0.2	613	221	392	30%	0
6	PFBC HQ Harrisburg	2nd Floor		Private Office 223	Private Office	8' Direct/Indirect BP 6L 32W T8 DS	2	175	1750	RT, 4' 10.5W SE LED 6L	2	63	1750	-	0	0.3	0.1	0.2	613	221	392	30%	0
7	PFBC HQ Harrisburg	2nd Floor		Executive Office 209	Open Office	8' Direct/Indirect BP 6L 32W T8 DS	12	175	2860	RT, 4' 10.5W SE LED 6L	12	63	2860	-	0	1.7	0.6	1.1	6,006	2,162	3,844	15%	0
8	PFBC HQ Harrisburg	2nd Floor		Executive Office 209	Open Office	8' Direct/Indirect BP 6L 32W T8 DS	12	175	2860	RT, 4' 10.5W SE LED 6L	12	63	2860	-	0	1.7	0.6	1.1	6,006	2,162	3,844	15%	0
9	PFBC HQ Harrisburg	2nd Floor		Private Office 208	Private Office	4' Direct/Indirect BP 4L 32W T8 DS	2	118	1750	RT, 4' 10.5W SE LED 4L	2	42	1750	-	0	0.2	0.1	0.1	413	147	266	30%	0
10	PFBC HQ Harrisburg	2nd Floor		Private Office 207	Private Office	4' Direct/Indirect BP 4L 32W T8 DS	2	118	1750	RT, 4' 10.5W SE LED 4L	2	42	1750	-	0	0.2	0.1	0.1	413	147	266	30%	0
11	PFBC HQ Harrisburg	2nd Floor		Private Office 206	Private Office	8' Direct/Indirect BP 6L 32W T8 DS	4	175	1750	RT, 4' 10.5W SE LED 6L	4	63	1750	-	0	0.6	0.2	0.4	1,225	441	784	30%	0
12	PFBC HQ Harrisburg	2nd Floor		Conference Room 205	Conference Room	8' Direct/Indirect BP 4L 32W T8 DS	4	118	2000	RT, 4' 10.5W SE LED 4L	4	42	2000	-	0	0.4	0.1	0.2	944	336	608	35%	0
13	PFBC HQ Harrisburg	2nd Floor		Conference Room 205	Conference Room	7" Rec Can Hal 250W PAR38	4	250	2000	LED 26W PAR38 Replacement	4	26	2000	-	0	0.8	0.1	0.7	2,000	208	1,792	35%	0
14	PFBC HQ Harrisburg	2nd Floor		Private Office 204	Private Office	12' Direct/Indirect BP 9L 32W T8 DS	2	264	1750	RT, 4' 10.5W SE LED 9L	2	95	1750	-	0	0.4	0.2	0.3	924	331	593	30%	0
15	PFBC HQ Harrisburg	2nd Floor		Private Office 203	Private Office	12' Direct/Indirect BP 9L 32W T8 DS	2	264	1750	RT, 4' 10.5W SE LED 9L	2	95	1750	-	0	0.4	0.2	0.3	924	331	593	30%	0
16	PFBC HQ Harrisburg	2nd Floor		Private Office 202	Private Office	8' Direct/Indirect BP 6L 32W T8 DS	2	175	1750	RT, 4' 10.5W SE LED 6L	2	63	1750	-	0	0.3	0.1	0.2	613	221	392	30%	0
17	PFBC HQ Harrisburg	2nd Floor		Private Office 201	Private Office	4' Direct/Indirect BP 4L 32W T8 DS	2	118	1750	RT, 4' 10.5W SE LED 4L	2	42	1750	-	0	0.2	0.1	0.1	413	147	266	30%	0
18	PFBC HQ Harrisburg	2nd Floor		Corridor 210	Hallways and Common Areas	2x2 Prism Rec 2L FT40	4	72	8760	RT, LED 17W 4P 2G11 2L	4	34	8760	-	0	0.2	0.1	0.1	2,523	1,191	1,332	0%	0
19	PFBC HQ Harrisburg	2nd Floor	Expansion	Corridor 210	Hallways and Common Areas	2x2 Par Rec 2L FT40	2	72	8760	RT, LED 17W 4P 2G11 2L	2	34	8760	-	0	0.1	0.1	0.1	1,261	596	666	0%	0
20	PFBC HQ Harrisburg	2nd Floor		Elevator Lobby	Hallways and Common Areas	Wall Sconce MH 175W	2	215	8760	LED HID Omni Retrofit 4 kLm Med Base	2	25	8760	-	0	0.3	0.0	0.3	3,767	438	3,329	0%	0
21	PFBC HQ Harrisburg	2nd Floor		Elevator	Exit Signs/Night Lights	4' Strip BP 1L 32W T8	2	31	8760	RT, 4' 10.5W SE LED 1L	2	11	8760	-	0	0.1	0.0	0.0	543	184	359	0%	0
22	PFBC HQ Harrisburg	2nd Floor		Corridor 219	Hallways and Common Areas	2x2 Prism Rec 2L FT40	1	72	8760	RT, LED 17W 4P 2G11 2L	1	34	8760	-	0	0.1	0.0	0.0	631	298	333	0%	0
23	PFBC HQ Harrisburg	2nd Floor		Corridor 219	Hallways and Common Areas	2x2 Prism Rec 2L FT40	1	72	8760	RT, LED 17W 4P 2G11 2L	1	34	8760	-	0	0.1	0.0	0.0	631	298	333	0%	0
24	PFBC HQ Harrisburg	2nd Floor		Coffee Area 216	Open Office	4' Wrap BP 2L 32W T8	1	59	2431	RT, 4' 10.5W SE LED 2L	1	21	2431	-	0	0.0	0.0	0.0	143	51	92	15%	0
25	PFBC HQ Harrisburg	2nd Floor		Storage 220	Storage Room	4' Wrap BP 2L 32W T8	1	59	819	RT, 4' 10.5W SE LED 2L	1	21	819	-	0	0.0	0.0	0.0	48	17	31	25%	0
26	PFBC HQ Harrisburg	2nd Floor		Men's Restroom 218	Restroom	2x2 Prism Rec 2L FT40	1	72	2860	RT, LED 17W 4P 2G11 2L	1	34	2860	-	0	0.1	0.0	0.0	206	97	109	45%	0
27	PFBC HQ Harrisburg	2nd Floor		Men's Restroom 218	Restroom	8' Linear Slot BP 4L 32W T8	3	112	2860	RT, 4' 10.5W SE LED 4L	3	42	2860	-	0	0.3	0.1	0.2	961	360	601	45%	0
28	PFBC HQ Harrisburg	2nd Floor		Men's Restroom 218	Restroom	4' Linear Slot BP 2L 32W T8	2	59	2860	RT, 4' 10.5W SE LED 2L	2	21	2860	-	0	0.1	0.0	0.1	337	120	217	45%	0
29	PFBC HQ Harrisburg	2nd Floor		Janitorial Closet 221	Janitor Closet / Inactive Storage	4' Wrap BP 2L 32W T8	1	59	375	RT, 4' 10.5W SE LED 2L	1	21	375	-	0	0.0	0.0	0.0	22	8	14	25%	0
30	PFBC HQ Harrisburg	2nd Floor		Women's Restroom 217	Restroom	8' Linear Slot BP 4L 32W T8	3	112	2860	RT, 4' 10.5W SE LED 4L	3	42	2860	-	0	0.3	0.1	0.2	961	360	601	45%	0
31	PFBC HQ Harrisburg	2nd Floor		Women's Restroom 217	Restroom	4' Linear Slot BP 2L 32W T8	2	59	2860	RT, 4' 10.5W SE LED 2L	2	21	2860	-	0	0.1	0.0	0.1	337	120	217	45%	0
32	PFBC HQ Harrisburg	2nd Floor		Women's Restroom 217	Restroom	3' Linear Slot 2L T8	1	46	2860	RT, 3' 12W SE LED 2L	1	24	2860	-	0	0.0	0.0	0.0	132	69	63	45%	0
33	PFBC HQ Harrisburg	2nd Floor		Mechanical Chase	Mechanical/Electrical Room	4' Strip BP 1L 32W T8	2	31	1092	RT, 4' 10.5W SE LED 1L	2	11	1092	-	0	0.0	0.0	0.0	68	23	45	25%	0
34	PFBC HQ Harrisburg	2nd Floor		Open Office 213	Open Office	8' Direct/Indirect BP 6L 32W T8 DS	3	175	2431	RT, 4' 10.5W SE LED 6L	3	63	2431	-	0	0.4	0.2	0.3	1,276	459	817	15%	0
35	PFBC HQ Harrisburg	2nd Floor		Private Office 215	Private Office	4' Direct/Indirect BP 4L 32W T8 DS	2	118	1750	RT, 4' 10.5W SE LED 4L	2	42	1750	-	0	0.2	0.1	0.1	413	147	266	30%	0
36	PFBC HQ Harrisburg	2nd Floor		Private Office 214	Private Office	4' Direct/Indirect BP 4L 32W T8 DS	2	118	1750	RT, 4' 10.5W SE LED 4L	2	42	1750	-	0	0.2	0.1	0.1	413	147	266	30%	0
37	PFBC HQ Harrisburg	2nd Floor		Telephone Room 212	Mechanical/Electrical Room	4' Industrial BP 2L 32W T8	1	59	819	RT, 4' 10.5W SE LED 2L	1	21	819	-	0	0.0	0.0	0.0	48	17	31	25%	0
38	PFBC HQ Harrisburg	2nd Floor		Electric Room 211	Mechanical/Electrical Room	4' Industrial BP 2L 32W T8	1	59	819	RT, 4' 10.5W SE LED 2L	1	21	819	-	0	0.0	0.0	0.0	48	17	31	25%	0
39	PFBC HQ Harrisburg	2nd Floor		Stairs B	Stairwell	4' Wall Bracket BP 2L 32W T8	2	59	8760	RT, 4' 10.5W SE LED 2L	2	21	8760	-	0	0.1	0.0	0.1	1,034	368	666	25%	0
40	PFBC HQ Harrisburg	2nd Floor	Expansion	Vestibule	Hallways and Common Areas	2x2 Par Rec 2L FT40	1	72	8760	RT, LED 17W 4P 2G11 2L	1	34	8760	-	0	0.1	0.0	0.0	631	298	333	0%	0
41	PFBC HQ Harrisburg	2nd Floor	Expansion	Closet 227	Storage Room	2x2 Prism Rec 2L FT40	1	72	1092	RT, LED 17W 4P 2G11 2L	1	34	1092	-	0	0.0	0.0	0.0	79	37	41	25%	0
42	PFBC HQ Harrisburg	2nd Floor	Expansion	Closet 226	Storage Room	2x2 Prism Rec 2L FT40	1	72	1092	RT, LED 17W 4P 2G11 2L	1	34	1092	-	0	0.0	0.0	0.0	79	37	41	25%	0
43	PFBC HQ Harrisburg	2nd Floor	Expansion	Open Area Corridors	Open Office	6' Direct/Indirect 4L T8	4	87	2860	RT, 3' 12W SE LED 4L	4	48	2860	-	0	0.3	0.2	0.1	995	549	446	15%	0
44	PFBC HQ Harrisburg	2nd Floor	Expansion	Open Area Corridors	Open Office	8' Direct/Indirect BP 4L 32W T8	4	112	2860	RT, 4' 10.5W SE LED 4L	4	42	2860	-	0	0.4	0.1	0.2	1,281	480	801	15%	0
45	PFBC HQ Harrisburg	2nd Floor	Expansion	Open Area Corridors	Open Office	4' Direct/Indirect BP 2L 32W T8	1	59	2860	RT, 4' 10.5W SE LED 2L	1	21	2860	-	0	0.0	0.0	0.0	169	60	109	15%	0
46	PFBC HQ Harrisburg	2nd Floor	Expansion	Open Area Corridors	Open Office	3' Direct/Indirect 2L 25W T8	1	46	2860	RT, 3' 12W SE LED 2L	1	24	2860	-	0	0.0	0.0	0.0	132	69	63	15%	0
47	PFBC HQ Harrisburg	2nd Floor	Expansion	Open Area Offices / Files	Open Office	8' Direct/Indirect BP 6L 32W T8 DS	8	175	2860	RT, 4' 10.5W SE LED 6L	8	63	2860	-	0	1.1	0.4	0.7	4,004	1,441	2,563	15%	0
48	PFBC HQ Harrisburg	2nd Floor	Expansion	Open Area Corridors	Open Office	Decorative 6L FT36	2	212	2860	RT, LED 17W 4P 2G11 6L	2	102	2860	-	0	0.3	0.2	0.2	1,213	583	629	15%	0
49	PFBC HQ Harrisburg	2nd Floor	Expansion	Conference Room 212	Conference Room	8' Direct/Indirect BP 4L 32W T8	6	112	2000	RT, 4' 10.5W SE LED 4L	6	42	2000	-	0	0.5	0.2	0.3	1,344	504	840	35%	0
50	PFBC HQ Harrisburg	2nd Floor	Expansion	Conference Room 212	Conference Room	Decorative 6L FT55	2	336	2000	RT, LED 17W 4P 2G11 6L	2	102	2000	-	0	0.5	0.2	0.4	1,344	408	936	35%	0
51	PFBC HQ Harrisburg	2nd Floor	Expansion	Open Area PPC Offices	Open Office	8' Direct/Indirect BP 6L 32W T8 DS	6	175	2860	RT, 4' 10.5W SE LED 6L	6	63	2860	-	0	0.8	0.3	0.5	3,003	1,081	1,922	15%	0
52	PFBC HQ Harrisburg	2nd Floor	Expansion	Private Office 225 - HR	Private Office	8' Direct/Indirect BP 6L 32W T8 DS	1	175	1750	RT, 4' 10.5W SE LED 6L	1	63	1750	-	0	0.1	0.1	0.1	306	110	196	30%	0
53	PFBC HQ Harrisburg	2nd Floor	Expansion	Private Office 224 - HR	Private Office	8' Direct/Indirect BP 6L 32W T8 DS	1	175	1750	RT, 4' 10.5W SE LED 6L	1	63	1750	-	0	0.1	0.1	0.1	306	110	196	30%	0
54	PFBC HQ Harrisburg	2nd Floor	Expansion	Private Office 223 - HR	Private Office	8' Direct/Indirect BP 6L 32W T8 DS	1	175	1750	RT, 4' 10.5W SE LED 6L	1	63	1750	-	0	0.1	0.1	0.1	306	110	196	30%	0
55	PFBC HQ Harrisburg	2nd Floor	Expansion	Private Office 222 - HR	Private Office	8' Direct/Indirect BP 6L 32W T8 DS	2	175	1750	RT, 4' 10.5W SE LED 6L	2	63	1750	-	0	0.3	0.1	0.2	613	221	392	30%	0
56	PFBC HQ Harrisburg	2nd Floor	Expansion	Private Office 221 - HR	Private Office	8' Direct/Indirect BP 6L 32W T8 DS	1	175	1750	RT, 4' 10.5W SE LED 6L	1	63	1750	-	0	0.1	0.1	0.1	306	110	196	30%	0
57	PFBC HQ Harrisburg	2nd Floor	Expansion	Private Office 219	Private Office	8' Direct/Indirect BP 6L 32W T8 DS	1	175	1750	RT, 4' 10.5W SE LED 6L	1	63	1750	-	0	0.1	0.1	0.1	306	110	196	30%	0
58	PFBC HQ Harrisburg	2nd Floor	Expansion	Private Office 218	Private Office	8' Direct/Indirect BP 6L 32W T8 DS	2	175	1750	RT, 4' 10.5W SE LED 6L	2	63	1750	-	0	0.3	0.1	0.2	613	221	392	30%	0
59	PFBC HQ Harrisburg	2nd Floor	Expansion	Private Office 217	Private Office	8' Direct/Indirect BP 6L 32W T8 DS	1	175	1750	RT, 4' 10.5W SE LED 6L	1	63	1750	-	0	0.1	0.1	0.1	306	110	196	30%	0
60	PFBC HQ Harrisburg	2nd Floor	Expansion	Private Office 216	Private Office	8' Direct/Indirect BP 6L 32W T8 DS	1	175	1750	RT, 4' 10.5W SE LED 6L	1	63	1750	-	0	0.1	0.1	0.1	306	110	196	30%	0
61	PFBC HQ Harrisburg	2nd Floor	Expansion	Private Office 215	Private Office	8' Direct/Indirect BP 6L 32W T8 DS	1	175	1750	RT, 4' 10.5W SE LED 6L	1	63	1750	-	0	0.1	0.1	0.1	306	110	196	30%	0
62	PFBC HQ Harrisburg	2nd Floor	Expansion	Coffee Area 213	Private Office	8' Direct/Indirect BP 4L 32W T8 DS	1	118	1750	RT, 4' 10.5W SE LED 4L	1	42	1750	-	0	0.1	0.0	0.1	207	74	133	30%	0
63	PFBC HQ Harrisburg	2nd Floor	Expansion	Private Office 210 - PPC	Private Office	8' Direct/Indirect BP 6L 32W T8 DS	1	175	1750	RT, 4' 10.5W SE LED 6L	1	63	1750	-	0	0.1	0.1	0.1	306	110	196	30%	0
64	PFBC HQ Harrisburg	2nd Floor	Expansion	Private Office 209 - PPC	Private Office	8' Direct/Indirect BP 6L 32W T8 DS	1	175	1750	RT, 4' 10.5W SE LED 6L	1	63	1750	-	0	0.1	0.1	0.1	306	110	196	30%	0
65	PFBC HQ Harrisburg	2nd Floor	Expansion	Private Office 208 - PPC	Private Office	8' Direct/Indirect BP 6L 32W T8 DS	1	175	1750	RT, 4' 10.5W SE LED 6L	1	63	1750	-	0	0.1	0.1	0.1	306	110	196	30%	0
66	PFBC HQ Harrisburg	2nd Floor	Expansion	Private Office 207 - PPC	Private Office	8' Direct/Indirect BP 6L 32W T8 DS	1	175	1750	RT, 4' 10.5W SE LED 6L	1	63	1750	-	0	0.1	0.1	0.1	306	110	196	30%	0
67	PFBC HQ Harrisburg	2nd Floor	Expansion	Private Office 206 - Division Chief	Private Office	8' Direct/Indirect BP 6L 32W T8 DS	1	175	1750	RT, 4' 10.5W SE LED 6L	1	63	1750	-	0	0.1	0.1	0.1	306	110	196	30%	0
68	PFBC HQ Harrisburg	2nd Floor	Expansion	Private Office 206 - Division Chief	Private Office	4' Direct/Indirect BP 4L 32W T8 DS	1	118	1750	RT, 4' 10.5W SE LED 4L	1	42	1750	-	0	0.1	0.0	0.1	207	74	133	30%	0
69	PFBC HQ Harrisburg	2nd Floor	Expansion	Private Office 205 - PPC	Private Office	8' Direct/Indirect BP 6L 32W T8 DS	2	175	1750	RT, 4' 10.5W SE LED 6L	2	63	1750	-	0	0.3	0.1	0.2	613	221	392	30%	0
70	PFBC HQ Harrisburg	2nd Floor	Expansion	Private Office 204 - PPC	Private Office	8' Direct/Indirect BP 6L 32W T8 DS	1	175	1750	RT, 4' 10.5W SE LED 6L	1	63	1750	-	0	0.1	0.1	0.1	306	110	196	30%	0
71	PFBC HQ Harrisburg	2nd Floor	Expansion	Private Office 203 - PPC	Private Office	8' Direct/Indirect BP 6L 32W T8 DS	1	175	1750	RT, 4' 10.5W SE LED 6L	1	63	1750	-	0	0.1	0.1	0.1	306	110	196	30%	0
72	PFBC HQ Harrisburg	2nd Floor	Expansion	Private Office 202 - PPC	Private Office	8' Direct/Indirect BP 6L 32W T8 DS	1	175	1750	RT, 4' 10.5W SE LED 6L	1	63	1750	-	0	0.1	0.1	0.1	306	110	196	30%	0
73	PFBC HQ Harrisburg	2nd Floor	Expansion	Private Office 201 - PPC	Private Office	8' Direct/Indirect BP 6L 32W T8 DS	1	175	1750	RT, 4' 10.5W SE LED 6L	1	63	1750	-	0	0.1	0.1	0.1	306	110	196	30%	0
74	PFBC HQ Harrisburg	1st Floor		Stairs A	Stairwell	4' Wall Bracket BP 2L 32W T8	2	59	8760	RT, 4' 10.5W SE LED 2L	2	21	8760	-	0	0.1	0.0	0.1	1,034	368	666	25%	0
75	PFBC HQ Harrisburg	1st Floor		Corridor to Main Lobby	Hallways and Common Areas	8" Rec Can CFL 26W 4P 2L	4	50	8760	RT, LED 16W 2P G24D/Q H 2L	4	32	8760	-	0	0.2	0.1	0.1	1,752	1,121	631	0%	0
76	PFBC HQ Harrisburg	1st Floor		Corridor to Main Lobby	Hallways and Common Areas	Track Head Hal 50W MR16	5	60	8760	LED 7W MR16 Replacement	5	7	8760	-	0	0.2	0.0	0.2	2,628	307	2,321	0%	0
77	PFBC HQ Harrisburg	1st Floor		Main Entrance Vestibule 126	Hallways and Common Areas	8" Rec Can CFL 26W 4P 2L	3	50	8760	RT, LED 16W 2P G24D/Q H 2L	3	32	8760	-	0	0.1	0.1	0.0	1,314	841	473	0%	0
78	PFBC HQ Harrisburg	1st Floor		Lobby 125 (Open to Above)	Hallways and Common Areas	Decorative MH 250W 4L	1	1180	8760	LED HID Omni Retrofit 5 kLm Med Base	1	144	8760	-	0	0.9	0.1	0.8	10,337	1,261	9,075	0%	0
79	PFBC HQ Harrisburg	1st Floor		Lobby 125	Hallways and Common Areas	8" Rec Can CFL 32W 4P 2L	14	62	8760	RT, LED 16W 2P G24D/Q H 2L	14	32	8760	-	0	0.7	0.4	0.3	7,604	3,924	3,679	0%	0
80	PFBC HQ Harrisburg	1st Floor		Lobby 125 - Vestibule to Restrooms	Hallways and Common Areas	8" Rec Can CFL 18W 4P 2L	2	38	8760	RT, LED 16W 2P G24D/Q H 2L	2	32	8760	-	0	0.1	0.1	0.0	666	561	105	0%	0
81	PFBC HQ Harrisburg	1st Floor		bby 125 - Vestibule to Multi-Purpos	Hallways and Common Areas	8" Rec Can CFL 18W 4P 2L	2	38	8760	RT, LED 16W 2P G24D/Q H 2L	2	32	8760	-	0	0.1	0.1	0.0	666	561	105	0%	0
82	PFBC HQ Harrisburg	1st Floor		Lobby 125 - Hallway to Reception	Hallways and Common Areas	8" Rec Can CFL 26W 4P 2L	1	50	8760	RT, LED 16W 2P G24D/Q H 2L	1	32	8760	-	0	0.0	0.0	0.0	438	280	158	0%	0
83	PFBC HQ Harrisburg	1st Floor		obby 125 - Vestibule to Lunch Room	Hallways and Common Areas	8" Rec Can CFL 18W 4P 2L	2	38	8760	RT, LED 16W 2P G24D/Q H 2L	2	32	8760	-	0	0.1	0.1	0.0	666	561	105	0%	0
84	PFBC HQ Harrisburg	1st Floor		Lobby 125	Hallways and Common Areas	6" Rec Can Hal 50W MR16	6	60	8760	LED 7W MR16 Replacement	6	7	8760	-	0	0.3	0.0	0.3	3,154	368	2,786	0%	0
85	PFBC HQ Harrisburg	1st Floor		Lobby 125	Hallways and Common Areas	6" Rec Can Hal 50W MR16	8	60	8760	LED 7W MR16 Replacement	8	7	8760	-	0	0.4	0.0	0.3	4,205	491	3,714	0%	0
86	PFBC HQ Harrisburg	1st Floor		Multi-Purpose Room 130A	Conference Room	8" Rec Can CFL 26W 4P 2L	1	50	2000	RT, LED 16W 2P G24D/Q H 2L	1	32	2000	-	0	0.0	0.0	0.0	100	64	36	35%	0
87	PFBC HQ Harrisburg	1st Floor		Multi-Purpose Room 130A	Conference Room	8' Direct/Indirect BP 4L 32W T8 DS	4	118	2000	RT, 4' 10.5W SE LED 4L	4	42	2000	-	0	0.4	0.1	0.2	944	336	608	35%	0
88	PFBC HQ Harrisburg	1st Floor		Multi-Purpose Room 130A	Conference Room	6' Direct/Indirect 4L T8 DS	4	92	2000	RT, 3' 12W SE LED 4L	4	48	2000	-	0	0.3	0.2	0.1	736	384	352	35%	0
89	PFBC HQ Harrisburg	1st Floor		Multi-Purpose Room 130A	Conference Room	7" Rec Can Hal 250W PAR38	12	250	2000	LED 26W PAR38 Replacement	12	26	2000	-	0	2.4	0.2	2.2	6,000	624	5,376	35%	0
90	PFBC HQ Harrisburg	1st Floor		Multi-Purpose Room 130A	Conference Room	Wall Sconce CFL 26W 4P 2L	2	50	2000	RT, LED 8W 2P G24D/Q H 2L	2	16	2000	-	0	0.1	0.0	0.1	200	64	136	35%	0
91	PFBC HQ Harrisburg	1st Floor		Coat Closet 128	Storage Room	8" Rec Can CFL 26W 4P 2L	1	50	819	RT, LED 16W 2P G24D/Q H 2L	1	32	819	-	0	0.0	0.0	0.0	41	26	15	25%	0
92	PFBC HQ Harrisburg	1st Floor		Chair Storage 129	Storage Room	2X4 Prism Rec 2L 32W T8	1	59	819	RT, 4' 10.5W SE LED 2L	1	21	819	-	0	0.0	0.0	0.0	48	17	31	25%	0
93	PFBC HQ Harrisburg	1st Floor		Rear Vestibule 131	Hallways and Common Areas	8" Rec Can CFL 26W 4P 2L	3	50	8760	RT, LED 16W 2P G24D/Q H 2L	3	32	8760	-	0	0.1	0.1	0.0	1,314	841	473	0%	0
94	PFBC HQ Harrisburg	1st Floor		Multi-Purpose Room 130B	Conference Room	8" Rec Can CFL 26W 4P 2L	1	50	2000	RT, LED 16W 2P G24D/Q H 2L	1	32	2000	-	0	0.0	0.0	0.0	100	64	36	35%	0
95	PFBC HQ Harrisburg	1st Floor		Multi-Purpose Room 130B	Conference Room	8' Direct/Indirect BP 4L 32W T8 DS	4	118	2000	RT, 4' 10.5W SE LED 4L	4	42	2000	-	0	0.4	0.1	0.2	944	336	608	35%	0
96	PFBC HQ Harrisburg	1st Floor		Multi-Purpose Room 130B	Conference Room	6' Direct/Indirect 4L T8 DS	4	92	2000	RT, 3' 12W SE LED 4L	4	48	2000	-	0	0.3	0.2	0.1	736	384	352	35%	0
97	PFBC HQ Harrisburg	1st Floor		Multi-Purpose Room 130B	Conference Room	7" Rec Can Hal 250W PAR38	12	250	2000	LED 26W PAR38 Replacement	12	26	2000	-	0	2.4	0.2	2.2	6,000	624	5,376	35%	0
98	PFBC HQ Harrisburg	1st Floor		Multi-Purpose Room 130B	Conference Room	Wall Sconce CFL 26W 4P 2L	2	50	2000	RT, LED 8W 2P G24D/Q H 2L	2	16	2000	-	0	0.1	0.0	0.1	200	64	136	35%	0
99	PFBC HQ Harrisburg	1st Floor		Coat Closet 127	Storage Room	8" Rec Can CFL 26W 4P 2L	1	50	819	RT, LED 16W 2P G24D/Q H 2L	1	32	819	-	0	0.0	0.0	0.0	41	26	15	25%	0
100	PFBC HQ Harrisburg	1st Floor		Multi-Purpose Room 136	Conference Room	8" Rec Can CFL 26W 4P 2L	1	50	2000	RT, LED 16W 2P G24D/Q H 2L	1	32	2000	-	0	0.0	0.0	0.0	100	64	36	35%	0
101	PFBC HQ Harrisburg	1st Floor		Multi-Purpose Room 136	Conference Room	8' Direct/Indirect BP 4L 32W T8 DS	4	118	2000	RT, 4' 10.5W SE LED 4L	4	42	2000	-	0	0.4	0.1	0.2	944	336	608	35%	0
102	PFBC HQ Harrisburg	1st Floor		Multi-Purpose Room 136	Conference Room	6' Direct/Indirect 4L T8 DS	4	92	2000	RT, 3' 12W SE LED 4L	4	48	2000	-	0	0.3	0.2	0.1	736	384	352	35%	0
103	PFBC HQ Harrisburg	1st Floor		Multi-Purpose Room 136	Conference Room	7" Rec Can Hal 250W PAR38	12	250	2000	LED 26W PAR38 Replacement	12	26	2000	-	0	2.4	0.2	2.2	6,000	624	5,376	35%	0
104	PFBC HQ Harrisburg	1st Floor		Multi-Purpose Room 136	Conference Room	Wall Sconce CFL 26W 4P 2L	4	50	2000	RT, LED 8W 2P G24D/Q H 2L	4	16	2000	-	0	0.2	0.1	0.1	400	128	272	35%	0
105	PFBC HQ Harrisburg	1st Floor		Coat Closet 137	Storage Room	8" Rec Can CFL 26W 4P 2L	1	50	819	RT, LED 16W 2P G24D/Q H 2L	1	32	819	-	0	0.0	0.0	0.0	41	26	15	25%	0
106	PFBC HQ Harrisburg	1st Floor		Lunch Room 105	Break Room	8" Rec Can CFL 26W 4P 2L	1	50	2860	RT, LED 16W 2P G24D/Q H 2L	1	32	2860	-	0	0.0	0.0	0.0	143	92	51	25%	0
107	PFBC HQ Harrisburg	1st Floor		Lunch Room 105	Break Room	2X4 Prism Rec 3L 32W T8 DS	12	90	2860	RT, 4' 10.5W SE LED 3L	12	32	2860	-	0	0.9	0.3	0.6	3,089	1,081	2,008	25%	0
108	PFBC HQ Harrisburg	1st Floor		Kitchen 107	Break Room	2X4 Prism Rec 3L 32W T8 DS	1	90	2145	RT, 4' 10.5W SE LED 3L	1	32	2145	-	0	0.1	0.0	0.0	193	68	125	25%	0
109	PFBC HQ Harrisburg	1st Floor		Conference Room 119	Conference Room	8' Direct/Indirect BP 4L 32W T8 DS	6	118	2000	RT, 4' 10.5W SE LED 4L	6	42	2000	-	0	0.6	0.2	0.4	1,416	504	912	35%	0
110	PFBC HQ Harrisburg	1st Floor		Conference Room 119	Conference Room	7" Rec Can Hal 250W PAR38	8	250	2000	LED 26W PAR38 Replacement	8	26	2000	-	0	1.6	0.2	1.4	4,000	416	3,584	35%	0

ID #	Location					Existing Fixture				Proposed Fixture						PeakDemand			Usage			Controls	
	Building # : Name	Floor	Area	Sub Area / Room	Usage Group	Fixture	Quantity	Input Wattage	Hours of Operation	ECM	Quantity	Input Wattage	Hours of Operation	Occ Sensor Type	Occ Sensor Qty	Pre	Post	Savings	Pre	Post	Savings	Savings %	Savings
111	PFBC HQ Harrisburg	1st Floor		Men's Restroom 123	Restroom	8' Linear Slot BP 4L 32W T8	4	112	2860	RT, 4' 10.5W SE LED 4L	4	42	2860	-	0	0.4	0.1	0.2	1,281	480	801	45%	0
112	PFBC HQ Harrisburg	1st Floor		Men's Restroom 123	Restroom	4' Linear Slot BP 2L 32W T8	1	59	2860	RT, 4' 10.5W SE LED 2L	1	21	2860	-	0	0.0	0.0	0.0	169	60	109	45%	0
113	PFBC HQ Harrisburg	1st Floor		Men's Restroom 123	Restroom	3' Linear Slot 2L T8	2	46	2860	RT, 3' 12W SE LED 2L	2	24	2860	-	0	0.1	0.0	0.0	263	137	126	45%	0
114	PFBC HQ Harrisburg	1st Floor		Women's Restroom 122	Restroom	8' Linear Slot BP 4L 32W T8	4	112	2860	RT, 4' 10.5W SE LED 4L	4	42	2860	-	0	0.4	0.1	0.2	1,281	480	801	45%	0
115	PFBC HQ Harrisburg	1st Floor		Women's Restroom 122	Restroom	4' Linear Slot BP 2L 32W T8	1	59	2860	RT, 4' 10.5W SE LED 2L	1	21	2860	-	0	0.0	0.0	0.0	169	60	109	45%	0
116	PFBC HQ Harrisburg	1st Floor		Women's Restroom 122	Restroom	3' Linear Slot 2L T8	2	46	2860	RT, 3' 12W SE LED 2L	2	24	2860	-	0	0.1	0.0	0.0	263	137	126	45%	0
117	PFBC HQ Harrisburg	1st Floor		AV Storage 112	Storage Room	4' Industrial BP 2L 32W T8	1	59	819	RT, 4' 10.5W SE LED 2L	1	21	819	-	0	0.0	0.0	0.0	48	17	31	25%	0
118	PFBC HQ Harrisburg	1st Floor		Janitorial Closet 124	Janitor Closet / Inactive Storage	4' Industrial BP 2L 32W T8	1	59	375	RT, 4' 10.5W SE LED 2L	1	21	375	-	0	0.0	0.0	0.0	22	8	14	25%	0
119	PFBC HQ Harrisburg	1st Floor		Reception / Sales Office 135	Open Office	2X4 Prism Rec 3L 32W T8 DS	8	90	2431	RT, 4' 10.5W SE LED 3L	8	32	2431	-	0	0.6	0.2	0.4	1,750	613	1,138	15%	0
120	PFBC HQ Harrisburg	1st Floor		Open Office	Open Office	8' Direct/Indirect BP 6L 32W T8 DS	28	175	2860	RT, 4' 10.5W SE LED 6L	28	63	2860	-	0	3.9	1.4	2.5	14,014	5,045	8,969	15%	0
121	PFBC HQ Harrisburg	1st Floor		Open Office	Open Office	12' Direct/Indirect BP 9L 32W T8 DS	2	264	2860	RT, 4' 10.5W SE LED 9L	2	95	2860	-	0	0.4	0.2	0.3	1,510	541	970	15%	0
122	PFBC HQ Harrisburg	1st Floor		Open Office	Open Office	2x2 Prism Rec 2L FT40	8	72	2860	RT, LED 17W 4P 2G11 2L	8	34	2860	-	0	0.5	0.2	0.2	1,647	778	869	15%	0
123	PFBC HQ Harrisburg	1st Floor		Stairs B	Stairwell	4' Wall Bracket BP 2L 32W T8	2	59	8760	RT, 4' 10.5W SE LED 2L	2	21	8760	-	0	0.1	0.0	0.1	1,034	368	666	25%	0
124	PFBC HQ Harrisburg	1st Floor		Electric Room 108	Mechanical/Electrical Room	4' Industrial BP 2L 32W T8	1	59	819	RT, 4' 10.5W SE LED 2L	1	21	819	-	0	0.0	0.0	0.0	48	17	31	25%	0
125	PFBC HQ Harrisburg	1st Floor		Telephone Room 109	Mechanical/Electrical Room	4' Industrial BP 2L 32W T8	1	59	819	RT, 4' 10.5W SE LED 2L	1	21	819	-	0	0.0	0.0	0.0	48	17	31	25%	0
126	PFBC HQ Harrisburg	1st Floor		Copy Room 110	Open Office	2X4 Prism Rec 2L 32W T8	1	59	2431	RT, 4' 10.5W SE LED 2L	1	21	2431	-	0	0.0	0.0	0.0	143	51	92	15%	0
127	PFBC HQ Harrisburg	1st Floor		Side Corridor 113	Hallways and Common Areas	2x2 Prism Rec 2L FT40	6	72	8760	RT, LED 17W 4P 2G11 2L	6	34	8760	-	0	0.3	0.2	0.2	3,784	1,787	1,997	0%	0
128	PFBC HQ Harrisburg	1st Floor		Women's Restroom 120	Restroom	4' Linear Slot BP 2L 32W T8	2	59	1573	RT, 4' 10.5W SE LED 2L	2	21	1573	-	0	0.1	0.0	0.1	186	66	120	45%	0
129	PFBC HQ Harrisburg	1st Floor		Men's Restroom 121	Restroom	4' Linear Slot BP 2L 32W T8	2	59	1573	RT, 4' 10.5W SE LED 2L	2	21	1573	-	0	0.1	0.0	0.1	186	66	120	45%	0
130	PFBC HQ Harrisburg	1st Floor		M.I.S. Room 111	Storage Room	12' Direct/Indirect BP 9L 32W T8 DS	3	264	819	RT, 4' 10.5W SE LED 9L	3	95	819	-	0	0.4	0.2	0.3	649	232	416	25%	0
131	PFBC HQ Harrisburg	1st Floor		Projection Office 118	Private Office	2X4 Prism Rec 3L 32W T8 DS	2	90	1750	RT, 4' 10.5W SE LED 3L	2	32	1750	-	0	0.1	0.1	0.1	315	110	205	30%	0
132	PFBC HQ Harrisburg	1st Floor		Private Office 117	Private Office	8' Direct/Indirect BP 6L 32W T8 DS	1	175	1750	RT, 4' 10.5W SE LED 6L	1	63	1750	-	0	0.1	0.1	0.1	306	110	196	30%	0
133	PFBC HQ Harrisburg	1st Floor		Private Office 116	Private Office	8' Direct/Indirect BP 6L 32W T8 DS	1	175	1750	RT, 4' 10.5W SE LED 6L	1	63	1750	-	0	0.1	0.1	0.1	306	110	196	30%	0
134	PFBC HQ Harrisburg	1st Floor		Private Office 115	Private Office	8' Direct/Indirect BP 6L 32W T8 DS	2	175	1750	RT, 4' 10.5W SE LED 6L	2	63	1750	-	0	0.3	0.1	0.2	613	221	392	30%	0
135	PFBC HQ Harrisburg	1st Floor		Private Office 114	Private Office	8' Direct/Indirect BP 6L 32W T8 DS	2	175	1750	RT, 4' 10.5W SE LED 6L	2	63	1750	-	0	0.3	0.1	0.2	613	221	392	30%	0
136	PFBC HQ Harrisburg	1st Floor		oating and Education Open Office 10	Open Office	8' Direct/Indirect BP 6L 32W T8 DS	6	175	2860	RT, 4' 10.5W SE LED 6L	6	63	2860	-	0	0.8	0.3	0.5	3,003	1,081	1,922	15%	0
137	PFBC HQ Harrisburg	1st Floor	North Wing	Administration Open Office 100	Open Office	12' Direct/Indirect BP 9L 32W T8 DS	22	264	2860	RT, 4' 10.5W SE LED 9L	22	95	2860	-	0	4.6	1.7	3.0	16,611	5,946	10,665	15%	0
138	PFBC HQ Harrisburg	1st Floor	North Wing	Administration Open Office 100	Open Office	8' Direct/Indirect BP 6L 32W T8 DS	6	175	2860	RT, 4' 10.5W SE LED 6L	6	63	2860	-	0	0.8	0.3	0.5	3,003	1,081	1,922	15%	0
139	PFBC HQ Harrisburg	1st Floor	North Wing	Administration Open Office 100	Open Office	4' Direct/Indirect BP 4L 32W T8 DS	3	118	2860	RT, 4' 10.5W SE LED 4L	3	42	2860	-	0	0.3	0.1	0.2	1,012	360	652	15%	0
140	PFBC HQ Harrisburg	1st Floor	North Wing	Administration Open Office 100	Open Office	7" Rec Can Hal 250W PAR38	10	250	2860	LED 26W PAR38 Replacement	10	26	2860	-	0	2.0	0.2	1.8	7,150	744	6,406	15%	0
141	PFBC HQ Harrisburg	1st Floor	North Wing	Administration Open Office 100	Open Office	Decorative 6L FT55	4	336	2860	RT, LED 17W 4P 2G11 6L	4	102	2860	-	0	1.1	0.3	0.7	3,844	1,167	2,677	15%	0
142	PFBC HQ Harrisburg	1st Floor	North Wing	Private Office 101	Private Office	8' Direct/Indirect BP 6L 32W T8 DS	2	175	2500	RT, 4' 10.5W SE LED 6L	2	63	2500	-	0	0.3	0.1	0.2	875	315	560	30%	0
143	PFBC HQ Harrisburg	Basement		Stairs A	Stairwell	4' Wall Bracket BP 2L 32W T8	2	59	8760	RT, 4' 10.5W SE LED 2L	2	21	8760	-	0	0.1	0.0	0.1	1,034	368	666	25%	0
144	PFBC HQ Harrisburg	Basement		Stairs vestibule	Hallways and Common Areas	2x2 Prism Rec 2L FT40	2	72	8760	RT, LED 17W 4P 2G11 2L	2	34	8760	-	0	0.1	0.1	0.1	1,261	596	666	0%	0
145	PFBC HQ Harrisburg	Basement		Corridor G21	Hallways and Common Areas	2x2 Prism Rec 2L FT40	6	72	8760	RT, LED 17W 4P 2G11 2L	6	34	8760	-	0	0.3	0.2	0.2	3,784	1,787	1,997	0%	0
146	PFBC HQ Harrisburg	Basement		Exercise Room G22	Open Office	2X4 Prism Rec 3L 32W T8 DS	8	90	2431	RT, 4' 10.5W SE LED 3L	8	32	2431	-	0	0.6	0.2	0.4	1,750	613	1,138	15%	0
147	PFBC HQ Harrisburg	Basement		Application Storage G16	Storage Room	4' Industrial BP 2L 32W T8	2	59	1092	RT, 4' 10.5W SE LED 2L	2	21	1092	-	0	0.1	0.0	0.0	129	46	83	25%	0
148	PFBC HQ Harrisburg	Basement		Application Storage G16	Storage Room	8' Industrial BP 4L 32W T8	8	112	1092	RT, 4' 10.5W SE LED 4L	8	42	1092	-	0	0.5	0.2	0.3	978	367	612	25%	0
149	PFBC HQ Harrisburg	Basement		Corridor G17 - Elevator Lobby	Hallways and Common Areas	8" Rec Can CFL 26W 4P 2L	6	50	8760	RT, LED 16W 2P G24D/Q H 2L	6	32	8760	-	0	0.2	0.2	0.1	2,628	1,682	946	0%	0
150	PFBC HQ Harrisburg	Basement		orridor G17 - Vestibule to Restroom	Hallways and Common Areas	8" Rec Can CFL 26W 4P 2L	2	50	8760	RT, LED 16W 2P G24D/Q H 2L	2	32	8760	-	0	0.1	0.1	0.0	876	561	315	0%	0
151	PFBC HQ Harrisburg	Basement		Men's Restroom G14	Restroom	8' Linear Slot BP 4L 32W T8	2	112	2860	RT, 4' 10.5W SE LED 4L	2	42	2860	-	0	0.2	0.1	0.1	641	240	400	45%	0
152	PFBC HQ Harrisburg	Basement		Men's Restroom G14	Restroom	4' Linear Slot BP 2L 32W T8	2	59	2860	RT, 4' 10.5W SE LED 2L	2	21	2860	-	0	0.1	0.0	0.1	337	120	217	45%	0
153	PFBC HQ Harrisburg	Basement		Men's Restroom G14	Restroom	3' Linear Slot 2L T8	2	46	2860	RT, 3' 12W SE LED 2L	2	24	2860	-	0	0.1	0.0	0.0	263	137	126	45%	0
154	PFBC HQ Harrisburg	Basement		Men's Restroom G14 - Shower Area	Restroom	8" Rec Can CFL 18W 4P 2L	6	38	2860	RT, LED 16W 2P G24D/Q H 2L	6	32	2860	-	0	0.2	0.2	0.0	652	549	103	45%	0
155	PFBC HQ Harrisburg	Basement		Women's Restroom G13	Restroom	8' Linear Slot BP 4L 32W T8	2	112	2860	RT, 4' 10.5W SE LED 4L	2	42	2860	-	0	0.2	0.1	0.1	641	240	400	45%	0
156	PFBC HQ Harrisburg	Basement		Women's Restroom G13	Restroom	4' Linear Slot BP 2L 32W T8	2	59	2860	RT, 4' 10.5W SE LED 2L	2	21	2860	-	0	0.1	0.0	0.1	337	120	217	45%	0
157	PFBC HQ Harrisburg	Basement		Women's Restroom G13	Restroom	3' Linear Slot 2L T8	2	46	2860	RT, 3' 12W SE LED 2L	2	24	2860	-	0	0.1	0.0	0.0	263	137	126	45%	0
158	PFBC HQ Harrisburg	Basement		omen's Restroom G13 - Shower Are	Restroom	8" Rec Can CFL 18W 4P 2L	6	38	2860	RT, LED 16W 2P G24D/Q H 2L	6	32	2860	-	0	0.2	0.2	0.0	652	549	103	45%	0
159	PFBC HQ Harrisburg	Basement		Elevator Shaft	Mechanical/Electrical Room	Jelly Jar CFL 18W 4P	1	20	819	RT, LED 8W 2P G24D/Q Omni	1	8	819	-	0	0.0	0.0	0.0	16	7	10	25%	0
160	PFBC HQ Harrisburg	Basement		Mail Room	Open Office	2X4 Prism Rec 3L 32W T8 DS	6	90	2431	RT, 4' 10.5W SE LED 3L	6	32	2431	-	0	0.4	0.2	0.3	1,313	459	853	15%	0
161	PFBC HQ Harrisburg	Basement		Corridor C10	Hallways and Common Areas	2x2 Prism Rec 2L FT40	9	72	8760	RT, LED 17W 4P 2G11 2L	9	34	8760	-	0	0.5	0.2	0.3	5,676	2,681	2,996	0%	0
162	PFBC HQ Harrisburg	Basement		Machine Room G12	Mechanical/Electrical Room	4' Industrial BP 2L 32W T8	1	59	819	RT, 4' 10.5W SE LED 2L	1	21	819	-	0	0.0	0.0	0.0	48	17	31	25%	0
163	PFBC HQ Harrisburg	Basement		Janitor / Storage G11	Janitor Closet / Inactive Storage	4' Industrial BP 2L 32W T8	1	59	375	RT, 4' 10.5W SE LED 2L	1	21	375	-	0	0.0	0.0	0.0	22	8	14	25%	0
164	PFBC HQ Harrisburg	Basement		Graphic Services G09	Open Office	2X4 Prism Rec 3L 32W T8 DS	14	90	2860	RT, 4' 10.5W SE LED 3L	14	32	2860	-	0	1.0	0.4	0.7	3,604	1,261	2,342	15%	0
165	PFBC HQ Harrisburg	Basement		Graphic Services G09	Open Office	2X4 Prism Rec 3L 32W T8 DS	12	90	2860	RT, 4' 10.5W SE LED 3L	12	32	2860	-	0	0.9	0.3	0.6	3,089	1,081	2,008	15%	0
166	PFBC HQ Harrisburg	Basement		Graphics Office G15	Open Office	2X4 Prism Rec 3L 32W T8 DS	2	90	2860	RT, 4' 10.5W SE LED 3L	2	32	2860	-	0	0.1	0.1	0.1	515	180	335	15%	0
167	PFBC HQ Harrisburg	Basement		Telephone Room G08	Mechanical/Electrical Room	4' Industrial BP 2L 32W T8	1	59	819	RT, 4' 10.5W SE LED 2L	1	21	819	-	0	0.0	0.0	0.0	48	17	31	25%	0
168	PFBC HQ Harrisburg	Basement		Electric Room G07	Mechanical/Electrical Room	4' Industrial BP 2L 32W T8	1	59	819	RT, 4' 10.5W SE LED 2L	1	21	819	-	0	0.0	0.0	0.0	48	17	31	25%	0
169	PFBC HQ Harrisburg	Basement		Stairs B	Stairwell	4' Wall Bracket BP 2L 32W T8	2	59	8760	RT, 4' 10.5W SE LED 2L	2	21	8760	-	0	0.1	0.0	0.1	1,034	368	666	25%	0
170	PFBC HQ Harrisburg	Basement		Corridor / Lower Lobby G02	Hallways and Common Areas	2x2 Prism Rec 2L FT40	5	72	8760	RT, LED 17W 4P 2G11 2L	5	34	8760	-	0	0.3	0.1	0.2	3,154	1,489	1,664	0%	0
171	PFBC HQ Harrisburg	Basement		Mechanical Room G06	Mechanical/Electrical Room	8' Industrial BP 4L 32W T8	5	112	1092	RT, 4' 10.5W SE LED 4L	5	42	1092	-	0	0.3	0.1	0.2	612	229	382	25%	0
172	PFBC HQ Harrisburg	Basement		Mechanical Room G06	Mechanical/Electrical Room	8' Industrial BP 4L 32W T8	1	112	1092	RT, 4' 10.5W SE LED 4L	1	42	1092	-	0	0.1	0.0	0.0	122	46	76	25%	0
173	PFBC HQ Harrisburg	Basement		Mechanical Room G06	Mechanical/Electrical Room	4' Industrial BP 2L 32W T8	7	59	1092	RT, 4' 10.5W SE LED 2L	7	21	1092	-	0	0.2	0.1	0.1	451	161	290	25%	0
174	PFBC HQ Harrisburg	Basement		Warehouse Office G05	Private Office	2X4 Prism Rec 3L 32W T8 DS	2	90	1750	RT, 4' 10.5W SE LED 3L	2	32	1750	-	0	0.1	0.1	0.1	315	110	205	30%	0
175	PFBC HQ Harrisburg	Basement		Pump Room G04	Mechanical/Electrical Room	4' Industrial BP 2L 32W T8	1	59	819	RT, 4' 10.5W SE LED 2L	1	21	819	-	0	0.0	0.0	0.0	48	17	31	25%	0
176	PFBC HQ Harrisburg	Basement		Main Electric Room G03	Mechanical/Electrical Room	4' Industrial BP 2L 32W T8	1	59	819	RT, 4' 10.5W SE LED 2L	1	21	819	-	0	0.0	0.0	0.0	48	17	31	25%	0
177	PFBC HQ Harrisburg	Basement		Warehouse G01	Warehouse	High Bay MH 175W	30	215	2860	High Bay LED 12 kLm	30	79	2860	-	0	5.2	1.9	3.3	18,447	6,778	11,669	25%	0
178	PFBC HQ Harrisburg	Basement		Warehouse G01	Warehouse	High Bay MH 175W	13	215	2860	High Bay LED 12 kLm	13	79	2860	-	0	2.2	0.8	1.4	7,994	2,937	5,056	25%	0
179	PFBC HQ Harrisburg	Basement		Warehouse G01	Warehouse	High Bay MH 250W	5	295	2860	High Bay LED 18 kLm	5	114	2860	-	0	1.2	0.5	0.7	4,219	1,630	2,588	25%	0
180	PFBC HQ Harrisburg	Basement		Warehouse G01	Warehouse	High Bay MH 250W	4	295	2860	High Bay LED 18 kLm	4	114	2860	-	0	0.9	0.4	0.6	3,375	1,304	2,071	25%	0
181	PFBC HQ Harrisburg	Basement		Ammunition Storage G19	Storage Room	8' Industrial BP 4L 32W T8	1	112	819	RT, 4' 10.5W SE LED 4L	1	42	819	-	0	0.1	0.0	0.0	92	34	57	25%	0
182	PFBC HQ Harrisburg	Basement		Law Enforcement Storage G20	Storage Room	8' Industrial BP 4L 32W T8	4	112	1092	RT, 4' 10.5W SE LED 4L	4	42	1092	-	0	0.2	0.1	0.2	489	183	306	25%	0
183	PFBC HQ Harrisburg	Exterior	Building Mounted	Lower Level Warehouse Doors	Exterior - Dusk to Dawn	10" Rec Can MH 70W	3	95	4380	LED 17W A21 Retrofit	3	17	4380	-	0	0.0	0.0	0.0	1,248	223	1,025	0%	0
184	PFBC HQ Harrisburg	Exterior	Building Mounted	Lower Level Warehouse Doors	Exterior - Dusk to Dawn	10" Rec Can MH 70W	1	95	4380	LED 17W A21 Retrofit	1	17	4380	-	0	0.0	0.0	0.0	416	74	342	0%	0
185	PFBC HQ Harrisburg	Exterior	Building Mounted	Main Entrance Canopy	Exterior - Dusk to Dawn	10" Rec Can MH 70W	1	95	4380	LED 17W A21 Retrofit	1	17	4380	-	0	0.0	0.0	0.0	416	74	342	0%	0
186	PFBC HQ Harrisburg	Exterior	Building Mounted	Main Entrance Canopy	Exterior - Dusk to Dawn	10" Rec Can MH 70W	2	95	4380	LED 17W A21 Retrofit	2	17	4380	-	0	0.0	0.0	0.0	832	149	683	0%	0
187	PFBC HQ Harrisburg	Exterior	Building Mounted	Rear Entrance Canopy (To Deck)	Exterior - Dusk to Dawn	10" Rec Can MH 70W	1	95	4380	LED 17W A21 Retrofit	1	17	4380	-	0	0.0	0.0	0.0	416	74	342	0%	0
188	PFBC HQ Harrisburg	Exterior	Building Mounted	Rear Entrance Canopy (To Deck)	Exterior - Dusk to Dawn	10" Rec Can MH 70W	2	95	4380	LED 17W A21 Retrofit	2	17	4380	-	0	0.0	0.0	0.0	832	149	683	0%	0
189	PFBC HQ Harrisburg	Exterior	Site Plan	Side Entrance	Exterior - Dusk to Dawn	Post Top MH 100W	1	128	4380	LED 25W A21 Retrofit	1	25	4380	-	0	0.0	0.0	0.0	561	110	451	0%	0
190	PFBC HQ Harrisburg	Exterior	Site Plan	Front Entrance	Exterior - Dusk to Dawn	Post Top MH 100W	1	128	4380	LED 25W A21 Retrofit	1	25	4380	-	0	0.0	0.0	0.0	561	110	451	0%	0
191	PFBC HQ Harrisburg	Exterior	Site Plan	Sidewalk Stairs A / Front of Building	Exterior - Dusk to Dawn	Bollard MH 50W	11	72	4380	LED 17W A21 Retrofit	11	17	4380	-	0	0.0	0.0	0.0	3,469	819	2,650	0%	0
192	PFBC HQ Harrisburg	Exterior	Site Plan	Flag Grass Island	Exterior - Dusk to Dawn	Bollard MH 50W	8	72	4380	LED 17W A21 Retrofit	8	17	4380	-	0	0.0	0.0	0.0	2,523	596	1,927	0%	0
193	PFBC HQ Harrisburg	Exterior	Site Plan	Flag Grass Island	Exterior - Dusk to Dawn	Flood MH 175W	4	215	4380	Flood LED 3 kLm KN	4	21	4380	-	0	0.0	0.0	0.0	3,767	368	3,399	0%	0
194	PFBC HQ Harrisburg	Exterior	Site Plan	Parking Lot	Exterior - Dusk to Dawn	Shoebox MH 175W	10	215	4380	Area LED 7 kLm	10	51	4380	-	0	0.0	0.0	0.0	9,417	2,234	7,183	0%	0
195	PFBC HQ Harrisburg	Exterior	Site Plan	Entry Driveway	Exterior - Dusk to Dawn	Shoebox MH 175W	3	215	4380	Area LED 7 kLm	3	51	4380	-	0	0.0	0.0	0.0	2,825	670	2,155	0%	0
196	PFBC HQ Harrisburg	Exterior	Site Plan	Sign Lighting	Exterior - Dusk to Dawn	Flood MH 50W	2	72	4380	Flood LED 3 kLm KN	2	21	4380	-	0	0.0	0.0	0.0	631	184	447	0%	0
197	PFBC HQ Harrisburg	Exterior	Site Plan	Rear Driveway / Truck Loop	Exterior - Dusk to Dawn	Shoebox MH 175W	6	215	4380	Area LED 7 kLm	6	51	4380	-	0	0.0	0.0	0.0	5,650	1,340	4,310	0%	0
198	Pleasant Gap SFH	2nd Floor	Hatch House 450B	Main Hall	Office Hours 9h 7d/week	2X4 Prism Rec 2L 28W T8	7	48	3285	RT, 4' 10.5W SE LED 2L	7	21	3285	-	0	0.3	0.1	0.2	1,104	483	621	25%	0
199	Pleasant Gap SFH	2nd Floor	Hatch House 450B	Electrical Closet	Mechanical/Electrical Room Hatcheries	2X4 Prism Rec 2L 28W T8	1	48	782	RT, 4' 10.5W SE LED 2L	1	21	782	-	0	0.0	0.0	0.0	38	16	21	25%	0
200	Pleasant Gap SFH	2nd Floor	Hatch House 450B	Storage Room	Storage / Janitor Closet Hatcheries	2X4 Prism Rec 3L 28W T8	1	72	782	RT, 4' 10.5W SE LED 3L	1	32	782	-	0	0.0	0.0	0.0	56	25	32	25%	0
201	Pleasant Gap SFH	2nd Floor	Hatch House 450B	Bin Storage Room	Storage / Janitor Closet Hatcheries	2X4 Prism Rec 3L 28W T8	2	72	782	RT, 4' 10.5W SE LED 3L	2	32	782	-	0	0.1	0.0	0.0	113	49	63	25%	0
202	Pleasant Gap SFH	2nd Floor	Hatch House 450B	Water Cooler Nook	Office Hours 9h 7d/week	2X4 Prism Rec 3L 28W T8	1	72	3285	RT, 4' 10.5W SE LED 3L	1	32	3285	-	0	0.1	0.0	0.0	237	103	133	25%	0
203	Pleasant Gap SFH	2nd Floor	Hatch House 450B	Vestibule to Offices	Office Hours 9h 7d/week	2X4 Prism Rec 3L 28W T8	1	72	3285	RT, 4' 10.5W SE LED 3L	1	32	3285	-	0	0.1	0.0	0.0	237	103	133	25%	0
204	Pleasant Gap SFH	2nd Floor	Hatch House 450B	Private Office 1	Office Hours 9h 7d/week	2X4 Prism Rec 3L 28W T8	2	72	3285	RT, 4' 10.5W SE LED 3L	2	32	2464	WS	1	0.1	0.1	0.1	473	207	266	25%	52
205	Pleasant Gap SFH	2nd Floor	Hatch House 450B	Private Office 2	Office Hours 9h 7d/week	2X4 Prism Rec 3L 28W T8	2	72	3285	RT, 4' 10.5W SE LED 3L	2	32	2464	WS	1	0.1	0.1	0.1	473	207	266	25%	52
206	Pleasant Gap SFH	2nd Floor	Hatch House 450B	Private Office 3	Office Hours 9h 7d/week	2X4 Prism Rec 3L 28W T8	2	72	3285	RT, 4' 10.5W SE LED 3L	2	32	2464	WS	1	0.1	0.1	0.1	473	207	266	25%	52
207	Pleasant Gap SFH	2nd Floor	Hatch House 450B	Laboratory	Office Hours 9h 7d/week	2X4 Prism Rec 4L 28W T8	1	96	3285	RT, 4' 10.5W SE LED 4L	1	42	2464	WS	1	0.1	0.0	0.0	315	138	177	25%	34
208	Pleasant Gap SFH	2nd Floor	Hatch House 450B	Women's Restroom	Restroom Public Hatcheries	2X4 Prism Rec 3L 28W T8	1	72	1564	RT, 4' 10.5W SE LED 3L	1	32	860	CM	1	0.0	0.0	0.0	113	49	63	45%	22
209	Pleasant Gap SFH	2nd Floor	Hatch House 450B	Women's Restroom	Restroom Public Hatcheries	2' Wall Bracket 2L T8	1	33	1564	RT, 2' 7W SE LED 2L	1	14	860	PL	0	0.0	0.0	0.0	52	22	30	45%	10
210	Pleasant Gap SFH	2nd Floor	Hatch House 450B	Women's Restroom	Restroom Public Hatcheries	Fan Inc 60W A	1	60	1564	LED 9W A19 Replacement	1	9	1564	-	0	0.0	0.0	0.0	94	14	80	45%	0
211	Pleasant Gap SFH	2nd Floor	Hatch House 450B	Private Office / Storage Room	Storage / Janitor Closet Hatcheries	2X4 Prism Rec 3L 28W T8	3	72	782	RT, 4' 10.5W SE LED 3L	3	32	587	WS	1	0.1	0.1	0.1	169	74	95	25%	18
212	Pleasant Gap SFH	2nd Floor	Hatch House 450B	Open Office - Secretary	Office Hours 9h 7d/week	2X4 Prism Rec 3L 28W T8	4	72	3285	RT, 4' 10.5W SE LED 3L	4	32	3285	-	0	0.2	0.1	0.1	946	414	532	25%	0
213	Pleasant Gap SFH	2nd Floor	Hatch House 450B	Private Office - Manager	Office Hours 9h 7d/week	2X4 Prism Rec 3L 28W T8	3	72	3285	RT, 4' 10.5W SE LED 3L	3	32	2464	WS	1	0.2	0.1	0.1	710	310	399	25%	78
214	Pleasant Gap SFH	2nd Floor	Hatch House 450B	Private Office - Jason	Office Hours 9h 7d/week	2X4 Prism Rec 3L 28W T8	3	72	3285	RT, 4' 10.5W SE LED 3L	3	32	2464	WS	1	0.2	0.1	0.1	710	310	399	25%	78
215	Pleasant Gap SFH	2nd Floor	Hatch House 450B	Vestibule to Stairs	Office Hours 9h 7d/week	2X4 Prism Rec 2L 28W T8	1	48	3285	RT, 4' 10.5W SE LED 2L	1	21	3285	-	0	0.0	0.0	0.0	158	69	89	25%	0
216	Pleasant Gap SFH	2nd Floor	Hatch House 450B	Men's Restroom	Restroom Public Hatcheries	2X4 Prism Rec 2L 28W T8	1	48	1564	RT, 4' 10.5W SE LED 2L	1	21	860	CM	1	0.0	0.0	0.0	75	33	42	45%	15
217	Pleasant Gap SFH	2nd Floor	Hatch House 450B	Men's Restroom	Restroom Public Hatcheries	2' Wall Bracket 2L T8	2	33	1564	RT, 2' 7W SE LED 2L	2	14	860	PL	0	0.0	0.0	0.0	103	44	59	45%	20
218	Pleasant Gap SFH	2nd Floor	Hatch House 450B	Men's Restroom	Restroom Public Hatcheries	Fan Inc 60W A	3	60	1564	LED 9W A19 Replacement	3	9	1564	-	0	0.1	0.0	0.1	282	42	239	45%	0
219	Pleasant Gap SFH	2nd Floor	Hatch House 450B	Back Passage	Office Hours 9h 7d/week	2X4 Prism Rec 2L 28W T8	2	48	3285	RT, 4' 10.5W SE LED 2L	2	21	3285	-	0	0.1	0.0	0.0	315	138	177	25%	0
220	Pleasant Gap SFH	2nd Floor	Hatch House 450B	Locker Room	Restroom Public Hatcheries	2X4 Prism Rec 2L 28W T8	2	48	1564	RT, 4' 10.5W SE LED 2L	2	21	860	CM	2	0.1	0.0	0.0	150	66	84	45%	30

ID #	Location					Existing Fixture				Proposed Fixture						PeakDemand			Usage			Controls	
	Building # : Name	Floor	Area	Sub Area / Room	Usage Group	Fixture	Quantity	Input Wattage	Hours of Operation	ECM	Quantity	Input Wattage	Hours of Operation	Occ Sensor Type	Occ Sensor Qty	Pre	Post	Savings	Pre	Post	Savings	Savings %	Savings
221	Pleasant Gap SFH	2nd Floor	Hatch House 450B	Break Room	Office Hours 9h 7d/week	2X4 Prism Rec 3L 28W T8	4	72	3285	RT, 4' 10.5W SE LED 3L	4	32	2464	CM	4	0.2	0.1	0.1	946	414	532	25%	103
222	Pleasant Gap SFH	2nd Floor	Hatch House 450B	Break Room - Sink	Office Hours 9h 7d/week	2' Wall Bracket 1L T8	1	20	3285	RT, 2' 7W SE LED 1L	1	7	3285	-	0	0.0	0.0	0.0	66	23	43	25%	0
223	Pleasant Gap SFH	2nd Floor	Hatch House 450B	Stairwell Back	Office Hours 9h 7d/week	2' Wall Bracket 2L T8	1	33	3285	RT, 2' 7W SE LED 2L	1	14	3285	-	0	0.0	0.0	0.0	108	46	62	25%	0
224	Pleasant Gap SFH	3rd Floor	Hatch House 450B	Attic	Storage / Janitor Closet Hatcheries	Keyless CFL 13W Screw In	2	13	782	LED 9W A19 Replacement	2	9	782	-	0	0.0	0.0	0.0	20	14	6	25%	0
225	Pleasant Gap SFH	2nd Floor	Hatch House 450B	Stairwell Front	Office Hours 9h 7d/week	Globe Inc 60W A	1	60	3285	LED 9W A19 Replacement	1	9	3285	-	0	0.0	0.0	0.0	197	30	168	25%	0
226	Pleasant Gap SFH	2nd Floor	Hatch House 450B	Stairwell Front	Office Hours 9h 7d/week	2' Wall Bracket 2L T8	1	33	3285	RT, 2' 7W SE LED 2L	1	14	3285	-	0	0.0	0.0	0.0	108	46	62	25%	0
227	Pleasant Gap SFH	1st Floor	Hatch House 450B	Fish Hatchery	Office Hours 9h 7d/week	RLM CFL 32W Screw In	1	32	3285	LED 9W A19 Replacement	1	9	3285	-	0	0.0	0.0	0.0	105	30	76	25%	0
228	Pleasant Gap SFH	1st Floor	Hatch House 450B	Fish Hatchery	Office Hours 9h 7d/week	4' Vaportight BP 3L 28W T8	16	72	3285	RT, 4' 10.5W SE LED 3L	16	32	3285	-	0	0.9	0.4	0.5	3,784	1,656	2,129	25%	0
229	Pleasant Gap SFH	1st Floor	Hatch House 450B	Fish Hatchery	Office Hours 9h 7d/week	Keyless LED 9W A	2	9	3285	No Action - Existing Efficient Fixture	2	9	3285	-	0	0.0	0.0	0.0	59	59	0	25%	0
230	Pleasant Gap SFH	Exterior	Hatch House 450B	Front Wall	Exterior - Dusk to Dawn	Wall Pack MH 175W	1	215	4380	Wall Pack LED FT TWR 4.4 kLm PC	1	40	4380	-	0	0.0	0.0	0.0	942	175	767	0%	0
231	Pleasant Gap SFH	Exterior	Hatch House 450B	Back Wall	Exterior - Dusk to Dawn	Wall Pack MH 175W	1	215	4380	Wall Pack LED FT TWR 4.4 kLm PC	1	40	4380	-	0	0.0	0.0	0.0	942	175	767	0%	0
232	Pleasant Gap SFH	Exterior	Hatch House 450B	Side Wall	Exterior - Dusk to Dawn	Keyless Empty E26	2	0	4380	LED 9W A19 Replacement	2	9	4380	-	0	0.0	0.0	0.0	0	79	-79	0%	0
233	Pleasant Gap SFH	1st Floor	dmin / Visitor Cente	Entrance Vestibule	Limited Daily Use	Canopy LED 20W	3	20	1460	No Action - Existing Efficient Fixture	3	20	1460	-	0	0.0	0.0	0.0	88	88	0	25%	0
234	Pleasant Gap SFH	1st Floor	dmin / Visitor Cente	Conference Room	Limited Daily Use	8' Direct/Indirect BP 6L 28W T8 DS	4	144	1460	RT, 4' 10.5W SE LED 6L	4	63	1095	CM	4	0.3	0.1	0.2	841	368	473	25%	92
235	Pleasant Gap SFH	1st Floor	dmin / Visitor Cente	Conference Room	Limited Daily Use	4' Direct/Indirect BP 3L 28W T8 DS	2	74	1460	RT, 4' 10.5W SE LED 3L	2	32	1095	PL	0	0.1	0.0	0.0	216	92	124	25%	23
236	Pleasant Gap SFH	1st Floor	dmin / Visitor Cente	Conference Room	Limited Daily Use	Track Head Hal 50W MR16	2	60	1460	LED 7W MR16 Replacement	2	7	1460	-	0	0.1	0.0	0.1	175	20	155	25%	0
237	Pleasant Gap SFH	1st Floor	dmin / Visitor Cente	Conference Room - Board	Limited Daily Use	4' Strip BP 1L 28W T8	1	26	1460	RT, 4' 10.5W SE LED 1L	1	11	1460	-	0	0.0	0.0	0.0	38	15	23	25%	0
238	Pleasant Gap SFH	1st Floor	dmin / Visitor Cente	Women's Restroom	Restroom Public Hatcheries	4' Wrap LED 15W T8 ULB 2L	3	30	1564	No Action - Existing Efficient Fixture	3	30	1564	-	0	0.0	0.0	0.0	141	141	0	45%	0
239	Pleasant Gap SFH	1st Floor	dmin / Visitor Cente	Women's Restroom	Restroom Public Hatcheries	Vanity LED 9W A 2L	2	18	1564	No Action - Existing Efficient Fixture	2	18	1564	-	0	0.0	0.0	0.0	56	56	0	45%	0
240	Pleasant Gap SFH	1st Floor	dmin / Visitor Cente	Janitorial Closet	Storage / Janitor Closet Hatcheries	Drum CFL 22W Circ.	2	20	782	Drum LED 700 Lm 7"	2	10	782	-	0	0.0	0.0	0.0	31	16	16	25%	0
241	Pleasant Gap SFH	1st Floor	dmin / Visitor Cente	Men's Restroom	Restroom Public Hatcheries	4' Wrap LED 15W T8 ULB 2L	2	30	1564	No Action - Existing Efficient Fixture	2	30	1564	-	0	0.0	0.0	0.0	94	94	0	45%	0
242	Pleasant Gap SFH	1st Floor	dmin / Visitor Cente	Men's Restroom	Restroom Public Hatcheries	Vanity LED 9W A 2L	2	18	1564	No Action - Existing Efficient Fixture	2	18	1564	-	0	0.0	0.0	0.0	56	56	0	45%	0
243	Pleasant Gap SFH	1st Floor	dmin / Visitor Cente	Reception	Limited Daily Use	2X4 Prism Rec 3L 28W T8	4	72	1460	RT, 4' 10.5W SE LED 3L	4	32	1460	-	0	0.2	0.1	0.1	420	184	237	25%	0
244	Pleasant Gap SFH	1st Floor	dmin / Visitor Cente	Hallway	Limited Daily Use	Wall Sconce CFL 18W 2P 2L	7	45	1460	RT, LED 6W 2P G24D/Q H 2L	7	12	1460	-	0	0.2	0.0	0.1	460	123	337	25%	0
245	Pleasant Gap SFH	1st Floor	dmin / Visitor Cente	Hallway	Limited Daily Use	4' Wrap BP 4L 28W T8	2	96	1460	RT, 4' 10.5W SE LED 4L	2	42	1460	-	0	0.1	0.0	0.1	280	123	158	25%	0
246	Pleasant Gap SFH	1st Floor	dmin / Visitor Cente	Hallway	Limited Daily Use	Exit Sign Inc	1	30	1460	Exit Sign LED	1	3	1460	-	0	0.0	0.0	0.0	44	4	39	25%	0
247	Pleasant Gap SFH	1st Floor	dmin / Visitor Cente	Kitchenette	Limited Daily Use	2' Wrap 2L T8	1	33	1460	RT, 2' 7W SE LED 2L	1	14	1460	-	0	0.0	0.0	0.0	48	20	28	25%	0
248	Pleasant Gap SFH	1st Floor	dmin / Visitor Cente	Kitchenette	Limited Daily Use	Wall Sconce CFL 18W 2P 2L	2	45	1460	RT, LED 6W 2P G24D/Q H 2L	2	12	1460	-	0	0.0	0.0	0.0	131	35	96	25%	0
249	Pleasant Gap SFH	1st Floor	dmin / Visitor Cente	Private Office 1	Limited Daily Use	4' Strip BP 1L 28W T8	8	26	1460	RT, 4' 10.5W SE LED 1L	8	11	1095	WS	1	0.1	0.0	0.1	304	123	181	25%	31
250	Pleasant Gap SFH	1st Floor	dmin / Visitor Cente	Private Office 2	Limited Daily Use	4' Strip BP 1L 28W T8	8	26	1460	RT, 4' 10.5W SE LED 1L	8	11	1095	WS	1	0.1	0.0	0.1	304	123	181	25%	31
251	Pleasant Gap SFH	1st Floor	dmin / Visitor Cente	Private Office 3	Limited Daily Use	4' Strip BP 1L 28W T8	8	26	1460	RT, 4' 10.5W SE LED 1L	8	11	1095	WS	1	0.1	0.0	0.1	304	123	181	25%	31
252	Pleasant Gap SFH	1st Floor	dmin / Visitor Cente	Private Office 4	Limited Daily Use	4' Strip BP 1L 28W T8	8	26	1460	RT, 4' 10.5W SE LED 1L	8	11	1095	WS	1	0.1	0.0	0.1	304	123	181	25%	31
253	Pleasant Gap SFH	1st Floor	dmin / Visitor Cente	Private Office 5	Limited Daily Use	4' Strip BP 1L 28W T8	8	26	1460	RT, 4' 10.5W SE LED 1L	8	11	1095	WS	1	0.1	0.0	0.1	304	123	181	25%	31
254	Pleasant Gap SFH	1st Floor	dmin / Visitor Cente	Mechanical Room	Mechanical/Electrical Room Hatcheries	RLM LED 9W A	4	9	782	No Action - Existing Efficient Fixture	4	9	782	-	0	0.0	0.0	0.0	28	28	0	25%	0
255	Pleasant Gap SFH	1st Floor	dmin / Visitor Cente	Passage / Storage Area	Storage / Janitor Closet Hatcheries	RLM CFL 13W Screw In	2	13	782	LED 9W A19 Replacement	2	9	782	-	0	0.0	0.0	0.0	20	14	6	25%	0
256	Pleasant Gap SFH	1st Floor	dmin / Visitor Cente	Passage / Storage Area - Fan Hood	Storage / Janitor Closet Hatcheries	Keyless Inc 60W A	1	60	782	LED 9W A19 Replacement	1	9	782	-	0	0.0	0.0	0.0	47	7	40	25%	0
257	Pleasant Gap SFH	1st Floor	dmin / Visitor Cente	Lab	Limited Daily Use	2X4 Prism Rec 3L 28W T8	3	72	1460	RT, 4' 10.5W SE LED 3L	3	32	1460	-	0	0.1	0.1	0.1	315	138	177	25%	0
258	Pleasant Gap SFH	1st Floor	dmin / Visitor Cente	Visitor Center	Not In Use	Track Head Hal 100W PAR56	19	100	0	Track Head LED	19	10	0	-	0	0.0	0.0	0.0	0	0	0	0%	0
259	Pleasant Gap SFH	1st Floor	dmin / Visitor Cente	Visitor Center	Not In Use	Track Head Hal 75W PAR38	10	75	0	LED 13W PAR38 Replacement	10	13	0	-	0	0.0	0.0	0.0	0	0	0	0%	0
260	Pleasant Gap SFH	1st Floor	dmin / Visitor Cente	Visitor Center - Case Lighting	Not In Use	8' Strip SP 1L	2	83	0	RT, 4' 10.5W SE LED 2L, 8' BC Kit	2	21	0	-	0	0.0	0.0	0.0	0	0	0	0%	0
261	Pleasant Gap SFH	1st Floor	dmin / Visitor Cente	Visitor Center - Case Lighting	Not In Use	8' Strip SP 2L	1	138	0	RT, 4' 10.5W SE LED 4L, 8' BC Kit	1	42	0	-	0	0.0	0.0	0.0	0	0	0	0%	0
262	Pleasant Gap SFH	Exterior	dmin / Visitor Cente	Main Entrance	Exterior - Dusk to Dawn	Wall Pack LED 15W	1	15	4380	No Action - Existing Efficient Fixture	1	15	4380	-	0	0.0	0.0	0.0	66	66	0	0%	0
263	Pleasant Gap SFH	Exterior	dmin / Visitor Cente	Visitor Entrance	Exterior - Dusk to Dawn	Drum Inc 60W A 2L	1	120	4380	LED 9W A19 Replacement 2L	1	18	4380	-	0	0.0	0.0	0.0	526	79	447	0%	0
264	Pleasant Gap SFH	Exterior	dmin / Visitor Cente	Back Wall	Exterior - Dusk to Dawn	Wall Pack MH 150W	1	190	4380	Wall Pack LED FT TWR 4.4 kLm PC	1	40	4380	-	0	0.0	0.0	0.0	832	175	657	0%	0
265	Pleasant Gap SFH	1st Floor	Lower Garage 450D	Garage Bay	Limited Daily Use	4' Strip LED 15W T8 ULB 2L	13	30	1460	No Action - Existing Efficient Fixture	13	30	1460	-	0	0.2	0.2	0.0	569	569	0	25%	0
266	Pleasant Gap SFH	1st Floor	Lower Garage 450D	Garage Bay	Limited Daily Use	Keyless LED 9W A	1	9	1460	No Action - Existing Efficient Fixture	1	9	1460	-	0	0.0	0.0	0.0	13	13	0	25%	0
267	Pleasant Gap SFH	1st Floor	Lower Garage 450D	Open Storage Area	Storage / Janitor Closet Hatcheries	2X4 Prism Rec 3L 28W T8	3	72	782	RT, 4' 10.5W SE LED 3L	3	32	782	-	0	0.1	0.1	0.1	169	74	95	25%	0
268	Pleasant Gap SFH	1st Floor	Lower Garage 450D	Open Storage Area	Storage / Janitor Closet Hatcheries	2X4 Prism Rec 4L 28W T8	3	96	782	RT, 4' 10.5W SE LED 4L	3	42	782	-	0	0.2	0.1	0.1	225	99	127	25%	0
269	Pleasant Gap SFH	1st Floor	Lower Garage 450D	Open Storage Area	Storage / Janitor Closet Hatcheries	2X4 Prism Rec 4L 28W T8	1	96	782	RT, 4' 10.5W SE LED 4L	1	42	782	-	0	0.1	0.0	0.0	75	33	42	25%	0
270	Pleasant Gap SFH	1st Floor	Lower Garage 450D	Restroom	Restroom Private Hatcheries	Fan Inc 60W A	1	60	782	LED 9W A19 Replacement	1	9	782	-	0	0.0	0.0	0.0	47	7	40	25%	0
271	Pleasant Gap SFH	1st Floor	Lower Garage 450D	Storage Room	Storage / Janitor Closet Hatcheries	2X4 Prism Rec 4L 28W T8	2	96	782	RT, 4' 10.5W SE LED 4L	2	42	782	-	0	0.1	0.0	0.1	150	66	84	25%	0
272	Pleasant Gap SFH	2nd Floor	Lower Garage 450D	Attic	Storage / Janitor Closet Hatcheries	Keyless Inc 60W A	5	60	782	LED 9W A19 Replacement	5	9	782	-	0	0.2	0.0	0.1	235	35	199	25%	0
273	Pleasant Gap SFH	1st Floor	Feed Storage	Storage / Loading Area	Utility Work Buildings	8' Vaportight BP 4L 28W T8	11	96	78	RT, 4' 10.5W SE LED 4L	11	42	78	-	0	0.6	0.3	0.3	82	36	46	25%	0
274	Pleasant Gap SFH	2nd Floor	Feed Storage	Attic	Utility Work Buildings	8' Vaportight BP 4L 28W T8	2	96	78	RT, 4' 10.5W SE LED 4L	2	42	78	-	0	0.1	0.0	0.1	15	7	8	25%	0
275	Pleasant Gap SFH	Exterior	Feed Storage	Building Mounted	Exterior - Dusk to Dawn	Wall Pack MH 150W	4	190	4380	Wall Pack LED FT TWR 4.4 kLm PC	4	40	4380	-	0	0.0	0.0	0.0	3,329	701	2,628	0%	0
276	Pleasant Gap SFH	1st Floor	Pump Shed	Pump Shed	Utility Building	Keyless Empty E26	1	0	26	LED 9W A19 Replacement	1	9	26	-	0	0.0	0.0	0.0	0	0	0	25%	0
277	Pleasant Gap SFH	1st Floor	Generator Building	Generator Room	Utility Building	Keyless CFL 23W Screw In	4	23	26	LED 9W A19 Replacement	4	9	26	-	0	0.1	0.0	0.0	2	1	1	25%	0
278	Pleasant Gap SFH	1st Floor	Generator Building	Generator Room	Utility Building	Keyless Inc 60W A	2	60	26	LED 9W A19 Replacement	2	9	26	-	0	0.1	0.0	0.1	3	0	3	25%	0
279	Pleasant Gap SFH	Exterior	Generator Building	Building Mounted	Exterior - Dusk to Dawn	Wall Pack HPS 50W	1	66	4380	Wall Pack LED Security 1.8 kLm PC	1	15	4380	-	0	0.0	0.0	0.0	289	66	223	0%	0
280	Pleasant Gap SFH	1st Floor	Spring House	Entry / Panel Room	Utility Building	8' Vaportight SP 2L	1	138	26	RT, 4' 10.5W SE LED 4L, 8' VT Kit	1	42	26	-	0	0.1	0.0	0.1	4	1	2	25%	0
281	Pleasant Gap SFH	1st Floor	Spring House	Spring House	Utility Building	8' Vaportight SP 2L	2	138	26	RT, 4' 10.5W SE LED 4L, 8' VT Kit	2	42	26	-	0	0.2	0.0	0.1	7	2	5	25%	0
282	Pleasant Gap SFH	1st Floor	Spring House	Spring House	Utility Building	4' Vaportight BP 2L 28W T8	1	48	26	RT, 4' 10.5W SE LED 2L	1	21	26	-	0	0.0	0.0	0.0	1	1	1	25%	0
283	Pleasant Gap SFH	1st Floor	Spring House	Mechanical Room	Utility Building	8' Vaportight SP 2L	1	138	26	RT, 4' 10.5W SE LED 4L, 8' VT Kit	1	42	26	-	0	0.1	0.0	0.1	4	1	2	25%	0
284	Pleasant Gap SFH	1st Floor	Spring House	Tank Room	Utility Building	8' Vaportight SP 2L	1	138	26	RT, 4' 10.5W SE LED 4L, 8' VT Kit	1	42	26	-	0	0.1	0.0	0.1	4	1	2	25%	0
285	Pleasant Gap SFH	Exterior	Spring House	Building Mounted	Exterior - Dusk to Dawn	Wall Pack MH 175W	2	215	4380	Wall Pack LED FT TWR 4.4 kLm PC	2	40	4380	-	0	0.0	0.0	0.0	1,883	350	1,533	0%	0
286	Pleasant Gap SFH	1st Floor	Mixing Building	Mixing Building	Very Low Hours	8' Vaportight SP 2L	2	138	5	RT, 4' 10.5W SE LED 4L, 8' VT Kit	2	42	5	-	0	0.1	0.0	0.0	1	0	1	25%	0
287	Pleasant Gap SFH	1st Floor	Barn	Barn	Very Low Hours	4' Vaportight BP 2L 28W T8	5	48	5	RT, 4' 10.5W SE LED 2L	5	21	5	-	0	0.1	0.0	0.0	1	1	1	25%	0
288	Pleasant Gap SFH	1st Floor	Upper Garage	Bay 1	Limited Daily Use	8' Industrial T5HO 4L	6	234	1460	RT, 4' 25W SE LED T5HO 4L	6	100	1460	-	0	0.8	0.3	0.4	2,050	876	1,174	25%	0
289	Pleasant Gap SFH	1st Floor	Upper Garage	Bay 1	Limited Daily Use	Low Bay MH 175W	2	215	1460	High Bay LED 10 kLm Round Acrylic	2	89	1460	-	0	0.2	0.1	0.1	628	260	368	25%	0
290	Pleasant Gap SFH	1st Floor	Upper Garage	Bay 2	Limited Daily Use	8' Industrial T5HO 4L	18	234	1460	RT, 4' 25W SE LED T5HO 4L	18	100	1460	-	0	2.3	1.0	1.3	6,150	2,628	3,522	25%	0
291	Pleasant Gap SFH	1st Floor	Upper Garage	Bay 2 - Under Mezzanine	Limited Daily Use	4' Industrial BP 2L 28W T8	1	48	1460	RT, 4' 10.5W SE LED 2L	1	21	1460	-	0	0.0	0.0	0.0	70	31	39	25%	0
292	Pleasant Gap SFH	1st Floor	Upper Garage	Bay 2 - Under Mezzanine	Limited Daily Use	4' Industrial BP 4L	1	144	1460	RT, 4' 10.5W SE LED 4L	1	42	1460	-	0	0.1	0.0	0.1	210	61	149	25%	0
293	Pleasant Gap SFH	1st Floor	Upper Garage	Bay 2 - Cage Storage	Limited Daily Use	4' Industrial BP 4L	1	144	1460	RT, 4' 10.5W SE LED 4L	1	42	1460	-	0	0.1	0.0	0.1	210	61	149	25%	0
294	Pleasant Gap SFH	1st Floor	Upper Garage	Bay 2 - Upper Mezzanine	Limited Daily Use	8' Industrial 2L T5HO	1	117	1460	RT, 4' 25W SE LED T5HO 2L	1	50	1460	-	0	0.1	0.0	0.0	171	73	98	25%	0
295	Pleasant Gap SFH	1st Floor	Upper Garage	Bay 2 - Private Office	Limited Daily Use	4' Wrap BP 2L 32W T8	1	59	1460	RT, 4' 10.5W SE LED 2L	1	21	1095	WS	1	0.0	0.0	0.0	86	31	55	25%	8
296	Pleasant Gap SFH	1st Floor	Upper Garage	Bay 2	Limited Daily Use	RLM Inc 300W A	2	300	1460	LED 15W A19 Replacement	2	15	1460	-	0	0.3	0.0	0.3	876	44	832	25%	0
297	Pleasant Gap SFH	1st Floor	Upper Garage	Mechanical Room	Mechanical/Electrical Room Hatcheries	8' Industrial 2L T5HO	1	117	782	RT, 4' 25W SE LED T5HO 2L	1	50	782	-	0	0.1	0.0	0.0	91	39	52	25%	0
298	Pleasant Gap SFH	1st Floor	Upper Garage	Bay 3	Limited Daily Use	8' Vaportight 4L T5HO	6	234	1460	RT, 4' 25W SE LED T5HO 4L	6	100	1460	-	0	0.8	0.3	0.4	2,050	876	1,174	25%	0
299	Pleasant Gap SFH	1st Floor	Upper Garage	Bay 3	Limited Daily Use	RLM Inc 100W A	1	100	1460	LED 9W A19 Replacement	1	9	1460	-	0	0.1	0.0	0.1	146	13	133	25%	0
300	Pleasant Gap SFH	1st Floor	Upper Garage	Break Room	Limited Daily Use	2X4 Prism Rec 3L 28W T8	3	72	1460	RT, 4' 10.5W SE LED 3L	3	32	1095	CM	3	0.1	0.1	0.1	315	138	177	25%	34
301	Pleasant Gap SFH	1st Floor	Upper Garage	Restroom	Restroom Private Hatcheries	Drum Inc 60W A 2L	1	120	782	LED 9W A19 Replacement 2L	1	18	587	CM	1	0.1	0.0	0.1	94	14	80	25%	4
302	Pleasant Gap SFH	1st Floor	Upper Garage	Restroom	Restroom Private Hatcheries	2X4 Prism Rec 2L 28W T8	1	48	782	RT, 4' 10.5W SE LED 2L	1	21	587	PL	0	0.0	0.0	0.0	38	16	21	25%	4
303	Pleasant Gap SFH	1st Floor	Upper Garage	Bay 4	Limited Daily Use	8' Industrial T5HO 4L	6	234	1460	RT, 4' 25W SE LED T5HO 4L	6	100	1460	-	0	0.8	0.3	0.4	2,050	876	1,174	25%	0
304	Pleasant Gap SFH	1st Floor	Upper Garage	Bay 4 - Task	Limited Daily Use	4' Wrap BP 4L	2	144	1460	RT, 4' 10.5W SE LED 4L	2	42	1460	-	0	0.2	0.0	0.1	420	123	298	25%	0
305	Pleasant Gap SFH	1st Floor	Upper Garage	Bay 5	Limited Daily Use	8' Industrial T5HO 4L	6	234	1460	RT, 4' 25W SE LED T5HO 4L	6	100	1460	-	0	0.8	0.3	0.4	2,050	876	1,174	25%	0
306	Pleasant Gap SFH	1st Floor	Upper Garage	Bay 5	Limited Daily Use	8' Industrial SP 2L	1	138	1460	RT, 4' 10.5W SE LED 4L, 8' BC Kit	1	42	1460	-	0	0.1	0.0	0.1	201	61	140	25%	0
307	Pleasant Gap SFH	1st Floor	Upper Garage	Bay 6	Limited Daily Use	Explosion Proof MH 100W	8	128	1460	Canopy LED 1.4 kLm	8	13	1460	-	0	0.6	0.1	0.5	1,495	152	1,343	25%	0
308	Pleasant Gap SFH	1st Floor	Upper Garage	Bay 6	Limited Daily Use	Explosion Proof MH 100W	1	128	1460	Canopy LED 1.4 kLm	1	13	1460	-	0	0.1	0.0	0.1	187	19	168	25%	0
309	Pleasant Gap SFH	1st Floor	Upper Garage	Bay 6	Limited Daily Use	Explosion Proof MH 70W	6	95	1460	Jelly Jar LED 600Lm Ceiling	6	15	1460	-	0	0.3	0.0	0.3	832	131	701	25%	0
310	Pleasant Gap SFH	Exterior	Upper Garage	Man Door Canopy	Exterior - Dusk to Dawn	6" Rec Can Hal 75W PAR38	2	75	4380	LED 13W PAR38 Replacement	2	13	4380	-	0	0.0	0.0	0.0	657	114	543	0%	0
311	Pleasant Gap SFH	Exterior	Upper Garage	Side of Building	Exterior - Dusk to Dawn	Wall Pack MH 150W PC	2	190	4380	Wall Pack LED FT TWR 4.4 kLm PC	2	40	4380	-	0	0.0	0.0	0.0	1,664	350	1,314	0%	0
312	Pleasant Gap SFH	1st Floor	Blue Butler Building	Bay	Limited Daily Use	High Bay HPS 150W	12	188	1460	High Bay LED 10 kLm Round Acrylic	12	89	1095	FI-OCC	12	1.2	0.6	0.7	3,294	1,559	1,734	25%	390
313	Pleasant Gap SFH	1st Floor	Blue Butler Building	Bay	Limited Daily Use	2X4 Prism Sur 3L	2	115	1460	RT, 4' 10.5W SE LED 3L	2	32	1460	-	0	0.1	0.0	0.1	336	92	244	25%	0
314	Pleasant Gap SFH	1st Floor	Blue Butler Building	Bay	Limited Daily Use	Flood Hal 90 PAR38	1	90	1460	LED 14W PAR38 Replacement WL	1	14	1460	-	0	0.0	0.0	0.0	131	20	111	25%	0
315	Pleasant Gap SFH	1st Floor	Blue Butler Building	Bay	Limited Daily Use	Keyless Inc 60W A	7	60	1460	LED 9W A19 Replacement	7	9	1460	-	0	0.2	0.0	0.2	613	92	521	25%	0
316	Pleasant Gap SFH	1st Floor	Blue Butler Building	Bay	Limited Daily Use	2X4 Prism Rec 2L	1	72	1460	RT, 4' 10.5W SE LED 2L	1	21	1460	-	0	0.0	0.0	0.0	105	31	74	25%	0
317	Pleasant Gap SFH	1st Floor	Blue Butler Building	Bay - Task	Limited Daily Use	8' Industrial HO 2L	2	207	1460	RT, 4' 10.5W SE LED 4L, 8' BC Kit	2	42	1460	-	0	0.2	0.0	0.2	604	123	482	25%	0
318	Pleasant Gap SFH	1st Floor	Blue Butler Building	Bay - Cage Storage	Limited Daily Use	Flood Quartz 250W	1	250	1460	Flood LED 3 kLm KN	1	21	1460	-	0	0.1	0.0	0.1	365	31	334	25%	0
319	Pleasant Gap SFH	Exterior	Blue Butler Building	Building Mounted	Exterior - Dusk to Dawn	Wall Pack MH 175W	2	215	4380	Wall Pack LED FT TWR 4.4 kLm	2	40	4380	-	0	0.0	0.0	0.0	1,883	350	1,533	0%	0
320	Pleasant Gap SFH	Exterior	Open Garage	Open Garage Bay	Limited Daily Use	Keyless Inc 100W A	6	100	1460	LED 9W A19 Replacement	6	9	1460	-	0	0.3	0.0	0.3	876	79	797	25%	0
321	Pleasant Gap SFH	1st Floor	per Generator Buildi	Upper Generator Building	Utility Building	Keyless Inc 60W A	4	60	26	LED 9W A19 Replacement	4	9	26	-	0	0.1	0.0	0.1	6	1	5	25%	0
322	Pleasant Gap SFH	1st Floor	Oxygen Building	Oxygen Building	Utility Building	Keyless LED 9W A	4	9	26	No Action - Existing Efficient Fixture	4	9	26	-	0	0.0	0.0	0.0	1	1	0	25%	0
323	Pleasant Gap SFH	1st Floor	icro screening Buildi	Storage Room	Limited Daily Use	8' Industrial HO 2L	4	207	1460	RT, 4' 10.5W SE LED 4L, 8' BC Kit	4	42	1460	-	0	0.5	0.1	0.4	1,209	245	964	25%	0
324	Pleasant Gap SFH	1st Floor	icro screening Buildi	Screen Room	Limited Daily Use	8' Vaportight SP 2L	2	138	1460	RT, 4' 10.5W SE LED 4L, 8' VT Kit	2	42	1460	-	0	0.2	0.0	0.1	403	123	280	25%	0
325	Pleasant Gap SFH	1st Floor	icro screening Buildi	Attic	Storage / Janitor Closet Hatcheries	Keyless Inc 60W A	2	60	782	LED 9W A19 Replacement	2	9	782	-	0	0.1	0.0	0.1	94	14	80	25%	0
326	Pleasant Gap SFH	Exterior	icro screening Buildi	Building Mounted	Exterior - Dusk to Dawn	Wall Pack MH 70W	2	95	4380	Wall Pack LED Security 1.8 kLm PC	2	15	4380	-	0	0.0	0.0	0.0	832	131	701	0%	0
327	Pleasant Gap SFH	1st Floor	wer Generator Buildi	Storage Room	Limited Daily Use	8' Industrial SP 2L	4	138	1460	RT, 4' 10.5W SE LED 4L, 8' BC Kit	4	42	1460	-	0	0.3	0.1	0.2	806	245	561	25%	0
328	Pleasant Gap SFH	1st Floor	wer Generator Buildi	Attic	Storage / Janitor Closet Hatcheries	Keyless Inc 60W A	1	60	782	LED 9W A19 Replacement	1	9	782	-	0	0.0	0.0	0.0	47	7	40	25%	0
329	Pleasant Gap SFH	Exterior	wer Generator Buildi	Building Mounted	Exterior - Dusk to Dawn	Wall Pack MH 70W	2	95	4380	Wall Pack LED Security 1.8 kLm PC	2	15	4380	-	0	0.0	0.0	0.0	832	131	701	0%	0
330	Pleasant Gap SFH	1st Floor	Truck Shed	Truck Shed	Very Low Hours	Keyless Inc 100W A	1	100	5	LED 9W A19 Replacement	1	9	5	-	0	0.0	0.0	0.0	1	0	0	25%	0

ID #	Location					Existing Fixture				Proposed Fixture						PeakDemand			Usage			Controls	
	Building # : Name	Floor	Area	Sub Area / Room	Usage Group	Fixture	Quantity	Input Wattage	Hours of Operation	ECM	Quantity	Input Wattage	Hours of Operation	Occ Sensor Type	Occ Sensor Qty	Pre	Post	Savings	Pre	Post	Savings	Savings %	Savings
331	Pleasant Gap SFH	Exterior	Area Lighting	Screening	Exterior - Switch	Globe MV 175W	4	215	469	Area LED 7 kLm, PC Wood Pole	4	51	469	-	0	0.0	0.0	0.0	403	96	308	0%	0
332	Pleasant Gap SFH	Exterior	Area Lighting	Dirt Road to Screening	Exterior - Switch	Globe MV 175W	3	215	469	Area LED 7 kLm, PC Wood Pole	3	51	469	-	0	0.0	0.0	0.0	303	72	231	0%	0
333	Pleasant Gap SFH	Exterior	Area Lighting	By Lower Garage	Exterior - Switch	Globe MV 175W	1	215	469	Area LED 7 kLm, PC Wood Pole	1	51	469	-	0	0.0	0.0	0.0	101	24	77	0%	0
334	Pleasant Gap SFH	Exterior	Area Lighting	Feed Storage Loading Dock	Exterior - Dusk to Dawn	Shoebox LED 105W	1	105	4380	No Action - Existing Efficient Fixture	1	105	4380	-	0	0.0	0.0	0.0	460	460	0	0%	0
335	Pleasant Gap SFH	Exterior	Area Lighting	Parking by Feed Storage	Exterior - Switch	Globe MV 175W	5	215	469	Area LED 7 kLm, PC Wood Pole	5	51	469	-	0	0.0	0.0	0.0	504	120	385	0%	0
336	Pleasant Gap SFH	Exterior	Area Lighting	Small Raceways	Exterior - Dusk to Dawn	Shoebox LED 105W	4	105	4380	No Action - Existing Efficient Fixture	4	105	4380	-	0	0.0	0.0	0.0	1,840	1,840	0	0%	0
337	Pleasant Gap SFH	Exterior	Area Lighting	Parking by Hatch House	Exterior - Dusk to Dawn	Shoebox LED 105W	1	105	4380	No Action - Existing Efficient Fixture	1	105	4380	-	0	0.0	0.0	0.0	460	460	0	0%	0
338	Pleasant Gap SFH	Exterior	Area Lighting	Main Entry Drive / Front Parking	Exterior - Switch	Globe MV 175W	5	215	469	Area LED 7 kLm, PC Wood Pole	5	51	469	-	0	0.0	0.0	0.0	504	120	385	0%	0
339	Pleasant Gap SFH	Exterior	Area Lighting	Center Raceways	Exterior - Dusk to Dawn	Shoebox LED 105W	6	105	4380	No Action - Existing Efficient Fixture	6	105	4380	-	0	0.0	0.0	0.0	2,759	2,759	0	0%	0
340	Pleasant Gap SFH	Exterior	Area Lighting	Upper Raceways	Exterior - Switch	Shoebox HPS 250W	14	295	469	Area LED 10 kLm, PC	14	72	469	-	0	0.0	0.0	0.0	1,937	473	1,464	0%	0
341	Pleasant Gap SFH	Exterior	Area Lighting	Oxygen Building	Exterior - Switch	Shoebox HPS 250W	1	295	469	Area LED 10 kLm, PC	1	72	469	-	0	0.0	0.0	0.0	138	34	105	0%	0
342	Pleasant Gap SFH	Exterior	Area Lighting	By Barn	Exterior - Switch	Missing Fixture	1	0	469	Area LED 7 kLm, PC Wood Pole	1	51	469	-	0	0.0	0.0	0.0	0	24	-24	0%	0
343	Pleasant Gap SFH	Exterior	Area Lighting	By Feed Silos	Exterior - Switch	Globe MV 175W	1	215	469	Area LED 7 kLm, PC Wood Pole	1	51	469	-	0	0.0	0.0	0.0	101	24	77	0%	0
344	Pleasant Gap SFH	Exterior	Area Lighting	Dirt Road to Upper Garage	Exterior - Dusk to Dawn	Cobra Head HPS 400W	3	465	4380	Area LED 14 kLm, MA	3	109	4380	-	0	0.0	0.0	0.0	6,110	1,432	4,678	0%	0
345	Bellefonte SFH	1st Floor	Office / Hatch House	Hallway	Office Hours 9h 7d/week	2x2 Prism Rec 2L 32W U6 T8	2	59	3285	RT, 2' 7W SE LED 2L, 2x2 Refl Kit	2	14	3285	-	0	0.1	0.0	0.1	388	92	296	25%	0
346	Bellefonte SFH	1st Floor	Office / Hatch House	Private Office 1	Office Hours 9h 7d/week	2x2 Prism Rec 2L 32W U6 T8	5	59	3285	RT, 2' 7W SE LED 2L, 2x2 Refl Kit	5	14	2464	WS	1	0.2	0.1	0.2	969	230	739	25%	57
347	Bellefonte SFH	1st Floor	Office / Hatch House	Closet	Storage / Janitor Closet Hatcheries	2X4 Prism Rec 4L	1	144	782	RT, 4' 10.5W SE LED 4L	1	42	782	-	0	0.1	0.0	0.1	113	33	80	25%	0
348	Bellefonte SFH	1st Floor	Office / Hatch House	Private Office 2	Office Hours 9h 7d/week	2x2 Prism Rec 2L 32W U6 T8	5	59	3285	RT, 2' 7W SE LED 2L, 2x2 Refl Kit	5	14	2464	WS	1	0.2	0.1	0.2	969	230	739	25%	57
349	Bellefonte SFH	1st Floor	Office / Hatch House	Reception	Office Hours 9h 7d/week	2x2 Prism Rec 2L 32W U6 T8	6	59	3285	RT, 2' 7W SE LED 2L, 2x2 Refl Kit	6	14	3285	-	0	0.3	0.1	0.2	1,163	276	887	25%	0
350	Bellefonte SFH	1st Floor	Office / Hatch House	Hallway by Restrooms	Office Hours 9h 7d/week	2x2 Prism Rec 2L 32W U6 T8	1	59	3285	RT, 2' 7W SE LED 2L, 2x2 Refl Kit	1	14	3285	-	0	0.0	0.0	0.0	194	46	148	25%	0
351	Bellefonte SFH	1st Floor	Office / Hatch House	Men's Restroom	Restroom Public Hatcheries	2x2 Prism Rec 2L 32W U6 T8	2	59	1564	RT, 2' 7W SE LED 2L, 2x2 Refl Kit	2	14	860	CM	2	0.1	0.0	0.0	185	44	141	45%	20
352	Bellefonte SFH	1st Floor	Office / Hatch House	Women's Restroom	Restroom Public Hatcheries	2x2 Prism Rec 2L 32W U6 T8	2	59	1564	RT, 2' 7W SE LED 2L, 2x2 Refl Kit	2	14	860	CM	2	0.1	0.0	0.0	185	44	141	45%	20
353	Bellefonte SFH	1st Floor	Office / Hatch House	Visitor Center	Visitor Center 7.5h 7d/week	2X4 Prism Rec 4L	9	144	2738	RT, 4' 10.5W SE LED 4L	9	42	2738	-	0	1.0	0.3	0.7	3,548	1,035	2,513	30%	0
354	Bellefonte SFH	1st Floor	Office / Hatch House	Hallway to Hatchery	Office Hours 9h 7d/week	2x2 Prism Rec 2L 32W U6 T8	2	59	3285	RT, 2' 7W SE LED 2L, 2x2 Refl Kit	2	14	3285	-	0	0.1	0.0	0.1	388	92	296	25%	0
355	Bellefonte SFH	1st Floor	Office / Hatch House	Lab / Kitchenette	Office Hours 9h 7d/week	2X2 Prism Rec LED 10W T8 ULB 2L	4	20	3285	No Action - Existing Efficient Fixture	4	20	3285	-	0	0.1	0.1	0.0	263	263	0	25%	0
356	Bellefonte SFH	1st Floor	Office / Hatch House	Storage Closet	Storage / Janitor Closet Hatcheries	Drum Inc 60W A 2L	1	120	782	LED 9W A19 Replacement 2L	1	18	782	-	0	0.1	0.0	0.1	94	14	80	25%	0
357	Bellefonte SFH	1st Floor	Office / Hatch House	Storage Closet	Storage / Janitor Closet Hatcheries	2X2 Prism Rec LED 10W T8 ULB 2L	4	20	782	No Action - Existing Efficient Fixture	4	20	782	-	0	0.0	0.0	0.0	63	63	0	25%	0
358	Bellefonte SFH	1st Floor	Office / Hatch House	Locker Room	Restroom Public Hatcheries	2X2 Prism Rec LED 10W T8 ULB 2L	5	20	1564	No Action - Existing Efficient Fixture	5	20	860	CM	5	0.1	0.1	0.0	156	156	0	45%	70
359	Bellefonte SFH	1st Floor	Office / Hatch House	Locker Room - Shower	Restroom Public Hatcheries	Drum Inc 60W A 2L	1	120	1564	LED 9W A19 Replacement 2L	1	18	1564	-	0	0.1	0.0	0.1	188	28	160	45%	0
360	Bellefonte SFH	1st Floor	Office / Hatch House	Break Room	Office Hours 9h 7d/week	2X4 Prism Rec 2L	4	72	3285	RT, 4' 10.5W SE LED 2L	4	21	2464	CM	4	0.2	0.1	0.2	946	276	670	25%	69
361	Bellefonte SFH	1st Floor	Office / Hatch House	Hatchery	Office Hours 9h 7d/week	2X4 Prism Rec 4L 32W T8	18	112	3285	RT, 4' 10.5W SE LED 4L	18	42	3285	-	0	1.6	0.6	1.0	6,623	2,483	4,139	25%	0
362	Bellefonte SFH	1st Floor	Office / Hatch House	Hatchery	Office Hours 9h 7d/week	Exit Sign Inc	1	30	3285	Exit Sign LED	1	3	3285	-	0	0.0	0.0	0.0	99	10	89	25%	0
363	Bellefonte SFH	1st Floor	Office / Hatch House	Incubator	Office Hours 9h 7d/week	2X4 Prism Rec 4L 32W T8	3	112	3285	RT, 4' 10.5W SE LED 4L	3	42	3285	-	0	0.3	0.1	0.2	1,104	414	690	25%	0
364	Bellefonte SFH	1st Floor	Office / Hatch House	Vestibule	Office Hours 9h 7d/week	2x2 Prism Rec 2L 32W U6 T8	1	59	3285	RT, 2' 7W SE LED 2L, 2x2 Refl Kit	1	14	3285	-	0	0.0	0.0	0.0	194	46	148	25%	0
365	Bellefonte SFH	1st Floor	Office / Hatch House	Garage Bay	Office Hours 9h 7d/week	8' Industrial T5HO 4L	10	234	3285	RT, 4' 25W SE LED T5HO 4L	10	100	3285	-	0	1.9	0.8	1.1	7,687	3,285	4,402	25%	0
366	Bellefonte SFH	1st Floor	Office / Hatch House	Garage Bay - Storage Area	Storage / Janitor Closet Hatcheries	2X4 Prism Rec 3L	1	115	782	RT, 4' 10.5W SE LED 3L	1	32	782	-	0	0.1	0.0	0.0	90	25	65	25%	0
367	Bellefonte SFH	2nd Floor	Office / Hatch House	Attic	Storage / Janitor Closet Hatcheries	Keyless Inc 60W A	1	60	782	LED 9W A19 Replacement	1	9	782	-	0	0.0	0.0	0.0	47	7	40	25%	0
368	Bellefonte SFH	Exterior	Office / Hatch House	Building Mounted	Exterior - Dusk to Dawn	Wall Pack LED 30W	1	30	4380	No Action - Existing Efficient Fixture	1	30	4380	-	0	0.0	0.0	0.0	131	131	0	0%	0
369	Bellefonte SFH	1st Floor	Feed Silo Shed	Feed Silo Shed	Utility Building	Keyless Inc 60W A	1	60	26	LED 9W A19 Replacement	1	9	26	-	0	0.0	0.0	0.0	2	0	1	25%	0
370	Bellefonte SFH	1st Floor	Generator Building	Generator Building	Utility Building	8' Industrial HO 2L	3	207	26	RT, 4' 10.5W SE LED 4L, 8' BC Kit	3	42	26	-	0	0.3	0.1	0.3	16	3	13	25%	0
371	Bellefonte SFH	1st Floor	Pump Building	Pump	Utility Building	8' Industrial SP 2L	3	138	26	RT, 4' 10.5W SE LED 4L, 8' BC Kit	3	42	26	-	0	0.2	0.1	0.2	11	3	7	25%	0
372	Bellefonte SFH	Exterior	Pump Building	Outdoor Pump	Utility Building	8' Vaportight SP 2L	1	138	26	RT, 4' 10.5W SE LED 4L, 8' VT Kit	1	42	26	-	0	0.1	0.0	0.1	4	1	2	25%	0
373	Bellefonte SFH	Exterior	Pump Building	Outdoor Pump	Exterior - Switch	Wall Pack MH 100W PC	1	128	469	Wall Pack LED FT TWR 3.4 kLm PC	1	28	469	-	0	0.0	0.0	0.0	60	13	47	0%	0
374	Bellefonte SFH	Exterior	Pump Building	Outdoor Pump	Exterior - Switch	Wall Pack LED 30W	1	30	469	No Action - Existing Efficient Fixture	1	30	469	-	0	0.0	0.0	0.0	14	14	0	0%	0
375	Bellefonte SFH	1st Floor	Spring Flow Building	Spring Flow - Above Water	Low Hours	High Bay LED 55W	2	55	8	No Action - Existing Efficient Fixture	2	55	8	-	0	0.1	0.1	0.0	1	1	0	25%	0
376	Bellefonte SFH	1st Floor	Lower Pump	Lower Pump	Utility Building	8' Industrial SP 2L	1	138	26	RT, 4' 10.5W SE LED 4L, 8' BC Kit	1	42	26	-	0	0.1	0.0	0.1	4	1	2	25%	0
377	Bellefonte SFH	1st Floor	Lower Pump	Lower Pump	Utility Building	4' Industrial BP 2L	1	72	26	RT, 4' 10.5W SE LED 2L	1	21	26	-	0	0.0	0.0	0.0	2	1	1	25%	0
378	Bellefonte SFH	1st Floor	Lower Pump	Lower Pump	Utility Building	8' Strip SP 2L	2	138	26	RT, 4' 10.5W SE LED 4L, 8' BC Kit	2	42	26	-	0	0.2	0.0	0.1	7	2	5	25%	0
379	Bellefonte SFH	Exterior	Lower Pump	Outdoor Lower Pump	Utility Building	4' Vaportight BP 2L	1	72	26	RT, 4' 10.5W SE LED 2L	1	21	26	-	0	0.0	0.0	0.0	2	1	1	25%	0
380	Bellefonte SFH	Exterior	Lower Pump	Outdoor Lower Pump	Exterior - Dusk to Dawn	Wall Pack MH 100W PC	1	128	4380	Wall Pack LED FT TWR 3.4 kLm PC	1	28	4380	-	0	0.0	0.0	0.0	561	123	438	0%	0
381	Bellefonte SFH	Exterior	Lower Pump	Outdoor Lower Pump	Utility Building	8' Vaportight SP 2L	1	138	26	RT, 4' 10.5W SE LED 4L, 8' VT Kit	1	42	26	-	0	0.1	0.0	0.1	4	1	2	25%	0
382	Bellefonte SFH	1st Floor	Mid-Point LHO	Mid-Point LHO	Utility Work Buildings	8' Vaportight SP 2L	2	138	78	RT, 4' 10.5W SE LED 4L, 8' VT Kit	2	42	78	-	0	0.2	0.0	0.1	22	7	15	25%	0
383	Bellefonte SFH	Exterior	Mid-Point LHO	Building Mounted	Exterior - Switch	Jelly Jar Inc 100W A	2	100	469	LED 9W A19 Replacement	2	9	469	-	0	0.0	0.0	0.0	94	8	85	0%	0
384	Bellefonte SFH	Exterior	Mid-Point LHO	Building Mounted	Exterior - Switch	8' Vaportight SP 2L	1	138	469	RT, 4' 10.5W SE LED 4L, 8' VT Kit	1	42	469	-	0	0.0	0.0	0.0	65	20	45	0%	0
385	Bellefonte SFH	Exterior	Mid-Point LHO	Building Mounted	Exterior - Switch	Barnlight LED 30W	1	30	469	No Action - Existing Efficient Fixture	1	30	469	-	0	0.0	0.0	0.0	14	14	0	0%	0
386	Bellefonte SFH	1st Floor	wer Generator Buildi	Lower Generator	Utility Building	8' Industrial SP 2L	3	138	26	RT, 4' 10.5W SE LED 4L, 8' BC Kit	3	42	26	-	0	0.2	0.1	0.2	11	3	7	25%	0
387	Bellefonte SFH	Exterior	wer Generator Buildi	Building Mounted	Exterior - Switch	Wall Pack CFL 26W 4P	1	27	469	Wall Pack LED Security 1.8 kLm PC	1	15	469	-	0	0.0	0.0	0.0	13	7	6	0%	0
388	Bellefonte SFH	1st Floor	Lower Hatch House	Lower Hatch House	Limited Daily Use	4' Vaportight BP 2L	13	72	1460	RT, 4' 10.5W SE LED 2L	13	21	1460	-	0	0.5	0.2	0.4	1,367	399	968	25%	0
389	Bellefonte SFH	1st Floor	Lower Hatch House	Lower Hatch House	Limited Daily Use	4' Vaportight BP 2L	2	72	1460	RT, 4' 10.5W SE LED 2L	2	21	1460	-	0	0.1	0.0	0.1	210	61	149	25%	0
390	Bellefonte SFH	Exterior	Lower Hatch House	Building Mounted	Exterior - Switch	Barnlight LED 30W	1	30	469	No Action - Existing Efficient Fixture	1	30	469	-	0	0.0	0.0	0.0	14	14	0	0%	0
391	Bellefonte SFH	1st Floor	Carpenter Shop	Carpenter Shop	Utility Work Buildings	8' Industrial SP 2L	4	138	78	RT, 4' 10.5W SE LED 4L, 8' BC Kit	4	42	78	-	0	0.3	0.1	0.2	43	13	30	25%	0
392	Bellefonte SFH	1st Floor	Pole Barn	Garage Bay	Limited Daily Use	High Bay HPS 250W	5	295	1460	LED HID High Bay Retrofit 12 kLm Mog	5	90	1460	-	0	0.8	0.2	0.6	2,154	657	1,497	25%	0
393	Bellefonte SFH	1st Floor	Pole Barn	Storage Area	Storage / Janitor Closet Hatcheries	High Bay HPS 250W	1	295	782	LED HID High Bay Retrofit 12 kLm Mog	1	90	782	-	0	0.2	0.0	0.1	231	70	160	25%	0
394	Bellefonte SFH	1st Floor	Pole Barn	Storage Area	Storage / Janitor Closet Hatcheries	4' Vaportight BP 2L	1	72	782	RT, 4' 10.5W SE LED 2L	1	21	782	-	0	0.0	0.0	0.0	56	16	40	25%	0
395	Bellefonte SFH	1st Floor	Pole Barn	Chemical Storage	Limited Daily Use	4' Strip BP 2L	2	72	1460	RT, 4' 10.5W SE LED 2L	2	21	1460	-	0	0.1	0.0	0.1	210	61	149	25%	0
396	Bellefonte SFH	Exterior	Pole Barn	Side Area	Exterior - Switch	Keyless Empty E26	1	0	469	LED 9W A19 Replacement	1	9	469	-	0	0.0	0.0	0.0	0	4	-4	0%	0
397	Bellefonte SFH	1st Floor	ffluent Filter Buildin	Affluent Filter Building	Utility Work Buildings	4' Vaportight BP 2L 32W T8	24	59	78	RT, 4' 10.5W SE LED 2L	24	21	78	-	0	0.8	0.3	0.5	110	39	71	25%	0
398	Bellefonte SFH	1st Floor	ffluent Filter Buildin	Mechanical Room	Utility Work Buildings	4' Wrap BP 2L 32W T8	2	59	78	RT, 4' 10.5W SE LED 2L	2	21	78	-	0	0.1	0.0	0.0	9	3	6	25%	0
399	Bellefonte SFH	Exterior	ffluent Filter Buildin	Building Mounted	Exterior - Dusk to Dawn	Wall Pack LED 30W	5	30	4380	No Action - Existing Efficient Fixture	5	30	4380	-	0	0.0	0.0	0.0	657	657	0	0%	0
400	Bellefonte SFH	Exterior	Area Lighting	Water Cleaning Station	Exterior - Switch	Barnlight HPS 250W	1	295	469	Barnlight LED 4 kLm PC	1	29	469	-	0	0.0	0.0	0.0	138	14	125	0%	0
401	Bellefonte SFH	Exterior	Area Lighting	Lower Raceway	Exterior - Dusk to Dawn	Flood LED 100W	6	100	4380	No Action - Existing Efficient Fixture	6	100	4380	-	0	0.0	0.0	0.0	2,628	2,628	0	0%	0
402	Bellefonte SFH	Exterior	Area Lighting	Mid Raceway	Exterior - Dusk to Dawn	Cobra Head LED 140W	6	140	4380	No Action - Existing Efficient Fixture	6	140	4380	-	0	0.0	0.0	0.0	3,679	3,679	0	0%	0
403	Bellefonte SFH	Exterior	Area Lighting	Upper Raceways	Exterior - Dusk to Dawn	Flood LED 100W	1	100	4380	No Action - Existing Efficient Fixture	1	100	4380	-	0	0.0	0.0	0.0	438	438	0	0%	0
404	Bellefonte SFH	Exterior	Area Lighting	Upper Generator Building	Exterior - Switch	Barnlight MV 175W	1	205	469	Barnlight LED 4 kLm PC	1	29	469	-	0	0.0	0.0	0.0	96	14	83	0%	0
405	Bellefonte SFH	Exterior	Area Lighting	Feed Silos	Exterior - Switch	Barnlight LED 30W	1	30	469	No Action - Existing Efficient Fixture	1	30	469	-	0	0.0	0.0	0.0	14	14	0	0%	0
406	Tionesta SFH	1st Floor	dmin / Visitor Cente	Rear Entrance Vestibule	Office Hours 9h 7d/week	2X4 Prism Rec 2L 32W T8	1	59	3285	RT, 4' 10.5W SE LED 2L	1	21	3285	-	0	0.0	0.0	0.0	194	69	125	25%	0
407	Tionesta SFH	1st Floor	dmin / Visitor Cente	Hallway	Office Hours 9h 7d/week	2X4 Flat Panel Rec LED 40W	6	40	3285	No Action - Existing Efficient Fixture	6	40	3285	-	0	0.2	0.2	0.0	788	788	0	25%	0
408	Tionesta SFH	1st Floor	dmin / Visitor Cente	Private Office 1	Office Hours 9h 7d/week	2X4 Par Rec 4L 32W T8	2	112	3285	RT, 4' 10.5W SE LED 4L	2	42	2464	WS	1	0.2	0.1	0.1	736	276	460	25%	69
409	Tionesta SFH	1st Floor	dmin / Visitor Cente	Private Office 2	Office Hours 9h 7d/week	2X4 Par Rec 4L 32W T8	2	112	3285	RT, 4' 10.5W SE LED 4L	2	42	2464	WS	1	0.2	0.1	0.1	736	276	460	25%	69
410	Tionesta SFH	1st Floor	dmin / Visitor Cente	Men's Restroom	Restroom Public Hatcheries	2X4 Prism Rec 2L 32W T8	2	59	860	RT, 4' 10.5W SE LED 2L	2	21	860	-	0	0.1	0.0	0.0	101	36	65	45%	0
411	Tionesta SFH	1st Floor	dmin / Visitor Cente	Men's Restroom	Restroom Public Hatcheries	2' Wall Bracket 2L T8	1	33	1564	RT, 2' 7W SE LED 2L	1	14	1564	-	0	0.0	0.0	0.0	52	22	30	45%	0
412	Tionesta SFH	1st Floor	dmin / Visitor Cente	Kitchenette	Office Hours 9h 7d/week	2X4 Flat Panel Rec LED 40W	2	40	3285	No Action - Existing Efficient Fixture	2	40	3285	-	0	0.1	0.1	0.0	263	263	0	25%	0
413	Tionesta SFH	1st Floor	dmin / Visitor Cente	Women's Restroom	Restroom Public Hatcheries	2X4 Prism Rec 2L 32W T8	1	59	1564	RT, 4' 10.5W SE LED 2L	1	21	860	WS	1	0.0	0.0	0.0	92	33	59	45%	15
414	Tionesta SFH	1st Floor	dmin / Visitor Cente	Women's Restroom	Restroom Public Hatcheries	2' Wall Bracket 2L T8	1	33	1564	RT, 2' 7W SE LED 2L	1	14	860	PL	0	0.0	0.0	0.0	52	22	30	45%	10
415	Tionesta SFH	1st Floor	dmin / Visitor Cente	Break Room	Office Hours 9h 7d/week	2X4 Prism Rec 2L 32W T8	6	59	3285	RT, 4' 10.5W SE LED 2L	6	21	2464	CM	6	0.3	0.1	0.2	1,163	414	749	25%	103
416	Tionesta SFH	1st Floor	dmin / Visitor Cente	Private Office 3	Office Hours 9h 7d/week	2X4 Par Rec 4L 32W T8	2	112	3285	RT, 4' 10.5W SE LED 4L	2	42	2464	WS	1	0.2	0.1	0.1	736	276	460	25%	69
417	Tionesta SFH	1st Floor	dmin / Visitor Cente	Private Office 4	Office Hours 9h 7d/week	2X4 Par Rec 4L 32W T8	2	112	3285	RT, 4' 10.5W SE LED 4L	2	42	2464	WS	1	0.2	0.1	0.1	736	276	460	25%	69
418	Tionesta SFH	1st Floor	dmin / Visitor Cente	Storage Closet	Storage / Janitor Closet Hatcheries	2X4 Prism Rec 2L 32W T8	1	59	782	RT, 4' 10.5W SE LED 2L	1	21	782	-	0	0.0	0.0	0.0	46	16	30	25%	0
419	Tionesta SFH	1st Floor	dmin / Visitor Cente	Private Office 5	Office Hours 9h 7d/week	2X4 Par Rec 4L 32W T8	2	112	3285	RT, 4' 10.5W SE LED 4L	2	42	2464	WS	1	0.2	0.1	0.1	736	276	460	25%	69
420	Tionesta SFH	1st Floor	dmin / Visitor Cente	Visitor Center	Visitor Center 7.5h 7d/week	2x2 Prism Rec MH 250W	4	295	2738	2x2 Rec High Bay LED 12 kLm	4	113	2738	-	0	0.9	0.4	0.6	3,231	1,238	1,993	30%	0
421	Tionesta SFH	1st Floor	dmin / Visitor Cente	Visitor Center	Visitor Center 7.5h 7d/week	2X4 Prism Rec 2L 32W T8	2	59	2738	RT, 4' 10.5W SE LED 2L	2	21	2738	-	0	0.1	0.0	0.1	323	115	208	30%	0
422	Tionesta SFH	1st Floor	dmin / Visitor Cente	Visitor Center - Vestibule	Visitor Center 7.5h 7d/week	4' Wrap BP 2L 32W T8	1	59	2738	RT, 4' 10.5W SE LED 2L	1	21	2738	-	0	0.0	0.0	0.0	162	57	104	30%	0
423	Tionesta SFH	1st Floor	dmin / Visitor Cente	Under Stairs Closet	Storage / Janitor Closet Hatcheries	Keyless Empty E26	1	0	782	LED 9W A19 Replacement	1	9	782	-	0	0.0	0.0	0.0	0	7	-7	25%	0
424	Tionesta SFH	1st Floor	dmin / Visitor Cente	Men's Restroom	Restroom Public Hatcheries	2X4 Prism Rec 2L 32W T8	1	59	1564	RT, 4' 10.5W SE LED 2L	1	21	860	CM	1	0.0	0.0	0.0	92	33	59	45%	15
425	Tionesta SFH	1st Floor	dmin / Visitor Cente	Men's Restroom	Restroom Public Hatcheries	2' Wall Bracket 2L T8	1	33	1564	RT, 2' 7W SE LED 2L	1	14	860	PL	0	0.0	0.0	0.0	52	22	30	45%	10
426	Tionesta SFH	1st Floor	dmin / Visitor Cente	Women's Restroom	Restroom Public Hatcheries	2X4 Prism Rec 2L 32W T8	1	59	1564	RT, 4' 10.5W SE LED 2L	1	21	860	CM	1	0.0	0.0	0.0	92	33	59	45%	15
427	Tionesta SFH	1st Floor	dmin / Visitor Cente	Women's Restroom	Restroom Public Hatcheries	2' Wall Bracket 2L T8	1	33	1564	RT, 2' 7W SE LED 2L	1	14	860	PL	0	0.0	0.0	0.0	52	22	30	45%	10
428	Tionesta SFH	2nd Floor	dmin / Visitor Cente	Visitor Center	Visitor Center 7.5h 7d/week	2X4 Prism Rec 2L 32W T8	4	59	2738	RT, 4' 10.5W SE LED 2L	4	21	2738	-	0	0.2	0.1	0.1	646	230	416	30%	0
429	Tionesta SFH	1st Floor	dmin / Visitor Cente	Garage Bay 1	Office Hours 9h 7d/week	8' Industrial SP 2L	6	138	3285	RT, 4' 10.5W SE LED 4L, 8' BC Kit	6	42	3285	-	0	0.7	0.2	0.5	2,720	828	1,892	25%	0
430	Tionesta SFH	1st Floor	dmin / Visitor Cente	Mechanical Room	Mechanical/Electrical Room Hatcheries	4' Industrial BP 2L	4	72	782	RT, 4' 10.5W SE LED 2L	4	21	782	-	0	0.2	0.0	0.1	225	66	160	25%	0
431	Tionesta SFH	1st Floor	dmin / Visitor Cente	Garage Bay 2	Office Hours 9h 7d/week	8' Vaportight SP 2L	5	138	3285	RT, 4' 10.5W SE LED 4L, 8' VT Kit	5	42	3285	-	0	0.6	0.2	0.4	2,267	690	1,577	25%	0
432	Tionesta SFH	Exterior	dmin / Visitor Cente	Visitor Center Entrance	Exterior - Dusk to Dawn	Decorative HPS 150W	1	188	4380	LED HID Omni Retrofit 5 kLm Med Base	1	36	4380	-	0	0.0	0.0	0.0	823	158	666	0%	0
433	Tionesta SFH	Exterior	dmin / Visitor Cente	Garage Doors	Exterior - Dusk to Dawn	Wall Pack HPS 150W	1	188	4380	Wall Pack LED FT TWR 4.4 kLm PC	1	40	4380	-	0	0.0	0.0	0.0	823	175	648	0%	0
434	Tionesta SFH	Exterior	dmin / Visitor Cente	Entrance	Exterior - Dusk to Dawn	Wall Pack HPS 70W PC	1	95	4380	Wall Pack LED Security 1.8 kLm PC	1	15	4380	-	0	0.0	0.0	0.0	416	66	350	0%	0
435	Tionesta SFH	1st Floor	Hatch House	Hatchery	Office Hours 9h 7d/week	8' Vaportight BP 4L	14	144	3285	RT, 4' 10.5W SE LED 4L	14	42	3285	-	0	1.6	0.5	1.1	6,623	1,932	4,691	25%	0
436	Tionesta SFH	1st Floor	Hatch House	Upper Mezzanine	Storage / Janitor Closet Hatcheries	Keyless Inc 60W A	2	60	782	LED 9W A19 Replacement	2	9	782	-	0	0.1	0.0	0.1	94	14	80	25%	0
437	Tionesta SFH	1st Floor	Hatch House	Kitchenette	Limited Daily Use	4' Wrap LED 15W T8 ULB 2L	1	30	1460	No Action - Existing Efficient Fixture	1	30	1460	-	0	0.0	0.0	0.0	44	44	0	25%	0
438	Tionesta SFH	1st Floor	Hatch House	Restroom	Restroom Private Hatcheries	Globe LED 9W A	1	9	782	No Action - Existing Efficient Fixture	1	9	782	-	0	0.0	0.0	0.0	7	7	0	25%	0
439	Tionesta SFH	1st Floor	Hatch House	Locker Room	Restroom Private Hatcheries	2X4 Prism Sur 4L 32W T8	1	112	782	RT, 4' 10.5W SE LED 4L	1	42	782	-	0	0.1	0.0	0.0	88	33	55	25%	0
440	Tionesta SFH	1st Floor	Hatch House	Mechanical Room	Mechanical/Electrical Room Hatcheries	Drum LED 9W A	1	9	782	No Action - Existing Efficient Fixture	1	9	782	-	0	0.0	0.0	0.0	7	7	0	25%	0

ID #	Location					Existing Fixture				Proposed Fixture						PeakDemand			Usage			Controls	
	Building # : Name	Floor	Area	Sub Area / Room	Usage Group	Fixture	Quantity	Input Wattage	Hours of Operation	ECM	Quantity	Input Wattage	Hours of Operation	Occ Sensor Type	Occ Sensor Qty	Pre	Post	Savings	Pre	Post	Savings	Savings %	Savings
441	Tionesta SFH	1st Floor	Hatch House	Mechanical Room	Mechanical/Electrical Room Hatcheries	8' Strip LED 15W T8 ULB 4L	1	60	782	No Action - Existing Efficient Fixture	1	60	782	-	0	0.0	0.0	0.0	47	47	0	25%	0
442	Tionesta SFH	1st Floor	Hatch House	Mechanical Room Storage	Mechanical/Electrical Room Hatcheries	8' Industrial SP 2L	1	138	782	RT, 4' 10.5W SE LED 4L, 8' BC Kit	1	42	782	-	0	0.1	0.0	0.1	108	33	75	25%	0
443	Tionesta SFH	Exterior	Hatch House	Building Mounted	Exterior - Dusk to Dawn	Lantern Inc 60W A	8	60	4380	LED 9W A19 Replacement	8	9	4380	-	0	0.0	0.0	0.0	2,102	315	1,787	0%	0
444	Tionesta SFH	1st Floor	Well 1	Well 1	Utility Building	Keyless LED 9W A	1	9	26	No Action - Existing Efficient Fixture	1	9	26	-	0	0.0	0.0	0.0	0	0	0	25%	0
445	Tionesta SFH	1st Floor	ld Generator Buildin	Old Generator Building	Utility Building	Keyless Inc 60W A	2	60	26	LED 9W A19 Replacement	2	9	26	-	0	0.1	0.0	0.1	3	0	3	25%	0
446	Tionesta SFH	1st Floor	ew Generator Buildir	New Generator Building	Utility Building	8' Vaportight BP 4L 32W T8	1	112	26	RT, 4' 10.5W SE LED 4L	1	42	26	-	0	0.1	0.0	0.0	3	1	2	25%	0
447	Tionesta SFH	1st Floor	ew Generator Buildir	New Generator Building	Utility Building	4' Vaportight BP 2L 32W T8	2	59	26	RT, 4' 10.5W SE LED 2L	2	21	26	-	0	0.1	0.0	0.0	3	1	2	25%	0
448	Tionesta SFH	Exterior	ew Generator Buildir	New Generator Building	Exterior - Dusk to Dawn	Wall Pack CFL 32W 4P	1	34	4380	Wall Pack LED Security 1.8 kLm PC	1	15	4380	-	0	0.0	0.0	0.0	149	66	83	0%	0
449	Tionesta SFH	1st Floor	Well 2	Well 2	Utility Building	Keyless LED 9W A	1	9	26	No Action - Existing Efficient Fixture	1	9	26	-	0	0.0	0.0	0.0	0	0	0	25%	0
450	Tionesta SFH	1st Floor	Well 3	Well 3	Utility Building	Keyless LED 9W A	1	9	26	No Action - Existing Efficient Fixture	1	9	26	-	0	0.0	0.0	0.0	0	0	0	25%	0
451	Tionesta SFH	1st Floor	Sand Filter	Sand Filter	Very Low Hours	Keyless LED 9W A	3	9	5	No Action - Existing Efficient Fixture	3	9	5	-	0	0.0	0.0	0.0	0	0	0	25%	0
452	Tionesta SFH	1st Floor	eries Management O	Garage	Limited Daily Use	8' Wrap BP 4L 32W T8	2	112	1460	RT, 4' 10.5W SE LED 4L	2	42	1460	-	0	0.1	0.0	0.1	327	123	204	25%	0
453	Tionesta SFH	1st Floor	eries Management O	Garage	Limited Daily Use	Jelly Jar Inc 60W A	1	60	1460	LED 9W A19 Replacement	1	9	1460	-	0	0.0	0.0	0.0	88	13	74	25%	0
454	Tionesta SFH	1st Floor	eries Management O	Garage	Limited Daily Use	Canopy Inc 100W	1	100	1460	LED 9W A19 Replacement	1	9	1460	-	0	0.1	0.0	0.1	146	13	133	25%	0
455	Tionesta SFH	1st Floor	eries Management O	Garage	Limited Daily Use	8' Wrap BP 4L 32W T8	2	112	1460	RT, 4' 10.5W SE LED 4L	2	42	1460	-	0	0.1	0.0	0.1	327	123	204	25%	0
456	Tionesta SFH	1st Floor	eries Management O	Garage	Limited Daily Use	Jelly Jar Inc 60W A	1	60	1460	LED 9W A19 Replacement	1	9	1460	-	0	0.0	0.0	0.0	88	13	74	25%	0
457	Tionesta SFH	1st Floor	eries Management O	Storage Area	Storage / Janitor Closet Hatcheries	2X4 Prism Rec 2L 32W T8	3	59	782	RT, 4' 10.5W SE LED 2L	3	21	782	-	0	0.1	0.0	0.1	138	49	89	25%	0
458	Tionesta SFH	1st Floor	eries Management O	Storage Closet	Storage / Janitor Closet Hatcheries	Canopy Inc 60W A	2	60	782	LED 9W A19 Replacement	2	9	782	-	0	0.1	0.0	0.1	94	14	80	25%	0
459	Tionesta SFH	1st Floor	eries Management O	Storage / IT Room	Storage / Janitor Closet Hatcheries	2X4 Prism Rec 2L 32W T8	2	59	782	RT, 4' 10.5W SE LED 2L	2	21	782	-	0	0.1	0.0	0.0	92	33	59	25%	0
460	Tionesta SFH	1st Floor	eries Management O	Storage Closet	Storage / Janitor Closet Hatcheries	Keyless Inc 60W A	1	60	782	LED 9W A19 Replacement	1	9	782	-	0	0.0	0.0	0.0	47	7	40	25%	0
461	Tionesta SFH	1st Floor	eries Management O	Passage	Limited Daily Use	Canopy Inc 60W A	1	60	1460	LED 9W A19 Replacement	1	9	1460	-	0	0.0	0.0	0.0	88	13	74	25%	0
462	Tionesta SFH	1st Floor	eries Management O	Specimen Storage	Storage / Janitor Closet Hatcheries	2X4 Prism Rec 2L 32W T8	2	59	782	RT, 4' 10.5W SE LED 2L	2	21	782	-	0	0.1	0.0	0.0	92	33	59	25%	0
463	Tionesta SFH	1st Floor	eries Management O	Storage Room	Storage / Janitor Closet Hatcheries	2X4 Prism Rec 2L 32W T8	4	59	782	RT, 4' 10.5W SE LED 2L	4	21	782	-	0	0.1	0.0	0.1	185	66	119	25%	0
464	Tionesta SFH	1st Floor	eries Management O	Restroom	Restroom Private Hatcheries	Fan Inc 75W A	1	75	782	LED 9W A19 Replacement	1	9	782	-	0	0.0	0.0	0.0	59	7	52	25%	0
465	Tionesta SFH	1st Floor	eries Management O	Restroom	Restroom Private Hatcheries	Vanity Inc 40W G25 5L	1	200	782	LED 5W G25 Replacement 5L	1	25	782	-	0	0.1	0.0	0.1	156	20	137	25%	0
466	Tionesta SFH	1st Floor	eries Management O	Mechanical Room	Mechanical/Electrical Room Hatcheries	4' Industrial BP 2L	2	72	782	RT, 4' 10.5W SE LED 2L	2	21	782	-	0	0.1	0.0	0.1	113	33	80	25%	0
467	Tionesta SFH	2nd Floor	eries Management O	Stairs	Office Hours 9h 7d/week	Chandelier LED 5.5W C10 E12 3L	1	16.5	3285	No Action - Existing Efficient Fixture	1	17	3285	-	0	0.0	0.0	0.0	54	54	0	25%	0
468	Tionesta SFH	2nd Floor	eries Management O	Stairs	Office Hours 9h 7d/week	Chandelier Inc 25W C10 E12	1	25	3285	LED 5W B11 E12 Replacement	1	5	3285	-	0	0.0	0.0	0.0	82	16	66	25%	0
469	Tionesta SFH	2nd Floor	eries Management O	Open Office	Office Hours 9h 7d/week	4' Wrap BP 2L 32W T8	1	59	3285	RT, 4' 10.5W SE LED 2L	1	21	3285	-	0	0.0	0.0	0.0	194	69	125	25%	0
470	Tionesta SFH	2nd Floor	eries Management O	Break Room	Office Hours 9h 7d/week	Chandelier Inc 40W C10 E12 8L	1	320	3285	LED 5W B11 E12 Replacement 8L	1	40	3285	-	0	0.3	0.0	0.2	1,051	131	920	25%	0
471	Tionesta SFH	2nd Floor	eries Management O	Kitchen	Limited Daily Use	2X4 Prism Sur 2L 32W T8	1	59	1460	RT, 4' 10.5W SE LED 2L	1	21	1460	-	0	0.0	0.0	0.0	86	31	55	25%	0
472	Tionesta SFH	2nd Floor	eries Management O	Kitchen	Limited Daily Use	2' Undercabinet 1L	2	26	1460	RT, 2' 7W SE LED 1L	2	7	1460	-	0	0.0	0.0	0.0	76	20	55	25%	0
473	Tionesta SFH	2nd Floor	eries Management O	Kitchen	Limited Daily Use	1.5' Undercabinet 1L T8	3	19	1460	RT, 1.5' 7W SE LED 1L	3	7	1460	-	0	0.0	0.0	0.0	83	31	53	25%	0
474	Tionesta SFH	2nd Floor	eries Management O	Kitchen	Limited Daily Use	3' Undercabinet 1L	1	38	1460	RT, 3' 12W SE LED 1L	1	12	1460	-	0	0.0	0.0	0.0	55	18	38	25%	0
475	Tionesta SFH	2nd Floor	eries Management O	Hallway	Office Hours 9h 7d/week	Canopy Inc 60W A	1	60	3285	LED 9W A19 Replacement	1	9	3285	-	0	0.0	0.0	0.0	197	30	168	25%	0
476	Tionesta SFH	2nd Floor	eries Management O	Restroom	Restroom Private Hatcheries	Fan Inc 40W A	1	40	782	LED 9W A19 Replacement	1	9	782	-	0	0.0	0.0	0.0	31	7	24	25%	0
477	Tionesta SFH	2nd Floor	eries Management O	Restroom	Restroom Private Hatcheries	Vanity Inc 40W G25 5L	1	200	782	LED 5W G25 Replacement 5L	1	25	782	-	0	0.1	0.0	0.1	156	20	137	25%	0
478	Tionesta SFH	2nd Floor	eries Management O	Private Office 1	Office Hours 9h 7d/week	4' Wrap BP 4L 32W T8	2	112	3285	RT, 4' 10.5W SE LED 4L	2	42	3285	-	0	0.2	0.1	0.1	736	276	460	25%	0
479	Tionesta SFH	2nd Floor	eries Management O	Private Office 2	Office Hours 9h 7d/week	4' Wrap BP 4L 32W T8	4	112	3285	RT, 4' 10.5W SE LED 4L	4	42	3285	-	0	0.4	0.1	0.2	1,472	552	920	25%	0
480	Tionesta SFH	2nd Floor	eries Management O	Private Office 2 - Restroom	Restroom Private Hatcheries	Fan Inc 40W A	1	40	782	LED 9W A19 Replacement	1	9	782	-	0	0.0	0.0	0.0	31	7	24	25%	0
481	Tionesta SFH	2nd Floor	eries Management O	Private Office 2 - Restroom	Restroom Private Hatcheries	Vanity Inc 40W G25 5L	1	200	782	LED 5W G25 Replacement 5L	1	25	782	-	0	0.1	0.0	0.1	156	20	137	25%	0
482	Tionesta SFH	2nd Floor	eries Management O	Private Office 2 - Closet	Not In Use	Canopy Inc 60W A	2	60	0	LED 9W A19 Replacement	2	9	0	-	0	0.0	0.0	0.0	0	0	0	0%	0
483	Tionesta SFH	2nd Floor	eries Management O	Private Office 3	Office Hours 9h 7d/week	4' Wrap BP 4L 32W T8	2	112	3285	RT, 4' 10.5W SE LED 4L	2	42	3285	-	0	0.2	0.1	0.1	736	276	460	25%	0
484	Tionesta SFH	2nd Floor	eries Management O	Private Office 3 - Closet	Not In Use	8" Rec Sq. Inc 60W A	1	60	0	LED 9W A19 Replacement	1	9	0	-	0	0.0	0.0	0.0	0	0	0	0%	0
485	Tionesta SFH	Exterior	eries Management O	Deck	Exterior - Switch	Wall Pack Inc 75W A	1	75	469	Wall Pack LED Security 1.8 kLm PC	1	15	469	-	0	0.0	0.0	0.0	35	7	28	0%	0
486	Tionesta SFH	Exterior	eries Management O	Front Door	Exterior - Switch	Lantern Inc 100W A	1	100	469	LED 9W A19 Replacement	1	9	469	-	0	0.0	0.0	0.0	47	4	43	0%	0
487	Tionesta SFH	Exterior	eries Management O	Garage Door	Exterior - Switch	4" Rec Can Hal 39W PAR20	1	39	469	LED 7W R20 Replacement	1	7	469	-	0	0.0	0.0	0.0	18	3	15	0%	0
488	Tionesta SFH	Exterior	eries Management O	Garage Bay Doors	Exterior - Switch	Lantern LED 9W A	3	9	469	No Action - Existing Efficient Fixture	3	9	469	-	0	0.0	0.0	0.0	13	13	0	0%	0
489	Tionesta SFH	1st Floor	Warm Water Pump	Warm Water Pump	Limited Weekly Use	Keyless Inc 60W A	2	60	626	LED 9W A19 Replacement	2	9	626	-	0	0.0	0.0	0.0	75	11	64	25%	0
490	Tionesta SFH	1st Floor	Warm Water Pump	Warm Water Pump	Limited Weekly Use	Keyless LED 9W A	2	9	626	No Action - Existing Efficient Fixture	2	9	626	-	0	0.0	0.0	0.0	11	11	0	25%	0
491	Tionesta SFH	1st Floor	Warm Water Well	Warm Water Well	Limited Weekly Use	Flood Inc 60W A 2L	2	120	626	LED 9W A19 Replacement 2L	2	18	626	-	0	0.1	0.0	0.1	150	23	128	25%	0
492	Tionesta SFH	1st Floor	Sign Shop	Sign Shop	Very Low Hours	Keyless Inc 60W A	3	60	5	LED 9W A19 Replacement	3	9	5	-	0	0.0	0.0	0.0	1	0	1	25%	0
493	Tionesta SFH	1st Floor	Sign Shop	Sign Shop	Very Low Hours	4' Industrial BP 2L	2	72	5	RT, 4' 10.5W SE LED 2L	2	21	5	-	0	0.0	0.0	0.0	1	0	1	25%	0
494	Tionesta SFH	1st Floor	Sign Shop	Sign Shop	Very Low Hours	4' Wrap BP 4L	1	144	5	RT, 4' 10.5W SE LED 4L	1	42	5	-	0	0.0	0.0	0.0	1	0	1	25%	0
495	Tionesta SFH	1st Floor	Building Generator	Building Generator	Limited Weekly Use	8' Industrial SP 2L	2	138	626	RT, 4' 10.5W SE LED 4L, 8' BC Kit	2	42	626	-	0	0.1	0.0	0.0	173	53	120	25%	0
496	Tionesta SFH	1st Floor	Building Generator	Building Generator	Limited Weekly Use	Keyless Inc 60W A	1	60	626	LED 9W A19 Replacement	1	9	626	-	0	0.0	0.0	0.0	38	6	32	25%	0
497	Tionesta SFH	1st Floor	Building Generator	Building Generator	Limited Weekly Use	Keyless Empty E26	1	0	626	LED 9W A19 Replacement	1	9	626	-	0	0.0	0.0	0.0	0	6	-6	25%	0
498	Tionesta SFH	1st Floor	Meat House	Meat House	Very Low Hours	4' Wrap BP 2L	1	72	5	RT, 4' 10.5W SE LED 2L	1	21	5	-	0	0.0	0.0	0.0	0	0	0	25%	0
499	Tionesta SFH	1st Floor	Meat House	Meat House	Very Low Hours	Flood Inc 72W A 2L	2	144	5	LED 9W A19 Replacement 2L	2	18	5	-	0	0.1	0.0	0.1	1	0	1	25%	0
500	Tionesta SFH	1st Floor	Meat House	Meat House	Very Low Hours	Keyless Empty E26	1	0	5	LED 9W A19 Replacement	1	9	5	-	0	0.0	0.0	0.0	0	0	0	25%	0
501	Tionesta SFH	1st Floor	Meat House	Meat House	Very Low Hours	Jelly Jar Inc 75W A	1	75	5	LED 9W A19 Replacement	1	9	5	-	0	0.0	0.0	0.0	0	0	0	25%	0
502	Tionesta SFH	1st Floor	Oxygen Building	Oxygen Building	Utility Building	Keyless Inc 60W A	4	60	26	LED 9W A19 Replacement	4	9	26	-	0	0.1	0.0	0.1	6	1	5	25%	0
503	Tionesta SFH	1st Floor	Garage	Tool Room	Storage / Janitor Closet Hatcheries	4' Schoolhouse BP 4L	7	144	782	RT, 4' 10.5W SE LED 4L	7	42	782	-	0	0.6	0.2	0.4	788	230	558	25%	0
504	Tionesta SFH	1st Floor	Garage	Bay	Limited Daily Use	8' Industrial SP 2L	5	138	1460	RT, 4' 10.5W SE LED 4L, 8' BC Kit	5	42	1460	-	0	0.4	0.1	0.3	1,007	307	701	25%	0
505	Tionesta SFH	1st Floor	Garage	Bay	Limited Daily Use	4' Industrial BP 4L	1	144	1460	RT, 4' 10.5W SE LED 4L	1	42	1460	-	0	0.1	0.0	0.1	210	61	149	25%	0
506	Tionesta SFH	1st Floor	Garage	Bay - Task	Limited Daily Use	4' Industrial BP 2L	2	72	1460	RT, 4' 10.5W SE LED 2L	2	21	1460	-	0	0.1	0.0	0.1	210	61	149	25%	0
507	Tionesta SFH	1st Floor	Garage	Attic	Storage / Janitor Closet Hatcheries	Keyless Inc 75W A	3	75	782	LED 9W A19 Replacement	3	9	782	-	0	0.1	0.0	0.1	176	21	155	25%	0
508	Tionesta SFH	1st Floor	Garage	Attic Closet	Storage / Janitor Closet Hatcheries	Keyless Inc 75W A	1	75	782	LED 9W A19 Replacement	1	9	782	-	0	0.0	0.0	0.0	59	7	52	25%	0
509	Tionesta SFH	1st Floor	Garage	Side Bay	Storage / Janitor Closet Hatcheries	Keyless Inc 200W A	2	200	782	LED 11W A19 Replacement	2	11	782	-	0	0.2	0.0	0.2	313	17	296	25%	0
510	Tionesta SFH	1st Floor	3-Side Building	Bay 1 - Owned by Fish Hatchery	Limited Daily Use	8' Industrial SP 3L	2	221	1460	RT, 4' 10.5W SE LED 6L, 8' BC Kit	2	63	1460	-	0	0.2	0.1	0.2	645	184	461	25%	0
511	Tionesta SFH	1st Floor	3-Side Building	y 2 - Owned by Fisheries Manageme	Limited Daily Use	8' Industrial SP 3L	2	221	1460	RT, 4' 10.5W SE LED 6L, 8' BC Kit	2	63	1460	-	0	0.2	0.1	0.2	645	184	461	25%	0
512	Tionesta SFH	1st Floor	3-Side Building	y 3 - Owned by Fisheries Manageme	Limited Daily Use	8' Industrial SP 3L	2	221	1460	RT, 4' 10.5W SE LED 6L, 8' BC Kit	2	63	1460	-	0	0.2	0.1	0.2	645	184	461	25%	0
513	Tionesta SFH	Exterior	3-Side Building	Building Mounted	Exterior - Dusk to Dawn	Wall Pack HPS 150W	1	188	4380	Wall Pack LED FT TWR 4.4 kLm PC	1	40	4380	-	0	0.0	0.0	0.0	823	175	648	0%	0
514	Tionesta SFH	Exterior	Area Lighting	Flag Lighting	Exterior - Dusk to Dawn	Flood Hal 100W PAR38	1	100	4380	LED 26W PAR38 Replacement	1	26	4380	-	0	0.0	0.0	0.0	438	114	324	0%	0
515	Tionesta SFH	Exterior	Area Lighting	Admin Parking Lot	Exterior - Dusk to Dawn	Post Top HPS 150W	1	188	4380	Area LED 10 kLm, PC	1	72	4380	-	0	0.0	0.0	0.0	823	315	508	0%	0
516	Tionesta SFH	Exterior	Area Lighting	3-Sided Garage	Exterior - Dusk to Dawn	Post Top HPS 150W	1	188	4380	Area LED 10 kLm, PC	1	72	4380	-	0	0.0	0.0	0.0	823	315	508	0%	0
517	Tionesta SFH	Exterior	Area Lighting	Area by Well Buildings	Exterior - Dusk to Dawn	Post Top HPS 150W	8	188	4380	Area LED 10 kLm, PC	8	72	4380	-	0	0.0	0.0	0.0	6,588	2,523	4,065	0%	0
518	Tionesta SFH	Exterior	Area Lighting	Area by Raceways	Exterior - Dusk to Dawn	Post Top HPS 150W	6	188	4380	Area LED 10 kLm, PC	6	72	4380	-	0	0.0	0.0	0.0	4,941	1,892	3,048	0%	0
519	Tionesta SFH	Exterior	Area Lighting	Admin Parking Lot	Exterior - Dusk to Dawn	Post Top HPS 150W	1	188	4380	Area LED 10 kLm, PC	1	72	4380	-	0	0.0	0.0	0.0	823	315	508	0%	0
520	Oswayo SFH	1st Floor	Visitor Center / Hatc	Lobby	Office Hours 9h 7d/week	4' Wrap BP 4L	4	144	3285	RT, 4' 10.5W SE LED 4L	4	42	3285	-	0	0.5	0.1	0.3	1,892	552	1,340	25%	0
521	Oswayo SFH	1st Floor	Visitor Center / Hatc	Lobby	Office Hours 9h 7d/week	Track Head Hal 100W PAR38	4	100	3285	LED 13W PAR38 Replacement	4	13	3285	-	0	0.3	0.0	0.3	1,314	171	1,143	25%	0
522	Oswayo SFH	1st Floor	Visitor Center / Hatc	Reception	Office Hours 9h 7d/week	3' Strip 1L T8	18	22	3285	RT, 3' 12W SE LED 1L	18	12	3285	-	0	0.3	0.2	0.1	1,301	710	591	25%	0
523	Oswayo SFH	1st Floor	Visitor Center / Hatc	Copy Room / Passage	Office Hours 9h 7d/week	3' Strip 1L T8	6	22	3285	RT, 3' 12W SE LED 1L	6	12	2464	WS	1	0.1	0.1	0.0	434	237	197	25%	59
524	Oswayo SFH	1st Floor	Visitor Center / Hatc	Private Office 1	Office Hours 9h 7d/week	3' Strip 1L T8	12	22	3285	RT, 3' 12W SE LED 1L	12	12	2464	WS	1	0.2	0.1	0.1	867	473	394	25%	118
525	Oswayo SFH	1st Floor	Visitor Center / Hatc	Passage	Office Hours 9h 7d/week	Wall Pack LED 15W	2	15	3285	No Action - Existing Efficient Fixture	2	15	3285	-	0	0.0	0.0	0.0	99	99	0	25%	0
526	Oswayo SFH	1st Floor	Visitor Center / Hatc	Private Office / Lab	Office Hours 9h 7d/week	3' Strip 1L T8	6	22	3285	RT, 3' 12W SE LED 1L	6	12	2464	WS	1	0.1	0.1	0.0	434	237	197	25%	59
527	Oswayo SFH	1st Floor	Visitor Center / Hatc	Private Office - Foreman	Office Hours 9h 7d/week	3' Strip 1L T8	8	22	3285	RT, 3' 12W SE LED 1L	8	12	2464	WS	1	0.1	0.1	0.1	578	315	263	25%	79
528	Oswayo SFH	1st Floor	Visitor Center / Hatc	Back Hallways	Office Hours 9h 7d/week	Vandal Proof Inc 60W A	4	60	3285	LED 9W A19 Replacement	4	9	3285	-	0	0.2	0.0	0.2	788	118	670	25%	0
529	Oswayo SFH	1st Floor	Visitor Center / Hatc	Break Room	Office Hours 9h 7d/week	4' Wrap BP 2L	4	72	3285	RT, 4' 10.5W SE LED 2L	4	21	2464	CM	4	0.2	0.1	0.2	946	276	670	25%	69
530	Oswayo SFH	1st Floor	Visitor Center / Hatc	Break Room	Office Hours 9h 7d/week	4' Wrap BP 4L 32W T8	2	112	3285	RT, 4' 10.5W SE LED 4L	2	42	2464	PL	0	0.2	0.1	0.1	736	276	460	25%	69
531	Oswayo SFH	1st Floor	Visitor Center / Hatc	Break Room	Office Hours 9h 7d/week	3' Strip 1L T8	4	22	3285	RT, 3' 12W SE LED 1L	4	12	2464	PL	0	0.1	0.0	0.0	289	158	131	25%	39
532	Oswayo SFH	1st Floor	Visitor Center / Hatc	Hallway to Hatchery	Office Hours 9h 7d/week	Track Head Hal 100W PAR38	1	100	3285	LED 13W PAR38 Replacement	1	13	3285	-	0	0.1	0.0	0.1	329	43	286	25%	0
533	Oswayo SFH	1st Floor	Visitor Center / Hatc	Hallway to Hatchery	Office Hours 9h 7d/week	Track Head Hal 100W PAR38	1	100	3285	LED 13W PAR38 Replacement	1	13	3285	-	0	0.1	0.0	0.1	329	43	286	25%	0
534	Oswayo SFH	1st Floor	Visitor Center / Hatc	Men's Restroom	Restroom Public Hatcheries	Wall Sconce Inc 60W A 2L	2	120	860	LED 9W A19 Replacement 2L	2	18	860	-	0	0.1	0.0	0.1	206	31	175	45%	0
535	Oswayo SFH	1st Floor	Visitor Center / Hatc	Men's Restroom	Restroom Public Hatcheries	Fan Inc 100W A	1	100	860	LED 9W A19 Replacement	1	9	860	-	0	0.1	0.0	0.1	86	8	78	45%	0
536	Oswayo SFH	1st Floor	Visitor Center / Hatc	Men's Restroom	Restroom Public Hatcheries	Drum CFL 22/32W Circ.	1	58	860	Drum LED 2000 Lm 13"	1	28	860	-	0	0.0	0.0	0.0	50	24	26	45%	0
537	Oswayo SFH	1st Floor	Visitor Center / Hatc	Women's Restroom	Restroom Public Hatcheries	Wall Sconce Inc 60W A 2L	3	120	860	LED 9W A19 Replacement 2L	3	18	860	-	0	0.2	0.0	0.2	310	46	263	45%	0
538	Oswayo SFH	1st Floor	Visitor Center / Hatc	Women's Restroom	Restroom Public Hatcheries	Fan Inc 100W A	2	100	860	LED 9W A19 Replacement	2	9	860	-	0	0.1	0.0	0.1	172	15	157	45%	0
539	Oswayo SFH	1st Floor	Visitor Center / Hatc	Women's Restroom	Restroom Public Hatcheries	Drum CFL 22/32W Circ.	1	58	860	Drum LED 2000 Lm 13"	1	28	860	-	0	0.0	0.0	0.0	50	24	26	45%	0
540	Oswayo SFH	1st Floor	Visitor Center / Hatc	Storage Closet	Storage / Janitor Closet Hatcheries	Track Head Inc 60W A	1	60	782	LED 9W A19 Replacement	1	9	782	-	0	0.0	0.0	0.0	47	7	40	25%	0
541	Oswayo SFH	1st Floor	Visitor Center / Hatc	Hatchery	Office Hours 9h 7d/week	8' Vaportight 4L T5HO	14	234	3285	RT, 4' 25W SE LED T5HO 4L	14	100	3285	-	0	2.6	1.1	1.5	10,762	4,599	6,163	25%	0
542	Oswayo SFH	1st Floor	Visitor Center / Hatc	Hatchery	Office Hours 9h 7d/week	2X2 Prism Sur 4L	3	102	3285	RT, 2' 7W SE LED 4L	3	28	3285	-	0	0.2	0.1	0.2	1,005	276	729	25%	0
543	Oswayo SFH	1st Floor	Visitor Center / Hatc	Back Hallways	Office Hours 9h 7d/week	Vanity Inc 60W A 2L	2	120	3285	LED 9W A19 Replacement 2L	2	18	3285	-	0	0.2	0.0	0.2	788	118	670	25%	0
544	Oswayo SFH	1st Floor	Visitor Center / Hatc	Locker Room	Restroom Public Hatcheries	2X4 Prism Sur 4L 32W T8	2	112	1564	RT, 4' 10.5W SE LED 4L	2	42	860	CM	2	0.1	0.0	0.1	350	131	219	45%	59
545	Oswayo SFH	1st Floor	Visitor Center / Hatc	Locker Room	Restroom Public Hatcheries	Wall Sconce Inc 60W A 2L	2	120	1564	LED 9W A19 Replacement 2L	2	18	860	PL	0	0.1	0.0	0.1	375	56	319	45%	25
546	Oswayo SFH	1st Floor	Visitor Center / Hatc	Locker Room	Restroom Public Hatcheries	Drum CFL 22/32W Circ.	1	58	1564	Drum LED 2000 Lm 13"	1	28	860	PL	0	0.0	0.0	0.0	91	44	47	45%	20
547	Oswayo SFH	1st Floor	Visitor Center / Hatc	Locker Room	Restroom Public Hatcheries	Fan Inc 60W A	2	60	1564	LED 9W A19 Replacement	2	9	1564	-	0	0.1	0.0	0.1	188	28	160	45%	0
548	Oswayo SFH	1st Floor	Visitor Center / Hatc	Storage Closet	Storage / Janitor Closet Hatcheries	Keyless Inc 100W A	1	100	782	LED 9W A19 Replacement	1	9	782	-	0	0.1	0.0	0.1	78	7	71	25%	0
549	Oswayo SFH	1st Floor	Visitor Center / Hatc	Tray Storage	Storage / Janitor Closet Hatcheries	Flood Inc 60W A 2L	2	120	782	LED 9W A19 Replacement 2L	2	18	782	-	0	0.1	0.0	0.1	188	28	160	25%	0
550	Oswayo SFH	1st Floor	Visitor Center / Hatc	Chemical Storage	Storage / Janitor Closet Hatcheries	4' Industrial BP 2L 32W T8	1	59	782	RT, 4' 10.5W SE LED 2L	1	21	782	-	0	0.0	0.0	0.0	46	16	30	25%	0

ID #	Location					Existing Fixture				Proposed Fixture						PeakDemand			Usage			Controls	
	Building # : Name	Floor	Area	Sub Area / Room	Usage Group	Fixture	Quantity	Input Wattage	Hours of Operation	ECM	Quantity	Input Wattage	Hours of Operation	Occ Sensor Type	Occ Sensor Qty	Pre	Post	Savings	Pre	Post	Savings	Savings %	Savings
551	Oswayo SFH	1st Floor	Visitor Center / Hatc	Chemical Storage	Storage / Janitor Closet Hatcheries	4' Wrap BP 2L 32W T8	1	59	782	RT, 4' 10.5W SE LED 2L	1	21	782	-	0	0.0	0.0	0.0	46	16	30	25%	0
552	Oswayo SFH	1st Floor	Visitor Center / Hatc	Wood Shop	Limited Daily Use	8' Vaportight 4L T5HO	3	234	1460	RT, 4' 25W SE LED T5HO 4L	3	100	1460	-	0	0.4	0.2	0.2	1,025	438	587	25%	0
553	Oswayo SFH	1st Floor	Visitor Center / Hatc	Wood Shop	Limited Daily Use	8' Industrial SP 2L	2	138	1460	RT, 4' 10.5W SE LED 4L, 8' BC Kit	2	42	1460	-	0	0.2	0.0	0.1	403	123	280	25%	0
554	Oswayo SFH	1st Floor	Visitor Center / Hatc	Wood Shop - Mezzanine	Storage / Janitor Closet Hatcheries	2X2 Prism Sur 4L	1	102	782	RT, 2' 7W SE LED 4L	1	28	782	-	0	0.1	0.0	0.0	80	22	58	25%	0
555	Oswayo SFH	1st Floor	Visitor Center / Hatc	Boiler Room	Mechanical/Electrical Room Hatcheries	RLM Inc 60W A	4	60	782	LED 9W A19 Replacement	4	9	782	-	0	0.1	0.0	0.1	188	28	160	25%	0
556	Oswayo SFH	1st Floor	Visitor Center / Hatc	Garage Bay	Limited Daily Use	8' Industrial BP 32W 6L	20	175	1460	RT, 4' 10.5W SE LED 6L	20	63	1460	-	0	1.9	0.7	1.2	5,110	1,840	3,270	25%	0
557	Oswayo SFH	Exterior	Visitor Center / Hatc	Garage Doors	Exterior - Dusk to Dawn	Vandal Proof Inc 100W A	5	100	4380	LED 9W A19 Replacement	5	9	4380	-	0	0.0	0.0	0.0	2,190	197	1,993	0%	0
558	Oswayo SFH	Exterior	Visitor Center / Hatc	Side Doors	Exterior - Dusk to Dawn	Vandal Proof Inc 100W A	3	100	4380	LED 9W A19 Replacement	3	9	4380	-	0	0.0	0.0	0.0	1,314	118	1,196	0%	0
559	Oswayo SFH	Exterior	Visitor Center / Hatc	Main Door	Exterior - Dusk to Dawn	Globe Inc 60W A	1	60	4380	LED 9W A19 Replacement	1	9	4380	-	0	0.0	0.0	0.0	263	39	223	0%	0
560	Oswayo SFH	Exterior	Visitor Center / Hatc	Back Doors	Exterior - Dusk to Dawn	Vandal Proof Inc 100W A	2	100	4380	LED 9W A19 Replacement	2	9	4380	-	0	0.0	0.0	0.0	876	79	797	0%	0
561	Oswayo SFH	1st Floor	Pole Barn	Bay	Limited Daily Use	Keyless Inc 100W A	3	100	1460	LED 9W A19 Replacement	3	9	1460	-	0	0.2	0.0	0.2	438	39	399	25%	0
562	Oswayo SFH	1st Floor	Pole Barn	Food Storage	Storage / Janitor Closet Hatcheries	Keyless Inc 100W A	6	100	782	LED 9W A19 Replacement	6	9	782	-	0	0.3	0.0	0.3	469	42	427	25%	0
563	Oswayo SFH	1st Floor	Pole Barn	Chemical Storage	Storage / Janitor Closet Hatcheries	Keyless Inc 60W A	1	60	782	LED 9W A19 Replacement	1	9	782	-	0	0.0	0.0	0.0	47	7	40	25%	0
564	Oswayo SFH	1st Floor	Rack Storage Shed	Rack Storage Shed	Low Hours	Keyless Inc 60W A	2	60	8	LED 9W A19 Replacement	2	9	8	-	0	0.1	0.0	0.1	1	0	1	25%	0
565	Oswayo SFH	1st Floor	Fuel Shed	Fuel Shed	Low Hours	Drum Inc 60W A 2L	1	120	8	LED 9W A19 Replacement 2L	1	18	8	-	0	0.1	0.0	0.1	1	0	1	25%	0
566	Oswayo SFH	Exterior	Fuel Shed	Building Mounted	Exterior - Dusk to Dawn	Flood Hal 75W PAR38	2	75	4380	LED 14W PAR38 Replacement WL 2L	2	28	4380	-	0	0.0	0.0	0.0	657	245	412	0%	0
567	Oswayo SFH	1st Floor	Generator Building	Generator Building	Utility Building	8' Strip LED 15W T8 ULB 4L	3	60	26	No Action - Existing Efficient Fixture	3	60	26	-	0	0.1	0.1	0.0	5	5	0	25%	0
568	Oswayo SFH	1st Floor	Oxygen Building	Oxygen Building	Utility Building	4' Strip BP 2L 32W T8	2	59	26	RT, 4' 10.5W SE LED 2L	2	21	26	-	0	0.1	0.0	0.0	3	1	2	25%	0
569	Oswayo SFH	1st Floor	ecirculation Building	Recirculation Building	Utility Building	Keyless Inc 60W A	2	60	26	LED 9W A19 Replacement	2	9	26	-	0	0.1	0.0	0.1	3	0	3	25%	0
570	Oswayo SFH	Exterior	Area Lighting	Raceways	Exterior - Dusk to Dawn	Post Top LED 55W Corn Cob	7	55	4380	No Action - Existing Efficient Fixture	7	55	4380	-	0	0.0	0.0	0.0	1,686	1,686	0	0%	0
571	Oswayo SFH	Exterior	Area Lighting	Raceways	Exterior - Dusk to Dawn	Post Top LED 55W Corn Cob	7	55	4380	No Action - Existing Efficient Fixture	7	55	4380	-	0	0.0	0.0	0.0	1,686	1,686	0	0%	0
572	Oswayo SFH	Exterior	Area Lighting	Entry Drive	Exterior - Dusk to Dawn	Post Top LED 55W Corn Cob	2	55	4380	No Action - Existing Efficient Fixture	2	55	4380	-	0	0.0	0.0	0.0	482	482	0	0%	0
573	Oswayo SFH	Exterior	Area Lighting	Recirculation Building	Exterior - Dusk to Dawn	Post Top LED 55W Corn Cob	1	55	4380	No Action - Existing Efficient Fixture	1	55	4380	-	0	0.0	0.0	0.0	241	241	0	0%	0
574	Oswayo SFH	1st Floor	Next Door Barn	Barn	Very Low Hours	Keyless Inc 100W A	13	100	5	LED 9W A19 Replacement	13	9	5	-	0	0.3	0.0	0.3	7	1	6	25%	0
575	Oswayo SFH	2nd Floor	Next Door Barn	Barn	Very Low Hours	Keyless Inc 100W A	6	100	5	LED 9W A19 Replacement	6	9	5	-	0	0.2	0.0	0.1	3	0	3	25%	0
576	Reynoldsdale SFH	1st Floor	nistration / Visitor C	Visitor Center	Office Hours 8.5h 7d/week	Track Head LED 12W PAR30	5	12	3103	No Action - Existing Efficient Fixture	5	12	3103	-	0	0.0	0.0	0.0	186	186	0	25%	0
577	Reynoldsdale SFH	1st Floor	nistration / Visitor C	Visitor Center - Display	Office Hours 8.5h 7d/week	4' Wall Bracket BP 1L	1	43	3103	RT, 4' 10.5W SE LED 1L	1	11	3103	-	0	0.0	0.0	0.0	133	33	101	25%	0
578	Reynoldsdale SFH	1st Floor	nistration / Visitor C	Women's Restroom	Restroom Public Hatcheries	8' Wrap BP 4L 32W T8	1	112	860	RT, 4' 10.5W SE LED 4L	1	42	860	-	0	0.1	0.0	0.0	96	36	60	45%	0
579	Reynoldsdale SFH	1st Floor	nistration / Visitor C	Women's Restroom	Restroom Public Hatcheries	Wall Sconce LED 9W A 2L	3	18	1564	No Action - Existing Efficient Fixture	3	18	1564	-	0	0.0	0.0	0.0	84	84	0	45%	0
580	Reynoldsdale SFH	1st Floor	nistration / Visitor C	Women's Restroom - Nursing Room	Restroom Public Hatcheries	4' Wrap BP 2L 32W T8	1	59	860	RT, 4' 10.5W SE LED 2L	1	21	860	-	0	0.0	0.0	0.0	51	18	33	45%	0
581	Reynoldsdale SFH	1st Floor	nistration / Visitor C	Men's Restroom	Restroom Public Hatcheries	8' Wrap BP 4L 32W T8	1	112	860	RT, 4' 10.5W SE LED 4L	1	42	860	-	0	0.1	0.0	0.0	96	36	60	45%	0
582	Reynoldsdale SFH	1st Floor	nistration / Visitor C	Men's Restroom	Restroom Public Hatcheries	Wall Sconce LED 9W A 2L	3	18	1564	No Action - Existing Efficient Fixture	3	18	1564	-	0	0.0	0.0	0.0	84	84	0	45%	0
583	Reynoldsdale SFH	1st Floor	nistration / Visitor C	Supply Storage Room	Storage / Janitor Closet Hatcheries	4' Strip BP 2L 32W T8	1	59	782	RT, 4' 10.5W SE LED 2L	1	21	782	-	0	0.0	0.0	0.0	46	16	30	25%	0
584	Reynoldsdale SFH	1st Floor	nistration / Visitor C	Stairwell Front	Office Hours 8.5h 7d/week	4' Wrap BP 2L 32W T8	2	59	3103	RT, 4' 10.5W SE LED 2L	2	21	3103	-	0	0.1	0.0	0.1	366	130	236	25%	0
585	Reynoldsdale SFH	2nd Floor	nistration / Visitor C	Stairwell Front	Office Hours 8.5h 7d/week	4' Wrap BP 2L 32W T8	2	59	3103	RT, 4' 10.5W SE LED 2L	2	21	3103	-	0	0.1	0.0	0.1	366	130	236	25%	0
586	Reynoldsdale SFH	Basement	nistration / Visitor C	Stairwell Front	Office Hours 8.5h 7d/week	4' Wrap BP 2L 32W T8	2	59	3103	RT, 4' 10.5W SE LED 2L	2	21	3103	-	0	0.1	0.0	0.1	366	130	236	25%	0
587	Reynoldsdale SFH	Basement	nistration / Visitor C	Stairwell Front	Office Hours 8.5h 7d/week	4' Strip BP 2L 32W T8	1	59	3103	RT, 4' 10.5W SE LED 2L	1	21	3103	-	0	0.0	0.0	0.0	183	65	118	25%	0
588	Reynoldsdale SFH	2nd Floor	nistration / Visitor C	Waiting Area	Office Hours 8.5h 7d/week	2x2 Flat Panel Rec LED 22W	1	22	3103	No Action - Existing Efficient Fixture	1	22	3103	-	0	0.0	0.0	0.0	68	68	0	25%	0
589	Reynoldsdale SFH	2nd Floor	nistration / Visitor C	Passage	Office Hours 8.5h 7d/week	4' Vaportight LED 30W	1	30	3103	No Action - Existing Efficient Fixture	1	30	3103	-	0	0.0	0.0	0.0	93	93	0	25%	0
590	Reynoldsdale SFH	2nd Floor	nistration / Visitor C	Storage Closet	Storage / Janitor Closet Hatcheries	Globe Inc 60W A	1	60	782	LED 9W A19 Replacement	1	9	782	-	0	0.0	0.0	0.0	47	7	40	25%	0
591	Reynoldsdale SFH	2nd Floor	nistration / Visitor C	Open Office	Office Hours 8.5h 7d/week	8' Vaportight LED 60W	2	60	3103	No Action - Existing Efficient Fixture	2	60	3103	-	0	0.1	0.1	0.0	372	372	0	25%	0
592	Reynoldsdale SFH	2nd Floor	nistration / Visitor C	Restroom	Restroom Private Hatcheries	Wall Sconce Inc 60W A 2L	2	120	782	LED 9W A19 Replacement 2L	2	18	782	-	0	0.1	0.0	0.1	188	28	160	25%	0
593	Reynoldsdale SFH	2nd Floor	nistration / Visitor C	Private Office 1	Office Hours 8.5h 7d/week	8' Vaportight LED 60W	1	60	3103	No Action - Existing Efficient Fixture	1	60	3103	-	0	0.0	0.0	0.0	186	186	0	25%	0
594	Reynoldsdale SFH	2nd Floor	nistration / Visitor C	Copy / Passage	Office Hours 8.5h 7d/week	2X4 Flat Panel Sur LED 40W	1	40	3103	No Action - Existing Efficient Fixture	1	40	3103	-	0	0.0	0.0	0.0	124	124	0	25%	0
595	Reynoldsdale SFH	2nd Floor	nistration / Visitor C	Private Office 2	Office Hours 8.5h 7d/week	8' Vaportight LED 60W	2	60	3103	No Action - Existing Efficient Fixture	2	60	3103	-	0	0.1	0.1	0.0	372	372	0	25%	0
596	Reynoldsdale SFH	2nd Floor	nistration / Visitor C	Stairwell Back	Office Hours 8.5h 7d/week	4' Wrap BP 2L 32W T8	2	59	3103	RT, 4' 10.5W SE LED 2L	2	21	3103	-	0	0.1	0.0	0.1	366	130	236	25%	0
597	Reynoldsdale SFH	1st Floor	nistration / Visitor C	Stairwell Back	Office Hours 8.5h 7d/week	4' Wrap BP 2L 32W T8	2	59	3103	RT, 4' 10.5W SE LED 2L	2	21	3103	-	0	0.1	0.0	0.1	366	130	236	25%	0
598	Reynoldsdale SFH	Basement	nistration / Visitor C	Stairwell Back	Office Hours 8.5h 7d/week	4' Wrap BP 2L 32W T8	2	59	3103	RT, 4' 10.5W SE LED 2L	2	21	3103	-	0	0.1	0.0	0.1	366	130	236	25%	0
599	Reynoldsdale SFH	Basement	nistration / Visitor C	Stairwell Back	Office Hours 8.5h 7d/week	4' Strip BP 2L 32W T8	1	59	3103	RT, 4' 10.5W SE LED 2L	1	21	3103	-	0	0.0	0.0	0.0	183	65	118	25%	0
600	Reynoldsdale SFH	Basement	nistration / Visitor C	Visitor Center - Fish Tank	Visitor Center 7.5h 7d/week	Track Head LED 12W PAR30	12	12	2738	No Action - Existing Efficient Fixture	12	12	2738	-	0	0.1	0.1	0.0	394	394	0	30%	0
601	Reynoldsdale SFH	Basement	nistration / Visitor C	Visitor Center - Lower Display	Visitor Center 7.5h 7d/week	2X4 Prism Rec 2L 32W T8	5	59	2738	RT, 4' 10.5W SE LED 2L	5	21	2738	-	0	0.2	0.1	0.2	808	287	520	30%	0
602	Reynoldsdale SFH	Basement	nistration / Visitor C	Visitor Center - Lower Display	Emergency Only	6" Rec Can Inc 60W A	8	60	0	No Action	8	60	0	-	0	0.0	0.0	0.0	0	0	0	0%	0
603	Reynoldsdale SFH	Basement	nistration / Visitor C	Visitor Center - Lower Display	Visitor Center 7.5h 7d/week	4' Strip BP 1L 32W T8	2	31	2738	RT, 4' 10.5W SE LED 1L	2	11	2738	-	0	0.0	0.0	0.0	170	57	112	30%	0
604	Reynoldsdale SFH	Basement	nistration / Visitor C	Visitor Center - Lower Display	Visitor Center 7.5h 7d/week	2' Strip 1L T8	24	20	2738	RT, 2' 7W SE LED 1L	24	7	2738	-	0	0.4	0.1	0.2	1,314	460	854	30%	0
605	Reynoldsdale SFH	Basement	nistration / Visitor C	Behind Display	Storage / Janitor Closet Hatcheries	RLM CFL 32W Screw In	7	32	782	LED 9W A19 Replacement	7	9	782	-	0	0.1	0.0	0.1	175	49	126	25%	0
606	Reynoldsdale SFH	Basement	nistration / Visitor C	Hallway	Office Hours 8.5h 7d/week	2X4 Flat Panel Rec LED 40W	1	40	3103	No Action - Existing Efficient Fixture	1	40	3103	-	0	0.0	0.0	0.0	124	124	0	25%	0
607	Reynoldsdale SFH	Basement	nistration / Visitor C	Boiler Room	Mechanical/Electrical Room Hatcheries	RLM LED 9W A	3	9	782	No Action - Existing Efficient Fixture	3	9	782	-	0	0.0	0.0	0.0	21	21	0	25%	0
608	Reynoldsdale SFH	Basement	nistration / Visitor C	Conference Room	Office Hours 8.5h 7d/week	2X4 Flat Panel Rec LED 40W	6	40	3103	No Action - Existing Efficient Fixture	6	40	3103	-	0	0.2	0.2	0.0	745	745	0	25%	0
609	Reynoldsdale SFH	1st Floor	nistration / Visitor C	Hallway to Garage	Office Hours 8.5h 7d/week	4' Wrap BP 2L 32W T8	5	59	3103	RT, 4' 10.5W SE LED 2L	5	21	3103	-	0	0.2	0.1	0.2	915	326	590	25%	0
610	Reynoldsdale SFH	1st Floor	nistration / Visitor C	Garage Bay	Office Hours 8.5h 7d/week	8' Industrial T5HO 4L	20	234	3103	RT, 4' 25W SE LED T5HO 4L	20	100	3103	-	0	3.7	1.6	2.1	14,522	6,206	8,316	25%	0
611	Reynoldsdale SFH	1st Floor	nistration / Visitor C	Garage Task	Office Hours 8.5h 7d/week	4' Undercabinet BP 1L 32W T8	1	31	3103	RT, 4' 10.5W SE LED 1L	1	11	3103	-	0	0.0	0.0	0.0	96	33	64	25%	0
612	Reynoldsdale SFH	1st Floor	nistration / Visitor C	Men's Restroom	Restroom Public Hatcheries	Wall Sconce Inc 60W A 2L	3	120	1564	LED 9W A19 Replacement 2L	3	18	860	CM	3	0.2	0.0	0.2	563	84	479	45%	38
613	Reynoldsdale SFH	1st Floor	nistration / Visitor C	Men's Restroom	Restroom Public Hatcheries	Wall Sconce LED 9W A 2L	2	18	1564	No Action - Existing Efficient Fixture	2	18	860	PL	0	0.0	0.0	0.0	56	56	0	45%	25
614	Reynoldsdale SFH	1st Floor	nistration / Visitor C	Men's Restroom	Restroom Public Hatcheries	8' Wrap BP 4L 32W T8	2	112	1564	RT, 4' 10.5W SE LED 4L	2	42	860	PL	0	0.1	0.0	0.1	350	131	219	45%	59
615	Reynoldsdale SFH	1st Floor	nistration / Visitor C	Locker Room	Restroom Public Hatcheries	Wall Sconce Inc 60W A 2L	1	120	1564	LED 9W A19 Replacement 2L	1	18	860	CM	1	0.1	0.0	0.1	188	28	160	45%	13
616	Reynoldsdale SFH	1st Floor	nistration / Visitor C	Locker Room	Restroom Public Hatcheries	8' Wrap BP 4L 32W T8	1	112	1564	RT, 4' 10.5W SE LED 4L	1	42	860	PL	0	0.1	0.0	0.0	175	66	109	45%	30
617	Reynoldsdale SFH	1st Floor	nistration / Visitor C	Break Room	Office Hours 8.5h 7d/week	8' Wrap BP 4L 32W T8	4	112	3103	RT, 4' 10.5W SE LED 4L	4	42	2327	CM	4	0.4	0.1	0.2	1,390	521	869	25%	130
618	Reynoldsdale SFH	1st Floor	nistration / Visitor C	Break Room	Office Hours 8.5h 7d/week	4' Strip BP 2L 32W T8	1	59	3103	RT, 4' 10.5W SE LED 2L	1	21	2327	PL	0	0.0	0.0	0.0	183	65	118	25%	16
619	Reynoldsdale SFH	1st Floor	nistration / Visitor C	Break Room	Office Hours 8.5h 7d/week	2' Undercabinet 1L 17W T8	2	20	3103	RT, 2' 7W SE LED 1L	2	7	3103	-	0	0.0	0.0	0.0	124	43	81	25%	0
620	Reynoldsdale SFH	1st Floor	nistration / Visitor C	Sink Storage Closet	Storage / Janitor Closet Hatcheries	Globe LED 9W A	1	9	782	No Action - Existing Efficient Fixture	1	9	782	-	0	0.0	0.0	0.0	7	7	0	25%	0
621	Reynoldsdale SFH	1st Floor	nistration / Visitor C	Janitorial Closet	Storage / Janitor Closet Hatcheries	Globe LED 9W A	1	9	782	No Action - Existing Efficient Fixture	1	9	782	-	0	0.0	0.0	0.0	7	7	0	25%	0
622	Reynoldsdale SFH	1st Floor	nistration / Visitor C	Carpenter Shop	Office Hours 8.5h 7d/week	8' Vaportight BP 4L 32W T8	5	112	3103	RT, 4' 10.5W SE LED 4L	5	42	3103	-	0	0.4	0.2	0.3	1,738	652	1,086	25%	0
623	Reynoldsdale SFH	1st Floor	nistration / Visitor C	Lab	Office Hours 8.5h 7d/week	8' Vaportight LED 60W	1	60	3103	No Action - Existing Efficient Fixture	1	60	3103	-	0	0.0	0.0	0.0	186	186	0	25%	0
624	Reynoldsdale SFH	1st Floor	nistration / Visitor C	Lab Task	Office Hours 8.5h 7d/week	2' Undercabinet LED 6W	4	6	3103	No Action - Existing Efficient Fixture	4	6	3103	-	0	0.0	0.0	0.0	74	74	0	25%	0
625	Reynoldsdale SFH	1st Floor	nistration / Visitor C	Lab Storage Room	Storage / Janitor Closet Hatcheries	Globe Inc 60W A	1	60	782	LED 9W A19 Replacement	1	9	782	-	0	0.0	0.0	0.0	47	7	40	25%	0
626	Reynoldsdale SFH	Exterior	nistration / Visitor C	Building Mounted	Exterior - Dusk to Dawn	Flood Hal 90 PAR38 2L	3	180	4380	LED 14W PAR38 Replacement WL 2L	3	28	4380	-	0	0.0	0.0	0.0	2,365	368	1,997	0%	0
627	Reynoldsdale SFH	Exterior	nistration / Visitor C	Building Mounted	Exterior - Dusk to Dawn	Wall Pack LED 15W	6	15	4380	No Action - Existing Efficient Fixture	6	15	4380	-	0	0.0	0.0	0.0	394	394	0	0%	0
628	Reynoldsdale SFH	Exterior	nistration / Visitor C	Flag Flood	Exterior - Dusk to Dawn	Flood LED 22W	1	22	4380	No Action - Existing Efficient Fixture	1	22	4380	-	0	0.0	0.0	0.0	96	96	0	0%	0
629	Reynoldsdale SFH	1st Floor	Pole Barn	Open Garage	Limited Daily Use	High Bay LED 40W	8	40	1460	No Action - Existing Efficient Fixture	8	40	1460	-	0	0.2	0.2	0.0	467	467	0	25%	0
630	Reynoldsdale SFH	Exterior	Gas Shed	Gas Shed	Utility Building	Jelly Jar Inc 100W A	1	100	26	LED 9W A19 Replacement	1	9	26	-	0	0.1	0.0	0.1	3	0	2	25%	0
631	Reynoldsdale SFH	1st Floor	Hatch House	Boiler Room / Back Storage Rooms	Limited Daily Use	Keyless LED 10W A	5	10	1460	No Action - Existing Efficient Fixture	5	10	1460	-	0	0.0	0.0	0.0	73	73	0	25%	0
632	Reynoldsdale SFH	2nd Floor	Hatch House	Feed Storage / Feed Loading	Limited Daily Use	4' Vaportight LED 30W	4	30	1460	No Action - Existing Efficient Fixture	4	30	1460	-	0	0.1	0.1	0.0	175	175	0	25%	0
633	Reynoldsdale SFH	3rd Floor	Hatch House	Attic	Storage / Janitor Closet Hatcheries	Keyless LED 10W A	2	10	782	No Action - Existing Efficient Fixture	2	10	782	-	0	0.0	0.0	0.0	16	16	0	25%	0
634	Reynoldsdale SFH	1st Floor	Hatch House	Passage to Hatchery	Office Hours 8.5h 7d/week	4' Vaportight LED 30W	3	30	3103	No Action - Existing Efficient Fixture	3	30	3103	-	0	0.1	0.1	0.0	279	279	0	25%	0
635	Reynoldsdale SFH	1st Floor	Hatch House	Private Office	Office Hours 8.5h 7d/week	4' Vaportight LED 30W	1	30	3103	No Action - Existing Efficient Fixture	1	30	3103	-	0	0.0	0.0	0.0	93	93	0	25%	0
636	Reynoldsdale SFH	1st Floor	Hatch House	Storage Closet	Storage / Janitor Closet Hatcheries	Keyless LED 10W A	1	10	782	No Action - Existing Efficient Fixture	1	10	782	-	0	0.0	0.0	0.0	8	8	0	25%	0
637	Reynoldsdale SFH	1st Floor	Hatch House	Light House Room	Office Hours 8.5h 7d/week	8' Vaportight LED 60W	6	60	3103	No Action - Existing Efficient Fixture	6	60	3103	-	0	0.3	0.3	0.0	1,117	1,117	0	25%	0
638	Reynoldsdale SFH	1st Floor	Hatch House	Hatchery	Office Hours 8.5h 7d/week	8' Vaportight LED 60W	12	60	3103	No Action - Existing Efficient Fixture	12	60	3103	-	0	0.6	0.6	0.0	2,234	2,234	0	25%	0
639	Reynoldsdale SFH	1st Floor	O.I.S. Building	Pump Room	Utility Building	4' Wrap BP 2L 32W T8	2	59	26	RT, 4' 10.5W SE LED 2L	2	21	26	-	0	0.1	0.0	0.0	3	1	2	25%	0
640	Reynoldsdale SFH	1st Floor	O.I.S. Building	Controls Room	Utility Building	4' Vaportight T5HO 3L	2	177	26	RT, 4' 25W SE LED T5HO 3L	2	75	26	-	0	0.2	0.1	0.1	9	4	5	25%	0
641	Reynoldsdale SFH	Exterior	O.I.S. Building	Building Mounted	Exterior - Dusk to Dawn	Wall Pack CFL 32W 4P	1	34	4380	Wall Pack LED Security 1.8 kLm PC	1	15	4380	-	0	0.0	0.0	0.0	149	66	83	0%	0
642	Reynoldsdale SFH	1st Floor	Old Garage	Bay 1	Low Hours	Keyless LED 15W A	3	15	8	No Action - Existing Efficient Fixture	3	15	8	-	0	0.0	0.0	0.0	0	0	0	25%	0
643	Reynoldsdale SFH	1st Floor	Old Garage	Bay 1 Task	Low Hours	4' Strip BP 2L	1	72	8	RT, 4' 10.5W SE LED 2L	1	21	8	-	0	0.0	0.0	0.0	1	0	0	25%	0
644	Reynoldsdale SFH	1st Floor	Old Garage	Chemical Storage	Storage / Janitor Closet Hatcheries	4' Industrial BP 2L 32W T8	2	59	782	RT, 4' 10.5W SE LED 2L	2	21	782	-	0	0.1	0.0	0.0	92	33	59	25%	0
645	Reynoldsdale SFH	1st Floor	Old Garage	Chemical Storage	Storage / Janitor Closet Hatcheries	4' Industrial BP 2L 32W T8	1	59	782	RT, 4' 10.5W SE LED 2L	1	21	782	-	0	0.0	0.0	0.0	46	16	30	25%	0
646	Reynoldsdale SFH	1st Floor	Old Garage	Bay 2	Low Hours	Keyless LED 15W A	7	15	8	No Action - Existing Efficient Fixture	7	15	8	-	0	0.1	0.1	0.0	1	1	0	25%	0
647	Reynoldsdale SFH	Basement	Old Garage	Basement Storage Area	Low Hours	Keyless LED 15W A	4	15	8	No Action - Existing Efficient Fixture	4	15	8	-	0	0.0	0.0	0.0	0	0	0	25%	0
648	Reynoldsdale SFH	1st Floor	Main Generator	Generator Room	Utility Building	Keyless LED 15W A	5	15	26	No Action - Existing Efficient Fixture	5	15	26	-	0	0.0	0.0	0.0	2	2	0	25%	0
649	Reynoldsdale SFH	1st Floor	Treatment Building	Mechanical Room	Utility Building	4' Vaportight T5HO 3L	10	177	26	RT, 4' 25W SE LED T5HO 3L	10	75	26	-	0	1.0	0.4	0.6	46	20	27	25%	0
650	Reynoldsdale SFH	1st Floor	Treatment Building	Panel Room	Utility Building	4' Vaportight T5HO 3L	5	177	26	RT, 4' 25W SE LED T5HO 3L	5	75	26	-	0	0.5	0.2	0.3	23	10	13	25%	0
651	Reynoldsdale SFH	Exterior	Treatment Building	Building Mounted	Exterior - Dusk to Dawn	Wall Pack CFL 32W 4P	4	34	4380	Wall Pack LED Security 1.8 kLm PC	4	15	4380	-	0	0.0	0.0	0.0	596	263	333	0%	0
652	Reynoldsdale SFH	Exterior	Treatment Building	Building Mounted	Exterior - Dusk to Dawn	Flood Hal 90 PAR38 2L	2	180	4380	LED 14W PAR38 Replacement WL 2L	2	28	4380	-	0	0.0	0.0	0.0	1,577	245	1,332	0%	0
653	Reynoldsdale SFH	Exterior	Area Lighting	Raceways Perimeter Poles	Exterior - Dusk to Dawn	Shoebox LED 105W	11	105	4380	No Action - Existing Efficient Fixture	11	105	4380	-	0	0.0	0.0	0.0	5,059	5,059	0	0%	0
654	Reynoldsdale SFH	Exterior	Area Lighting	Wood Poles	Not In Use	Globe MV 175W	5	215	0	LED HID Omni Retrofit 5 kLm Med Base	5	36	0	-	0	0.0	0.0	0.0	0	0	0	0%	0
655	Benner Spring SFH	1st Floor	dministration Buildin	Conference Room	Office Hours 9h 7d/week	2X4 Prism Rec LED 55W	6	55	3285	No Action - Existing Efficient Fixture	6	55	3285	-	0	0.3	0.3	0.0	1,084	1,084	0	25%	0
656	Benner Spring SFH	1st Floor	dministration Buildin	Lobby	Office Hours 9h 7d/week	2X4 Prism Rec LED 55W	3	55	3285	No Action - Existing Efficient Fixture	3	55	3285	-	0	0.1	0.1	0.0	542	542	0	25%	0
657	Benner Spring SFH	1st Floor	dministration Buildin	Men's Restroom	Restroom Private Hatcheries	2X4 Prism Rec LED 55W	1	55	782	No Action - Existing Efficient Fixture	1	55	782	-	0	0.0	0.0	0.0	43	43	0	25%	0
658	Benner Spring SFH	1st Floor	dministration Buildin	Women's Restroom	Restroom Private Hatcheries	2X4 Prism Rec LED 55W	1	55	782	No Action - Existing Efficient Fixture	1	55	782	-	0	0.0	0.0	0.0	43	43	0	25%	0
659	Benner Spring SFH	1st Floor	dministration Buildin	Reception	Office Hours 9h 7d/week	2X4 Prism Rec LED 55W	5	55	3285	No Action - Existing Efficient Fixture	5	55	3285	-	0	0.2	0.2	0.0	903	903	0	25%	0
660	Benner Spring SFH	1st Floor	dministration Buildin	Main Hallway	Office Hours 9h 7d/week	2x2 Prism Rec LED 50W	11	50	3285	No Action - Existing Efficient Fixture	11	50	3285	-	0	0.4	0.4	0.0	1,807	1,807	0	25%	0

ID #	Location					Existing Fixture				Proposed Fixture						PeakDemand			Usage			Controls	
	Building # : Name	Floor	Area	Sub Area / Room	Usage Group	Fixture	Quantity	Input Wattage	Hours of Operation	ECM	Quantity	Input Wattage	Hours of Operation	Occ Sensor Type	Occ Sensor Qty	Pre	Post	Savings	Pre	Post	Savings	Savings %	Savings
661	Benner Spring SFH	1st Floor	dministration Buildin	Copy Room	Office Hours 9h 7d/week	2X4 Prism Rec LED 55W	4	55	3285	No Action - Existing Efficient Fixture	4	55	3285	-	0	0.2	0.2	0.0	723	723	0	25%	0
662	Benner Spring SFH	1st Floor	dministration Buildin	Hallway to Fish Culture	Office Hours 9h 7d/week	2x2 Prism Rec LED 50W	2	50	3285	No Action - Existing Efficient Fixture	2	50	3285	-	0	0.1	0.1	0.0	329	329	0	25%	0
663	Benner Spring SFH	1st Floor	dministration Buildin	Storage Room	Storage / Janitor Closet Hatcheries	2X4 Prism Rec LED 55W	4	55	782	No Action - Existing Efficient Fixture	4	55	782	-	0	0.1	0.1	0.0	172	172	0	25%	0
664	Benner Spring SFH	1st Floor	dministration Buildin	Storage Closet	Storage / Janitor Closet Hatcheries	2X4 Prism Rec LED 55W	1	55	782	No Action - Existing Efficient Fixture	1	55	782	-	0	0.0	0.0	0.0	43	43	0	25%	0
665	Benner Spring SFH	1st Floor	dministration Buildin	Private Office	Office Hours 9h 7d/week	2X4 Prism Rec LED 55W	3	55	3285	No Action - Existing Efficient Fixture	3	55	3285	-	0	0.1	0.1	0.0	542	542	0	25%	0
666	Benner Spring SFH	1st Floor	dministration Buildin	Private Office	Office Hours 9h 7d/week	2X4 Prism Rec LED 55W	3	55	3285	No Action - Existing Efficient Fixture	3	55	3285	-	0	0.1	0.1	0.0	542	542	0	25%	0
667	Benner Spring SFH	1st Floor	dministration Buildin	Library	Office Hours 9h 7d/week	2X4 Prism Rec LED 55W	6	55	3285	No Action - Existing Efficient Fixture	6	55	3285	-	0	0.3	0.3	0.0	1,084	1,084	0	25%	0
668	Benner Spring SFH	1st Floor	dministration Buildin	Hallway to data room	Office Hours 9h 7d/week	2x2 Prism Rec LED 50W	1	50	3285	No Action - Existing Efficient Fixture	1	50	3285	-	0	0.0	0.0	0.0	164	164	0	25%	0
669	Benner Spring SFH	1st Floor	dministration Buildin	Locker Room	Restroom Public Hatcheries	2X4 Prism Rec LED 55W	3	55	1564	No Action - Existing Efficient Fixture	3	55	1564	-	0	0.1	0.1	0.0	258	258	0	45%	0
670	Benner Spring SFH	1st Floor	dministration Buildin	Locker Room Shower	Restroom Public Hatcheries	6" Rec Can LED 9W A	1	9	1564	No Action - Existing Efficient Fixture	1	9	1564	-	0	0.0	0.0	0.0	14	14	0	45%	0
671	Benner Spring SFH	1st Floor	dministration Buildin	Break Room	Office Hours 9h 7d/week	2X4 Prism Rec LED 55W	4	55	3285	No Action - Existing Efficient Fixture	4	55	3285	-	0	0.2	0.2	0.0	723	723	0	25%	0
672	Benner Spring SFH	1st Floor	dministration Buildin	Restroom	Restroom Private Hatcheries	2X4 Prism Rec LED 55W	4	55	782	No Action - Existing Efficient Fixture	4	55	782	-	0	0.1	0.1	0.0	172	172	0	25%	0
673	Benner Spring SFH	1st Floor	dministration Buildin	Locker Room	Office Hours 9h 7d/week	2X4 Prism Rec LED 55W	1	55	3285	No Action - Existing Efficient Fixture	1	55	3285	-	0	0.0	0.0	0.0	181	181	0	25%	0
674	Benner Spring SFH	1st Floor	dministration Buildin	Pathology Lab	Office Hours 9h 7d/week	2X4 Prism Rec LED 55W	8	55	3285	No Action - Existing Efficient Fixture	8	55	3285	-	0	0.4	0.4	0.0	1,445	1,445	0	25%	0
675	Benner Spring SFH	1st Floor	dministration Buildin	Storage	Storage / Janitor Closet Hatcheries	2X4 Prism Rec LED 55W	4	55	782	No Action - Existing Efficient Fixture	4	55	782	-	0	0.1	0.1	0.0	172	172	0	25%	0
676	Benner Spring SFH	1st Floor	dministration Buildin	Research	Office Hours 9h 7d/week	2X4 Prism Rec LED 55W	2	55	3285	No Action - Existing Efficient Fixture	2	55	3285	-	0	0.1	0.1	0.0	361	361	0	25%	0
677	Benner Spring SFH	1st Floor	dministration Buildin	Storage	Storage / Janitor Closet Hatcheries	2X4 Prism Rec LED 55W	1	55	782	No Action - Existing Efficient Fixture	1	55	782	-	0	0.0	0.0	0.0	43	43	0	25%	0
678	Benner Spring SFH	1st Floor	dministration Buildin	Private Office	Office Hours 9h 7d/week	2X4 Prism Rec LED 55W	1	55	3285	No Action - Existing Efficient Fixture	1	55	3285	-	0	0.0	0.0	0.0	181	181	0	25%	0
679	Benner Spring SFH	1st Floor	dministration Buildin	Private Office	Office Hours 9h 7d/week	2X4 Prism Rec LED 55W	2	55	3285	No Action - Existing Efficient Fixture	2	55	3285	-	0	0.1	0.1	0.0	361	361	0	25%	0
680	Benner Spring SFH	1st Floor	dministration Buildin	Private Office	Office Hours 9h 7d/week	2X4 Prism Rec LED 55W	2	55	3285	No Action - Existing Efficient Fixture	2	55	3285	-	0	0.1	0.1	0.0	361	361	0	25%	0
681	Benner Spring SFH	1st Floor	dministration Buildin	Open Office	Office Hours 9h 7d/week	2X4 Prism Rec LED 55W	4	55	3285	No Action - Existing Efficient Fixture	4	55	3285	-	0	0.2	0.2	0.0	723	723	0	25%	0
682	Benner Spring SFH	1st Floor	dministration Buildin	Private Office	Office Hours 9h 7d/week	2X4 Prism Rec LED 55W	3	55	3285	No Action - Existing Efficient Fixture	3	55	3285	-	0	0.1	0.1	0.0	542	542	0	25%	0
683	Benner Spring SFH	1st Floor	dministration Buildin	Hallway to Exit	Office Hours 9h 7d/week	2x2 Prism Rec LED 50W	2	50	3285	No Action - Existing Efficient Fixture	2	50	3285	-	0	0.1	0.1	0.0	329	329	0	25%	0
684	Benner Spring SFH	1st Floor	dministration Buildin	Stair to Exit	Office Hours 9h 7d/week	2x2 Prism Rec LED 50W	4	50	3285	No Action - Existing Efficient Fixture	4	50	3285	-	0	0.2	0.2	0.0	657	657	0	25%	0
685	Benner Spring SFH	1st Floor	dministration Buildin	Water Chem Lab	Office Hours 9h 7d/week	2X4 Prism Rec LED 55W	6	55	3285	No Action - Existing Efficient Fixture	6	55	3285	-	0	0.3	0.3	0.0	1,084	1,084	0	25%	0
686	Benner Spring SFH	1st Floor	dministration Buildin	Closet 1	Storage / Janitor Closet Hatcheries	2x2 Prism Rec LED 50W	1	50	782	No Action - Existing Efficient Fixture	1	50	782	-	0	0.0	0.0	0.0	39	39	0	25%	0
687	Benner Spring SFH	1st Floor	dministration Buildin	Closet 2	Storage / Janitor Closet Hatcheries	2x2 Prism Rec LED 50W	1	50	782	No Action - Existing Efficient Fixture	1	50	782	-	0	0.0	0.0	0.0	39	39	0	25%	0
688	Benner Spring SFH	1st Floor	dministration Buildin	Fume Hood	Storage / Janitor Closet Hatcheries	Jelly Jar Inc 60W A	2	60	782	LED 9W A19 Replacement	2	9	782	-	0	0.1	0.0	0.1	94	14	80	25%	0
689	Benner Spring SFH	1st Floor	dministration Buildin	Kitchenette	Office Hours 9h 7d/week	2X4 Prism Rec LED 55W	2	55	3285	No Action - Existing Efficient Fixture	2	55	3285	-	0	0.1	0.1	0.0	361	361	0	25%	0
690	Benner Spring SFH	1st Floor	dministration Buildin	Fume Hood	Storage / Janitor Closet Hatcheries	Jelly Jar Inc 60W A	2	60	782	LED 9W A19 Replacement	2	9	782	-	0	0.1	0.0	0.1	94	14	80	25%	0
691	Benner Spring SFH	1st Floor	dministration Buildin	Open Office	Office Hours 9h 7d/week	2X4 Prism Rec LED 55W	4	55	3285	No Action - Existing Efficient Fixture	4	55	3285	-	0	0.2	0.2	0.0	723	723	0	25%	0
692	Benner Spring SFH	1st Floor	dministration Buildin	Closet	Storage / Janitor Closet Hatcheries	2X4 Prism Rec LED 55W	1	55	782	No Action - Existing Efficient Fixture	1	55	782	-	0	0.0	0.0	0.0	43	43	0	25%	0
693	Benner Spring SFH	1st Floor	dministration Buildin	Lab	Office Hours 9h 7d/week	2X4 Prism Rec LED 55W	5	55	3285	No Action - Existing Efficient Fixture	5	55	3285	-	0	0.2	0.2	0.0	903	903	0	25%	0
694	Benner Spring SFH	1st Floor	dministration Buildin	Radiation	Office Hours 9h 7d/week	2X4 Prism Rec LED 55W	1	55	3285	No Action - Existing Efficient Fixture	1	55	3285	-	0	0.0	0.0	0.0	181	181	0	25%	0
695	Benner Spring SFH	1st Floor	dministration Buildin	Lab Equipment Closet	Storage / Janitor Closet Hatcheries	2X4 Prism Rec LED 55W	2	55	782	No Action - Existing Efficient Fixture	2	55	782	-	0	0.1	0.1	0.0	86	86	0	25%	0
696	Benner Spring SFH	1st Floor	dministration Buildin	Microscopy	Office Hours 9h 7d/week	2x2 Prism Rec LED 50W	1	50	3285	No Action - Existing Efficient Fixture	1	50	3285	-	0	0.0	0.0	0.0	164	164	0	25%	0
697	Benner Spring SFH	1st Floor	dministration Buildin	Elevator	Exit Signs/Night Lights	4' Strip BP 2L	1	72	8760	RT, 4' 10.5W SE LED 2L	1	21	8760	-	0	0.1	0.0	0.1	631	184	447	0%	0
698	Benner Spring SFH	1st Floor	dministration Buildin	Electric	Mechanical/Electrical Room Hatcheries	2x2 Prism Rec LED 50W	1	50	782	No Action - Existing Efficient Fixture	1	50	782	-	0	0.0	0.0	0.0	39	39	0	25%	0
699	Benner Spring SFH	Basement	dministration Buildin	Work Room	Office Hours 9h 7d/week	2X4 Prism Rec LED 55W	5	55	3285	No Action - Existing Efficient Fixture	5	55	3285	-	0	0.2	0.2	0.0	903	903	0	25%	0
700	Benner Spring SFH	Basement	dministration Buildin	Closet	Storage / Janitor Closet Hatcheries	Keyless Inc 60W A	5	60	782	LED 9W A19 Replacement	5	9	782	-	0	0.2	0.0	0.1	235	35	199	25%	0
701	Benner Spring SFH	Basement	dministration Buildin	Corridor	Office Hours 9h 7d/week	2x2 Prism Rec LED 50W	3	50	3285	No Action - Existing Efficient Fixture	3	50	3285	-	0	0.1	0.1	0.0	493	493	0	25%	0
702	Benner Spring SFH	Basement	dministration Buildin	Acid	Storage / Janitor Closet Hatcheries	Keyless Inc 300W A	1	300	782	LED 15W A19 Replacement	1	15	782	-	0	0.2	0.0	0.2	235	12	223	25%	0
703	Benner Spring SFH	Basement	dministration Buildin	Caustic	Storage / Janitor Closet Hatcheries	Keyless Inc 300W A	1	300	782	LED 15W A19 Replacement	1	15	782	-	0	0.2	0.0	0.2	235	12	223	25%	0
704	Benner Spring SFH	Basement	dministration Buildin	Locked	Storage / Janitor Closet Hatcheries	Keyless Inc 300W A	1	300	782	LED 15W A19 Replacement	1	15	782	-	0	0.2	0.0	0.2	235	12	223	25%	0
705	Benner Spring SFH	Basement	dministration Buildin	Lighthouse 1	Office Hours 9h 7d/week	2X4 Prism Rec LED 55W	5	55	3285	No Action - Existing Efficient Fixture	5	55	3285	-	0	0.2	0.2	0.0	903	903	0	25%	0
706	Benner Spring SFH	Basement	dministration Buildin	Hatchery	Office Hours 9h 7d/week	2X4 Prism Rec LED 55W	12	55	3285	No Action - Existing Efficient Fixture	12	55	3285	-	0	0.5	0.5	0.0	2,168	2,168	0	25%	0
707	Benner Spring SFH	Basement	dministration Buildin	Lighthouse 2	Office Hours 9h 7d/week	2X4 Prism Rec LED 55W	5	55	3285	No Action - Existing Efficient Fixture	5	55	3285	-	0	0.2	0.2	0.0	903	903	0	25%	0
708	Benner Spring SFH	Basement	dministration Buildin	Hatchery	Office Hours 9h 7d/week	2X4 Prism Rec LED 55W	13	55	3285	No Action - Existing Efficient Fixture	13	55	3285	-	0	0.6	0.6	0.0	2,349	2,349	0	25%	0
709	Benner Spring SFH	Basement	dministration Buildin	Hatchery	Office Hours 9h 7d/week	2x2 Prism Rec LED 50W	3	50	3285	No Action - Existing Efficient Fixture	3	50	3285	-	0	0.1	0.1	0.0	493	493	0	25%	0
710	Benner Spring SFH	Basement	dministration Buildin	Furnace	Mechanical/Electrical Room Hatcheries	4' Strip LED 15W T8 ULB 2L	2	30	782	No Action - Existing Efficient Fixture	2	30	782	-	0	0.0	0.0	0.0	47	47	0	25%	0
711	Benner Spring SFH	Basement	dministration Buildin	Hatchery	Office Hours 9h 7d/week	2X4 Prism Rec LED 55W	16	55	3285	No Action - Existing Efficient Fixture	16	55	3285	-	0	0.7	0.7	0.0	2,891	2,891	0	25%	0
712	Benner Spring SFH	Basement	dministration Buildin	Hatchery	Office Hours 9h 7d/week	2x2 Prism Rec LED 50W	3	50	3285	No Action - Existing Efficient Fixture	3	50	3285	-	0	0.1	0.1	0.0	493	493	0	25%	0
713	Benner Spring SFH	Basement	dministration Buildin	Egg Incubation	Office Hours 9h 7d/week	2X4 Prism Rec LED 55W	8	55	3285	No Action - Existing Efficient Fixture	8	55	3285	-	0	0.4	0.4	0.0	1,445	1,445	0	25%	0
714	Benner Spring SFH	Basement	dministration Buildin	Mechanical	Mechanical/Electrical Room Hatcheries	4' Strip LED 15W T8 ULB 2L	3	30	782	No Action - Existing Efficient Fixture	3	30	782	-	0	0.0	0.0	0.0	70	70	0	25%	0
715	Benner Spring SFH	Exterior	dministration Buildin	Lower Door	Exterior - Dusk to Dawn	Wall Pack LED 15W	1	15	4380	No Action - Existing Efficient Fixture	1	15	4380	-	0	0.0	0.0	0.0	66	66	0	0%	0
716	Benner Spring SFH	Exterior	dministration Buildin	Employee Entrance	Exterior - Dusk to Dawn	Wall Pack LED 15W	1	15	4380	No Action - Existing Efficient Fixture	1	15	4380	-	0	0.0	0.0	0.0	66	66	0	0%	0
717	Benner Spring SFH	Exterior	dministration Buildin	Front Entrance	Exterior - Dusk to Dawn	Canopy LED 20W	1	20	4380	No Action - Existing Efficient Fixture	1	20	4380	-	0	0.0	0.0	0.0	88	88	0	0%	0
718	Benner Spring SFH	Exterior	dministration Buildin	Lower Employee Entrance	Exterior - Dusk to Dawn	Wall Pack CFL 13W Screw In	1	13	4380	Wall Pack LED Security 1.8 kLm PC	1	15	4380	-	0	0.0	0.0	0.0	57	66	-9	0%	0
719	Benner Spring SFH	Exterior	dministration Buildin	Lower	Exterior - Dusk to Dawn	Canopy LED 20W	1	20	4380	No Action - Existing Efficient Fixture	1	20	4380	-	0	0.0	0.0	0.0	88	88	0	0%	0
720	Benner Spring SFH	1st Floor	Garage	Bay 1	Limited Daily Use	4' Strip LED 15W T8 ULB 2L	9	30	1460	No Action - Existing Efficient Fixture	9	30	1460	-	0	0.1	0.1	0.0	394	394	0	25%	0
721	Benner Spring SFH	1st Floor	Garage	Bay 2	Limited Daily Use	4' Strip LED 15W T8 ULB 2L	19	30	1460	No Action - Existing Efficient Fixture	19	30	1460	-	0	0.3	0.3	0.0	832	832	0	25%	0
722	Benner Spring SFH	1st Floor	Garage	Private Office	Limited Daily Use	4' Wrap LED 15W T8 ULB 2L	2	30	1460	No Action - Existing Efficient Fixture	2	30	1460	-	0	0.0	0.0	0.0	88	88	0	25%	0
723	Benner Spring SFH	1st Floor	Garage	Mechanical	Mechanical/Electrical Room Hatcheries	4' Strip LED 15W T8 ULB 2L	1	30	782	No Action - Existing Efficient Fixture	1	30	782	-	0	0.0	0.0	0.0	23	23	0	25%	0
724	Benner Spring SFH	1st Floor	Garage	Chem Storage	Storage / Janitor Closet Hatcheries	4' Vaportight LED 15W T8 ULB 2L	8	30	782	No Action - Existing Efficient Fixture	8	30	782	-	0	0.1	0.1	0.0	188	188	0	25%	0
725	Benner Spring SFH	1st Floor	Garage	Chem Storage	Storage / Janitor Closet Hatcheries	Jelly Jar LED 9W A	1	9	782	No Action - Existing Efficient Fixture	1	9	782	-	0	0.0	0.0	0.0	7	7	0	25%	0
726	Benner Spring SFH	1st Floor	Garage	Chem Storage	Storage / Janitor Closet Hatcheries	Jelly Jar LED 15W A	1	15	782	No Action - Existing Efficient Fixture	1	15	782	-	0	0.0	0.0	0.0	12	12	0	25%	0
727	Benner Spring SFH	Exterior	Garage	Front	Exterior - Dusk to Dawn	Flood LED 45W	2	45	4380	No Action - Existing Efficient Fixture	2	45	4380	-	0	0.0	0.0	0.0	394	394	0	0%	0
728	Benner Spring SFH	Exterior	Garage	Pump Station #2	Exterior - Dusk to Dawn	Barnlight LED 30W	1	30	4380	No Action - Existing Efficient Fixture	1	30	4380	-	0	0.0	0.0	0.0	131	131	0	0%	0
729	Benner Spring SFH	Exterior	Garage	Spring Pump Building	Exterior - Dusk to Dawn	Barnlight LED 30W	1	30	4380	No Action - Existing Efficient Fixture	1	30	4380	-	0	0.0	0.0	0.0	131	131	0	0%	0
730	Benner Spring SFH	Exterior	Generator Room	Wall	Exterior - Dusk to Dawn	Wall Pack LED 30W	1	30	4380	No Action - Existing Efficient Fixture	1	30	4380	-	0	0.0	0.0	0.0	131	131	0	0%	0
731	Benner Spring SFH	1st Floor	Generator Room	Inside	Utility Building	Keyless LED 9W A	6	9	26	No Action - Existing Efficient Fixture	6	9	26	-	0	0.0	0.0	0.0	1	1	0	25%	0
732	Benner Spring SFH	Exterior	Cold Storage	Wall	Exterior - Dusk to Dawn	Wall Pack LED 30W	1	30	4380	No Action - Existing Efficient Fixture	1	30	4380	-	0	0.0	0.0	0.0	131	131	0	0%	0
733	Benner Spring SFH	1st Floor	Cold Storage	Large Bay	Utility Building	High Bay LED 40W	6	40	26	No Action - Existing Efficient Fixture	6	40	26	-	0	0.1	0.1	0.0	6	6	0	25%	0
734	Benner Spring SFH	1st Floor	Cold Storage	Bay 1	Utility Building	High Bay LED 40W	1	40	26	No Action - Existing Efficient Fixture	1	40	26	-	0	0.0	0.0	0.0	1	1	0	25%	0
735	Benner Spring SFH	1st Floor	Cold Storage	Bay 2	Utility Building	High Bay LED 40W	1	40	26	No Action - Existing Efficient Fixture	1	40	26	-	0	0.0	0.0	0.0	1	1	0	25%	0
736	Benner Spring SFH	1st Floor	Cold Storage	Bay 3	Utility Building	High Bay LED 40W	1	40	26	No Action - Existing Efficient Fixture	1	40	26	-	0	0.0	0.0	0.0	1	1	0	25%	0
737	Benner Spring SFH	Exterior	Cold Storage	Raceway 1	Exterior - Dusk to Dawn	Flood LED 100W	11	100	4380	No Action - Existing Efficient Fixture	11	100	4380	-	0	0.0	0.0	0.0	4,818	4,818	0	0%	0
738	Benner Spring SFH	Exterior	Cold Storage	Flag	Exterior - Dusk to Dawn	Flood LED 22W	1	22	4380	No Action - Existing Efficient Fixture	1	22	4380	-	0	0.0	0.0	0.0	96	96	0	0%	0
739	Benner Spring SFH	Exterior	Cold Storage	Raceway 2	Exterior - Dusk to Dawn	Flood LED 100W	7	100	4380	No Action - Existing Efficient Fixture	7	100	4380	-	0	0.0	0.0	0.0	3,066	3,066	0	0%	0
740	Benner Spring SFH	Exterior	Micro screen	Walls	Exterior - Dusk to Dawn	Wall Pack LED 30W	4	30	4380	No Action - Existing Efficient Fixture	4	30	4380	-	0	0.0	0.0	0.0	526	526	0	0%	0
741	Benner Spring SFH	Exterior	Micro screen	Door	Exterior - Dusk to Dawn	Wall Pack LED 15W	1	15	4380	No Action - Existing Efficient Fixture	1	15	4380	-	0	0.0	0.0	0.0	66	66	0	0%	0
742	Benner Spring SFH	1st Floor	Micro screen	Main	Utility Building	4' Vaportight BP 2L 32W T8	22	59	26	RT, 4' 10.5W SE LED 2L	22	21	26	-	0	0.7	0.3	0.5	34	12	22	25%	0
743	Benner Spring SFH	1st Floor	Micro screen	Electric	Utility Building	4' Wrap BP 2L 32W T8	2	59	26	RT, 4' 10.5W SE LED 2L	2	21	26	-	0	0.1	0.0	0.0	3	1	2	25%	0
744	Tylersville SFH	1st Floor	Garage	Small Vehicle Bay	Limited Daily Use	8' Strip LED 8' 36W T8 ULB 2L	11	72	1460	No Action - Existing Efficient Fixture	11	72	1460	-	0	0.4	0.4	0.0	1,156	1,156	0	25%	0
745	Tylersville SFH	1st Floor	Garage	Food Storage	Storage / Janitor Closet Hatcheries	8' Vaportight SP 2L	3	138	782	RT, 4' 10.5W SE LED 4L, 8' VT Kit	3	42	782	-	0	0.2	0.1	0.2	324	99	225	25%	0
746	Tylersville SFH	1st Floor	Garage	Furnace	Mechanical/Electrical Room Hatcheries	4' Industrial BP 2L	3	72	782	RT, 4' 10.5W SE LED 2L	3	21	782	-	0	0.1	0.0	0.1	169	49	120	25%	0
747	Tylersville SFH	1st Floor	Garage	Large Vehicle Bay	Limited Daily Use	Keyless LED 10W A	7	10	1460	No Action - Existing Efficient Fixture	7	10	1460	-	0	0.0	0.0	0.0	102	102	0	25%	0
748	Tylersville SFH	1st Floor	Garage	Large Vehicle Bay	Limited Daily Use	Keyless Inc 100W A	7	100	1460	LED 9W A19 Replacement	7	9	1460	-	0	0.4	0.0	0.4	1,022	92	930	25%	0
749	Tylersville SFH	Exterior	Exterior	Raceway	Exterior - Dusk to Dawn	Flood LED 70W	16	70	4380	No Action - Existing Efficient Fixture	16	70	4380	-	0	0.0	0.0	0.0	4,906	4,906	0	0%	0
750	Tylersville SFH	Exterior	Garage	Back Wall	Exterior - Dusk to Dawn	Wall Pack Inc 100W A	1	100	4380	Wall Pack LED Security 1.8 kLm PC	1	15	4380	-	0	0.0	0.0	0.0	438	66	372	0%	0
751	Tylersville SFH	Exterior	Garage	Bay Doors	Exterior - Dusk to Dawn	Wall Pack MH 70W	3	95	4380	Wall Pack LED Security 1.8 kLm PC	3	15	4380	-	0	0.0	0.0	0.0	1,248	197	1,051	0%	0
752	Tylersville SFH	Exterior	Garage	Bay Doors	Exterior - Dusk to Dawn	Wall Pack Inc 100W A	3	100	4380	Wall Pack LED Security 1.8 kLm PC	3	15	4380	-	0	0.0	0.0	0.0	1,314	197	1,117	0%	0
753	Tylersville SFH	Exterior	Exterior	Raceway	Exterior - Dusk to Dawn	Shoebox LED 105W	4	105	4380	No Action - Existing Efficient Fixture	4	105	4380	-	0	0.0	0.0	0.0	1,840	1,840	0	0%	0
754	Tylersville SFH	1st Floor	Pump house	Inside	Utility Building	Keyless LED 15W A	3	15	26	No Action - Existing Efficient Fixture	3	15	26	-	0	0.0	0.0	0.0	1	1	0	25%	0
755	Tylersville SFH	1st Floor	Generator	Inside	Utility Building	8' Vaportight SP 2L	5	138	26	RT, 4' 10.5W SE LED 4L, 8' VT Kit	5	42	26	-	0	0.4	0.1	0.3	18	5	12	25%	0
756	Tylersville SFH	Exterior	Generator	Man Door	Exterior - Dusk to Dawn	Wall Pack CFL 32W 4P	1	34	4380	Wall Pack LED Security 1.8 kLm PC	1	15	4380	-	0	0.0	0.0	0.0	149	66	83	0%	0
757	Tylersville SFH	Exterior	Generator	Bay Door	Exterior - Dusk to Dawn	Wall Pack MH 70W	1	95	4380	Wall Pack LED Security 1.8 kLm PC	1	15	4380	-	0	0.0	0.0	0.0	416	66	350	0%	0
758	Tylersville SFH	1st Floor	Old Generator	Inside	Utility Building	4' Industrial BP 2L	4	72	26	RT, 4' 10.5W SE LED 2L	4	21	26	-	0	0.2	0.0	0.1	7	2	5	25%	0
759	Tylersville SFH	1st Floor	Hatch House	Men's Restroom	Restroom Private Hatcheries	2X4 Prism Rec 2L	1	72	782	RT, 4' 10.5W SE LED 2L	1	21	587	WS	1	0.0	0.0	0.0	56	16	40	25%	4
760	Tylersville SFH	1st Floor	Hatch House	Hallway Boiler	Office Hours 9h 7d/week	2X4 Prism Rec 2L	2	72	3285	RT, 4' 10.5W SE LED 2L	2	21	3285	-	0	0.1	0.0	0.1	473	138	335	25%	0
761	Tylersville SFH	1st Floor	Hatch House	Private Office Secretary	Office Hours 9h 7d/week	2X4 Prism Rec 2L	4	72	3285	RT, 4' 10.5W SE LED 2L	4	21	2464	WS	1	0.2	0.1	0.2	946	276	670	25%	69
762	Tylersville SFH	1st Floor	Hatch House	Private Office Manager	Office Hours 9h 7d/week	2X4 Prism Rec 2L	2	72	3285	RT, 4' 10.5W SE LED 2L	2	21	2464	WS	1	0.1	0.0	0.1	473	138	335	25%	34
763	Tylersville SFH	1st Floor	Hatch House	Women's Restroom	Restroom Private Hatcheries	2X4 Prism Rec 2L	1	72	782	RT, 4' 10.5W SE LED 2L	1	21	587	WS	1	0.0	0.0	0.0	56	16	40	25%	4
764	Tylersville SFH	1st Floor	Hatch House	Boiler	Mechanical/Electrical Room Hatcheries	4' Vaportight BP 2L 32W T8	2	59	782	RT, 4' 10.5W SE LED 2L	2	21	782	-	0	0.1	0.0	0.0	92	33	59	25%	0
765	Tylersville SFH	1st Floor	Hatch House	Hatchery	Office Hours 9h 7d/week	4' Vaportight BP 2L	16	72	3285	RT, 4' 10.5W SE LED 2L	16	21	3285	-	0	0.9	0.3	0.7	3,784	1,104	2,681	25%	0
766	Tylersville SFH	1st Floor	Hatch House	Hallway to Exit	Office Hours 9h 7d/week	4' Vaportight BP 2L	2	72	3285	RT, 4' 10.5W SE LED 2L	2	21	3285	-	0	0.1	0.0	0.1	473	138	335	25%	0
767	Tylersville SFH	1st Floor	Hatch House	Dark Hatchery	Office Hours 9h 7d/week	4' Vaportight BP 2L	2	72	3285	RT, 4' 10.5W SE LED 2L	2	21	3285	-	0	0.1	0.0	0.1	473	138	335	25%	0
768	Tylersville SFH	1st Floor	Hatch House	Eyewash Vestibule	Office Hours 9h 7d/week	4' Vaportight BP 2L	1	72	3285	RT, 4' 10.5W SE LED 2L	1	21	3285	-	0	0.1	0.0	0.0	237	69	168	25%	0
769	Tylersville SFH	1st Floor	Hatch House	Chemical Room	Office Hours 9h 7d/week	4' Vaportight BP 2L	2	72	3285	RT, 4' 10.5W SE LED 2L	2	21	3285	-	0	0.1	0.0	0.1	473	138	335	25%	0
770	Tylersville SFH	1st Floor	Hatch House	Chemical Storage	Storage / Janitor Closet Hatcheries	4' Vaportight BP 2L	2	72	782	RT, 4' 10.5W SE LED 2L	2	21	782	-	0	0.1	0.0	0.1	113	33	80	25%	0

ID #	Location					Existing Fixture				Proposed Fixture						PeakDemand			Usage			Controls	
	Building # : Name	Floor	Area	Sub Area / Room	Usage Group	Fixture	Quantity	Input Wattage	Hours of Operation	ECM	Quantity	Input Wattage	Hours of Operation	Occ Sensor Type	Occ Sensor Qty	Pre	Post	Savings	Pre	Post	Savings	Savings %	Savings
771	Tylersville SFH	1st Floor	Hatch House	Lighthouse	Office Hours 9h 7d/week	4' Vaportight BP 2L	3	72	3285	RT, 4' 10.5W SE LED 2L	3	21	3285	-	0	0.2	0.1	0.1	710	207	503	25%	0
772	Tylersville SFH	1st Floor	Hatch House	Lighthouse	Office Hours 9h 7d/week	8' Industrial SP 2L	1	138	3285	RT, 4' 10.5W SE LED 4L, 8' BC Kit	1	42	3285	-	0	0.1	0.0	0.1	453	138	315	25%	0
773	Tylersville SFH	1st Floor	Affluent	Room 1	Utility Building	8' Industrial SP 2L	4	138	26	RT, 4' 10.5W SE LED 4L, 8' BC Kit	4	42	26	-	0	0.3	0.1	0.2	14	4	10	25%	0
774	Tylersville SFH	1st Floor	Affluent	Lower Room	Utility Building	8' Vaportight SP 2L	6	138	26	RT, 4' 10.5W SE LED 4L, 8' VT Kit	6	42	26	-	0	0.5	0.1	0.3	22	7	15	25%	0
775	Tylersville SFH	Exterior	Affluent	Man Door	Exterior - Dusk to Dawn	Wall Pack CFL 18W 4P	2	20	4380	Wall Pack LED Security 1.8 kLm PC	2	15	4380	-	0	0.0	0.0	0.0	175	131	44	0%	0
776	Tylersville SFH	Exterior	Hatch House Filter	Bay Door	Exterior - Dusk to Dawn	Wall Pack CFL 18W 4P	1	20	4380	Wall Pack LED Security 1.8 kLm PC	1	15	4380	-	0	0.0	0.0	0.0	88	66	22	0%	0
777	Tylersville SFH	1st Floor	Hatch House Filter	Inside	Utility Building	8' Vaportight SP 2L	2	138	26	RT, 4' 10.5W SE LED 4L, 8' VT Kit	2	42	26	-	0	0.2	0.0	0.1	7	2	5	25%	0
778	Tylersville SFH	Exterior	Hatchery	Door	Exterior - Switch	Jelly Jar Inc 60W A	2	60	469	LED 9W A19 Replacement	2	9	469	-	0	0.0	0.0	0.0	56	8	48	0%	0
779	Tylersville SFH	1st Floor	dministration Buildin	Break Room	Office Hours 9h 7d/week	2X4 Prism Rec 2L 32W T8	6	59	3285	RT, 4' 10.5W SE LED 2L	6	21	2464	CM	6	0.3	0.1	0.2	1,163	414	749	25%	103
780	Tylersville SFH	1st Floor	dministration Buildin	Furnace	Mechanical/Electrical Room Hatcheries	Keyless Inc 60W A	1	60	782	LED 9W A19 Replacement	1	9	782	-	0	0.0	0.0	0.0	47	7	40	25%	0
781	Tylersville SFH	1st Floor	dministration Buildin	Electric/Storage	Mechanical/Electrical Room Hatcheries	2X4 Prism Rec 4L 32W T8	1	112	782	RT, 4' 10.5W SE LED 4L	1	42	782	-	0	0.1	0.0	0.0	88	33	55	25%	0
782	Tylersville SFH	1st Floor	dministration Buildin	Restroom	Restroom Private Hatcheries	2X4 Prism Rec 4L 32W T8	1	112	782	RT, 4' 10.5W SE LED 4L	1	42	587	WS	1	0.1	0.0	0.0	88	33	55	25%	8
783	Tylersville SFH	1st Floor	dministration Buildin	Carpentry Bay	Office Hours 9h 7d/week	4' Industrial BP 4L	1	144	3285	RT, 4' 10.5W SE LED 4L	1	42	3285	-	0	0.1	0.0	0.1	473	138	335	25%	0
784	Tylersville SFH	1st Floor	dministration Buildin	Carpentry Bay	Office Hours 9h 7d/week	4' Wrap BP 2L 32W T8	1	59	3285	RT, 4' 10.5W SE LED 2L	1	21	3285	-	0	0.0	0.0	0.0	194	69	125	25%	0
785	Tylersville SFH	1st Floor	dministration Buildin	Carpentry Bay	Office Hours 9h 7d/week	8' Strip T5HO 4L	1	234	3285	RT, 4' 25W SE LED T5HO 4L	1	100	3285	-	0	0.2	0.1	0.1	769	329	440	25%	0
786	Tylersville SFH	1st Floor	dministration Buildin	Locker Room	Restroom Public Hatcheries	2X4 Prism Rec 4L 32W T8	2	112	1564	RT, 4' 10.5W SE LED 4L	2	42	860	CM	2	0.1	0.0	0.1	350	131	219	45%	59
787	Tylersville SFH	1st Floor	dministration Buildin	Storage Bay	Storage / Janitor Closet Hatcheries	4' Industrial BP 2L 32W T8	1	59	782	RT, 4' 10.5W SE LED 2L	1	21	782	-	0	0.0	0.0	0.0	46	16	30	25%	0
788	Tylersville SFH	1st Floor	dministration Buildin	Storage Bay	Storage / Janitor Closet Hatcheries	4' Industrial BP 2L	2	72	782	RT, 4' 10.5W SE LED 2L	2	21	782	-	0	0.1	0.0	0.1	113	33	80	25%	0
789	Tylersville SFH	1st Floor	dministration Buildin	Storage Bay Storage Closet	Storage / Janitor Closet Hatcheries	4' Industrial BP 2L	2	72	782	RT, 4' 10.5W SE LED 2L	2	21	782	-	0	0.1	0.0	0.1	113	33	80	25%	0
790	Tylersville SFH	1st Floor	dministration Buildin	Open Office	Office Hours 9h 7d/week	2X4 Volumetric Rec 2L 32W T8	6	59	3285	RT, 4' 10.5W SE LED 2L	6	21	3285	-	0	0.3	0.1	0.2	1,163	414	749	25%	0
791	Tylersville SFH	1st Floor	dministration Buildin	Private Office 1	Office Hours 9h 7d/week	2X4 Volumetric Rec 2L 32W T8 DS	2	64	3285	RT, 4' 10.5W SE LED 2L	2	21	2464	WS	1	0.1	0.0	0.1	420	138	283	25%	34
792	Tylersville SFH	1st Floor	dministration Buildin	Private Office 2	Office Hours 9h 7d/week	2X4 Volumetric Rec 2L 32W T8 DS	2	64	3285	RT, 4' 10.5W SE LED 2L	2	21	2464	WS	1	0.1	0.0	0.1	420	138	283	25%	34
793	Tylersville SFH	Exterior	dministration Buildin	Door	Exterior - Dusk to Dawn	Flood LED 70W	3	70	4380	No Action - Existing Efficient Fixture	3	70	4380	-	0	0.0	0.0	0.0	920	920	0	0%	0
794	Tylersville SFH	Exterior	dministration Buildin	Back Wall	Exterior - Dusk to Dawn	Flood LED 70W	1	70	4380	No Action - Existing Efficient Fixture	1	70	4380	-	0	0.0	0.0	0.0	307	307	0	0%	0
795	Huntsdale SFH	1st Floor	dministration Buildin	Visitor's Entrance Lobby	Visitor Center 7.5h 5d/week 6h Weeke	8' Strip BP 4L 32W T8	2	112	2581	RT, 4' 10.5W SE LED 4L	2	42	2581	-	0	0.2	0.1	0.1	578	217	361	30%	0
796	Huntsdale SFH	1st Floor	dministration Buildin	Men's Restroom	Restroom Private Hatcheries	8' Wrap BP 4L 32W T8	1	112	587	RT, 4' 10.5W SE LED 4L	1	42	587	-	0	0.1	0.0	0.0	66	25	41	25%	0
797	Huntsdale SFH	1st Floor	dministration Buildin	Women's Restroom	Restroom Private Hatcheries	8' Wrap BP 4L 32W T8	1	112	587	RT, 4' 10.5W SE LED 4L	1	42	587	-	0	0.1	0.0	0.0	66	25	41	25%	0
798	Huntsdale SFH	1st Floor	dministration Buildin	Visitor's Showroom	Visitor Center 7.5h 5d/week 6h Weeke	8' Strip BP 4L 32W T8	13	112	1807	RT, 4' 10.5W SE LED 4L	13	42	1807	-	0	1.2	0.4	0.7	2,631	987	1,644	30%	0
799	Huntsdale SFH	1st Floor	dministration Buildin	Visitor's Showroom	Visitor Center 7.5h 5d/week 6h Weeke	4' Strip BP 2L 32W T8	2	59	1807	RT, 4' 10.5W SE LED 2L	2	21	1807	-	0	0.1	0.0	0.1	213	76	137	30%	0
800	Huntsdale SFH	1st Floor	dministration Buildin	Storage	Storage / Janitor Closet Hatcheries	8' Strip BP 4L 32W T8	1	112	782	RT, 4' 10.5W SE LED 4L	1	42	782	-	0	0.1	0.0	0.0	88	33	55	25%	0
801	Huntsdale SFH	1st Floor	dministration Buildin	Hallway	Office Hours 9h 7d/week	4' Wrap BP 2L 32W T8	4	59	3285	RT, 4' 10.5W SE LED 2L	4	21	3285	-	0	0.2	0.1	0.1	775	276	499	25%	0
802	Huntsdale SFH	1st Floor	dministration Buildin	Private Office	Office Hours 9h 7d/week	8' Wrap BP 4L 32W T8	2	112	3285	RT, 4' 10.5W SE LED 4L	2	42	2464	WS	1	0.2	0.1	0.1	736	276	460	25%	69
803	Huntsdale SFH	1st Floor	dministration Buildin	Closet 1	Storage / Janitor Closet Hatcheries	2' Strip 1L T8	1	20	782	RT, 2' 7W SE LED 1L	1	7	782	-	0	0.0	0.0	0.0	16	5	10	25%	0
804	Huntsdale SFH	1st Floor	dministration Buildin	Closet 2	Storage / Janitor Closet Hatcheries	2' Strip 1L T8	1	20	782	RT, 2' 7W SE LED 1L	1	7	782	-	0	0.0	0.0	0.0	16	5	10	25%	0
805	Huntsdale SFH	1st Floor	dministration Buildin	Private Office 1	Office Hours 9h 7d/week	8' Wrap BP 4L 32W T8	2	112	3285	RT, 4' 10.5W SE LED 4L	2	42	2464	WS	1	0.2	0.1	0.1	736	276	460	25%	69
806	Huntsdale SFH	1st Floor	dministration Buildin	Private Office 2	Office Hours 9h 7d/week	8' Wrap BP 4L 32W T8	2	112	3285	RT, 4' 10.5W SE LED 4L	2	42	2464	WS	1	0.2	0.1	0.1	736	276	460	25%	69
807	Huntsdale SFH	1st Floor	dministration Buildin	Private Office 3	Office Hours 9h 7d/week	8' Wrap BP 4L 32W T8	3	112	3285	RT, 4' 10.5W SE LED 4L	3	42	2464	WS	1	0.3	0.1	0.2	1,104	414	690	25%	103
808	Huntsdale SFH	1st Floor	dministration Buildin	Private Office 4	Office Hours 9h 7d/week	8' Wrap BP 4L 32W T8	1	112	3285	RT, 4' 10.5W SE LED 4L	1	42	2464	WS	1	0.1	0.0	0.1	368	138	230	25%	34
809	Huntsdale SFH	1st Floor	dministration Buildin	Private Office 4 back room	Storage / Janitor Closet Hatcheries	8' Wrap BP 4L 32W T8	1	112	782	RT, 4' 10.5W SE LED 4L	1	42	587	WS	1	0.1	0.0	0.0	88	33	55	25%	8
810	Huntsdale SFH	1st Floor	dministration Buildin	Break Room	Office Hours 9h 7d/week	8' Strip BP 4L 32W T8	2	112	2464	RT, 4' 10.5W SE LED 4L	2	42	2464	-	0	0.2	0.1	0.1	552	207	345	25%	0
811	Huntsdale SFH	1st Floor	dministration Buildin	Private Office	Office Hours 9h 7d/week	8' Strip BP 4L 32W T8	2	112	3285	RT, 4' 10.5W SE LED 4L	2	42	2464	WS	1	0.2	0.1	0.1	736	276	460	25%	69
812	Huntsdale SFH	1st Floor	dministration Buildin	Chemical Storage	Storage / Janitor Closet Hatcheries	4' Wrap BP 4L 32W T8	1	112	782	RT, 4' 10.5W SE LED 4L	1	42	782	-	0	0.1	0.0	0.0	88	33	55	25%	0
813	Huntsdale SFH	1st Floor	dministration Buildin	Restroom	Restroom Private Hatcheries	8' Strip LED 15W T8 ULB 4L	1	60	782	No Action - Existing Efficient Fixture	1	60	782	-	0	0.0	0.0	0.0	47	47	0	25%	0
814	Huntsdale SFH	1st Floor	dministration Buildin	Restroom	Restroom Private Hatcheries	8' Strip BP 4L 32W T8	2	112	782	RT, 4' 10.5W SE LED 4L	2	42	782	-	0	0.1	0.0	0.1	175	66	109	25%	0
815	Huntsdale SFH	1st Floor	dministration Buildin	Janitor's Closet	Storage / Janitor Closet Hatcheries	2' Strip 1L T8	1	20	782	RT, 2' 7W SE LED 1L	1	7	782	-	0	0.0	0.0	0.0	16	5	10	25%	0
816	Huntsdale SFH	1st Floor	dministration Buildin	Janitor's Closet	Storage / Janitor Closet Hatcheries	8' Strip BP 4L 32W T8	1	112	782	RT, 4' 10.5W SE LED 4L	1	42	782	-	0	0.1	0.0	0.0	88	33	55	25%	0
817	Huntsdale SFH	1st Floor	dministration Buildin	Hallway to Exit	Office Hours 9h 7d/week	4' Wrap BP 2L 32W T8	1	59	3285	RT, 4' 10.5W SE LED 2L	1	21	3285	-	0	0.0	0.0	0.0	194	69	125	25%	0
818	Huntsdale SFH	1st Floor	dministration Buildin	Break Room	Office Hours 9h 7d/week	8' Wrap BP 4L 32W T8	3	112	2464	RT, 4' 10.5W SE LED 4L	3	42	2464	-	0	0.3	0.1	0.2	828	310	517	25%	0
819	Huntsdale SFH	1st Floor	dministration Buildin	Garage Bay	Office Hours 9h 7d/week	8' Industrial T5HO 6L	12	351	3285	RT, 4' 25W SE LED T5HO 6L	12	150	3285	-	0	3.4	1.4	1.9	13,836	5,913	7,923	25%	0
820	Huntsdale SFH	1st Floor	dministration Buildin	Garage Bay	Office Hours 9h 7d/week	8' Industrial T5HO 4L	1	234	3285	RT, 4' 25W SE LED T5HO 4L	1	100	3285	-	0	0.2	0.1	0.1	769	329	440	25%	0
821	Huntsdale SFH	1st Floor	dministration Buildin	Mechanical	Mechanical/Electrical Room Hatcheries	4' Strip BP 2L 32W T8	1	59	782	RT, 4' 10.5W SE LED 2L	1	21	782	-	0	0.0	0.0	0.0	46	16	30	25%	0
822	Huntsdale SFH	1st Floor	dministration Buildin	Mechanical	Mechanical/Electrical Room Hatcheries	8' Strip BP 4L 32W T8	1	112	782	RT, 4' 10.5W SE LED 4L	1	42	782	-	0	0.1	0.0	0.0	88	33	55	25%	0
823	Huntsdale SFH	Exterior	dministration Buildin	Visitor's Ramp	Exterior - Dusk to Dawn	Barnlight LED 19W	1	19	4380	No Action - Existing Efficient Fixture	1	19	4380	-	0	0.0	0.0	0.0	83	83	0	0%	0
824	Huntsdale SFH	Exterior	dministration Buildin	Side Entrance	Exterior - Dusk to Dawn	Wall Pack MH 70W PC	1	95	4380	Wall Pack LED Security 1.8 kLm PC	1	15	4380	-	0	0.0	0.0	0.0	416	66	350	0%	0
825	Huntsdale SFH	Exterior	dministration Buildin	Break Room Entrance	Exterior - Dusk to Dawn	Wall Pack MH 70W PC	1	95	4380	Wall Pack LED Security 1.8 kLm PC	1	15	4380	-	0	0.0	0.0	0.0	416	66	350	0%	0
826	Huntsdale SFH	Exterior	dministration Buildin	Bay Doors	Exterior - Dusk to Dawn	Wall Pack MH 70W	1	95	4380	Wall Pack LED Security 1.8 kLm PC	1	15	4380	-	0	0.0	0.0	0.0	416	66	350	0%	0
827	Huntsdale SFH	Exterior	dministration Buildin	Bay Doors	Exterior - Dusk to Dawn	Barnlight MV 175W	1	205	4380	Barnlight LED 4 kLm PC	1	29	4380	-	0	0.0	0.0	0.0	898	127	771	0%	0
828	Huntsdale SFH	1st Floor	Hatch House	Hatchery	Office Hours 9h 7d/week	8' Vaportight BP 4L	10	144	3285	RT, 4' 10.5W SE LED 4L	10	42	3285	-	0	1.2	0.3	0.8	4,730	1,380	3,351	25%	0
829	Huntsdale SFH	1st Floor	Hatch House	Storage Closet 1	Storage / Janitor Closet Hatcheries	2' Strip 1L T8	1	20	782	RT, 2' 7W SE LED 1L	1	7	782	-	0	0.0	0.0	0.0	16	5	10	25%	0
830	Huntsdale SFH	1st Floor	Hatch House	Storage Closet 2	Storage / Janitor Closet Hatcheries	2' Strip 1L T8	1	20	782	RT, 2' 7W SE LED 1L	1	7	782	-	0	0.0	0.0	0.0	16	5	10	25%	0
831	Huntsdale SFH	1st Floor	Hatch House	Carpentry Bay	Office Hours 9h 7d/week	8' Strip BP 4L 32W T8	3	112	3285	RT, 4' 10.5W SE LED 4L	3	42	3285	-	0	0.3	0.1	0.2	1,104	414	690	25%	0
832	Huntsdale SFH	1st Floor	Hatch House	Carpentry Bay	Office Hours 9h 7d/week	8' Vaportight BP 4L 32W T8	1	112	3285	RT, 4' 10.5W SE LED 4L	1	42	3285	-	0	0.1	0.0	0.1	368	138	230	25%	0
833	Huntsdale SFH	1st Floor	Hatch House	Storage	Storage / Janitor Closet Hatcheries	8' Strip BP 4L 32W T8	2	112	782	RT, 4' 10.5W SE LED 4L	2	42	782	-	0	0.1	0.0	0.1	175	66	109	25%	0
834	Huntsdale SFH	1st Floor	Hatch House	Private Office- Lab	Office Hours 9h 7d/week	4' Vaportight BP 2L 32W T8	3	59	3285	RT, 4' 10.5W SE LED 2L	3	21	3285	-	0	0.1	0.1	0.1	581	207	374	25%	0
835	Huntsdale SFH	1st Floor	Hatch House	Lab Storage	Storage / Janitor Closet Hatcheries	4' Strip BP 2L 32W T8	1	59	782	RT, 4' 10.5W SE LED 2L	1	21	782	-	0	0.0	0.0	0.0	46	16	30	25%	0
836	Huntsdale SFH	1st Floor	Hatch House	Boiler	Mechanical/Electrical Room Hatcheries	8' Strip BP 4L 32W T8	1	112	782	RT, 4' 10.5W SE LED 4L	1	42	782	-	0	0.1	0.0	0.0	88	33	55	25%	0
837	Huntsdale SFH	Exterior	Hatch House	Front Door	Exterior - Dusk to Dawn	Jelly Jar Inc 60W A	4	60	4380	LED 9W A19 Replacement	4	9	4380	-	0	0.0	0.0	0.0	1,051	158	894	0%	0
838	Huntsdale SFH	Exterior	Hatch House	Pipe Chase	Low Hours	Keyless CFL 13W Screw In	2	13	8	LED 9W A19 Replacement	2	9	8	-	0	0.0	0.0	0.0	0	0	0	25%	0
839	Huntsdale SFH	Exterior	Small Pump Station	Small Pump Station	Exterior - Dusk to Dawn	Shoebox LED 105W	1	105	4380	No Action - Existing Efficient Fixture	1	105	4380	-	0	0.0	0.0	0.0	460	460	0	0%	0
840	Huntsdale SFH	1st Floor	Cool Water Hatchery	Hatchery	Office Hours 9h 7d/week	8' Vaportight BP 4L 32W T8	25	112	3285	RT, 4' 10.5W SE LED 4L	25	42	3285	-	0	2.2	0.8	1.4	9,198	3,449	5,749	25%	0
841	Huntsdale SFH	1st Floor	Cool Water Hatchery	Boiler Vestibule	Mechanical/Electrical Room Hatcheries	4' Vaportight BP 2L 32W T8	1	59	782	RT, 4' 10.5W SE LED 2L	1	21	782	-	0	0.0	0.0	0.0	46	16	30	25%	0
842	Huntsdale SFH	1st Floor	Cool Water Hatchery	Boiler	Mechanical/Electrical Room Hatcheries	8' Industrial BP 4L 32W T8	2	112	782	RT, 4' 10.5W SE LED 4L	2	42	782	-	0	0.1	0.0	0.1	175	66	109	25%	0
843	Huntsdale SFH	1st Floor	Cool Water Hatchery	Storage	Storage / Janitor Closet Hatcheries	8' Vaportight BP 4L 32W T8	1	112	782	RT, 4' 10.5W SE LED 4L	1	42	782	-	0	0.1	0.0	0.0	88	33	55	25%	0
844	Huntsdale SFH	1st Floor	Cool Water Hatchery	Chemical Room	Storage / Janitor Closet Hatcheries	8' Vaportight BP 4L 32W T8	2	112	782	RT, 4' 10.5W SE LED 4L	2	42	782	-	0	0.1	0.0	0.1	175	66	109	25%	0
845	Huntsdale SFH	Exterior	Cool Water Hatchery	Main Door	Exterior - Dusk to Dawn	Wall Pack Inc 60W A	1	60	4380	Wall Pack LED Security 1.8 kLm PC	1	15	4380	-	0	0.0	0.0	0.0	263	66	197	0%	0
846	Huntsdale SFH	Exterior	Cool Water Hatchery	Back Door	Exterior - Dusk to Dawn	Wall Pack Inc 60W A	1	60	4380	Wall Pack LED Security 1.8 kLm PC	1	15	4380	-	0	0.0	0.0	0.0	263	66	197	0%	0
847	Huntsdale SFH	Exterior	Cool Water Hatchery	Chemical Storage Door	Exterior - Dusk to Dawn	Wall Pack Inc 60W A	1	60	4380	Wall Pack LED Security 1.8 kLm PC	1	15	4380	-	0	0.0	0.0	0.0	263	66	197	0%	0
848	Huntsdale SFH	Exterior	Cool Water Hatchery	Side Wall	Exterior - Dusk to Dawn	Wall Pack Inc 60W A	4	60	4380	Wall Pack LED Security 1.8 kLm PC	4	15	4380	-	0	0.0	0.0	0.0	1,051	263	788	0%	0
849	Huntsdale SFH	Exterior	Cool Water Hatchery	Side Wall	Exterior - Dusk to Dawn	Flood Quartz 250W	2	250	4380	Flood LED 3 kLm KN PC	2	21	4380	-	0	0.0	0.0	0.0	2,190	184	2,006	0%	0
850	Huntsdale SFH	Exterior	Driveway	Driveway	Exterior - Dusk to Dawn	Shoebox LED 105W	1	105	4380	No Action - Existing Efficient Fixture	1	105	4380	-	0	0.0	0.0	0.0	460	460	0	0%	0
851	Huntsdale SFH	Exterior	Pond	Pond	Exterior - Dusk to Dawn	Shoebox HPS 150W	1	188	4380	Area LED 7 kLm, PC	1	51	4380	-	0	0.0	0.0	0.0	823	223	600	0%	0
852	Huntsdale SFH	1st Floor	Generator 3	Generator 3	Utility Building	8' Industrial SP 2L	3	138	26	RT, 4' 10.5W SE LED 4L, 8' BC Kit	3	42	26	-	0	0.2	0.1	0.2	11	3	7	25%	0
853	Huntsdale SFH	Exterior	Generator 3	Area	Exterior - Dusk to Dawn	Shoebox LED 105W	1	105	4380	No Action - Existing Efficient Fixture	1	105	4380	-	0	0.0	0.0	0.0	460	460	0	0%	0
854	Huntsdale SFH	Exterior	Generator 3	Area-Pole	Exterior - Dusk to Dawn	Shoebox LED 105W	3	105	4380	No Action - Existing Efficient Fixture	3	105	4380	-	0	0.0	0.0	0.0	1,380	1,380	0	0%	0
855	Huntsdale SFH	1st Floor	Generator 1	Generator 1	Utility Building	8' Industrial SP 2L	3	138	26	RT, 4' 10.5W SE LED 4L, 8' BC Kit	3	42	26	-	0	0.2	0.1	0.2	11	3	7	25%	0
856	Huntsdale SFH	1st Floor	Generator 2	Generator 2	Utility Building	8' Industrial SP 2L	3	138	26	RT, 4' 10.5W SE LED 4L, 8' BC Kit	3	42	26	-	0	0.2	0.1	0.2	11	3	7	25%	0
857	Huntsdale SFH	1st Floor	Generator 4	Inside	Utility Building	4' Industrial BP 2L 32W T8	4	59	26	RT, 4' 10.5W SE LED 2L	4	21	26	-	0	0.1	0.0	0.1	6	2	4	25%	0
858	Huntsdale SFH	1st Floor	Generator 4	Inside	Utility Building	8' Industrial BP 4L 32W T8	1	112	26	RT, 4' 10.5W SE LED 4L	1	42	26	-	0	0.1	0.0	0.0	3	1	2	25%	0
859	Huntsdale SFH	Exterior	Generator 4	Door	Exterior - Dusk to Dawn	Wall Pack MH 70W	1	95	4380	Wall Pack LED Security 1.8 kLm PC	1	15	4380	-	0	0.0	0.0	0.0	416	66	350	0%	0
860	Huntsdale SFH	Exterior	Micro screen	Walls	Exterior - Dusk to Dawn	Wall Pack MH 70W	4	95	4380	Wall Pack LED Security 1.8 kLm PC	4	15	4380	-	0	0.0	0.0	0.0	1,664	263	1,402	0%	0
861	Huntsdale SFH	1st Floor	Micro screen	Inside	Utility Building	4' Industrial BP 2L 32W T8	2	59	26	RT, 4' 10.5W SE LED 2L	2	21	26	-	0	0.1	0.0	0.0	3	1	2	25%	0
862	Huntsdale SFH	1st Floor	Micro screen	Inside	Utility Building	4' Vaportight BP 2L 32W T8	14	59	26	RT, 4' 10.5W SE LED 2L	14	21	26	-	0	0.5	0.2	0.3	21	8	14	25%	0
863	Huntsdale SFH	Exterior	Settling pool	Settling Pool	Exterior - Dusk to Dawn	Flood LED 70W	1	70	4380	No Action - Existing Efficient Fixture	1	70	4380	-	0	0.0	0.0	0.0	307	307	0	0%	0
864	Huntsdale SFH	Exterior	Pole Barn	Bay	Exterior - Dusk to Dawn	Keyless CFL 32W Screw In	6	32	4380	LED 9W A19 Replacement	6	9	4380	-	0	0.0	0.0	0.0	841	237	604	0%	0
865	Huntsdale SFH	1st Floor	Pole Barn	Bay	Limited Daily Use	Keyless CFL 32W Screw In	1	32	1460	LED 9W A19 Replacement	1	9	1460	-	0	0.0	0.0	0.0	47	13	34	25%	0
866	Huntsdale SFH	1st Floor	Pole Barn	Bay	Limited Daily Use	Keyless CFL 32W Screw In	1	32	1460	LED 9W A19 Replacement	1	9	1460	-	0	0.0	0.0	0.0	47	13	34	25%	0
867	Huntsdale SFH	Exterior	Raceways	Raceways	Exterior - Dusk to Dawn	Flood LED 70W	8	70	4380	No Action - Existing Efficient Fixture	8	70	4380	-	0	0.0	0.0	0.0	2,453	2,453	0	0%	0
868	Huntsdale SFH	1st Floor	Feed Barn	Feed Barn	Limited Daily Use	RLM Inc 200W A	6	200	1460	LED 11W A19 Replacement	6	11	1460	-	0	0.7	0.0	0.6	1,752	96	1,656	25%	0
869	Linesville SFH	1st Floor	ffices / Visitor Cente	Visitor Center	Visitor Center 7.5h 7d/week	8' Wrap LED 17W T8 ULB 4L	37	68	1917	No Action - Existing Efficient Fixture	37	68	1917	-	0	2.0	2.0	0.0	4,823	4,823	0	30%	0
870	Linesville SFH	1st Floor	ffices / Visitor Cente	Visitor Center - Display Case	Not In Use	4' Strip BP 2L 40W T12	4	80	0	RT, 4' 10.5W SE LED 2L	4	21	0	-	0	0.0	0.0	0.0	0	0	0	0%	0
871	Linesville SFH	1st Floor	ffices / Visitor Cente	Women's Restroom	Restroom Public Hatcheries	4' Wrap BP 2L 40W T12	4	80	860	RT, 4' 10.5W SE LED 2L	4	21	860	-	0	0.2	0.0	0.1	275	72	203	45%	0
872	Linesville SFH	1st Floor	ffices / Visitor Cente	Men's Restroom	Restroom Public Hatcheries	4' Wrap BP 2L 32W T8	1	59	860	RT, 4' 10.5W SE LED 2L	1	21	860	-	0	0.0	0.0	0.0	51	18	33	45%	0
873	Linesville SFH	1st Floor	ffices / Visitor Cente	Men's Restroom	Restroom Public Hatcheries	4' Wrap BP 2L 40W T12	2	80	860	RT, 4' 10.5W SE LED 2L	2	21	860	-	0	0.1	0.0	0.1	138	36	101	45%	0
874	Linesville SFH	1st Floor	ffices / Visitor Cente	Rear Stairs	Office Hours 8.5h 7d/week	4' Wall Bracket LED 17W T8 ULB 2L	2	34	3103	No Action - Existing Efficient Fixture	2	34	3103	-	0	0.1	0.1	0.0	211	211	0	25%	0
875	Linesville SFH	1st Floor	ffices / Visitor Cente	Rear Stairs	Office Hours 8.5h 7d/week	4' Vaportight LED 17W T8 ULB 2L	1	34	3103	No Action - Existing Efficient Fixture	1	34	3103	-	0	0.0	0.0	0.0	106	106	0	25%	0
876	Linesville SFH	1st Floor	ffices / Visitor Cente	Hallway to Offices	Office Hours 8.5h 7d/week	4' Wrap LED 17W T8 ULB 2L	3	34	3103	No Action - Existing Efficient Fixture	3	34	3103	-	0	0.1	0.1	0.0	317	317	0	25%	0
877	Linesville SFH	1st Floor	ffices / Visitor Cente	Storage Closet	Storage / Janitor Closet Hatcheries	4' Strip BP 2L 32W T8	1	59	782	RT, 4' 10.5W SE LED 2L	1	21	782	-	0	0.0	0.0	0.0	46	16	30	25%	0
878	Linesville SFH	1st Floor	ffices / Visitor Cente	Janitorial Closet	Storage / Janitor Closet Hatcheries	4' Wrap BP 2L 32W T8	1	59	782	RT, 4' 10.5W SE LED 2L	1	21	782	-	0	0.0	0.0	0.0	46	16	30	25%	0
879	Linesville SFH	1st Floor	ffices / Visitor Cente	Mechanical	Mechanical/Electrical Room Hatcheries	4' Wrap BP 2L 40W T12	2	80	782	RT, 4' 10.5W SE LED 2L	2	21	782	-	0	0.1	0.0	0.1	125	33	92	25%	0
880	Linesville SFH	1st Floor	ffices / Visitor Cente	Mechanical	Mechanical/Electrical Room Hatcheries	4' Wrap BP 2L 32W T8	2	59	782	RT, 4' 10.5W SE LED 2L	2	21	782	-	0	0.1	0.0	0.0	92	33	59	25%	0

ID #	Location					Existing Fixture				Proposed Fixture						PeakDemand			Usage			Controls	
	Building # : Name	Floor	Area	Sub Area / Room	Usage Group	Fixture	Quantity	Input Wattage	Hours of Operation	ECM	Quantity	Input Wattage	Hours of Operation	Occ Sensor Type	Occ Sensor Qty	Pre	Post	Savings	Pre	Post	Savings	Savings %	Savings
881	Linesville SFH	1st Floor	ffices / Visitor Cente	Women's Restroom	Restroom Private Hatcheries	4' Wrap BP 2L 40W T12	1	80	782	RT, 4' 10.5W SE LED 2L	1	21	587	WS	1	0.0	0.0	0.0	63	16	46	25%	4
882	Linesville SFH	1st Floor	ffices / Visitor Cente	Conference Room	Office Hours 8.5h 7d/week	4' Wrap LED 17W T8 ULB 2L	8	34	3103	No Action - Existing Efficient Fixture	8	34	3103	-	0	0.2	0.2	0.0	844	844	0	25%	0
883	Linesville SFH	1st Floor	ffices / Visitor Cente	Lab	Office Hours 8.5h 7d/week	4' Wrap LED 17W T8 ULB 4L	8	68	3103	No Action - Existing Efficient Fixture	8	68	3103	-	0	0.4	0.4	0.0	1,688	1,688	0	25%	0
884	Linesville SFH	1st Floor	ffices / Visitor Cente	Open Office	Office Hours 8.5h 7d/week	8' Wrap BP 8L 40W T12	6	344	3103	RT, 4' 10.5W SE LED 4L	6	42	3103	-	0	1.7	0.2	1.4	6,405	782	5,623	25%	0
885	Linesville SFH	1st Floor	ffices / Visitor Cente	Private Office 1	Office Hours 8.5h 7d/week	8' Wrap BP 8L 40W T12	2	344	3103	RT, 4' 10.5W SE LED 4L	2	42	2327	WS	1	0.6	0.1	0.5	2,135	261	1,874	25%	65
886	Linesville SFH	1st Floor	ffices / Visitor Cente	Private Office 2	Office Hours 8.5h 7d/week	8' Wrap BP 8L 40W T12	2	344	3103	RT, 4' 10.5W SE LED 4L	2	42	2327	WS	1	0.6	0.1	0.5	2,135	261	1,874	25%	65
887	Linesville SFH	1st Floor	ffices / Visitor Cente	Break Room	Office Hours 8.5h 7d/week	8' Industrial LED 17W T8 ULB 4L	3	68	3103	No Action - Existing Efficient Fixture	3	68	3103	-	0	0.2	0.2	0.0	633	633	0	25%	0
888	Linesville SFH	1st Floor	ffices / Visitor Cente	Garage Bay	Office Hours 8.5h 7d/week	8' Industrial BP 4L 40W T12	10	160	3103	RT, 4' 10.5W SE LED 4L	10	42	3103	-	0	1.3	0.3	0.9	4,965	1,303	3,662	25%	0
889	Linesville SFH	1st Floor	ffices / Visitor Cente	Garage Bay	Office Hours 8.5h 7d/week	4' Industrial BP 2L 40W T12	4	80	3103	RT, 4' 10.5W SE LED 2L	4	21	3103	-	0	0.3	0.1	0.2	993	261	732	25%	0
890	Linesville SFH	1st Floor	ffices / Visitor Cente	Locker Room	Restroom Public Hatcheries	8' Wrap BP 4L 40W T12	3	160	1564	RT, 4' 10.5W SE LED 4L	3	42	860	CM	3	0.3	0.1	0.2	751	197	554	45%	89
891	Linesville SFH	1st Floor	ffices / Visitor Cente	Locker Room	Restroom Public Hatcheries	8' Wrap BP 4L	1	144	1564	RT, 4' 10.5W SE LED 4L	1	42	860	PL	0	0.1	0.0	0.1	225	66	160	45%	30
892	Linesville SFH	1st Floor	ffices / Visitor Cente	Locker Room - Men's Restroom	Restroom Public Hatcheries	4' Wrap BP 2L	4	72	860	RT, 4' 10.5W SE LED 2L	4	21	860	-	0	0.2	0.0	0.1	248	72	175	45%	0
893	Linesville SFH	1st Floor	ffices / Visitor Cente	cker Room - Men's Restroom Showe	Restroom Public Hatcheries	4' Vaportight BP 2L 40W T12	1	80	1564	RT, 4' 10.5W SE LED 2L	1	21	1564	-	0	0.0	0.0	0.0	125	33	92	45%	0
894	Linesville SFH	1st Floor	ffices / Visitor Cente	cker Room - Men's Restroom Showe	Restroom Public Hatcheries	Jelly Jar Inc 60W A	2	60	1564	LED 9W A19 Replacement	2	9	1564	-	0	0.1	0.0	0.1	188	28	160	45%	0
895	Linesville SFH	1st Floor	ffices / Visitor Cente	Stairs	Office Hours 8.5h 7d/week	4' Wall Bracket BP 2L	2	72	3103	RT, 4' 10.5W SE LED 2L	2	21	3103	-	0	0.1	0.0	0.1	447	130	317	25%	0
896	Linesville SFH	Basement	ffices / Visitor Cente	Hatchery	Office Hours 8.5h 7d/week	8' Vaportight LED 17W T8 ULB 4L	43	68	3103	No Action - Existing Efficient Fixture	43	68	3103	-	0	2.3	2.3	0.0	9,073	9,073	0	25%	0
897	Linesville SFH	Basement	ffices / Visitor Cente	Hatchery	Office Hours 8.5h 7d/week	4' Vaportight LED 17W T8 ULB 2L	7	34	3103	No Action - Existing Efficient Fixture	7	34	3103	-	0	0.2	0.2	0.0	739	739	0	25%	0
898	Linesville SFH	Basement	ffices / Visitor Cente	Hatchery Storage	Storage / Janitor Closet Hatcheries	4' Wrap BP 4L	2	144	782	RT, 4' 10.5W SE LED 4L	2	42	782	-	0	0.2	0.0	0.1	225	66	160	25%	0
899	Linesville SFH	Basement	ffices / Visitor Cente	Lower Chemical Storage	Storage / Janitor Closet Hatcheries	4' Strip LED 17W T8 ULB 2L	7	34	782	No Action - Existing Efficient Fixture	7	34	782	-	0	0.1	0.1	0.0	186	186	0	25%	0
900	Linesville SFH	Basement	ffices / Visitor Cente	Chemical Storage	Storage / Janitor Closet Hatcheries	8' Industrial LED 17W T8 ULB 4L	4	68	782	No Action - Existing Efficient Fixture	4	68	782	-	0	0.1	0.1	0.0	213	213	0	25%	0
901	Linesville SFH	Basement	ffices / Visitor Cente	Mechanical Room	Mechanical/Electrical Room Hatcheries	8' Industrial BP 4L 40W T12	2	160	782	RT, 4' 10.5W SE LED 4L	2	42	782	-	0	0.2	0.0	0.1	250	66	185	25%	0
902	Linesville SFH	Exterior	ffices / Visitor Cente	Rear Bay Doors	Exterior - Dusk to Dawn	Flood Quartz 300W	2	300	4380	Flood LED 3 kLm KN PC	2	21	4380	-	0	0.0	0.0	0.0	2,628	184	2,444	0%	0
903	Linesville SFH	Exterior	ffices / Visitor Cente	Rear Exit Door	Exterior - Dusk to Dawn	Flood Hal 90 PAR38	1	90	4380	LED 14W PAR38 Replacement WL	1	14	4380	-	0	0.0	0.0	0.0	394	61	333	0%	0
904	Linesville SFH	Exterior	ffices / Visitor Cente	Lower Bay Doors	Exterior - Dusk to Dawn	Jelly Jar Inc 100W A	2	100	4380	LED 9W A19 Replacement	2	9	4380	-	0	0.0	0.0	0.0	876	79	797	0%	0
905	Linesville SFH	Exterior	ffices / Visitor Cente	Lower Exit Door	Exterior - Dusk to Dawn	Jelly Jar Inc 100W A	1	100	4380	LED 9W A19 Replacement	1	9	4380	-	0	0.0	0.0	0.0	438	39	399	0%	0
906	Linesville SFH	Exterior	ffices / Visitor Cente	Front Wall	Exterior - Dusk to Dawn	Wall Pack HPS 100W PC	1	138	4380	Wall Pack LED FT TWR 4.4 kLm PC	1	40	4380	-	0	0.0	0.0	0.0	604	175	429	0%	0
907	Linesville SFH	Exterior	ffices / Visitor Cente	Front Wall	Exterior - Dusk to Dawn	Jelly Jar Inc 100W A	1	100	4380	LED 9W A19 Replacement	1	9	4380	-	0	0.0	0.0	0.0	438	39	399	0%	0
908	Linesville SFH	Exterior	ffices / Visitor Cente	Visitor Entry	Exterior - Dusk to Dawn	Jelly Jar Inc 100W A	1	100	4380	LED 9W A19 Replacement	1	9	4380	-	0	0.0	0.0	0.0	438	39	399	0%	0
909	Linesville SFH	Exterior	ffices / Visitor Cente	Visitor Entry	Exterior - Dusk to Dawn	Flood Hal 90 PAR38	1	90	4380	LED 14W PAR38 Replacement WL	1	14	4380	-	0	0.0	0.0	0.0	394	61	333	0%	0
910	Linesville SFH	Exterior	ffices / Visitor Cente	Lower Side Doors	Exterior - Dusk to Dawn	Jelly Jar Inc 100W A	1	100	4380	LED 9W A19 Replacement	1	9	4380	-	0	0.0	0.0	0.0	438	39	399	0%	0
911	Linesville SFH	Exterior	ffices / Visitor Cente	Lower Side Doors	Exterior - Dusk to Dawn	Flood Hal 90 PAR38	1	90	4380	LED 14W PAR38 Replacement WL	1	14	4380	-	0	0.0	0.0	0.0	394	61	333	0%	0
912	Linesville SFH	1st Floor	Maintenance Garage	Bay 1	Limited Daily Use	8' Vaportight BP 2L	6	72	1460	RT, 4' 10.5W SE LED 2L	6	21	1460	-	0	0.2	0.1	0.2	631	184	447	25%	0
913	Linesville SFH	1st Floor	Maintenance Garage	Bay 1	Limited Daily Use	8' Industrial LED 17W T8 ULB 4L	10	68	1460	No Action - Existing Efficient Fixture	10	68	1460	-	0	0.4	0.4	0.0	993	993	0	25%	0
914	Linesville SFH	1st Floor	Maintenance Garage	Tool Work Area	Limited Daily Use	8' Industrial LED 17W T8 ULB 2L	4	34	1460	No Action - Existing Efficient Fixture	4	34	1460	-	0	0.1	0.1	0.0	199	199	0	25%	0
915	Linesville SFH	1st Floor	Maintenance Garage	Private Office	Limited Daily Use	4' Industrial LED 17W T8 ULB 2L	2	34	1460	No Action - Existing Efficient Fixture	2	34	1460	-	0	0.0	0.0	0.0	99	99	0	25%	0
916	Linesville SFH	1st Floor	Maintenance Garage	Men's Restroom	Restroom Private Hatcheries	8' Industrial LED 17W T8 ULB 2L	2	34	782	No Action - Existing Efficient Fixture	2	34	782	-	0	0.0	0.0	0.0	53	53	0	25%	0
917	Linesville SFH	1st Floor	Maintenance Garage	Tool Storage	Storage / Janitor Closet Hatcheries	4' Industrial LED 17W T8 ULB 2L	2	34	782	No Action - Existing Efficient Fixture	2	34	782	-	0	0.0	0.0	0.0	53	53	0	25%	0
918	Linesville SFH	1st Floor	Maintenance Garage	Storage Area	Storage / Janitor Closet Hatcheries	4' Industrial LED 17W T8 ULB 2L	6	34	782	No Action - Existing Efficient Fixture	6	34	782	-	0	0.1	0.1	0.0	160	160	0	25%	0
919	Linesville SFH	1st Floor	Maintenance Garage	Storage Area	Storage / Janitor Closet Hatcheries	8' Industrial LED 17W T8 ULB 2L	3	34	782	No Action - Existing Efficient Fixture	3	34	782	-	0	0.1	0.1	0.0	80	80	0	25%	0
920	Linesville SFH	1st Floor	Maintenance Garage	Bay 2	Limited Daily Use	4' Industrial LED 17W T8 ULB 2L	20	34	1460	No Action - Existing Efficient Fixture	20	34	1460	-	0	0.4	0.4	0.0	993	993	0	25%	0
921	Linesville SFH	1st Floor	Maintenance Garage	Feed Storage	Storage / Janitor Closet Hatcheries	4' Industrial LED 17W T8 ULB 2L	2	34	587	No Action - Existing Efficient Fixture	2	34	587	-	0	0.0	0.0	0.0	40	40	0	25%	0
922	Linesville SFH	Exterior	Maintenance Garage	Exit Doors	Exterior - Dusk to Dawn	Jelly Jar Inc 100W A	8	100	4380	LED 9W A19 Replacement	8	9	4380	-	0	0.0	0.0	0.0	3,504	315	3,189	0%	0
923	Linesville SFH	Exterior	Maintenance Garage	Walls	Exterior - Dusk to Dawn	Flood Quartz 300W	3	300	4380	Flood LED 3 kLm KN PC	3	21	4380	-	0	0.0	0.0	0.0	3,942	276	3,666	0%	0
924	Linesville SFH	1st Floor	Outside Shed	Shed	Low Hours	Keyless CFL 23W Screw In	1	23	8	LED 9W A19 Replacement	1	9	8	-	0	0.0	0.0	0.0	0	0	0	25%	0
925	Linesville SFH	Exterior	Outside Shed	Over Door	Exterior - Dusk to Dawn	Flood LED 15W	1	15	4380	No Action - Existing Efficient Fixture	1	15	4380	-	0	0.0	0.0	0.0	66	66	0	0%	0
926	Linesville SFH	Exterior	Area Lighting	Covered Raceways	Exterior - Switch	Jelly Jar Inc 100W A	6	100	469	LED 9W A19 Replacement	6	9	469	-	0	0.0	0.0	0.0	281	25	256	0%	0
927	Linesville SFH	Exterior	Area Lighting	Covered Raceways	Exterior - Switch	Flood Quartz 300W	2	300	469	Flood LED 3 kLm KN	2	21	469	-	0	0.0	0.0	0.0	281	20	262	0%	0
928	Linesville SFH	Exterior	Area Lighting	By Pump House	Exterior - Dusk to Dawn	Barnlight LED 30W	1	30	4380	No Action - Existing Efficient Fixture	1	30	4380	-	0	0.0	0.0	0.0	131	131	0	0%	0
929	Linesville SFH	Exterior	Area Lighting	By Generator	Exterior - Dusk to Dawn	Barnlight LED 30W	1	30	4380	No Action - Existing Efficient Fixture	1	30	4380	-	0	0.0	0.0	0.0	131	131	0	0%	0
930	Linesville SFH	Exterior	Area Lighting	South Pond	Exterior - Dusk to Dawn	Barnlight LED 30W	1	30	4380	No Action - Existing Efficient Fixture	1	30	4380	-	0	0.0	0.0	0.0	131	131	0	0%	0
931	Linesville SFH	1st Floor	Pump House	Pump Room	Low Hours	4' Vaportight BP 2L 40W T12	6	80	8	RT, 4' 10.5W SE LED 2L	6	21	8	-	0	0.3	0.1	0.2	4	1	3	25%	0
932	Linesville SFH	1st Floor	Pump House	Pump Room	Low Hours	4' Industrial BP 2L 40W T12	4	80	8	RT, 4' 10.5W SE LED 2L	4	21	8	-	0	0.2	0.0	0.1	3	1	2	25%	0
933	Linesville SFH	Exterior	Pump House	Over Door	Low Hours	Jelly Jar Inc 60W A	1	60	8	LED 9W A19 Replacement	1	9	8	-	0	0.0	0.0	0.0	0	0	0	25%	0
934	Linesville SFH	Exterior	Pump House	Over Door	Low Hours	Keyless Empty E26	2	0	8	LED 9W A19 Replacement	2	9	8	-	0	0.0	0.0	0.0	0	0	0	25%	0
935	Linesville SFH	1st Floor	Aeration Building	Interior	Utility Work Buildings	Flood Quartz 500W	5	500	78	Flood LED 7.7 kLm KN	5	54	78	-	0	1.4	0.1	1.2	195	21	174	25%	0
936	Linesville SFH	Exterior	Aeration Building	Aimed at Water Fountain	Exterior - Dusk to Dawn	Flood LED 15W	6	15	4380	No Action - Existing Efficient Fixture	6	15	4380	-	0	0.0	0.0	0.0	394	394	0	0%	0
937	Linesville SFH	Exterior	Aeration Building	Flag Lighting	Exterior - Dusk to Dawn	Flood LED 85W	1	85	4380	No Action - Existing Efficient Fixture	1	85	4380	-	0	0.0	0.0	0.0	372	372	0	0%	0
938	Linesville SFH	Exterior	Aeration Building	Over Door	Exterior - Dusk to Dawn	Keyless Empty E26	1	0	4380	LED 9W A19 Replacement	1	9	4380	-	0	0.0	0.0	0.0	0	39	-39	0%	0
939	Linesville SFH	Exterior	Aeration Building	Over Door	Exterior - Dusk to Dawn	Flood LED 15W	2	15	4380	No Action - Existing Efficient Fixture	2	15	4380	-	0	0.0	0.0	0.0	131	131	0	0%	0
940	Linesville SFH	Exterior	Area Lighting	Steelhead Silos	Exterior - Dusk to Dawn	Barnlight LED 30W	3	30	4380	No Action - Existing Efficient Fixture	3	30	4380	-	0	0.0	0.0	0.0	394	394	0	0%	0
941	Linesville SFH	Exterior	Area Lighting	Covered Raceways	Exterior - Switch	Flood Hal 90 PAR38	6	90	469	LED 14W PAR38 Replacement WL	6	14	469	-	0	0.0	0.0	0.0	253	39	214	0%	0
942	Linesville SFH	1st Floor	ls by Steelhead Silos	Shed by Silos	Low Hours	Keyless Inc 60W A	2	60	8	LED 9W A19 Replacement	2	9	8	-	0	0.1	0.0	0.1	1	0	1	25%	0
943	Linesville SFH	1st Floor	ls by Steelhead Silos	Small Shed 1	Low Hours	Keyless Inc 60W A	2	60	8	LED 9W A19 Replacement	2	9	8	-	0	0.1	0.0	0.1	1	0	1	25%	0
944	Linesville SFH	1st Floor	ls by Steelhead Silos	Small Shed 2	Low Hours	Keyless Inc 60W A	2	60	8	LED 9W A19 Replacement	2	9	8	-	0	0.1	0.0	0.1	1	0	1	25%	0
945	Linesville SFH	1st Floor	ls by Steelhead Silos	Small Shed 3	Low Hours	Keyless Inc 60W A	2	60	8	LED 9W A19 Replacement	2	9	8	-	0	0.1	0.0	0.1	1	0	1	25%	0
946	Linesville SFH	1st Floor	Well #3	Well #3	Low Hours	Keyless Inc 60W A	1	60	8	LED 9W A19 Replacement	1	9	8	-	0	0.0	0.0	0.0	0	0	0	25%	0
947	Linesville SFH	1st Floor	Well #3	Well #3	Low Hours	Keyless CFL 23W Screw In	1	23	8	LED 9W A19 Replacement	1	9	8	-	0	0.0	0.0	0.0	0	0	0	25%	0
948	Linesville SFH	1st Floor	Well #2	Well #2	Low Hours	Keyless CFL 23W Screw In	2	23	8	LED 9W A19 Replacement	2	9	8	-	0	0.0	0.0	0.0	0	0	0	25%	0
949	Linesville SFH	1st Floor	Well #1	Well #1	Low Hours	Jelly Jar Inc 60W A	2	60	8	LED 9W A19 Replacement	2	9	8	-	0	0.1	0.0	0.1	1	0	1	25%	0
950	Linesville SFH	1st Floor	Well #1	Well #1	Low Hours	Jelly Jar CFL 23W Screw In	1	23	8	LED 9W A19 Replacement	1	9	8	-	0	0.0	0.0	0.0	0	0	0	25%	0
951	Linesville SFH	1st Floor	Generator Building	Generator Building	Low Hours	Keyless CFL 23W Screw In	2	23	8	LED 9W A19 Replacement	2	9	8	-	0	0.0	0.0	0.0	0	0	0	25%	0
952	Linesville SFH	1st Floor	Generator Building	Generator Building	Low Hours	Keyless Empty E26	1	0	8	LED 9W A19 Replacement	1	9	8	-	0	0.0	0.0	0.0	0	0	0	25%	0
953	Linesville SFH	Exterior	Generator Building	Exterior Red Lamp	Low Hours	Jelly Jar Inc 60W A	1	60	8	LED 9W A19 Replacement	1	9	8	-	0	0.0	0.0	0.0	0	0	0	25%	0
954	Linesville SFH	1st Floor	Well #5	Well #5	Low Hours	Keyless CFL 23W Screw In	2	23	8	LED 9W A19 Replacement	2	9	8	-	0	0.0	0.0	0.0	0	0	0	25%	0
955	Fairview SFH	1st Floor	dministration Buildin	Entry Lobby	Office Hours 8.5h 7d/week	4x4 Prism Sur 8L	1	288	3103	RT, 4' 10.5W SE LED 8L	1	84	3103	-	0	0.2	0.1	0.2	894	261	633	25%	0
956	Fairview SFH	1st Floor	dministration Buildin	Entry Lobby	Office Hours 8.5h 7d/week	Track Head Hal 90W PAR38	2	90	3103	LED 13W PAR38 Replacement	2	13	3103	-	0	0.1	0.0	0.1	559	81	478	25%	0
957	Fairview SFH	1st Floor	dministration Buildin	Entry Lobby	Office Hours 8.5h 7d/week	Track Head Hal 90W PAR38	1	90	3103	LED 13W PAR38 Replacement	1	13	3103	-	0	0.1	0.0	0.1	279	40	239	25%	0
958	Fairview SFH	1st Floor	dministration Buildin	Men's Restroom	Restroom Public Hatcheries	Vanity Inc 60W A 4L	1	240	1564	LED 9W A19 Replacement 4L	1	36	860	WS	1	0.1	0.0	0.1	375	56	319	45%	25
959	Fairview SFH	1st Floor	dministration Buildin	Men's Restroom	Restroom Public Hatcheries	Globe Inc 60W A	1	60	1564	LED 9W A19 Replacement	1	9	860	PL	0	0.0	0.0	0.0	94	14	80	45%	6
960	Fairview SFH	1st Floor	dministration Buildin	Women's Restroom	Restroom Public Hatcheries	Vanity Inc 60W A 4L	1	240	1564	LED 9W A19 Replacement 4L	1	36	860	WS	1	0.1	0.0	0.1	375	56	319	45%	25
961	Fairview SFH	1st Floor	dministration Buildin	Women's Restroom	Restroom Public Hatcheries	Globe Inc 60W A	1	60	1564	LED 9W A19 Replacement	1	9	860	PL	0	0.0	0.0	0.0	94	14	80	45%	6
962	Fairview SFH	1st Floor	dministration Buildin	Janitorial Closet	Storage / Janitor Closet Hatcheries	Drum Empty E26 Base	1	0	782	LED 9W A19 Replacement	1	9	782	-	0	0.0	0.0	0.0	0	7	-7	25%	0
963	Fairview SFH	1st Floor	dministration Buildin	Secretary	Office Hours 8.5h 7d/week	4' Wrap BP 4L 32W T8	2	112	3103	RT, 4' 10.5W SE LED 4L	2	42	3103	-	0	0.2	0.1	0.1	695	261	434	25%	0
964	Fairview SFH	1st Floor	dministration Buildin	Secretary	Office Hours 8.5h 7d/week	2x2 Prism Sur 2L 32W U6 T8	4	59	3103	RT, 2' 7W SE LED 2L, 2x2 Refl Kit	4	14	3103	-	0	0.2	0.0	0.1	732	174	559	25%	0
965	Fairview SFH	1st Floor	dministration Buildin	Storage Closet	Storage / Janitor Closet Hatcheries	Drum Inc 60W A 2L	1	120	782	LED 9W A19 Replacement 2L	1	18	782	-	0	0.1	0.0	0.1	94	14	80	25%	0
966	Fairview SFH	1st Floor	dministration Buildin	Manager's Office	Office Hours 8.5h 7d/week	2X4 Prism Sur 4L	4	144	3103	RT, 4' 10.5W SE LED 4L	4	42	2327	WS	1	0.5	0.1	0.3	1,787	521	1,266	25%	130
967	Fairview SFH	1st Floor	dministration Buildin	Day Room	Office Hours 8.5h 7d/week	2X4 Prism Sur 4L 32W T8	4	112	3103	RT, 4' 10.5W SE LED 4L	4	42	2327	WS	1	0.4	0.1	0.2	1,390	521	869	25%	130
968	Fairview SFH	1st Floor	dministration Buildin	Locker Room	Restroom Public Hatcheries	2X4 Prism Sur 4L 32W T8	2	112	1564	RT, 4' 10.5W SE LED 4L	2	42	860	CM	2	0.1	0.0	0.1	350	131	219	45%	59
969	Fairview SFH	1st Floor	dministration Buildin	Locker Room	Restroom Public Hatcheries	Drum Inc 60W A 2L	1	120	1564	LED 9W A19 Replacement 2L	1	18	860	PL	0	0.1	0.0	0.1	188	28	160	45%	13
970	Fairview SFH	1st Floor	dministration Buildin	Locker Room	Restroom Public Hatcheries	2' Vanity 2L	1	51	1564	RT, 2' 7W SE LED 2L	1	14	860	PL	0	0.0	0.0	0.0	80	22	58	45%	10
971	Fairview SFH	1st Floor	dministration Buildin	Passage	Office Hours 8.5h 7d/week	Drum Inc 60W A 3L	1	180	3103	LED 9W A19 Replacement 3L	1	27	3103	-	0	0.1	0.0	0.1	559	84	475	25%	0
972	Fairview SFH	1st Floor	dministration Buildin	Foreman Office	Office Hours 8.5h 7d/week	2X4 Prism Sur 4L 32W T8	1	112	3103	RT, 4' 10.5W SE LED 4L	1	42	2327	WS	1	0.1	0.0	0.1	348	130	217	25%	33
973	Fairview SFH	1st Floor	dministration Buildin	LERU Private Office	Office Hours 8.5h 7d/week	4' Wrap BP 4L 32W T8	2	112	3103	RT, 4' 10.5W SE LED 4L	2	42	2327	WS	1	0.2	0.1	0.1	695	261	434	25%	65
974	Fairview SFH	1st Floor	dministration Buildin	Hallway	Office Hours 8.5h 7d/week	2X4 Prism Sur 4L 32W T8	5	112	3103	RT, 4' 10.5W SE LED 4L	5	42	3103	-	0	0.4	0.2	0.3	1,738	652	1,086	25%	0
975	Fairview SFH	1st Floor	dministration Buildin	LERU Open Office	Office Hours 8.5h 7d/week	2x2 Flat Panel Rec LED 22W	3	22	3103	No Action - Existing Efficient Fixture	3	22	3103	-	0	0.1	0.1	0.0	205	205	0	25%	0
976	Fairview SFH	1st Floor	dministration Buildin	Passage to Garage	Office Hours 8.5h 7d/week	Globe Inc 60W A	2	60	3103	LED 9W A19 Replacement	2	9	3103	-	0	0.1	0.0	0.1	372	56	317	25%	0
977	Fairview SFH	1st Floor	dministration Buildin	Spawning Room	Office Hours 8.5h 7d/week	2x2 Flat Panel Rec LED 22W	8	22	2327	No Action - Existing Efficient Fixture	8	22	2327	-	0	0.1	0.1	0.0	410	410	0	25%	0
978	Fairview SFH	1st Floor	dministration Buildin	Furnace Room	Mechanical/Electrical Room Hatcheries	RLM Inc 100W A	4	100	782	LED 9W A19 Replacement	4	9	782	-	0	0.2	0.0	0.2	313	28	285	25%	0
979	Fairview SFH	1st Floor	dministration Buildin	Chemical Storage	Storage / Janitor Closet Hatcheries	4' Industrial BP 2L	1	72	782	RT, 4' 10.5W SE LED 2L	1	21	782	-	0	0.0	0.0	0.0	56	16	40	25%	0
980	Fairview SFH	1st Floor	dministration Buildin	Garage Bay	Office Hours 8.5h 7d/week	High Bay LED 55W	16	55	3103	No Action - Existing Efficient Fixture	16	55	3103	-	0	0.7	0.7	0.0	2,731	2,731	0	25%	0
981	Fairview SFH	Exterior	dministration Buildin	Over Raceway	Exterior - Switch	Flood Quartz 300W	1	300	469	Flood LED 3 kLm KN	1	21	469	-	0	0.0	0.0	0.0	141	10	131	0%	0
982	Fairview SFH	Exterior	dministration Buildin	Doors	Exterior - Dusk to Dawn	Flood Hal 90 PAR38 2L	1	180	4380	LED 14W PAR38 Replacement WL 2L	1	28	4380	-	0	0.0	0.0	0.0	788	123	666	0%	0
983	Fairview SFH	Exterior	dministration Buildin	Doors	Exterior - Dusk to Dawn	Vandal Proof Inc 60W A	4	60	4380	LED 9W A19 Replacement	4	9	4380	-	0	0.0	0.0	0.0	1,051	158	894	0%	0
984	Fairview SFH	Exterior	dministration Buildin	Front / Side Wall	Exterior - Dusk to Dawn	Vandal Proof Inc 60W A	3	60	4380	LED 9W A19 Replacement	3	9	4380	-	0	0.0	0.0	0.0	788	118	670	0%	0
985	Fairview SFH	Exterior	dministration Buildin	Front Entrance	Exterior - Dusk to Dawn	Flood Hal 75 PAR30 2L	1	150	4380	LED 14W PAR38 Replacement WL 2L	1	28	4380	-	0	0.0	0.0	0.0	657	123	534	0%	0
986	Fairview SFH	1st Floor	Garage	Bay 1	Limited Daily Use	Flood Quartz 500W	3	500	1460	Flood LED 7.7 kLm KN	3	54	1460	-	0	0.8	0.1	0.7	2,190	237	1,953	25%	0
987	Fairview SFH	1st Floor	Garage	Feed Room	Storage / Janitor Closet Hatcheries	Flood Quartz 500W	5	500	782	Flood LED 7.7 kLm KN	5	54	782	-	0	1.4	0.1	1.2	1,955	211	1,744	25%	0
988	Fairview SFH	1st Floor	Garage	Chemical Storage	Storage / Janitor Closet Hatcheries	Jelly Jar CFL 23W Screw In	3	23	587	LED 9W A19 Replacement	3	9	587	-	0	0.0	0.0	0.0	41	16	25	25%	0
989	Fairview SFH	1st Floor	Garage	Bay 2	Limited Daily Use	Keyless Inc 60W A	2	60	1460	LED 9W A19 Replacement	2	9	1460	-	0	0.1	0.0	0.1	175	26	149	25%	0
990	Fairview SFH	1st Floor	Generator Building	Generator Building	Low Hours	Keyless Inc 60W A	6	60	8	LED 9W A19 Replacement	6	9	8	-	0	0.2	0.0	0.2	3	0	2	25%	0

ID #	Location					Existing Fixture				Proposed Fixture						PeakDemand			Usage			Controls	
	Building # : Name	Floor	Area	Sub Area / Room	Usage Group	Fixture	Quantity	Input Wattage	Hours of Operation	ECM	Quantity	Input Wattage	Hours of Operation	Occ Sensor Type	Occ Sensor Qty	Pre	Post	Savings	Pre	Post	Savings	Savings %	Savings
991	Fairview SFH	Exterior	Area Lighting	Covered Raceways	Exterior - Switch	Jelly Jar Inc 100W A	6	100	469	LED 9W A19 Replacement	6	9	469	-	0	0.0	0.0	0.0	281	25	256	0%	0
992	Fairview SFH	Exterior	Area Lighting	Raceways - Wood Poles	Exterior - Switch	Post Top MV 175W	2	205	469	Area LED 7 kLm, PC Wood Pole	2	51	469	-	0	0.0	0.0	0.0	192	48	144	0%	0
993	Fairview SFH	Exterior	Area Lighting	Raceways - Wood Poles	Exterior - Switch	Shoebox LED 105W	1	105	469	No Action - Existing Efficient Fixture	1	105	469	-	0	0.0	0.0	0.0	49	49	0	0%	0
994	Fairview SFH	1st Floor	UV Unit	UV Unit	Low Hours	8' Strip LED 15W T8 ULB 2L	2	30	8	No Action - Existing Efficient Fixture	2	30	8	-	0	0.0	0.0	0.0	0	0	0	25%	0
995	Fairview SFH	1st Floor	North Spring Building	North Spring Building	Low Hours	Flood Hal 150 PAR38	2	150	8	LED 14W PAR38 Replacement WL 2L	2	28	8	-	0	0.2	0.0	0.1	2	0	2	25%	0
996	Fairview SFH	1st Floor	South Spring Building	South Spring Building	Low Hours	Flood Quartz 500W	4	500	8	Flood LED 7.7 kLm KN	4	54	8	-	0	1.1	0.1	1.0	16	2	14	25%	0
997	Fairview SFH	Exterior	Area Lighting	Covered Raceways	Exterior - Switch	Jelly Jar Inc 100W A	4	100	469	LED 9W A19 Replacement	4	9	469	-	0	0.0	0.0	0.0	188	17	171	0%	0
998	Fairview SFH	Exterior	Area Lighting	Covered Raceways	Exterior - Switch	6" Rec Can Hal 75W PAR38	4	75	469	LED 13W PAR38 Replacement	4	13	469	-	0	0.0	0.0	0.0	141	24	116	0%	0
999	Fairview SFH	Exterior	Area Lighting	Covered Raceways	Exterior - Switch	6" Rec Can LED 10W	2	10	469	No Action - Existing Efficient Fixture	2	10	469	-	0	0.0	0.0	0.0	9	9	0	0%	0
1000	Fairview SFH	1st Floor	Raceway Shed	Raceway Shed	Low Hours	Keyless Inc 60W A	2	60	8	LED 9W A19 Replacement	2	9	8	-	0	0.1	0.0	0.1	1	0	1	25%	0
1001	Fairview SFH	1st Floor	Affluent Building	Affluent Building	Low Hours	Keyless CFL 23W Screw In	2	23	8	LED 9W A19 Replacement	2	9	8	-	0	0.0	0.0	0.0	0	0	0	25%	0
1002	Fairview SFH	Exterior	Affluent Building	Over Door	Exterior - Dusk to Dawn	Wall Pack HPS 50W PC	1	66	4380	Wall Pack LED Security 1.8 kLm PC	1	15	4380	-	0	0.0	0.0	0.0	289	66	223	0%	0
1003	Fairview SFH	1st Floor	rout Run Pump Hous	Trout Run Pump House	Low Hours	Keyless CFL 23W Screw In	1	23	8	LED 9W A19 Replacement	1	9	8	-	0	0.0	0.0	0.0	0	0	0	25%	0
1004	Corry SFH	1st Floor	ffice / Visitor Cente	Lobby	Office Hours 8h 5d/week	2x2 Prism Rec 2L 32W U6 T8	2	59	1884	RT, 2' 7W SE LED 2L, 2x2 Refl Kit	2	14	1884	-	0	0.1	0.0	0.1	222	53	170	15%	0
1005	Corry SFH	1st Floor	ffice / Visitor Cente	Visitor Center	Visitor Center 7.5h 5d/week 6h Weeke	2x2 Prism Rec 2L 32W U6 T8	8	59	1807	RT, 2' 7W SE LED 2L, 2x2 Refl Kit	8	14	1807	-	0	0.4	0.1	0.3	853	202	651	30%	0
1006	Corry SFH	1st Floor	ffice / Visitor Cente	Hallway to Restrooms	Office Hours 8h 5d/week	2x2 Prism Rec 2L 32W U6 T8	1	59	1884	RT, 2' 7W SE LED 2L, 2x2 Refl Kit	1	14	1884	-	0	0.0	0.0	0.0	111	26	85	15%	0
1007	Corry SFH	1st Floor	ffice / Visitor Cente	Women's Restroom	Restroom Private Hatcheries	2X4 Prism Rec 3L 32W T8	1	89	782	RT, 4' 10.5W SE LED 3L	1	32	587	WS	1	0.0	0.0	0.0	70	25	45	25%	6
1008	Corry SFH	1st Floor	ffice / Visitor Cente	Men's Restroom	Restroom Private Hatcheries	2X4 Prism Rec 3L 32W T8	1	89	782	RT, 4' 10.5W SE LED 3L	1	32	587	WS	1	0.0	0.0	0.0	70	25	45	25%	6
1009	Corry SFH	1st Floor	ffice / Visitor Cente	Reception	Office Hours 8h 5d/week	2x2 Flat Panel Rec LED 22W	4	22	2216	No Action - Existing Efficient Fixture	4	22	2216	-	0	0.1	0.1	0.0	195	195	0	15%	0
1010	Corry SFH	1st Floor	ffice / Visitor Cente	Passage	Office Hours 8h 5d/week	2x2 Prism Rec 2L 32W U6 T8	3	59	2216	RT, 2' 7W SE LED 2L, 2x2 Refl Kit	3	14	2216	-	0	0.1	0.0	0.1	392	93	299	15%	0
1011	Corry SFH	1st Floor	ffice / Visitor Cente	Private Office 1	Office Hours 8h 5d/week	2x2 Flat Panel Rec LED 22W	4	22	2216	No Action - Existing Efficient Fixture	4	22	2216	-	0	0.1	0.1	0.0	195	195	0	15%	0
1012	Corry SFH	1st Floor	ffice / Visitor Cente	Hallway to Offices	Office Hours 8h 5d/week	2x2 Prism Rec 2L 32W U6 T8	3	59	2216	RT, 2' 7W SE LED 2L, 2x2 Refl Kit	3	14	2216	-	0	0.1	0.0	0.1	392	93	299	15%	0
1013	Corry SFH	1st Floor	ffice / Visitor Cente	Private Office 2	Office Hours 8h 5d/week	2x2 Prism Rec 2L 32W U6 T8	5	59	2216	RT, 2' 7W SE LED 2L, 2x2 Refl Kit	5	14	1884	WS	1	0.2	0.1	0.2	654	155	499	15%	23
1014	Corry SFH	1st Floor	ffice / Visitor Cente	Storage Room	Storage / Janitor Closet Hatcheries	4' Industrial HO 2L	2	145	782	4' Industrial 4' 10.5W LED 2L	2	21	782	-	0	0.2	0.0	0.1	227	33	194	25%	0
1015	Corry SFH	1st Floor	ffice / Visitor Cente	Lecture Room	Office Hours 8h 5d/week	2x2 Prism Rec 2L 32W U6 T8	6	59	1884	RT, 2' 7W SE LED 2L, 2x2 Refl Kit	6	14	1884	-	0	0.3	0.1	0.2	667	158	509	15%	0
1016	Corry SFH	1st Floor	ffice / Visitor Cente	Garage Bay	Office Hours 8h 5d/week	8' Industrial BP 4L 32W T8	15	112	2216	RT, 4' 10.5W SE LED 4L	15	42	2216	-	0	1.3	0.5	0.8	3,723	1,396	2,327	15%	0
1017	Corry SFH	1st Floor	ffice / Visitor Cente	Garage Bay	Office Hours 8h 5d/week	4' Industrial HO 2L	1	145	2216	4' Industrial 4' 10.5W LED 2L	1	21	2216	-	0	0.1	0.0	0.1	321	47	275	15%	0
1018	Corry SFH	Exterior	ffice / Visitor Cente	Doors	Exterior - Dusk to Dawn	Vandal Proof Inc 60W A	12	60	4380	LED 9W A19 Replacement	12	9	4380	-	0	0.0	0.0	0.0	3,154	473	2,681	0%	0
1019	Corry SFH	1st Floor	Pole Barn	Garage Bay	Limited Daily Use	8' Industrial BP 4L 32W T8	6	112	1460	RT, 4' 10.5W SE LED 4L	6	42	1460	-	0	0.4	0.1	0.2	981	368	613	25%	0
1020	Corry SFH	1st Floor	Pole Barn	Feed Bay	Storage / Janitor Closet Hatcheries	Keyless Inc 75W A	2	75	782	LED 9W A19 Replacement	2	9	782	-	0	0.1	0.0	0.1	117	14	103	25%	0
1021	Corry SFH	1st Floor	Pole Barn	Feed Storage	Storage / Janitor Closet Hatcheries	Keyless Inc 75W A	2	75	782	LED 9W A19 Replacement	2	9	782	-	0	0.1	0.0	0.1	117	14	103	25%	0
1022	Corry SFH	1st Floor	Hatch House	Hatchery	Office Hours 8h 5d/week	8' Vaportight BP 4L 32W T8	14	112	2216	RT, 4' 10.5W SE LED 4L	14	42	2216	-	0	1.3	0.5	0.8	3,475	1,303	2,172	15%	0
1023	Corry SFH	1st Floor	Hatch House	Lab	Office Hours 8h 5d/week	4' Wrap BP 4L	2	144	2216	RT, 4' 10.5W SE LED 4L	2	42	2216	-	0	0.2	0.1	0.2	638	186	452	15%	0
1024	Corry SFH	2nd Floor	Hatch House	Storage Area - NIU	Not In Use	4' Wrap BP 4L 40W T12	1	160	0	RT, 4' 10.5W SE LED 4L	1	42	0	-	0	0.0	0.0	0.0	0	0	0	0%	0
1025	Corry SFH	2nd Floor	Hatch House	Storage Area - NIU	Not In Use	4' Wrap BP 4L 40W T12	3	160	0	RT, 4' 10.5W SE LED 4L	3	42	0	-	0	0.0	0.0	0.0	0	0	0	0%	0
1026	Corry SFH	2nd Floor	Hatch House	Lab Storage	Storage / Janitor Closet Hatcheries	2X4 Prism Rec 4L 32W T8	2	112	782	RT, 4' 10.5W SE LED 4L	2	42	782	-	0	0.1	0.0	0.1	175	66	109	25%	0
1027	Corry SFH	2nd Floor	Hatch House	Locker Room	Restroom Public Hatcheries	2X4 Prism Rec 3L 32W T8	3	89	1564	RT, 4' 10.5W SE LED 3L	3	32	860	CM	3	0.1	0.1	0.1	418	148	270	45%	67
1028	Corry SFH	2nd Floor	Hatch House	Men's Restroom	Restroom Public Hatcheries	2X4 Prism Rec 3L 32W T8	2	89	1564	RT, 4' 10.5W SE LED 3L	2	32	860	CM	2	0.1	0.0	0.1	278	99	180	45%	44
1029	Corry SFH	2nd Floor	Hatch House	Men's Restroom Shower	Restroom Public Hatcheries	8" Rec Sq. Inc 60W A 2L	1	120	1564	LED 9W A19 Replacement 2L	1	18	1564	-	0	0.1	0.0	0.1	188	28	160	45%	0
1030	Corry SFH	2nd Floor	Hatch House	Men's Restroom	Restroom Public Hatcheries	Drum Inc 60W A 3L	1	180	1564	LED 9W A19 Replacement 3L	1	27	860	PL	0	0.1	0.0	0.1	282	42	239	45%	19
1031	Corry SFH	2nd Floor	Hatch House	Break Room	Office Hours 8h 5d/week	2X4 Prism Rec 3L 32W T8	8	89	2216	RT, 4' 10.5W SE LED 3L	8	32	1884	CM	8	0.6	0.2	0.4	1,578	558	1,019	15%	84
1032	Corry SFH	2nd Floor	Hatch House	Break Room Alarm Lamp	Office Hours 8h 5d/week	Keyless Inc 75W A	1	75	2216	LED 9W A19 Replacement	1	9	2216	-	0	0.1	0.0	0.1	166	20	146	15%	0
1033	Corry SFH	2nd Floor	Hatch House	Hallway	Office Hours 8h 5d/week	Drum Inc 60W A	3	60	2216	LED 9W A19 Replacement	3	9	2216	-	0	0.1	0.0	0.1	399	60	339	15%	0
1034	Corry SFH	2nd Floor	Hatch House	Women's Restroom	Restroom Private Hatcheries	Drum Inc 60W A	1	60	782	LED 9W A19 Replacement	1	9	587	WS	1	0.0	0.0	0.0	47	7	40	25%	2
1035	Corry SFH	2nd Floor	Hatch House	Stairs	Office Hours 8h 5d/week	Drum Inc 60W A	1	60	2216	LED 9W A19 Replacement	1	9	2216	-	0	0.0	0.0	0.0	133	20	113	15%	0
1036	Corry SFH	2nd Floor	Hatch House	Stairs	Office Hours 8h 5d/week	Keyless Inc 75W A	1	75	2216	LED 9W A19 Replacement	1	9	2216	-	0	0.1	0.0	0.1	166	20	146	15%	0
1037	Corry SFH	Exterior	Hatch House	Doors	Exterior - Dusk to Dawn	Wall Pack HPS 50W PC	1	66	4380	Wall Pack LED Security 1.8 kLm PC	1	15	4380	-	0	0.0	0.0	0.0	289	66	223	0%	0
1038	Corry SFH	Exterior	Hatch House	Flag	Exterior - Dusk to Dawn	Flood Hal 90 PAR38	1	90	4380	LED 26W PAR38 Replacement	1	26	4380	-	0	0.0	0.0	0.0	394	114	280	0%	0
1039	Corry SFH	Exterior	Area Lighting	Wood Poles	Exterior - Dusk to Dawn	Flood LED 85W	1	85	4380	No Action - Existing Efficient Fixture	1	85	4380	-	0	0.0	0.0	0.0	372	372	0	0%	0
1040	Corry SFH	Exterior	Area Lighting	By Garage	Exterior - Dusk to Dawn	Flood LED 85W	1	85	4380	No Action - Existing Efficient Fixture	1	85	4380	-	0	0.0	0.0	0.0	372	372	0	0%	0
1041	Corry SFH	Exterior	Area Lighting	Raceways	Exterior - Dusk to Dawn	Flood LED 15W	17	15	4380	No Action - Existing Efficient Fixture	17	15	4380	-	0	0.0	0.0	0.0	1,117	1,117	0	0%	0
1042	Corry SFH	Exterior	Area Lighting	By Generator	Exterior - Dusk to Dawn	Globe MV 175W	1	215	4380	Area LED 7 kLm, PC Wood Pole	1	51	4380	-	0	0.0	0.0	0.0	942	223	718	0%	0
1043	Corry SFH	1st Floor	Lower Building	Bay	Limited Daily Use	8' Industrial BP 4L 32W T8	8	112	1460	RT, 4' 10.5W SE LED 4L	8	42	1460	-	0	0.5	0.2	0.3	1,308	491	818	25%	0
1044	Corry SFH	1st Floor	Lower Building	Bay Task	Limited Daily Use	4' Wrap BP 4L 32W T8	3	112	1460	RT, 4' 10.5W SE LED 4L	3	42	1460	-	0	0.2	0.1	0.1	491	184	307	25%	0
1045	Corry SFH	1st Floor	Lower Building	Chemical Storage	Storage / Janitor Closet Hatcheries	8' Industrial BP 4L 32W T8	2	112	782	RT, 4' 10.5W SE LED 4L	2	42	782	-	0	0.1	0.0	0.1	175	66	109	25%	0
1046	Corry SFH	Exterior	Lower Building	Doors	Exterior - Dusk to Dawn	Wall Pack HPS 50W PC	2	66	4380	Wall Pack LED Security 1.8 kLm PC	2	15	4380	-	0	0.0	0.0	0.0	578	131	447	0%	0
1047	Corry SFH	1st Floor	Lower Shed	Lower Shed	Low Hours	Keyless Inc 75W A	1	75	8	LED 9W A19 Replacement	1	9	8	-	0	0.0	0.0	0.0	1	0	1	25%	0
1048	Corry SFH	1st Floor	Generator 1	Generator 1	Low Hours	Keyless Inc 75W A	5	75	8	LED 9W A19 Replacement	5	9	8	-	0	0.2	0.0	0.2	3	0	3	25%	0
1049	Corry SFH	1st Floor	Generator 1	Generator 1	Low Hours	Keyless Empty E26	1	0	8	LED 9W A19 Replacement	1	9	8	-	0	0.0	0.0	0.0	0	0	0	25%	0
1050	Corry SFH	1st Floor	Generator 2	Generator 2	Low Hours	Keyless Inc 75W A	6	75	8	LED 9W A19 Replacement	6	9	8	-	0	0.2	0.0	0.2	4	0	3	25%	0
1051	Corry SFH	1st Floor	Generator 3	Generator 3	Low Hours	Keyless Inc 75W A	6	75	8	LED 9W A19 Replacement	6	9	8	-	0	0.2	0.0	0.2	4	0	3	25%	0
1052	Corry SFH	1st Floor	Well #1	Well #1	Low Hours	Keyless Inc 75W A	2	75	8	LED 9W A19 Replacement	2	9	8	-	0	0.1	0.0	0.1	1	0	1	25%	0
1053	Corry SFH	1st Floor	Well #2	Well #2	Low Hours	Keyless Inc 75W A	2	75	8	LED 9W A19 Replacement	2	9	8	-	0	0.1	0.0	0.1	1	0	1	25%	0
1054	Corry SFH	1st Floor	Well #3	Well #3	Low Hours	Keyless Inc 75W A	2	75	8	LED 9W A19 Replacement	2	9	8	-	0	0.1	0.0	0.1	1	0	1	25%	0
1055	Union City SFH	1st Floor	ower Motor Garage	Garage Bay	Utility Work Buildings	8' Industrial BP 4L 32W T8	14	112	78	RT, 4' 10.5W SE LED 4L	14	42	78	-	0	0.9	0.3	0.5	122	46	76	25%	0
1056	Union City SFH	Exterior	ower Motor Garage	Over Door	Exterior - Dusk to Dawn	Wall Pack HPS 50W PC	1	66	4380	Wall Pack LED Security 1.8 kLm PC	1	15	4380	-	0	0.0	0.0	0.0	289	66	223	0%	0
1057	Union City SFH	1st Floor	Pole Barn	Bay	Utility Building	8' Industrial SP 2L	8	138	26	RT, 4' 10.5W SE LED 4L, 8' BC Kit	8	42	26	-	0	0.6	0.2	0.4	29	9	20	25%	0
1058	Union City SFH	Exterior	Pole Barn	Over Door	Exterior - Dusk to Dawn	Wall Pack HPS 50W PC	2	66	4380	Wall Pack LED Security 1.8 kLm PC	2	15	4380	-	0	0.0	0.0	0.0	578	131	447	0%	0
1059	Union City SFH	1st Floor	Old Barn	Storage Area	Very Low Hours	Keyless Inc 75W A	2	75	5	LED 9W A19 Replacement	2	9	5	-	0	0.0	0.0	0.0	1	0	1	25%	0
1060	Union City SFH	1st Floor	Old Barn	Storage Area	Very Low Hours	Keyless CFL 23W Screw In	3	23	5	LED 9W A19 Replacement	3	9	5	-	0	0.0	0.0	0.0	0	0	0	25%	0
1061	Union City SFH	1st Floor	Old Barn	Feed Room	Very Low Hours	Keyless Inc 75W A	1	75	5	LED 9W A19 Replacement	1	9	5	-	0	0.0	0.0	0.0	0	0	0	25%	0
1062	Union City SFH	1st Floor	Old Barn	Feed	Very Low Hours	Keyless LED 9W A	1	9	5	No Action - Existing Efficient Fixture	1	9	5	-	0	0.0	0.0	0.0	0	0	0	25%	0
1063	Union City SFH	1st Floor	Old Barn	Basement	Very Low Hours	Keyless Inc 75W A	3	75	5	LED 9W A19 Replacement	3	9	5	-	0	0.1	0.0	0.0	1	0	1	25%	0
1064	Union City SFH	1st Floor	Old Barn	Basement	Very Low Hours	Keyless LED 9W A	2	9	5	No Action - Existing Efficient Fixture	2	9	5	-	0	0.0	0.0	0.0	0	0	0	25%	0
1065	Union City SFH	Exterior	Old Barn	Over Door	Exterior - Dusk to Dawn	Barnlight HPS 150W	1	188	4380	Barnlight LED 4 kLm PC	1	29	4380	-	0	0.0	0.0	0.0	823	127	696	0%	0
1066	Union City SFH	1st Floor	Hatch House	Hatchery	Office Hours 8.5h 7d/week	8' Vaportight BP 4L 32W T8	14	112	3103	RT, 4' 10.5W SE LED 4L	14	42	3103	-	0	1.3	0.5	0.8	4,866	1,825	3,041	25%	0
1067	Union City SFH	1st Floor	Hatch House	Hatchery Task	Office Hours 8.5h 7d/week	4' Industrial BP 2L 32W T8	1	59	3103	RT, 4' 10.5W SE LED 2L	1	21	3103	-	0	0.0	0.0	0.0	183	65	118	25%	0
1068	Union City SFH	1st Floor	Hatch House	Tool Storage	Storage / Janitor Closet Hatcheries	4' Industrial BP 2L 32W T8	1	59	782	RT, 4' 10.5W SE LED 2L	1	21	782	-	0	0.0	0.0	0.0	46	16	30	25%	0
1069	Union City SFH	1st Floor	Hatch House	Private Office	Office Hours 8.5h 7d/week	4' Wrap BP 2L 32W T8	2	59	3103	RT, 4' 10.5W SE LED 2L	2	21	2327	WS	1	0.1	0.0	0.1	366	130	236	25%	33
1070	Union City SFH	1st Floor	Hatch House	Restroom	Restroom Private Hatcheries	Fan Inc 60W A	1	60	782	LED 9W A19 Replacement	1	9	587	WS	1	0.0	0.0	0.0	47	7	40	25%	2
1071	Union City SFH	1st Floor	Hatch House	Mechanical Room	Mechanical/Electrical Room Hatcheries	4' Industrial HO 2L	3	145	782	4' Industrial 4' 10.5W LED 2L	3	21	782	-	0	0.2	0.0	0.2	340	49	291	25%	0
1072	Union City SFH	1st Floor	Hatch House	Break Room	Office Hours 8.5h 7d/week	2X4 Prism Rec 4L	4	144	3103	RT, 4' 10.5W SE LED 4L	4	42	2327	CM	4	0.5	0.1	0.3	1,787	521	1,266	25%	130
1073	Union City SFH	2nd Floor	Hatch House	Upstairs Storage	Storage / Janitor Closet Hatcheries	8' Vaportight BP 4L 32W T8	2	112	782	RT, 4' 10.5W SE LED 4L	2	42	782	-	0	0.1	0.0	0.1	175	66	109	25%	0
1074	Union City SFH	Exterior	Hatch House	Over Doors	Exterior - Dusk to Dawn	Wall Pack HPS 50W	2	66	4380	Wall Pack LED Security 1.8 kLm PC	2	15	4380	-	0	0.0	0.0	0.0	578	131	447	0%	0
1075	Union City SFH	1st Floor	Residence Garage	Garage Bay	Limited Daily Use	Keyless LED 10W A	3	10	1460	No Action - Existing Efficient Fixture	3	10	1460	-	0	0.0	0.0	0.0	44	44	0	25%	0
1076	Union City SFH	1st Floor	Residence	Residence	Not In Use	None Existing	0	0	0	No Action - Payback	0	0	0	-	0	0.0	0.0	0.0	0	0	0	0%	0
1077	Union City SFH	Exterior	Area Lighting	Parking Area	Exterior - Dusk to Dawn	Barnlight HPS 150W	1	188	4380	Barnlight LED 4 kLm PC	1	29	4380	-	0	0.0	0.0	0.0	823	127	696	0%	0
1078	Union City SFH	1st Floor	Filtration Building	Filtration Building	Very Low Hours	8' Vaportight BP 4L 32W T8	2	112	5	RT, 4' 10.5W SE LED 4L	2	42	5	-	0	0.1	0.0	0.0	1	0	1	25%	0
1079	Union City SFH	Exterior	Filtration Building	Over Door	Exterior - Dusk to Dawn	Wall Pack HPS 50W	1	66	4380	Wall Pack LED Security 1.8 kLm PC	1	15	4380	-	0	0.0	0.0	0.0	289	66	223	0%	0
1080	Pleasant Mount SFH	1st Floor	ation Building / Visit	Vestibule	Office Hours 8.5h 7d/week	2X4 Prism Rec LED 15W T8 ULB 4L	2	60	3103	No Action - Existing Efficient Fixture	2	60	3103	-	0	0.1	0.1	0.0	372	372	0	25%	0
1081	Pleasant Mount SFH	1st Floor	ation Building / Visit	Hallways	Office Hours 8.5h 7d/week	2X4 Prism Rec LED 15W T8 ULB 4L	6	60	3103	No Action - Existing Efficient Fixture	6	60	3103	-	0	0.3	0.3	0.0	1,117	1,117	0	25%	0
1082	Pleasant Mount SFH	1st Floor	ation Building / Visit	Visitor Center	Visitor Center 7.5h 7d/week	2X4 Prism Rec LED 15W T8 ULB 4L	2	60	2738	No Action - Existing Efficient Fixture	2	60	2738	-	0	0.1	0.1	0.0	329	329	0	30%	0
1083	Pleasant Mount SFH	1st Floor	ation Building / Visit	Secretary	Office Hours 8.5h 7d/week	2X4 Prism Rec LED 15W T8 ULB 4L	2	60	3103	No Action - Existing Efficient Fixture	2	60	3103	-	0	0.1	0.1	0.0	372	372	0	25%	0
1084	Pleasant Mount SFH	1st Floor	ation Building / Visit	Manager's Office	Office Hours 8.5h 7d/week	2X4 Prism Rec LED 15W T8 ULB 4L	2	60	3103	No Action - Existing Efficient Fixture	2	60	3103	-	0	0.1	0.1	0.0	372	372	0	25%	0
1085	Pleasant Mount SFH	1st Floor	ation Building / Visit	Private Office 2	Office Hours 8.5h 7d/week	2X4 Prism Rec LED 15W T8 ULB 4L	2	60	3103	No Action - Existing Efficient Fixture	2	60	3103	-	0	0.1	0.1	0.0	372	372	0	25%	0
1086	Pleasant Mount SFH	1st Floor	ation Building / Visit	Storage Closet	Limited Daily Use	2X4 Prism Rec LED 15W T8 ULB 4L	2	60	1460	No Action - Existing Efficient Fixture	2	60	1460	-	0	0.1	0.1	0.0	175	175	0	25%	0
1087	Pleasant Mount SFH	1st Floor	ation Building / Visit	Foreman's Office	Office Hours 8.5h 7d/week	2X4 Prism Rec LED 15W T8 ULB 4L	1	60	3103	No Action - Existing Efficient Fixture	1	60	3103	-	0	0.0	0.0	0.0	186	186	0	25%	0
1088	Pleasant Mount SFH	1st Floor	ation Building / Visit	Dayroom	Office Hours 8.5h 7d/week	2X4 Prism Rec LED 15W T8 ULB 4L	2	60	3103	No Action - Existing Efficient Fixture	2	60	3103	-	0	0.1	0.1	0.0	372	372	0	25%	0
1089	Pleasant Mount SFH	1st Floor	ation Building / Visit	Kitchenette	Office Hours 8.5h 7d/week	2X4 Prism Rec LED 15W T8 ULB 4L	4	60	3103	No Action - Existing Efficient Fixture	4	60	3103	-	0	0.2	0.2	0.0	745	745	0	25%	0
1090	Pleasant Mount SFH	1st Floor	ation Building / Visit	Locker Room / Men's Restroom	Restroom Public Hatcheries	2X4 Prism Rec LED 15W T8 ULB 4L	1	60	1564	No Action - Existing Efficient Fixture	1	60	1564	-	0	0.0	0.0	0.0	94	94	0	45%	0
1091	Pleasant Mount SFH	1st Floor	ation Building / Visit	Storage Closet	Storage / Janitor Closet Hatcheries	2X4 Prism Rec 4L 32W T8	3	112	782	RT, 4' 10.5W SE LED 4L	3	42	782	-	0	0.2	0.1	0.1	263	99	164	25%	0
1092	Pleasant Mount SFH	1st Floor	ation Building / Visit	Private Restroom	Restroom Private Hatcheries	Fan Inc 100W A	1	100	782	LED 9W A19 Replacement	1	9	782	-	0	0.1	0.0	0.1	78	7	71	25%	0
1093	Pleasant Mount SFH	1st Floor	ation Building / Visit	Women's Restroom	Restroom Public Hatcheries	2X4 Prism Rec LED 15W T8 ULB 4L	1	60	1564	No Action - Existing Efficient Fixture	1	60	1564	-	0	0.0	0.0	0.0	94	94	0	45%	0
1094	Pleasant Mount SFH	1st Floor	ation Building / Visit	Men's Restroom	Restroom Public Hatcheries	2X4 Prism Rec LED 15W T8 ULB 4L	2	60	1564	No Action - Existing Efficient Fixture	2	60	1564	-	0	0.1	0.1	0.0	188	188	0	45%	0
1095	Pleasant Mount SFH	1st Floor	ation Building / Visit	Conference Room	Office Hours 8.5h 7d/week	2X4 Prism Rec LED 15W T8 ULB 4L	2	60	2327	No Action - Existing Efficient Fixture	2	60	2327	-	0	0.1	0.1	0.0	279	279	0	25%	0
1096	Pleasant Mount SFH	Basement	ation Building / Visit	Hatchery	Office Hours 8.5h 7d/week	2X4 Prism Rec LED 15W T8 ULB 4L	6	60	3103	No Action - Existing Efficient Fixture	6	60	3103	-	0	0.3	0.3	0.0	1,117	1,117	0	25%	0
1097	Pleasant Mount SFH	Basement	ation Building / Visit	Hatchery	Office Hours 8.5h 7d/week	8' Vaportight BP 4L 32W T8	11	112	3103	RT, 4' 10.5W SE LED 4L	11	42	3103	-	0	1.0	0.4	0.6	3,823	1,434	2,389	25%	0
1098	Pleasant Mount SFH	Basement	ation Building / Visit	Hatchery	Office Hours 8.5h 7d/week	Keyless LED 12W A	1	12	3103	No Action - Existing Efficient Fixture	1	12	3103	-	0	0.0	0.0	0.0	37	37	0	25%	0
1099	Pleasant Mount SFH	Basement	ation Building / Visit	Storage Room	Storage / Janitor Closet Hatcheries	Keyless LED 12W A	1	12	782	No Action - Existing Efficient Fixture	1	12	782	-	0	0.0	0.0	0.0	9	9	0	25%	0
1100	Pleasant Mount SFH	Basement	ation Building / Visit	Storage Room	Storage / Janitor Closet Hatcheries	Keyless CFL 23W Screw In	1	23	782	LED 9W A19 Replacement	1	9	782	-	0	0.0	0.0	0.0	18	7	11	25%	0

ID #	Location					Existing Fixture				Proposed Fixture						PeakDemand			Usage			Controls	
	Building # : Name	Floor	Area	Sub Area / Room	Usage Group	Fixture	Quantity	Input Wattage	Hours of Operation	ECM	Quantity	Input Wattage	Hours of Operation	Occ Sensor Type	Occ Sensor Qty	Pre	Post	Savings	Pre	Post	Savings	Savings %	Savings
1101	Pleasant Mount SFH	Basement	ation Building / Visit	Tank Storage	Storage / Janitor Closet Hatcheries	Explosion Proof CFL 26W 4P	1	27	782	Jelly Jar LED 600Lm Ceiling	1	15	782	-	0	0.0	0.0	0.0	21	12	9	25%	0
1102	Pleasant Mount SFH	Basement	ation Building / Visit	Mechanical Room	Mechanical/Electrical Room Hatcheries	Keyless LED 12W A	1	12	782	No Action - Existing Efficient Fixture	1	12	782	-	0	0.0	0.0	0.0	9	9	0	25%	0
1103	Pleasant Mount SFH	Basement	ation Building / Visit	Chemical Storage	Storage / Janitor Closet Hatcheries	Explosion Proof CFL 26W 4P	3	27	782	Jelly Jar LED 600Lm Ceiling	3	15	782	-	0	0.0	0.0	0.0	63	35	28	25%	0
1104	Pleasant Mount SFH	Exterior	ation Building / Visit	Lower Exits	Exterior - Dusk to Dawn	Flood Hal 90 PAR38	2	90	4380	LED 14W PAR38 Replacement WL	2	14	4380	-	0	0.0	0.0	0.0	788	123	666	0%	0
1105	Pleasant Mount SFH	Exterior	ation Building / Visit	Front Exits	Exterior - Dusk to Dawn	Vandal Proof LED 12W A	3	12	4380	No Action - Existing Efficient Fixture	3	12	4380	-	0	0.0	0.0	0.0	158	158	0	0%	0
1106	Pleasant Mount SFH	Exterior	ation Building / Visit	Outdoor Aquarium	Limited Weekly Use	Flood Hal 90 PAR38 2L	3	180	626	LED 14W PAR38 Replacement WL 2L	3	28	626	-	0	0.1	0.0	0.1	338	53	285	25%	0
1107	Pleasant Mount SFH	Basement	Maintenance Garage	Garage Bay	Office Hours 8.5h 7d/week	8' Industrial T5HO 4L	15	234	3103	RT, 4' 25W SE LED T5HO 4L	15	100	3103	-	0	2.8	1.2	1.6	10,892	4,655	6,237	25%	0
1108	Pleasant Mount SFH	Basement	Maintenance Garage	Garage Bay	Office Hours 8.5h 7d/week	4' Wrap 4L T5HO	1	234	3103	RT, 4' 25W SE LED T5HO 4L	1	100	3103	-	0	0.2	0.1	0.1	726	310	416	25%	0
1109	Pleasant Mount SFH	Basement	Maintenance Garage	Restroom	Restroom Private Hatcheries	4' Industrial BP 2L 40W T12	1	80	782	RT, 4' 10.5W SE LED 2L	1	21	782	-	0	0.0	0.0	0.0	63	16	46	25%	0
1110	Pleasant Mount SFH	Basement	Maintenance Garage	Mechanical Room	Mechanical/Electrical Room Hatcheries	4' Industrial BP 2L 40W T12	2	80	782	RT, 4' 10.5W SE LED 2L	2	21	782	-	0	0.1	0.0	0.1	125	33	92	25%	0
1111	Pleasant Mount SFH	1st Floor	Maintenance Garage	Stairs	Office Hours 8.5h 7d/week	4' Industrial BP 2L 40W T12	2	80	3103	RT, 4' 10.5W SE LED 2L	2	21	3103	-	0	0.1	0.0	0.1	496	130	366	25%	0
1112	Pleasant Mount SFH	1st Floor	Maintenance Garage	Bay	Office Hours 8.5h 7d/week	8' Industrial T5HO 4L	11	234	3103	RT, 4' 25W SE LED T5HO 4L	11	100	3103	-	0	2.1	0.9	1.2	7,987	3,413	4,574	25%	0
1113	Pleasant Mount SFH	1st Floor	Maintenance Garage	Bay	Office Hours 8.5h 7d/week	4' Wrap 4L T5HO	1	234	3103	RT, 4' 25W SE LED T5HO 4L	1	100	3103	-	0	0.2	0.1	0.1	726	310	416	25%	0
1114	Pleasant Mount SFH	1st Floor	Maintenance Garage	Storage Room	Storage / Janitor Closet Hatcheries	8' Industrial BP 4L 40W T12	4	160	782	RT, 4' 10.5W SE LED 4L	4	42	782	-	0	0.4	0.1	0.3	500	131	369	25%	0
1115	Pleasant Mount SFH	1st Floor	Maintenance Garage	Storage Room	Storage / Janitor Closet Hatcheries	8' Industrial T5HO 4L	2	234	782	RT, 4' 25W SE LED T5HO 4L	2	100	782	-	0	0.3	0.1	0.1	366	156	210	25%	0
1116	Pleasant Mount SFH	1st Floor	Maintenance Garage	Mechanical Room	Mechanical/Electrical Room Hatcheries	4' Industrial BP 1L 32W T8	1	31	782	RT, 4' 10.5W SE LED 1L	1	11	782	-	0	0.0	0.0	0.0	24	8	16	25%	0
1117	Pleasant Mount SFH	Exterior	Maintenance Garage	Lower Doors	Exterior - Dusk to Dawn	Vandal Proof LED 12W A	6	12	4380	No Action - Existing Efficient Fixture	6	12	4380	-	0	0.0	0.0	0.0	315	315	0	0%	0
1118	Pleasant Mount SFH	Exterior	Maintenance Garage	Upper Doors	Exterior - Dusk to Dawn	Vandal Proof LED 12W A	5	12	4380	No Action - Existing Efficient Fixture	5	12	4380	-	0	0.0	0.0	0.0	263	263	0	0%	0
1119	Pleasant Mount SFH	1st Floor	Hatch House	Boiler Room	Mechanical/Electrical Room Hatcheries	2X4 Prism Rec 3L 32W T8	6	89	782	RT, 4' 10.5W SE LED 3L	6	32	782	-	0	0.3	0.1	0.2	418	148	270	25%	0
1120	Pleasant Mount SFH	1st Floor	Hatch House	Crawl Space	Low Hours	4' Wall Bracket BP 1L 40W T12	2	50	8	RT, 4' 10.5W SE LED 1L	2	11	8	-	0	0.1	0.0	0.0	1	0	1	25%	0
1121	Pleasant Mount SFH	1st Floor	Hatch House	Hatch 1	Office Hours 8.5h 7d/week	2X4 Prism Rec 3L 32W T8	6	89	3103	RT, 4' 10.5W SE LED 3L	6	32	3103	-	0	0.4	0.2	0.3	1,657	586	1,071	25%	0
1122	Pleasant Mount SFH	1st Floor	Hatch House	Hatch 1	Office Hours 8.5h 7d/week	4' Industrial BP 2L 40W T12	1	80	3103	RT, 4' 10.5W SE LED 2L	1	21	3103	-	0	0.1	0.0	0.0	248	65	183	25%	0
1123	Pleasant Mount SFH	1st Floor	Hatch House	Hatch 2	Office Hours 8.5h 7d/week	2X4 Prism Rec 3L 32W T8	12	89	3103	RT, 4' 10.5W SE LED 3L	12	32	3103	-	0	0.9	0.3	0.6	3,314	1,173	2,141	25%	0
1124	Pleasant Mount SFH	1st Floor	Hatch House	Hatch 2	Office Hours 8.5h 7d/week	4' Industrial BP 2L 40W T12	1	80	3103	RT, 4' 10.5W SE LED 2L	1	21	3103	-	0	0.1	0.0	0.0	248	65	183	25%	0
1125	Pleasant Mount SFH	1st Floor	Hatch House	Hatch 2	Office Hours 8.5h 7d/week	4' Wrap BP 4L 32W T8	2	112	3103	RT, 4' 10.5W SE LED 4L	2	42	3103	-	0	0.2	0.1	0.1	695	261	434	25%	0
1126	Pleasant Mount SFH	1st Floor	Hatch House	Hatch 3	Office Hours 8.5h 7d/week	2X4 Prism Rec 3L 32W T8	6	89	3103	RT, 4' 10.5W SE LED 3L	6	32	3103	-	0	0.4	0.2	0.3	1,657	586	1,071	25%	0
1127	Pleasant Mount SFH	1st Floor	Hatch House	Hatch 3	Office Hours 8.5h 7d/week	4' Wrap BP 4L 32W T8	4	112	3103	RT, 4' 10.5W SE LED 4L	4	42	3103	-	0	0.4	0.1	0.2	1,390	521	869	25%	0
1128	Pleasant Mount SFH	Exterior	Hatch House	Doors	Exterior - Dusk to Dawn	Vandal Proof LED 12W A	8	12	4380	No Action - Existing Efficient Fixture	8	12	4380	-	0	0.0	0.0	0.0	420	420	0	0%	0
1129	Pleasant Mount SFH	1st Floor	Generator Building	Mechanical Room	Utility Building	Keyless LED 12W A	6	12	26	No Action - Existing Efficient Fixture	6	12	26	-	0	0.0	0.0	0.0	2	2	0	25%	0
1130	Pleasant Mount SFH	1st Floor	Generator Building	Back Room	Utility Building	4' Industrial BP 4L	1	144	26	RT, 4' 10.5W SE LED 4L	1	42	26	-	0	0.1	0.0	0.1	4	1	3	25%	0
1131	Pleasant Mount SFH	Exterior	Generator Building	Door	Exterior - Dusk to Dawn	Keyless Inc 100W A	1	100	4380	LED 9W A19 Replacement	1	9	4380	-	0	0.0	0.0	0.0	438	39	399	0%	0
1132	Pleasant Mount SFH	1st Floor	Pole Barn	Bay	Limited Daily Use	Flood LED 17W PAR38	8	17	1460	No Action - Existing Efficient Fixture	8	17	1460	-	0	0.1	0.1	0.0	199	199	0	25%	0
1133	Pleasant Mount SFH	1st Floor	Upper Garage	Work Area	Utility Work Buildings	4' Industrial BP 2L 32W T8	2	59	78	RT, 4' 10.5W SE LED 2L	2	21	78	-	0	0.1	0.0	0.0	9	3	6	25%	0
1134	Pleasant Mount SFH	1st Floor	Upper Garage	Work Area	Utility Work Buildings	4' Strip BP 2L	2	72	78	RT, 4' 10.5W SE LED 2L	2	21	78	-	0	0.1	0.0	0.1	11	3	8	25%	0
1135	Pleasant Mount SFH	1st Floor	Upper Garage	Work Area	Utility Work Buildings	Keyless Inc 60W A	1	60	78	LED 9W A19 Replacement	1	9	78	-	0	0.0	0.0	0.0	5	1	4	25%	0
1136	Pleasant Mount SFH	1st Floor	Upper Garage	Bay	Utility Work Buildings	4' Schoolhouse BP 4L 40W T12	3	160	78	RT, 4' 10.5W SE LED 4L	3	42	78	-	0	0.3	0.1	0.2	37	10	28	25%	0
1137	Pleasant Mount SFH	1st Floor	Upper Garage	Bay	Utility Work Buildings	4' Industrial BP 2L 32W T8	2	59	78	RT, 4' 10.5W SE LED 2L	2	21	78	-	0	0.1	0.0	0.0	9	3	6	25%	0
1138	Pleasant Mount SFH	1st Floor	Upper Garage	Bay	Utility Work Buildings	4' Strip BP 2L 40W T12	1	80	78	RT, 4' 10.5W SE LED 2L	1	21	78	-	0	0.0	0.0	0.0	6	2	5	25%	0
1139	Pleasant Mount SFH	1st Floor	Upper Garage	Storage Closet	Low Hours	Keyless Inc 100W A	1	100	8	LED 9W A19 Replacement	1	9	8	-	0	0.1	0.0	0.1	1	0	1	25%	0
1140	Pleasant Mount SFH	1st Floor	Upper Garage	Upper Area	Low Hours	4' Wrap BP 2L 40W T12	5	80	8	RT, 4' 10.5W SE LED 2L	5	21	8	-	0	0.2	0.1	0.2	3	1	2	25%	0
1141	Pleasant Mount SFH	1st Floor	Upper Garage	Upper Area	Low Hours	4' Wrap BP 4L 32W T8	2	112	8	RT, 4' 10.5W SE LED 4L	2	42	8	-	0	0.1	0.0	0.1	2	1	1	25%	0
1142	Pleasant Mount SFH	1st Floor	Upper Garage	Upper Area	Low Hours	Keyless CFL 23W Screw In	3	23	8	LED 9W A19 Replacement	3	9	8	-	0	0.0	0.0	0.0	1	0	0	25%	0
1143	Pleasant Mount SFH	1st Floor	Upper Garage	Upper Area	Low Hours	RLM Empty E26	1	0	8	LED 9W A19 Replacement	1	9	8	-	0	0.0	0.0	0.0	0	0	0	25%	0
1144	Pleasant Mount SFH	1st Floor	Well Building	Well Building	Low Hours	Keyless CFL 13W Screw In	2	13	8	LED 9W A19 Replacement	2	9	8	-	0	0.0	0.0	0.0	0	0	0	25%	0
1145	Pleasant Mount SFH	Exterior	Manager's Residence	Above Doors	Not In Use	Flood Hal 90 PAR38	1	90	0	LED 14W PAR38 Replacement WL	1	14	0	-	0	0.0	0.0	0.0	0	0	0	0%	0
1146	Pleasant Mount SFH	Exterior	Manager's Residence	Above Doors	Not In Use	Flood Empty E26	1	0	0	LED 9W A19 Replacement	1	9	0	-	0	0.0	0.0	0.0	0	0	0	0%	0
1147	Pleasant Mount SFH	Exterior	Manager's Residence	Flag Flood	Exterior - Dusk to Dawn	Flood LED 17W PAR38	1	17	4380	No Action - Existing Efficient Fixture	1	17	4380	-	0	0.0	0.0	0.0	74	74	0	0%	0
1148	Pleasant Mount SFH	1st Floor	Manager's Residence	1st Floor	Not In Use	Drum Inc 60W A 2L	7	120	0	LED 9W A19 Replacement 2L	7	18	0	-	0	0.0	0.0	0.0	0	0	0	0%	0
1149	Pleasant Mount SFH	1st Floor	Manager's Residence	1st Floor	Not In Use	Chandelier Inc 40W A 5L	6	200	0	LED 6W A19 Replacement 5L	6	30	0	-	0	0.0	0.0	0.0	0	0	0	0%	0
1150	Pleasant Mount SFH	1st Floor	Manager's Residence	Stairs	Not In Use	Lantern Inc 90W A	1	90	0	LED 9W A19 Replacement	1	9	0	-	0	0.0	0.0	0.0	0	0	0	0%	0
1151	Pleasant Mount SFH	2nd Floor	Manager's Residence	2nd Floor	Not In Use	Drum Inc 40W A 2L	11	80	0	LED 9W A19 Replacement 2L	11	18	0	-	0	0.0	0.0	0.0	0	0	0	0%	0
1152	Pleasant Mount SFH	2nd Floor	Manager's Residence	2nd Floor	Not In Use	Vanity Inc 40W G25 3L	1	120	0	LED 5W G25 Replacement 3L	1	15	0	-	0	0.0	0.0	0.0	0	0	0	0%	0
1153	Pleasant Mount SFH	Basement	Manager's Residence	Basement	Not In Use	Keyless CFL 13W Screw In	5	13	0	LED 9W A19 Replacement	5	9	0	-	0	0.0	0.0	0.0	0	0	0	0%	0
1154	Pleasant Mount SFH	Exterior	Area Lighting	Lower Raceways	Exterior - Dusk to Dawn	Post Top HPS 150W	9	188	4380	Area LED 7 klm, PC Wood Pole	9	51	4380	-	0	0.0	0.0	0.0	7,411	2,010	5,401	0%	0
1155	Pleasant Mount SFH	Exterior	Area Lighting	Raceway 1	Exterior - Dusk to Dawn	Flood Hal 90 PAR38	4	90	4380	LED 14W PAR38 Replacement WL	4	14	4380	-	0	0.0	0.0	0.0	1,577	245	1,332	0%	0
1156	Pleasant Mount SFH	Exterior	Area Lighting	Raceway 2	Exterior - Dusk to Dawn	Flood Hal 90 PAR38	4	90	4380	LED 14W PAR38 Replacement WL	4	14	4380	-	0	0.0	0.0	0.0	1,577	245	1,332	0%	0
1157	Pleasant Mount SFH	Exterior	Area Lighting	Entry Drive	Exterior - Dusk to Dawn	Post Top HPS 150W	3	188	4380	Area LED 7 klm, PC Wood Pole	3	51	4380	-	0	0.0	0.0	0.0	2,470	670	1,800	0%	0
1158	Pleasant Mount SFH	Exterior	Area Lighting	Entry Drive	Exterior - Dusk to Dawn	Missing Fixture	2	0	4380	Area LED 7 klm, PC Wood Pole	2	51	4380	-	0	0.0	0.0	0.0	0	447	-447	0%	0
1159	Pleasant Mount SFH	Exterior	Area Lighting	Upper Raceway / Ponds	Exterior - Dusk to Dawn	Post Top HPS 150W	9	188	4380	Area LED 7 klm, PC Wood Pole	9	51	4380	-	0	0.0	0.0	0.0	7,411	2,010	5,401	0%	0
1160	Pleasant Mount SFH	Exterior	Area Lighting	Barn by Creek	Exterior - Dusk to Dawn	Post Top HPS 150W	1	188	4380	Area LED 7 klm, PC Wood Pole	1	51	4380	-	0	0.0	0.0	0.0	823	223	600	0%	0
	Totals						**3,807**				**3,807**				**147**	**216.4**	**85.3**	**131.1**	**888,626**	**367,096**	**521,530**		**4,940**

Zerodraft Central Pennsylvania

Pa Fish & Boat Commission

3/6/2020

Site	Building	Gas saved mcf	oil saved gallons	elect saved kwh	weatherstrip mandoors	weatherstrip OHD's	foam roof edge	airseal attic	Insulate attic	wx & ins attic hatch	pulldown stair cover	truss bottom sheathing	wall sheathing	wall insulate	caulk ceiling jts
Bellefont SFH															
	Hatch House air seal	746	-	-	7	5	336	-	-	-	-	7,405	-	-	-
	Hatch House Insulate	25	-	-	0	-	-	-	2,244	-	-	-	-	-	-
	LHO air seal	-	-	721	2	-	-	-	-	-	-	-	-	-	-
	LHO Insulate	-	-	2,194	0	-	-	-	648	-	-	-	-	-	-
	Mid-LHO air seal	-	-	360	1	-	-	-	-	-	-	-	-	-	-
	Mid-LHO Insulate	-	-	762	0	-	-	-	225	-	-	-	-	-	-
	Low Hatch House airseal	-	22	-	2	-	-	-	-	-	-	-	-	-	-
	Low Hatch House Insul.	-	136	-	0	-	-	-	1,296	-	-	-	-	-	-
Benner Spring SFH															
	Admin. air seal	-	2,997	10,458	9	-	138	-	-	0	-	4,500	-	0	-
	Garage air seal	-	22	-	-	-	-	-	-	0	-	-	-	0	-
	Micro Screen airseal	-	33	-	-	-	-	-	-	0	-	-	-	0	-
Corry SFH															
	Visitor Center airseal	792	-	21,206	5	-	236	-	-	0	-	5,280	236	-	0
	Hatch House airseal	-	-	35,096	5	-	-	-	-	0	-	1,152	-	-	0
	Lower Garage airseal	-	-	-	3	1	-	-	-	4	-	-	-	-	0
	Lower Garage insulation	36	-	-	0	-	-	-	3,344	0	-	-	-	-	0
Fairview SFH															
	Admin/Visitor airseal	12		332	5	-	-	-	-	-	-	0	-	-	-
	Chemical Storage airseal	-	-	1538	3	-	-	-	-	-	-	0	-	-	-
	UV Building airseal	-	-	3584	0	1	50	-	-	-	-	0	-	-	-
	Pump House 2 airseal	-	-	16344	0	-	-	-	-	-	-	580	-	-	-
	Pump House 2 insulate	-	-	22339	0	-	-	-		-	-	0		580	-
Huntsdale SFH															
	Admin airseal	-	59	418.05	7	-	-	-	-	-	-	0	-	-	-
	Cold Hatch Hs airseal	-	33	0	4	-	-	-	-	-	-	0	-	-	-
	Cold Hatch Hs insulate	-	398	0	0	-	-	-	4,557	-	-	0	-	-	-
	Warm Hatch airseal	-	100		6	2	-	-	-	-	-	0	-	-	-
	Large Generator Rm airsea	-	-	6650.87	2	-	-	-	-	-	-	416	-	-	-
	Large Generator Rm insula	-	-	13923.51	0	-	-	-	416	-	-	0	-	-	-

Zerodraft Central Pennsylvania

Pa Fish & Boat Commission

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Site	Building	Gas saved mcf	oil saved gallons	elect saved kwh	weatherstrip mandoors	weatherstrip OHD's	foam roof edge	airseal attic	Insulate attic	wx & ins attic hatch	pulldown stair cover	truss bottom sheathing	wall sheathing	wall insulate	caulk ceiling jts
Linesville SFH															
	Visitor Admin airseal	76	-	1377	5	3	140	-	-	0	-	-	-	-	-
	Garage airseal	179	-	0	7	7	370	-	-	0	-	-	-	-	-
	Pump House airseal	9	-	0	2	-	-	-	-	0	1	-	-	-	-
	Pump House insulate	147	-	0	0	-	-	-	1,024	0	-	-	-	-	-
	Well Gen. Bldg airseal	56	-	0	1	-	-	-	-	0	-	-	-	-	225
Oswayo SFH															
	Garage/Hatch Hs airseal	43	-	0	7	5	-	-	-	0	-	-	-	-	-
	Generator Bldg airseal	-	-	729.77	1	-	-	-	-	1	-	-	-	-	-
PFBC H2															
	Headquarters	6	-	267.55	8	-	-	-	-	0	-	-	-	-	-
	Server Room														
Pleasant Gap SFH															
	Admin/Visitor airseal	18	-	389.42	4	-	60	-	-	0	-	-	-	-	-
	Hatch House airseal	4	-	0	3	-	-	-	-	0	1	-	-	-	-
	Hatch House insulate	-	-	0	0	-	-	-	4,558	0	-	-	-	-	-
	Lower Garage airseal	6	-	0	2	-	-	-	-	0	-	-	-	-	-
	Lower Garage insulate	-	-	0	0	-	-	-	4,558	0	-	-	-	-	-
	Upper Garage airseal	16	-	0	3	-	-	-	-	0	-	-	-	-	-
	Generator Bldg airseal	-	-	1488.32	1	1	-	-	-	0	-	-	-	-	-
	Micro Screen airseal	-	-	2284.41	3	-	-	-	-	3	-	-	-	-	-
Pleasant Mount SFH															
	Carpenter Mtnc airseal	-	193	0	0	6	-	-	-	0	-	-	-	-	-
	Upper Garage airseal	-	22	0	2	-	-	-	-	0	-	-	-	-	-
	Hatch House 2 airseal	-	32	0	6	-	-	-	-	0	-	-	-	-	-
Reynoldsdale SFH															
	Admin/Visitor airseal	-	165	433.51	8	5	-	-	-	0	-	-	-	-	-
	Hatch House airseal	-	88	0	8	-	-	-	-	1	-	-	-	-	-
	Hatch House insulate	-	569	0	0	-	-	-	5,244	0	-	-	-	-	-
	Oxygen Inj Rm airseal	-	-	26.33	1	-	-	-	-	0	-	-	-	-	-
	Water Treatment airseal	-	68	0	4	1	-	-	-	0	-	-	-	-	-

Zerodraft Central Pennsylvania

Pa Fish & Boat Commission

3/6/2020

Site	Building	Gas saved mcf	oil saved gallons	elect saved kwh	weatherstrip mandoors	weatherstrip OHD's	foam roof edge	airseal attic	Insulate attic	wx & ins attic hatch	pulldown stair cover	truss bottom sheathing	wall sheathing	wall insulate	caulk ceiling jts
Tionesta SFH															
	Hatch House airseal	14	-	0	9	-	-	-	-	3	-	-	-	-	-
	Hatch House insulate	63	-	0	0	-	-	-	5,280	0	-	-	-	-	-
	Visitor Center airseal	510	-	8507.95	3	1	-	-	-	0	-	3,250	-	-	-
	Chemical Storage airseal	12	-	0	2	-	-	-	-	1	-	-	-	-	-
	Chemical Storage insulate	10	-	0	0	-	-	-	800	0	-	-	-	-	-
	Garage airseal	42	-	0	1	1	-	-	-	0	-	108	-	-	-
	Garage insulate	15	-	0	0	-	-	-	108	0	-	-	-	-	-
	Fish Mgt House airseal	97		1616.03	0	-	346	-	-	1	-	-	-	-	-
	Fish Mgt House insulate	21	-	0	0	-	-	-	1,750	0	-	-	-	-	-
		-	-	0	0	-	-	-	-	0	-	-	-	-	-
Tylersville SFH															
	Breakroom airseal		102	0	1	-	-	-	-	0	-	1,728	-	-	-
	Hatch House airseal	-	-	0	11	-	-	-	-	0	1	-	-	-	2,435
	Hatch House Insulate	-	655	0	0	-	-	-	6,560	0	-	-	-	-	-
	Feed/Garage airseal	-	117	0	3	2	-	-	-	2	-	-	-	-	-
	Feed/Garage insulate	-	126	0	0	-	-	-	1,260	0	-	-	-	-	-
	Admin airseal	-	593	2777.39	0	-	-	-	-	0	-	1,126	-	-	-
Union City SFH															
	Hatch Hs/Office airseal	53	1,417	0	2	-	-	-	-	7	-	250	-	-	-
	Hatch Hs/Office insulate	46	-	2322.74	0	-	-	-	2,244	0	-	-	-	-	-
	Garage airseal	12	-	0	2	-	-	-	-	0	-	-	-	-	-

ECM: **Owner's ECM #04**

Title: **Replace Window AC and Baseboard Heat with MZ Heat Pump**

Project: **PA Fish and Boat Commission**
Site: **Union City State Fish Hatchery**

Description Replace window unit AC and baseboard heat with multizone ductless heat pump system including programmable or occupancy based controls.

GENERAL			Symbol
Annual site electric use	82,069	kwh	A
Annual site natural gas use	21,385	CCF	B
Annual site fuel oil use	-	Gallons	C
Electric energy unit cost		$/kwh	D
Electric demand unit cost		$/kwd	E
Natural gas unit cost		$/CCF	F
Fuel oil unit cost		$/Gallon	G
HHV of natural gas	103,000	BTU/CC	H
HHV of fuel oil	139,000	BTU/Ga	I
Current hours per week in occupied mode	168		J
New hours per week in occupied mode	50		K

AIR CONDITIONING to be replaced with heat pump or VRF			
No. of window AC units to be replaced	1		L
Average capacity of window unit AC	12,000	BTUh	M
Combined capacity of all units	1.0	tons	N = L x M / 12,000
Average SEER of all units	12	BTU/watt	O
Annual hours of operation	2,700	(65º F balance pt)	P
Demand diversity factor	1.0		Q
Annual load factor	35%		R
Existing annual demand	5	kwd	S = N x (12/O) x Q x 5 (mo/yr)
Existing annual energy consumption	945	kwh = 1.2% of total	T = N x (12/O) x P x R
New SEER with heat pump or VRF	25	BTU/watt	U
New annual demand	2	kwd	V = S x (O/U)
Interim new annual energy consumption	454		W = T x (O/U)
Percent reduction in occupied hours	70%		X = (J - K) / K
Cooling diversity factor	50%		Y
New annual energy consumption	270	kwh	Z = W x (1 - X) / Y

HEATING to be replaced with heat pump or VRF

	Electric resistance		HW from gas boiler	HW from oil boiler		Symbol
No. of heating units to be replaced	-		-	-		A
Average capacity output of heating unit	-	kw	-	-	MBH	B
Combined capacity of all units	-	kw	-	-	MBH	C = A x B
Average system efficiency	100%		70%	70%		D
Combined input of all units	-	kw	-	-	MBH	E = C / D
Demand diversity factor	100%		100%	100%		F
Existing annual demand	-	kwd	NA	NA		G = E x F x 6 (mo/yr)
Annual hours of operation	5,000		5,000	5,000		H
Annual load factor	35%		35%	35%		I
Annual energy consumed	-	kwh	-	-	MBTU	J = E x H x I
		CCF	-	-	Gal	K = J / HHV of fuel
Percent of total site consumption	NA		NA	NA		
New COP with heat pump or VRF	5.3		5.3	5.3		L
New annual demand	-	kwd				M_1 = G / L
			-	-	kwd	M_2 = C / 3.413 x F / L x 6 (mo/yr)
Interim new annual energy used	-	kwh				N_1 = J / L
Interim new annual energy used			-	-	kwh	N_2 = J x D / L / 3.413
Percent reduction in occupied hours	70%		70%	70%		O = X from AC calcs above
Heating diversity factor	60%		60%	60%		P
New annual energy consumption	-	kwh	-	-	kwh	Q = N x (1 - O) / P

Result

	KWH (AC + heat)	KWD (AC + heat)	CCF	Gallons
Annual Existing Energy Use	945	5	-	-
Annual Proposed Energy Use	270	2	-	-
Annual Proposed Energy Savings	**675**	**3**	**-**	**-**
Percent Saved	71%	52%	NA	NA
Annual Proposed Cost Savings	**$0**	**$0**	**$0**	**$0**

ECM: **Owner's ECM #05**

Title **Add or integrate automated controls on existing VFDs**
Project **PA Fish and Boat Commission**
Site **Bellefonte State Fish Hatchery**

Description Calculate the energy savings by adding a feedback loop to control an existing VFD rather than current practice of manually controlling the pump speed.

Given

Electric Energy Costs	=		$/kWh
Electric Demand Charge	=		$/kWd
Total Operating Hours per Year	=	8,760	hrs
Motor Horsepower	=	60	HP
Motor Rated Efficiency	=	90%	
Existing System Control	=	VFD w/ no press reset	
Proposed System Control	=	VFD w/ 2/3 press reset	

Assumption

Demand Utilization Factor (DUF)	=	100%	(Estimate, percent of time that pump system is on during peak demand period)
Operating Months per Year	=	12	Months
Pump Load Factor	=	0.70	

Operating Schedule

% of Flow	100%	90%	80%	70%	60%	50%	40%	Total	
% of Time (Existing)	5%	15%	35%	20%	20%	5%	0%	100%	OK
% of Time (Proposed)	5%	15%	35%	20%	20%	5%	0%	100%	OK

Formula

EXISTING CONDITIONS
*Pump kWh Used = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (Annual Op Hours x % of Time at % Flow)
*Pump kW Dem'd = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (% of Time at % Flow x DUF x Months/year)

PROPOSED CONDITIONS
*Pump kWh Used After Conversion = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (Annual Op Hours x % of Time at % Flow)
*Pump kW Dem'd After Conversion = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (% of Time at % Flow x DUF x Months/year)

*NOTE: THIS CALCULATION IS DONE AT EVERY FLOW

Calculation

EXISTING CONDITIONS

*Pump kWh Used	HP		Load Factor		% Flow		Exponent	Conversion (HP to kW)		Efficiency		Annual Op Hrs		% of Time at % Flow		
at 100% Airflow	= (60.00	x	0.70	x (	100%	^	2.7	) x 0.746	/	90%	) x (	8,760.00	x	5%	) =	15,248
at 90% Airflow	= (60.00	x	0.70	x (	90%	^	2.7	) x 0.746	/	90%	) x (	8,760.00	x	15%	) =	34,419
at 80% Airflow	= (60.00	x	0.70	x (	80%	^	2.7	) x 0.746	/	90%	) x (	8,760.00	x	35%	) =	58,433
at 70% Airflow	= (60.00	x	0.70	x (	70%	^	2.7	) x 0.746	/	90%	) x (	8,760.00	x	20%	) =	23,283
at 60% Airflow	= (60.00	x	0.70	x (	60%	^	2.7	) x 0.746	/	90%	) x (	8,760.00	x	20%	) =	15,356
at 50% Airflow	= (60.00	x	0.70	x (	50%	^	2.7	) x 0.746	/	90%	) x (	8,760.00	x	5%	) =	2,347
at 40% Airflow	= (60.00	x	0.70	x (	40%	^	2.7	) x 0.746	/	90%	) x (	8,760.00	x	0%	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>															149,087 kWh

*Pump kW Dem'd	HP		Load Factor		% Flow		Exponent	Conversion (HP to kW)		Efficiency		% of Time at % Flow		DUF		Months/Yr		
at 100% Airflow	= (60.00	x	0.70	x (	100%	^	2.7	) x 0.746	/	90%	)x(	5%	x	100%	x	12	) =	20.9
at 90% Airflow	= (60.00	x	0.70	x (	90%	^	2.7	) x 0.746	/	90%	)x(	15%	x	100%	x	12	) =	47.1
at 80% Airflow	= (60.00	x	0.70	x (	80%	^	2.7	) x 0.746	/	90%	)x(	35%	x	100%	x	12	) =	80.0
at 70% Airflow	= (60.00	x	0.70	x (	70%	^	2.7	) x 0.746	/	90%	)x(	20%	x	100%	x	12	) =	31.9
at 60% Airflow	= (60.00	x	0.70	x (	60%	^	2.7	) x 0.746	/	90%	)x(	20%	x	100%	x	12	) =	21.0
at 50% Airflow	= (60.00	x	0.70	x (	50%	^	2.7	) x 0.746	/	90%	)x(	5%	x	100%	x	12	) =	3.2
at 40% Airflow	= (60.00	x	0.70	x (	40%	^	2.7	) x 0.746	/	90%	)x(	0%	x	100%	x	12	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>																	204.2 kW

PROPOSED CONDITIONS

*Pump kWh Used After Conversion	HP		Load Factor		% Flow		Exponent	Conversion (HP to kW)		Efficiency		Annual Op Hrs		% of Time at % Flow		
at 100% Airflow	= (60.00	x	0.70	x (	100%	^	2.9	) x 0.746	/	90%	) x (	8,760	x	5%	) =	15,248
at 90% Airflow	= (60.00	x	0.70	x (	90%	^	2.9	) x 0.746	/	90%	) x (	8,760	x	15%	) =	33,701
at 80% Airflow	= (60.00	x	0.70	x (	80%	^	2.9	) x 0.746	/	90%	) x (	8,760	x	35%	) =	55,883
at 70% Airflow	= (60.00	x	0.70	x (	70%	^	2.9	) x 0.746	/	90%	) x (	8,760	x	20%	) =	21,680
at 60% Airflow	= (60.00	x	0.70	x (	60%	^	2.9	) x 0.746	/	90%	) x (	8,760	x	20%	) =	13,865
at 50% Airflow	= (60.00	x	0.70	x (	50%	^	2.9	) x 0.746	/	90%	) x (	8,760	x	5%	) =	2,043
at 40% Airflow	= (60.00	x	0.70	x (	40%	^	2.9	) x 0.746	/	90%	) x (	8,760	x	0%	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>															142,420 kWh

*Pump kW Dem'd After Conversion	HP		Load Factor		% Flow		Exponent	Conversion (HP to kW)		Efficiency		% of Time at % Flow		DUF		Months		
at 100% Airflow	= (60.00	x	0.70	x (	100%	^	2.9	) x 0.746	/	90%	)x(	5%	x	100%	x	12	) =	20.9
at 90% Airflow	= (60.00	x	0.70	x (	90%	^	2.9	) x 0.746	/	90%	)x(	15%	x	100%	x	12	) =	46.2
at 80% Airflow	= (60.00	x	0.70	x (	80%	^	2.9	) x 0.746	/	90%	)x(	35%	x	100%	x	12	) =	76.6
at 70% Airflow	= (60.00	x	0.70	x (	70%	^	2.9	) x 0.746	/	90%	)x(	20%	x	100%	x	12	) =	29.7
at 60% Airflow	= (60.00	x	0.70	x (	60%	^	2.9	) x 0.746	/	90%	)x(	20%	x	100%	x	12	) =	19.0
at 50% Airflow	= (60.00	x	0.70	x (	50%	^	2.9	) x 0.746	/	90%	)x(	5%	x	100%	x	12	) =	2.8
at 40% Airflow	= (60.00	x	0.70	x (	40%	^	2.9	) x 0.746	/	90%	)x(	0%	x	100%	x	12	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>																	195.1 kW

Result

Annual Exist. Consumption	**149,087**	**kWh**	**=>**	$	-	
Annual Exist. Demand	**204.2**	**kW**	**=>**	$	-	
TOTAL EXIST COST PER YEAR				$	-	
Annual Proposed Consumption	**142,420**	**kWh**	**=>**	$	-	
Annual Proposed Demand	**195.1**	**kW**	**=>**	$	-	
TOTAL NEW COST PER YEAR				$	-	
100% **Annual Usage Savings**	**6,666**	**kWh**	**=>**	$	-	percent saved 4.5%
Annual Demand Savings	**9**	**kW**	**=>**	$	-	percent saved 4.5%
TOTAL SAVINGS PER YEAR				**$**	**-**	

Comments Includes 15 HP in upper LHO, 10 HP in intermediate LHO, 15 HP in mid point LHO, and 20 HP at well #2. Excludes effluent filter pumps that are assumed to already be automatically controlled.

ECM: Owner's ECM #05

Title Add or integrate automated controls on existing VFDs
Project PA Fish and Boat Commission
Site Corry State Fish Hatchery

Description Calculate the energy savings by adding a feedback loop to control an existing VFD rather than current practice of manually controlling the pump speed.

Given

Electric Energy Costs	=		$/kWh
Electric Demand Charge	=		$/kWd
Total Operating Hours per Year	=	8,760	hrs
Motor Horsepower	=	100	HP
Motor Rated Efficiency	=	90%	
Existing System Control	=	VFD w/ no press reset	
Proposed System Control	=	VFD w/ 2/3 press reset	

Assumption

Demand Utilization Factor (DUF)	=	100%	(Estimate, percent of time that pump system is on during peak demand period)
Operating Months per Year	=	12	Months
Pump Load Factor	=	0.70	

Operating Schedule

% of Flow	100%	90%	80%	70%	60%	50%	40%	Total	
% of Time (Existing)	5%	15%	35%	20%	20%	5%	0%	100%	OK
% of Time (Proposed)	5%	15%	35%	20%	20%	5%	0%	100%	OK

Formula

EXISTING CONDITIONS
*Pump kWh Used = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (Annual Op Hours x % of Time at % Flow)
*Pump kW Dem'd = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (% of Time at % Flow x DUF x Months/year)

PROPOSED CONDITIONS
*Pump kWh Used After Conversion = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (Annual Op Hours x % of Time at % Flow)
*Pump kW Dem'd After Conversion = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (% of Time at % Flow x DUF x Months/year)

*NOTE: THIS CALCULATION IS DONE AT EVERY FLOW

Calculation

EXISTING CONDITIONS

***Pump kWh Used**

	HP		Load Factor		% Flow		Exponent		Conversion (HP to kW)		Efficiency		Annual Op Hrs		% of Time at % Flow		
at 100% Airflow	= (100.00	x	0.70	x (	100%	^	2.7	) x	0.746	/	90%	) x (	8,760.00	x	5%	) =	25,414
at 90% Airflow	= (100.00	x	0.70	x (	90%	^	2.7	) x	0.746	/	90%	) x (	8,760.00	x	15%	) =	57,365
at 80% Airflow	= (100.00	x	0.70	x (	80%	^	2.7	) x	0.746	/	90%	) x (	8,760.00	x	35%	) =	97,389
at 70% Airflow	= (100.00	x	0.70	x (	70%	^	2.7	) x	0.746	/	90%	) x (	8,760.00	x	20%	) =	38,805
at 60% Airflow	= (100.00	x	0.70	x (	60%	^	2.7	) x	0.746	/	90%	) x (	8,760.00	x	20%	) =	25,594
at 50% Airflow	= (100.00	x	0.70	x (	50%	^	2.7	) x	0.746	/	90%	) x (	8,760.00	x	5%	) =	3,911
at 40% Airflow	= (100.00	x	0.70	x (	40%	^	2.7	) x	0.746	/	90%	) x (	8,760.00	x	0%	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>																248,478 kWh

***Pump kW Dem'd**

	HP		Load Factor		% Flow		Exponent		Conversion (HP to kW)		Efficiency		% of Time at % Flow		DUF		Months/Yr		
at 100% Airflow	= (100.00	x	0.70	x (	100%	^	2.7	) x	0.746	/	90%	)x(	5%	x	100%	x	12	) =	34.8
at 90% Airflow	= (100.00	x	0.70	x (	90%	^	2.7	) x	0.746	/	90%	)x(	15%	x	100%	x	12	) =	78.6
at 80% Airflow	= (100.00	x	0.70	x (	80%	^	2.7	) x	0.746	/	90%	)x(	35%	x	100%	x	12	) =	133.4
at 70% Airflow	= (100.00	x	0.70	x (	70%	^	2.7	) x	0.746	/	90%	)x(	20%	x	100%	x	12	) =	53.2
at 60% Airflow	= (100.00	x	0.70	x (	60%	^	2.7	) x	0.746	/	90%	)x(	20%	x	100%	x	12	) =	35.1
at 50% Airflow	= (100.00	x	0.70	x (	50%	^	2.7	) x	0.746	/	90%	)x(	5%	x	100%	x	12	) =	5.4
at 40% Airflow	= (100.00	x	0.70	x (	40%	^	2.7	) x	0.746	/	90%	)x(	0%	x	100%	x	12	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>																		340.4 kW

PROPOSED CONDITIONS

***Pump kWh Used After Conversion**

	HP		Load Factor		% Flow		Exponent		Conversion (HP to kW)		Efficiency		Annual Op Hrs		% of Time at % Flow		
at 100% Airflow	= (100.00	x	0.70	x (	100%	^	2.9	) x	0.746	/	90%	) x (	8,760	x	5%	) =	25,414
at 90% Airflow	= (100.00	x	0.70	x (	90%	^	2.9	) x	0.746	/	90%	) x (	8,760	x	15%	) =	56,169
at 80% Airflow	= (100.00	x	0.70	x (	80%	^	2.9	) x	0.746	/	90%	) x (	8,760	x	35%	) =	93,138
at 70% Airflow	= (100.00	x	0.70	x (	70%	^	2.9	) x	0.746	/	90%	) x (	8,760	x	20%	) =	36,134
at 60% Airflow	= (100.00	x	0.70	x (	60%	^	2.9	) x	0.746	/	90%	) x (	8,760	x	20%	) =	23,108
at 50% Airflow	= (100.00	x	0.70	x (	50%	^	2.9	) x	0.746	/	90%	) x (	8,760	x	5%	) =	3,405
at 40% Airflow	= (100.00	x	0.70	x (	40%	^	2.9	) x	0.746	/	90%	) x (	8,760	x	0%	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>																237,367 kWh

***Pump kW Dem'd After Conversion**

	HP		Load Factor		% Flow		Exponent		Conversion (HP to kW)		Efficiency		% of Time at % Flow		DUF		Months		
at 100% Airflow	= (100.00	x	0.70	x (	100%	^	2.9	) x	0.746	/	90%	)x(	5%	x	100%	x	12	) =	34.8
at 90% Airflow	= (100.00	x	0.70	x (	90%	^	2.9	) x	0.746	/	90%	)x(	15%	x	100%	x	12	) =	76.9
at 80% Airflow	= (100.00	x	0.70	x (	80%	^	2.9	) x	0.746	/	90%	)x(	35%	x	100%	x	12	) =	127.6
at 70% Airflow	= (100.00	x	0.70	x (	70%	^	2.9	) x	0.746	/	90%	)x(	20%	x	100%	x	12	) =	49.5
at 60% Airflow	= (100.00	x	0.70	x (	60%	^	2.9	) x	0.746	/	90%	)x(	20%	x	100%	x	12	) =	31.7
at 50% Airflow	= (100.00	x	0.70	x (	50%	^	2.9	) x	0.746	/	90%	)x(	5%	x	100%	x	12	) =	4.7
at 40% Airflow	= (100.00	x	0.70	x (	40%	^	2.9	) x	0.746	/	90%	)x(	0%	x	100%	x	12	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>																		325.2 kW

Result

Annual Exist. Consumption	**248,478**	**kWh**	**=>**	$	-		
Annual Exist. Demand	**340.4**	**kW**	**=>**	$	-		
TOTAL EXIST COST PER YEAR				$	-		
Annual Proposed Consumption	**237,367**	**kWh**	**=>**	$	-		
Annual Proposed Demand	**325.2**	**kW**	**=>**	$	-		
TOTAL NEW COST PER YEAR				$	-		
100% **Annual Usage Savings**	**11,111**	**kWh**	**=>**	$	-	percent saved	4.5%
Annual Demand Savings	**15**	**kW**	**=>**	$	-	percent saved	4.5%
TOTAL SAVINGS PER YEAR				**$**	**-**		

Comments Includes 20 HP recirculation pump in hatch house, 20 HP P-7 pump, and (1) 60 HP off site well.

ECM: **Owner's ECM #05**

Title **Add or integrate automated controls on existing VFDs**
Project **PA Fish and Boat Commission**
Site **Oswayo State Fish Hatchery**

Description Calculate the energy savings by adding a feedback loop to control an existing VFD rather than current practice of manually controlling the pump speed.

Given

Electric Energy Costs	=		$/kWh
Electric Demand Charge	=		$/kWd
Total Operating Hours per Year	=	8,760	hrs
Motor Horsepower	=	20	HP
Motor Rated Efficiency	=	90%	
Existing System Control	=	VFD w/ no press reset	
Proposed System Control	=	VFD w/ 2/3 press reset	

Assumption

Demand Utilization Factor (DUF)	=	100%	(Estimate, percent of time that pump system is on during peak demand period)
Operating Months per Year	=	12	Months
Pump Load Factor	=	0.70	

Operating Schedule

% of Flow	100%	90%	80%	70%	60%	50%	40%	Total	
% of Time (Existing)	5%	15%	35%	20%	20%	5%	0%	100%	OK
% of Time (Proposed)	5%	15%	35%	20%	20%	5%	0%	100%	OK

Formula

EXISTING CONDITIONS
*Pump kWh Used = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (Annual Op Hours x % of Time at % Flow)
*Pump kW Dem'd = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (% of Time at % Flow x DUF x Months/year)

PROPOSED CONDITIONS
*Pump kWh Used After Conversion = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (Annual Op Hours x % of Time at % Flow)
*Pump kW Dem'd After Conversion = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (% of Time at % Flow x DUF x Months/year)

*NOTE: THIS CALCULATION IS DONE AT EVERY FLOW

Calculation

EXISTING CONDITIONS

***Pump kWh Used**

	HP		Load Factor		% Flow		Exponent	Conversion (HP to kW)		Efficiency		Annual Op Hrs		% of Time at % Flow		
at 100% Airflow	= (20.00	x	0.70	x (	100%	^	2.7	) x 0.746	/	90%	) x (	8,760.00	x	5%	) =	5,083
at 90% Airflow	= (20.00	x	0.70	x (	90%	^	2.7	) x 0.746	/	90%	) x (	8,760.00	x	15%	) =	11,473
at 80% Airflow	= (20.00	x	0.70	x (	80%	^	2.7	) x 0.746	/	90%	) x (	8,760.00	x	35%	) =	19,478
at 70% Airflow	= (20.00	x	0.70	x (	70%	^	2.7	) x 0.746	/	90%	) x (	8,760.00	x	20%	) =	7,761
at 60% Airflow	= (20.00	x	0.70	x (	60%	^	2.7	) x 0.746	/	90%	) x (	8,760.00	x	20%	) =	5,119
at 50% Airflow	= (20.00	x	0.70	x (	50%	^	2.7	) x 0.746	/	90%	) x (	8,760.00	x	5%	) =	782
at 40% Airflow	= (20.00	x	0.70	x (	40%	^	2.7	) x 0.746	/	90%	) x (	8,760.00	x	0%	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>															49,696 kWh

***Pump kW Dem'd**

	HP		Load Factor		% Flow		Exponent	Conversion (HP to kW)		Efficiency		% of Time at % Flow		DUF		Months/Yr		
at 100% Airflow	= (20.00	x	0.70	x (	100%	^	2.7	) x 0.746	/	90%	)x(	5%	x	100%	x	12	) =	7.0
at 90% Airflow	= (20.00	x	0.70	x (	90%	^	2.7	) x 0.746	/	90%	)x(	15%	x	100%	x	12	) =	15.7
at 80% Airflow	= (20.00	x	0.70	x (	80%	^	2.7	) x 0.746	/	90%	)x(	35%	x	100%	x	12	) =	26.7
at 70% Airflow	= (20.00	x	0.70	x (	70%	^	2.7	) x 0.746	/	90%	)x(	20%	x	100%	x	12	) =	10.6
at 60% Airflow	= (20.00	x	0.70	x (	60%	^	2.7	) x 0.746	/	90%	)x(	20%	x	100%	x	12	) =	7.0
at 50% Airflow	= (20.00	x	0.70	x (	50%	^	2.7	) x 0.746	/	90%	)x(	5%	x	100%	x	12	) =	1.1
at 40% Airflow	= (20.00	x	0.70	x (	40%	^	2.7	) x 0.746	/	90%	)x(	0%	x	100%	x	12	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>																	68.1 kW

PROPOSED CONDITIONS

***Pump kWh Used After Conversion**

	HP		Load Factor		% Flow		Exponent	Conversion (HP to kW)		Efficiency		Annual Op Hrs		% of Time at % Flow		
at 100% Airflow	= (20.00	x	0.70	x (	100%	^	2.9	) x 0.746	/	90%	) x (	8,760	x	5%	) =	5,083
at 90% Airflow	= (20.00	x	0.70	x (	90%	^	2.9	) x 0.746	/	90%	) x (	8,760	x	15%	) =	11,234
at 80% Airflow	= (20.00	x	0.70	x (	80%	^	2.9	) x 0.746	/	90%	) x (	8,760	x	35%	) =	18,628
at 70% Airflow	= (20.00	x	0.70	x (	70%	^	2.9	) x 0.746	/	90%	) x (	8,760	x	20%	) =	7,227
at 60% Airflow	= (20.00	x	0.70	x (	60%	^	2.9	) x 0.746	/	90%	) x (	8,760	x	20%	) =	4,622
at 50% Airflow	= (20.00	x	0.70	x (	50%	^	2.9	) x 0.746	/	90%	) x (	8,760	x	5%	) =	681
at 40% Airflow	= (20.00	x	0.70	x (	40%	^	2.9	) x 0.746	/	90%	) x (	8,760	x	0%	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>															47,473 kWh

***Pump kW Dem'd After Conversion**

	HP		Load Factor		% Flow		Exponent	Conversion (HP to kW)		Efficiency		% of Time at % Flow		DUF		Months		
at 100% Airflow	= (20.00	x	0.70	x (	100%	^	2.9	) x 0.746	/	90%	)x(	5%	x	100%	x	12	) =	7.0
at 90% Airflow	= (20.00	x	0.70	x (	90%	^	2.9	) x 0.746	/	90%	)x(	15%	x	100%	x	12	) =	15.4
at 80% Airflow	= (20.00	x	0.70	x (	80%	^	2.9	) x 0.746	/	90%	)x(	35%	x	100%	x	12	) =	25.5
at 70% Airflow	= (20.00	x	0.70	x (	70%	^	2.9	) x 0.746	/	90%	)x(	20%	x	100%	x	12	) =	9.9
at 60% Airflow	= (20.00	x	0.70	x (	60%	^	2.9	) x 0.746	/	90%	)x(	20%	x	100%	x	12	) =	6.3
at 50% Airflow	= (20.00	x	0.70	x (	50%	^	2.9	) x 0.746	/	90%	)x(	5%	x	100%	x	12	) =	0.9
at 40% Airflow	= (20.00	x	0.70	x (	40%	^	2.9	) x 0.746	/	90%	)x(	0%	x	100%	x	12	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>																	65.0 kW

Result

Annual Exist. Consumption	**49,696**	**kWh**	**=>**	$	-	
Annual Exist. Demand	**68.1**	**kW**	**=>**	$	-	
TOTAL EXIST COST PER YEAR				$	-	
Annual Proposed Consumption	**47,473**	**kWh**	**=>**	$	-	
Annual Proposed Demand	**65.0**	**kW**	**=>**	$	-	
TOTAL NEW COST PER YEAR				$	-	
100% **Annual Usage Savings**	**2,222**	**kWh**	**=>**	$	-	percent saved 4.5%
Annual Demand Savings	**3**	**kW**	**=>**	$	-	percent saved 4.5%
TOTAL SAVINGS PER YEAR				**$**	**-**	

Comments Includes (1) 20 HP recirculating pump.

ECM: Owner's ECM #05

Title Add or integrate automated controls on existing VFDs
Project PA Fish and Boat Commission
Site Pleasant Gap State Fish Hatchery

Description Calculate the energy savings by adding a feedback loop to control an existing VFD rather than current practice of manually controlling the pump speed.

Given

Electric Energy Costs	=		$/kWh
Electric Demand Charge	=		$/kWd
Total Operating Hours per Year	=	8,760	hrs
Motor Horsepower	=	97.5	HP
Motor Rated Efficiency	=	90%	
Existing System Control	=	VFD w/ no press reset	
Proposed System Control	=	VFD w/ 2/3 press reset	

Assumption

Demand Utilization Factor (DUF)	=	100%	(Estimate, percent of time that pump system is on during peak demand period)
Operating Months per Year	=	12	Months
Pump Load Factor	=	0.70	

Operating Schedule

% of Flow	100%	90%	80%	70%	60%	50%	40%	Total	
% of Time (Existing)	5%	15%	35%	20%	20%	5%	0%	100%	OK
% of Time (Proposed)	5%	15%	35%	20%	20%	5%	0%	100%	OK

Formula

EXISTING CONDITIONS
*Pump kWh Used = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (Annual Op Hours x % of Time at % Flow)
*Pump kW Dem'd = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (% of Time at % Flow x DUF x Months/year)

PROPOSED CONDITIONS
*Pump kWh Used After Conversion = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (Annual Op Hours x % of Time at % Flow)
*Pump kW Dem'd After Conversion = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (% of Time at % Flow x DUF x Months/year)

*NOTE: THIS CALCULATION IS DONE AT EVERY FLOW

Calculation

EXISTING CONDITIONS

***Pump kWh Used**

	HP		Load Factor		% Flow		Exponent		Conversion (HP to kW)		Efficiency		Annual Op Hrs		% of Time at % Flow		
at 100% Airflow	= (97.50	x	0.70	x (	100%	^	2.7	) x	0.746	/	90%	) x (	8,760.00	x	5%	) =	24,778
at 90% Airflow	= (97.50	x	0.70	x (	90%	^	2.7	) x	0.746	/	90%	) x (	8,760.00	x	15%	) =	55,931
at 80% Airflow	= (97.50	x	0.70	x (	80%	^	2.7	) x	0.746	/	90%	) x (	8,760.00	x	35%	) =	94,954
at 70% Airflow	= (97.50	x	0.70	x (	70%	^	2.7	) x	0.746	/	90%	) x (	8,760.00	x	20%	) =	37,835
at 60% Airflow	= (97.50	x	0.70	x (	60%	^	2.7	) x	0.746	/	90%	) x (	8,760.00	x	20%	) =	24,954
at 50% Airflow	= (97.50	x	0.70	x (	50%	^	2.7	) x	0.746	/	90%	) x (	8,760.00	x	5%	) =	3,813
at 40% Airflow	= (97.50	x	0.70	x (	40%	^	2.7	) x	0.746	/	90%	) x (	8,760.00	x	0%	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>																242,266 kWh

***Pump kW Dem'd**

	HP		Load Factor		% Flow		Exponent		Conversion (HP to kW)		Efficiency		% of Time at % Flow		DUF		Months/Yr		
at 100% Airflow	= (97.50	x	0.70	x (	100%	^	2.7	) x	0.746	/	90%	)x(	5%	x	100%	x	12	) =	33.9
at 90% Airflow	= (97.50	x	0.70	x (	90%	^	2.7	) x	0.746	/	90%	)x(	15%	x	100%	x	12	) =	76.6
at 80% Airflow	= (97.50	x	0.70	x (	80%	^	2.7	) x	0.746	/	90%	)x(	35%	x	100%	x	12	) =	130.1
at 70% Airflow	= (97.50	x	0.70	x (	70%	^	2.7	) x	0.746	/	90%	)x(	20%	x	100%	x	12	) =	51.8
at 60% Airflow	= (97.50	x	0.70	x (	60%	^	2.7	) x	0.746	/	90%	)x(	20%	x	100%	x	12	) =	34.2
at 50% Airflow	= (97.50	x	0.70	x (	50%	^	2.7	) x	0.746	/	90%	)x(	5%	x	100%	x	12	) =	5.2
at 40% Airflow	= (97.50	x	0.70	x (	40%	^	2.7	) x	0.746	/	90%	)x(	0%	x	100%	x	12	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>																		331.9 kW

PROPOSED CONDITIONS

***Pump kWh Used After Conversion**

	HP		Load Factor		% Flow		Exponent		Conversion (HP to kW)		Efficiency		Annual Op Hrs		% of Time at % Flow		
at 100% Airflow	= (97.50	x	0.70	x (	100%	^	2.9	) x	0.746	/	90%	) x (	8,760	x	5%	) =	24,778
at 90% Airflow	= (97.50	x	0.70	x (	90%	^	2.9	) x	0.746	/	90%	) x (	8,760	x	15%	) =	54,764
at 80% Airflow	= (97.50	x	0.70	x (	80%	^	2.9	) x	0.746	/	90%	) x (	8,760	x	35%	) =	90,810
at 70% Airflow	= (97.50	x	0.70	x (	70%	^	2.9	) x	0.746	/	90%	) x (	8,760	x	20%	) =	35,230
at 60% Airflow	= (97.50	x	0.70	x (	60%	^	2.9	) x	0.746	/	90%	) x (	8,760	x	20%	) =	22,531
at 50% Airflow	= (97.50	x	0.70	x (	50%	^	2.9	) x	0.746	/	90%	) x (	8,760	x	5%	) =	3,320
at 40% Airflow	= (97.50	x	0.70	x (	40%	^	2.9	) x	0.746	/	90%	) x (	8,760	x	0%	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>																231,433 kWh

***Pump kW Dem'd After Conversion**

	HP		Load Factor		% Flow		Exponent		Conversion (HP to kW)		Efficiency		% of Time at % Flow		DUF		Months		
at 100% Airflow	= (97.50	x	0.70	x (	100%	^	2.9	) x	0.746	/	90%	)x(	5%	x	100%	x	12	) =	33.9
at 90% Airflow	= (97.50	x	0.70	x (	90%	^	2.9	) x	0.746	/	90%	)x(	15%	x	100%	x	12	) =	75.0
at 80% Airflow	= (97.50	x	0.70	x (	80%	^	2.9	) x	0.746	/	90%	)x(	35%	x	100%	x	12	) =	124.4
at 70% Airflow	= (97.50	x	0.70	x (	70%	^	2.9	) x	0.746	/	90%	)x(	20%	x	100%	x	12	) =	48.3
at 60% Airflow	= (97.50	x	0.70	x (	60%	^	2.9	) x	0.746	/	90%	)x(	20%	x	100%	x	12	) =	30.9
at 50% Airflow	= (97.50	x	0.70	x (	50%	^	2.9	) x	0.746	/	90%	)x(	5%	x	100%	x	12	) =	4.5
at 40% Airflow	= (97.50	x	0.70	x (	40%	^	2.9	) x	0.746	/	90%	)x(	0%	x	100%	x	12	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>																		317.0 kW

Result

Annual Exist. Consumption	**242,266**	**kWh**	**=>**	$	-	
Annual Exist. Demand	**331.9**	**kW**	**=>**	$	-	
TOTAL EXIST COST PER YEAR				$	-	
Annual Proposed Consumption	**231,433**	**kWh**	**=>**	$	-	
Annual Proposed Demand	**317.0**	**kW**	**=>**	$	-	
TOTAL NEW COST PER YEAR				$	-	
100% **Annual Usage Savings**	**10,833**	**kWh**	**=>**	$	-	percent saved 4.5%
Annual Demand Savings	**15**	**kW**	**=>**	$	-	percent saved 4.5%
TOTAL SAVINGS PER YEAR				**$**	**-**	

Comments Includes 7.5 HP hatch house aerator, 20 HP hydrostatic pump, 15 HP spring house building pump, 15 HP oxygen supply pump, and (1) 40 HP filtration plant pump.

ECM: **Owner's ECM #05**

Title **Add or integrate automated controls on existing VFDs**
Project **PA Fish and Boat Commission**
Site **Tionesta State Fish Hatchery**

Description Calculate the energy savings by adding a feedback loop to control an existing VFD rather than current practice of manually controlling the pump speed.

Given

Electric Energy Costs	=		$/kWh
Electric Demand Charge	=		$/kWd
Total Operating Hours per Year	=	8,760	hrs
Motor Horsepower	=	90	HP
Motor Rated Efficiency	=	90%	
Existing System Control	=	VFD w/ no press reset	
Proposed System Control	=	VFD w/ 2/3 press reset	

Assumption

Demand Utilization Factor (DUF)	=	100%	(Estimate, percent of time that pump system is on during peak demand period)
Operating Months per Year	=	12	Months
Pump Load Factor	=	0.70	

Operating Schedule

% of Flow	100%	90%	80%	70%	60%	50%	40%	Total	
% of Time (Existing)	5%	15%	35%	20%	20%	5%	0%	100%	OK
% of Time (Proposed)	5%	15%	35%	20%	20%	5%	0%	100%	OK

Formula

EXISTING CONDITIONS
*Pump kWh Used = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (Annual Op Hours x % of Time at % Flow)
*Pump kW Dem'd = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (% of Time at % Flow x DUF x Months/year)

PROPOSED CONDITIONS
*Pump kWh Used After Conversion = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (Annual Op Hours x % of Time at % Flow)
*Pump kW Dem'd After Conversion = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (% of Time at % Flow x DUF x Months/year)

*NOTE: THIS CALCULATION IS DONE AT EVERY FLOW

Calculation

EXISTING CONDITIONS

***Pump kWh Used**

	HP		Load Factor		% Flow		Exponent		Conversion (HP to kW)		Efficiency		Annual Op Hrs		% of Time at % Flow		
at 100% Airflow	= (90.00	x	0.70	x (	100%	^	2.7	) x	0.746	/	90%	) x (	8,760.00	x	5%	) =	22,872
at 90% Airflow	= (90.00	x	0.70	x (	90%	^	2.7	) x	0.746	/	90%	) x (	8,760.00	x	15%	) =	51,628
at 80% Airflow	= (90.00	x	0.70	x (	80%	^	2.7	) x	0.746	/	90%	) x (	8,760.00	x	35%	) =	87,650
at 70% Airflow	= (90.00	x	0.70	x (	70%	^	2.7	) x	0.746	/	90%	) x (	8,760.00	x	20%	) =	34,925
at 60% Airflow	= (90.00	x	0.70	x (	60%	^	2.7	) x	0.746	/	90%	) x (	8,760.00	x	20%	) =	23,035
at 50% Airflow	= (90.00	x	0.70	x (	50%	^	2.7	) x	0.746	/	90%	) x (	8,760.00	x	5%	) =	3,520
at 40% Airflow	= (90.00	x	0.70	x (	40%	^	2.7	) x	0.746	/	90%	) x (	8,760.00	x	0%	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>																223,630 kWh

***Pump kW Dem'd**

	HP		Load Factor		% Flow		Exponent		Conversion (HP to kW)		Efficiency		% of Time at % Flow		DUF		Months/Yr		
at 100% Airflow	= (90.00	x	0.70	x (	100%	^	2.7	) x	0.746	/	90%	)x(	5%	x	100%	x	12	) =	31.3
at 90% Airflow	= (90.00	x	0.70	x (	90%	^	2.7	) x	0.746	/	90%	)x(	15%	x	100%	x	12	) =	70.7
at 80% Airflow	= (90.00	x	0.70	x (	80%	^	2.7	) x	0.746	/	90%	)x(	35%	x	100%	x	12	) =	120.1
at 70% Airflow	= (90.00	x	0.70	x (	70%	^	2.7	) x	0.746	/	90%	)x(	20%	x	100%	x	12	) =	47.8
at 60% Airflow	= (90.00	x	0.70	x (	60%	^	2.7	) x	0.746	/	90%	)x(	20%	x	100%	x	12	) =	31.6
at 50% Airflow	= (90.00	x	0.70	x (	50%	^	2.7	) x	0.746	/	90%	)x(	5%	x	100%	x	12	) =	4.8
at 40% Airflow	= (90.00	x	0.70	x (	40%	^	2.7	) x	0.746	/	90%	)x(	0%	x	100%	x	12	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>																		306.3 kW

PROPOSED CONDITIONS

***Pump kWh Used After Conversion**

	HP		Load Factor		% Flow		Exponent		Conversion (HP to kW)		Efficiency		Annual Op Hrs		% of Time at % Flow		
at 100% Airflow	= (90.00	x	0.70	x (	100%	^	2.9	) x	0.746	/	90%	) x (	8,760	x	5%	) =	22,872
at 90% Airflow	= (90.00	x	0.70	x (	90%	^	2.9	) x	0.746	/	90%	) x (	8,760	x	15%	) =	50,552
at 80% Airflow	= (90.00	x	0.70	x (	80%	^	2.9	) x	0.746	/	90%	) x (	8,760	x	35%	) =	83,824
at 70% Airflow	= (90.00	x	0.70	x (	70%	^	2.9	) x	0.746	/	90%	) x (	8,760	x	20%	) =	32,520
at 60% Airflow	= (90.00	x	0.70	x (	60%	^	2.9	) x	0.746	/	90%	) x (	8,760	x	20%	) =	20,797
at 50% Airflow	= (90.00	x	0.70	x (	50%	^	2.9	) x	0.746	/	90%	) x (	8,760	x	5%	) =	3,064
at 40% Airflow	= (90.00	x	0.70	x (	40%	^	2.9	) x	0.746	/	90%	) x (	8,760	x	0%	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>																213,630 kWh

***Pump kW Dem'd After Conversion**

	HP		Load Factor		% Flow		Exponent		Conversion (HP to kW)		Efficiency		% of Time at % Flow		DUF		Months		
at 100% Airflow	= (90.00	x	0.70	x (	100%	^	2.9	) x	0.746	/	90%	)x(	5%	x	100%	x	12	) =	31.3
at 90% Airflow	= (90.00	x	0.70	x (	90%	^	2.9	) x	0.746	/	90%	)x(	15%	x	100%	x	12	) =	69.2
at 80% Airflow	= (90.00	x	0.70	x (	80%	^	2.9	) x	0.746	/	90%	)x(	35%	x	100%	x	12	) =	114.8
at 70% Airflow	= (90.00	x	0.70	x (	70%	^	2.9	) x	0.746	/	90%	)x(	20%	x	100%	x	12	) =	44.5
at 60% Airflow	= (90.00	x	0.70	x (	60%	^	2.9	) x	0.746	/	90%	)x(	20%	x	100%	x	12	) =	28.5
at 50% Airflow	= (90.00	x	0.70	x (	50%	^	2.9	) x	0.746	/	90%	)x(	5%	x	100%	x	12	) =	4.2
at 40% Airflow	= (90.00	x	0.70	x (	40%	^	2.9	) x	0.746	/	90%	)x(	0%	x	100%	x	12	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>																		292.6 kW

Result

Annual Exist. Consumption	**223,630**	**kWh**	**=>**	$	-	
Annual Exist. Demand	**306.3**	**kW**	**=>**	$	-	
TOTAL EXIST COST PER YEAR				$	-	
Annual Proposed Consumption	**213,630**	**kWh**	**=>**	$	-	
Annual Proposed Demand	**292.6**	**kW**	**=>**	$	-	
TOTAL NEW COST PER YEAR				$	-	
100% **Annual Usage Savings**	**10,000**	**kWh**	**=>**	$	-	percent saved 4.5%
Annual Demand Savings	**14**	**kW**	**=>**	$	-	percent saved 4.5%
TOTAL SAVINGS PER YEAR				**$**	**-**	

Comments Includes 10 HP hatch house hot water pump, 20 HP well #1, 40 HP well #2, and 20 HP well #3.

ECM: **Owner's ECM #07--SUMMARY**

TITLE: **Electric to Gas DHW Heater Conversion**
PROJECT: **PA Fish and Boat Commission**
SITE: **Multiple**

Location	Description of measure	Annual kwh saved	Annual kw saved	Annual CCF saved (cost)
Linesville	Convert electric DHW heaters to gas	1,203	54	(41)
Pleasant Gap	Convert electric DHW heaters to gas	1,783	120	(61)
Tionesta	Convert electric DHW heaters to gas	1,203	54	(41)
	Total	**4,190**	**228**	**(143)**

ECM: **Owner's ECM #07**

TITLE: **Electric to Gas DHW Heater Conversion**
PROJECT: **PA Fish and Boat Commission**
SITE: **Linesville State Fish Hatchery--Admin. Bldg.**

DESCRIPTION: When fuel costs are less expensive than electric, converting from electric to fuel heating results in reduce cost.

Water Heater Input	=	4.5	Kw
Operation (Hours/Week)	=	168	Hours/Week
Operation (Heating Weeks/Year)	=	52	Weeks/Year
Operation (Hours/Year)	=	8736	Hours/Year
Annual Electric use	=	591,547	Kwh

ASSUMPTION:

Efficiency (Fuel)	=	95%	
Efficiency (Electric)	=	98%	
Operating Months per Year	=	12	
Part Load Factor	=	3%	
Utilization Factor (Demand)	=	100%	
Domestic water supply temp	=	55	Degrees F
DHW heater set point	=	130	Degrees F
Average gallons per day	=	25	based on 5 days/wk

FORMULA:
Energy Use (Kwh) = (Capacity(Kw)) x (Hours of Operation/Year) x (Part Load Factor) / (Electric Efficiency)
Fuel Use (Unit) = (Electrical Use(Kwh)) x (3413 btu/kw) x (Electrical Efficiency) / (Fuel Efficiency) / (Heating Value of Fuel)
Energy Demand (Kw) = (Capacity (Kw)) x (Months/Year) x (Demand Utilization Factor)
Electrical Energy Cost ($) = (Energy Cost (Kwh) x ($/Kwh)) + (Demand (Kw) x ($/Kw))
Fuel Energy Cost ($) = ((Fuel Use(Unit) x Fuel Cost($/Unit))

CALCULATION:

Heating Value for Gallon of Water = 8.35 x (130 - 55) = **626.3** **btu/gal**

	Capacity		Hours/Year		Part Load Factor		Efficiency (Electric)		
Electric Usage = (	4.5	)x(	8736	)x(	3%	)/(	98%	) =	**1,203 Kwh**

	Electrical Use		Conversion		Efficiency (Electric)		Efficiency (Fuel)		Conversion		
Fuel Usage = (	1,203	)x(	3,413	) x (	98%	)/(	95%	)/(	103,000	) =	**41 CCF**

	Capacity		Months/Year		Utilization Factor		
Electric Demand =(	4.5	)*(	12	)*(	100%	) =	**54 Kw**

Result

	Existing Annual Use=	**1,203**	**Kwh**	**54 Kw**	**0.20% of annual use**
	Proposed Annual Use=			**41 CCF**	
100%	**Annual Savings=**	**1,203**	**Kwh**	**54 Kw**	**0.20% of annual use**
	Savings as Percent of Existing	**=**		**(41) CCF**	

COMMENTS: This ECM applies to electric DHW in Administration building only. See separate ECM for replacing existing natural gas fired unit in maintenance area with a high efficiency gas fired unit.

ECM: **Owner's ECM #07**

TITLE: **Electric to Gas DHW Heater Conversion**
PROJECT: **PA Fish and Boat Commission**
SITE: **Pleasant Gap State Fish Hatchery**

DESCRIPTION: When fuel costs are less expensive than electric, converting from electric to fuel heating results in reduce cost.

Water Heater Input	=	10	Kw (total of both heaters)
Operation (Hours/Week)	=	168	Hours/Week
Operation (Heating Weeks/Year)	=	52	Weeks/Year
Operation (Hours/Year)	=	8736	Hours/Year
Annual Electric use	=	210,736	Kwh

ASSUMPTION:

Efficiency (Fuel)	=	95%	
Efficiency (Electric)	=	98%	
Operating Months per Year	=	12	
Part Load Factor	=	2%	
Utilization Factor (Demand)	=	100%	
Domestic water supply temp	=	55	Degrees F
DHW heater set point	=	130	Degrees F
Average gallons per day	=	37	based on 5 days/wk

FORMULA:
Energy Use (Kwh) = (Capacity(Kw)) x (Hours of Operation/Year) x (Part Load Factor) / (Electric Efficiency)
Fuel Use (Unit) = (Electrical Use(Kwh)) x (3413 btu/kw) x (Electrical Efficiency) / (Fuel Efficiency) / (Heating Value of Fuel)
Energy Demand (Kw) = (Capacity (Kw)) x (Months/Year) x (Demand Utilization Factor)
Electrical Energy Cost ($) = (Energy Cost (Kwh) x ($/Kwh)) + (Demand (Kw) x ($/Kw))
Fuel Energy Cost ($) = ((Fuel Use(Unit) x Fuel Cost($/Unit))

CALCULATION:

Heating Value for Gallon of Water = 8.35 x (130 - 55) = **626.3** **btu/gal**

	Capacity		Hours/Year		Part Load Factor		Efficiency (Electric)		
Electric Usage = (	10	)x(	8736	)x(	2%	)/(	98%	) =	**1,783 Kwh**

	Electrical Use		Conversion		Efficiency (Electric)		Efficiency (Fuel)		Conversion		
Fuel Usage = (	1,783	)x(	3,413	) x (	98%	)/(	95%	)/(	103,000	) =	**61 CCF**

	Capacity		Months/Year		Utilization Factor		
Electric Demand =(	10	)*(	12	)*(	100%	) =	**120 Kw**

Result

Existing Annual Use=	**1,783**	**Kwh**	**120 Kw**	**0.85% of annual use**
Proposed Annual Use=			**61 CCF**	
100% **Annual Savings=**	**1,783**	**Kwh**	**120 Kw**	**0.85% of annual use**
Savings as Percent of Existing =			**(61) CCF**	

COMMENTS: This ECM applies to the 80 gallon unit in the garage/fab area and the 50 gallon unit in the hatchery. It does not include the Point Of Consumption units in the administration building.

ECM: **Owner's ECM #07**

TITLE: **Electric to Gas DHW Heater Conversion**
PROJECT: **PA Fish and Boat Commission**
SITE: **Tionesta State Fish Hatchery**

DESCRIPTION: When fuel costs are less expensive than electric, converting from electric to fuel heating results in reduce cost.

Water Heater Input	=	4.5	Kw
Operation (Hours/Week)	=	168	Hours/Week
Operation (Heating Weeks/Year)	=	52	Weeks/Year
Operation (Hours/Year)	=	8736	Hours/Year
Annual Electric use	=	430,553	Kwh

ASSUMPTION:

Efficiency (Fuel)	=	95%	
Efficiency (Electric)	=	98%	
Operating Months per Year	=	12	
Part Load Factor	=	3%	
Utilization Factor (Demand)	=	100%	
Domestic water supply temp	=	55	Degrees F
DHW heater set point	=	130	Degrees F
Average gallons per day	=	25	based on 5 days/wk

FORMULA:
Energy Use (Kwh) = (Capacity(Kw)) x (Hours of Operation/Year) x (Part Load Factor) / (Electric Efficiency)
Fuel Use (Unit) = (Electrical Use(Kwh)) x (3413 btu/kw) x (Electrical Efficiency) / (Fuel Efficiency) / (Heating Value of Fuel)
Energy Demand (Kw) = (Capacity (Kw)) x (Months/Year) x (Demand Utilization Factor)
Electrical Energy Cost ($) = (Energy Cost (Kwh) x ($/Kwh)) + (Demand (Kw) x ($/Kw))
Fuel Energy Cost ($) = ((Fuel Use(Unit) x Fuel Cost($/Unit))

CALCULATION:

Heating Value for Gallon of Water = 8.35 x (130 - 55) = **626.3** **btu/gal**

	Capacity		Hours/Year		Part Load Factor		Efficiency (Electric)		
Electric Usage = (	4.5	)x(	8736	)x(	3%	)/(	98%	) =	**1,203 Kwh**

	Electrical Use		Conversion		Efficiency (Electric)		Efficiency (Fuel)		Conversion		
Fuel Usage = (	1,203	)x(	3,413	) x (	98%	)/(	95%	)/(	103,000	) =	**41 CCF**

	Capacity		Months/Year		Utilization Factor		
Electric Demand =(	4.5	)*(	12	)*(	100%	) =	**54 Kw**

Result

Existing Annual Use=	**1,203**	**Kwh**	**54 Kw**	**0.28% of annual use**
Proposed Annual Use=			**41 CCF**	
100% **Annual Savings=**	**1,203**	**Kwh**	**54 Kw**	**0.28% of annual use**
Savings as Percent of Existing	**=**		**(41) CCF**	

COMMENTS:

ECM: **Owner's ECM #09--SUMMARY**

TITLE: **Retro-commissioning including unoccupied setback**
PROJECT: **PA Fish and Boat Commission**
SITE: **Headquarters**

Description of measure	Annual kwh saved	Annual kw saved	Annual CCF saved
Scheduling of equipment based on occupancy	127,502	-	7,819
Retro-commissioning	4,510	-	130
Total	**132,012**	**-**	**7,949**

ECM: **Owner's ECM #09**

TITLE: **Retro-commissioning: Scheduling of HVAC system based on occupancy**
PROJECT: **PA Fish and Boat Commission**
SITE: **Headquarters**

DESCRIPTION: Retro-commission building HVAC system including implementation of occupied/unoccupied schedules

METHODOLOGY: Calculates savings from reducing run time on HVAC equipment and closing outside air dampers during unoccupied times. Does not account for savings due to reduced conduction through the building envelope.

GIVENS/ASSUMPTIONS:		UNITS	SYMBOL:	SOURCE NOTES:
Present operational period	168	hrs/wk	A	Survey Information
Proposed operational period	60	hrs/wk	B	Proposed Operation
Cooling coil setpoint. (55 F)	23.5	BTU/lb	C	Psychometric Information (55 DB
Heating coil setpoint	90	F	D	Engineering Estimate
Average cooling season O.A. enthalpy	30.0	BTU/lb	E	Weather Data (75 DB / 60% RH)
Average heating season O.A. temperature	34.0	F	F	Weather Data (weighted average
Cooling season length	24	wk/yr	G	Weather Data
Heating season length	24	wk/yr	H	Weather Data
Boiler efficiency	90%		I	Based on Fulton Pulse Boilers
Chiller performance factor (IPLV)	0.60	KW/ton	J	Based on York YVAA chiller
Building temperature limit diversity factor	70%		K	Engineering Estimate
Avoided cost of gas		/CCF	L	Utility Data
Avoided cost of electricity (off peak)		/KWH	M	Estimate of energy only
Total fan motor power	75	HP	N	AHU fan nameplate data
Motor load factor	50%		O	Engineering Estimate (net of VFD
Total outside air flow	6,605	CFM	P	10% of total AHU capacity
Annual opertional period	52	wk/yr	Q	Operational Period
Power conversion factor	0.746	KW/HP		Conversion Factor
Air mass conversion factor	4.50	lb/hr-CFM		Conversion Factor
Specific heat of air	1.08	BTU/CFM-F		Conversion Factor
Heating conversion factor	103,000	BTU/CCF		Conversion Factor
Cooling conversion factor	12,000	BTU/ton-hr		Conversion Factor

UTILITY SAVINGS CALCULATIONS:

	Baseline	Post Retrofit	Savings	
Fan Energy (kWh/yr)	171,073	61,097	109,975	11% of annual use
Cooling Energy (kWh/yr)	27,264	9,737	17,527	2% of annual use
Heating Energy (CCF/yr)	12,163	4,344	7,819	44% of annual use
Electric cost ($/yr)				
Gas cost ($/yr)				
Total utility cost ($/yr)				

UTILITY SAVINGS FORMULAS:

Baseline Fan Consumption = Baseline Operating Hours x Fan HP x motor load factor x 0.746 x temp diversity
R = A x Q x N x O x 0.746 x K

Post Retrofit Fan Consumption = Post Retrofit Hours x Fan HP x motor load factor x 0.746 x temp diversity
S = B x Q x N x O x 0.746 x K

Fan Consumption Savings = Baseline Fan Consumption - Post-Retrofit Fan Consumption
T = R - S

Baseline Cooling Consumption = [(Cooling period x baseline weekly hours x chiller factor) / 12000] x vent CFM x 4.5 x enthaply difference x temp diversity
U = [(G x A x J) / 12000] x P x 4.5 x (E - C) x K

Post Retrofit Cooling Consumption = [(Cooling period x Post Retrofit weekly hours x chiller factor) / 12000] x vent CFM x 4.5 x enthaply difference x temp diversity
V = [(G x B x J) / 12000] x P x 4.5 x (E - C) x K

Cooling Consumption Savings = Baseline Cooling Consumption - Post Retrofit Cooling Consumption
W = U - V

Baseline Heating Consumption = [(heating period x Baseline weekly hours) / (BTU/CCF x boiler eff.)] x vent CFM x 1.08 x temperature difference x temp diversity
X = [(H x A) / (1,000,000 x I)] x P x 1.08 x (D - F) x K

Post Retrofit Heating Consumption = [(heating period x Post Retrofit weekly hours) / (BTU/CCF x boiler eff.)] x vent CFM x 1.08 x temperature difference x temp diversity
Y= [(H x B) / (1,000,000 x I)] x P x 1.08 x (D - F) x K

Heating Consumption Savings = Baseline Heating Consumption - Post Retrofit Heating Consumption
Z = X - Y

Cost Savings = (Fan Savings + Cooling Savings) x ($/kWh) + (Heating Savings) x ($/CCF)
= [(T + W) x M] + (Z x L)

ECM: **Owner's ECM #09**

TITLE: **Retro-commissioning: Other**
PROJECT: **PA Fish and Boat Commission**
SITE: **Headquarters**

DESCRIPTION: Retro-commission building HVAC algorithms other than occupancy based scheduling

METHODOLOGY: Includes adjustment of hot/chilled water reset schedules, demand based ventilation set points and algorithms, duct pressure set points, space temperature set points, etc.

ASSUMPTIONS:		**UNITS**	**SYMBOL:**	**SOURCE NOTES:**
Annual electric used for HVAC	150,328	kwh	A	Utility data, Equip. nameplate, NSB calc
Percent saved with retro-commissioning	3%		B	Engineering estimate
Annual electric saved	4,510	kwh	C = A x B	Calculation
Annual site natural gas consumption	4,344	CCF	F	Utility data, NSB calc
Percent saved with retro-commissioning	3%		G	Engineering estimate
Annual natural gas saved	130	CCF	H = F x G	Calculation

ECM: **Owner's ECM #10--SUMMARY**

TITLE: **Convert Unit Heaters To Radiant Heat**
PROJECT: **PA Fish and Boat Commission**
SITE: **Multiple**

Location	Description of measure	Annual CCF saved	Annual Gallons saved
Benner Springs	Convert Unit Heaters To Radiant Heat		1,151
Pleasant Gap	Convert Unit Heaters To Radiant Heat	1,942	
	Total	**1,942**	**1,151**

ECM: **Owner's ECM #10**

Title **Infrared Heating System Retrofit Savings**

Project **PA Fish and Boat Commission**
Site **Benner Springs State Fish Hatchery**

Description Calculate savings of infrared heating system vs. conventional heating system.

Given

Mounted height of infrared system	=	20	feet
Existing Unit Capacity	=	200	MBtu/hr
Energy Heating Value	=	139	Mbh/gallon
Operating hours per year	=	5,000	hours *Staff indicates unit heaters never used*
Annual site fuel use	=	5,732	units

Assumption

Radiant adjustment to heat loss	=	80%	
Part Load Percentage	=	30%	*used to balance model*
Existing Heating Efficiency	=	75%	

Formula

Height adjustment to heat loss = ((Mounted ht - 20 ft) x (1%)) + (1)
Existing Bldg Energy Use = (Existing unit capacity) x (Part Load Percentage) x (Operating hrs) / (efficiency) / (energy heating value)
New Bldg Energy Use = (Ex.unit capacity) x (Part Load %) x (radiant adjustment) x (height adj.) x (operating hrs) / (energy heating value)
Existing Cost = (Existing bldg energy use) x (gas rate)
New Cost = (new bldg energy use) x (gas rate)
Radiant Cost Savings = (existing cost - new cost)

Calculation

	Mounted ht.			% / ft			
Height adj to heat loss	= (20	-	20) x (	0.01	) +	1.0	= **1.00**

	Ex. Capacity		Part Load %		Op. hrs		eff.		heat val			
Existing Bldg Energy Use	= (200	) x (	30%	) x (	5,000	) / (	75%	) / (	139	) =	**2,878 gallons**	50%

	Ex. Capacity		Part Load %		radiant adj		ht. Adj		op. hrs		heat val		
New Bldg Energy Use	= (200	) x (	30%	) x (	80%	) x (	1.00	) x (	5,000	) / (	139	) =	**1,727 gallons**

Result

Annual Existing Heating Use	**2,878**	**gallons**
Annual Proposed Heating Use	**1,727**	**gallons**
Annual Proposed Heating Savings	**1,151**	**gallons**

Comment Includes replacing (2) hot water unit heaters in maintenance garage. Excludes units in hatchery (staff indicates that they are not currently in use) and chemical storage room due to not being good applications for radiant heat technology.

ECM: **Owner's ECM #10**

Title **Infrared Heating System Retrofit Savings**

Project Site **PA Fish and Boat Commission**
Pleasant Gap State Fish Hatchery

Description Calculate savings of infrared heating system vs. conventional heating system.

Given

Mounted height of infrared system	=	20	feet
Existing Unit Capacity	=	750	MBtu/hr
Energy Heating Value	=	103	Mbh/CCF
Operating hours per year	=	5,000	hours *based on 50º balance point*
Annual site fuel use	=	9,694	units

Assumption

Radiant adjustment to heat loss	=	80%	
Part Load Percentage	=	10%	*used to balance model*
Existing Heating Efficiency	=	75%	

Formula

Height adjustment to heat loss = ((Mounted ht - 20 ft) x (1%)) + (1)
Existing Bldg Energy Use = (Existing unit capacity) x (Part Load Percentage) x (Operating hrs) / (efficiency) / (energy heating value)
New Bldg Energy Use = (Ex.unit capacity) x (Part Load %) x (radiant adjustment) x (height adj.) x (operating hrs) / (energy heating value)
Existing Cost = (Existing bldg energy use) x (gas rate)
New Cost = (new bldg energy use) x (gas rate)
Radiant Cost Savings = (existing cost - new cost)

Calculation

	Mounted ht.		% / ft			
Height adj to heat loss	= (20	- 20) x (	0.01	) + 1.0	=	**1.00**

	Ex. Capacity	Part Load %	Op. hrs	eff.	heat val		
Existing Bldg Energy Use	= (750	) x (10%	) x (5,000	) / (75%	) / (103	) =	**4,854 CCF** 50%

	Ex. Capacity	Part Load %	radiant adj	ht. Adj	op. hrs	heat val		
New Bldg Energy Use	= (750	) x (10%	) x (80%	) x (1.00	) x (5,000	) / (103	) =	**2,913 CCF**

Result

Annual Existing Heating Use	**4,854**	**CCF**	
Annual Proposed Heating Use	**2,913**	**CCF**	
Annual Proposed Heating Savings	**1,942**	**CCF**	**40% of existing**

Comment Includes replacing (5) hot water unit heater in upper garage/vehicle maintenance/fabrication building. Excludes (2) units in hatchery due to not being a good application for radiant technology.

ECM: **Owner's ECM #11**

TITLE: **Boiler Replacement, fuel switch if feasible**
PROJECT: **PA Fish and Boat Commission**
SITE: **Pleasant Mount SFH--Hatch House #2**

DESCRIPTION: Replace existing oil fired boiler with high efficiency propane boiler of similar size and operation.

GIVEN:

Existing Fuel (oil) Energy Cost	=		$/Gallon
High Heating Value of Existing Fuel	=	139,000	BTU/Gallon
New Fuel (propane) Energy Cost	=		$/Gallon
High Heating Value of New Fuel	=	95,000	BTU/Gallon
Boiler Plant Capacity	=	100	Mbh
Operation (Hours/Week)	=	168	Hours/Week
Operation (Heating Weeks/Year)	=	24	Weeks/Year
Operation (Hours/Year)	=	4,032	Hours/Year
Annual Building Heat Energy Use	=	20,994	Fuel units

ASSUMPTION:

Existing Efficiency (Combustion)	=	70%
Existing Efficiency (Dist./Losses)	=	95%
New Efficiency (Combustion)	=	93%
New Efficiency (Dist./Losses)	=	95%
Part Load Factor	=	35%

FORMULA: Energy Usage = (Capacity(Mbh)) x (Hours of Operation/Year) x (Part Load Factor) / (Combustion Efficiency x Distribution Efficiency)
Fuel Use (Unit) = (Usage (Mbh)) / (Heating Value of Fuel)
Fuel Energy Cost ($) = ((Fuel Use(Unit) x Fuel Cost($/Unit))

CALCULATION:

	Capacity	Hours/Year	Part Load Factor	Efficiency (Comb.)	Efficiency (Dist.)	
Existing Energy Use = (	100)x(	4032)x(	35%)/((	70%)x(	95%)) =	**212,211 Mbtu**
New Energy Use = (	100)x(	4032)x(	35%)/((	93%)x(	95%)) =	**159,728 Mbtu**

	Usage (Mbtu)	Conversion(Mbtu/Gallon)		
Existing Fuel Use = (	212,211)/(	139) =	**1,527 Gallons of oil**	7% of total
New Fuel Use = (	159,728)/(	95) =	**1,681 Gallons of propane**	

	Gallons	$/fuel unit	
Existing Fuel Cost = (	**1,527**)*(	$0.000) =	**$ -**
Existing Fuel Cost = (	**1,681**)*(	$0.000) =	**$ -**

Result

	Gal of oil	Gal of propane	
Existing Annual Use =	**1,527**	**-**	**$ -**
Proposed Annual Use =	**-**	**1,681**	**$ -**
Annual Savings =	**1,527**	**(1,681)**	**$ -**

COMMENTS: Includes building heating boiler in hatch house #2 only. Natural gas not economically available to this site. Boiler will be converted to propane which complements ESCO ECM #01 which is to convert the fish water heaters to propane as well.

ECM: **Owner's ECM #12**

TITLE: **Reclaim energy from heated water**
PROJECT: **PA Fish and Boat Commission**
SITE: **Pleasant Mount SFH--Hatch House #2**

DESCRIPTION: Add heat reclamation system as primary means to heat well/spring water and use existing water heaters as supplemental.

High Heating Value (HHV) Of Fuel Oil	=	139,000	BTU/Gallon	
Water Heater Plant Capacity	=	1,390	Mbh	*Based on 2 of 3 units*
Operation (Hours/Week)	=	168	Hours/Week	
Operation (Heating Weeks/Year)	=	52	Weeks/Year	
Annual Operating Hours	=	8,736	Hours/Year	
Annual Site Fuel Usage	=	20,994	Gallons per year	

ASSUMPTION:

Average Load Factor	=	15%	*Adjust to calibrate model*	
Annual Fuel Used To Heat Fish Water (Gallons)	=	13,104	=	62% of site oil consumption
Existing Water Heater Combustion Efficiency	=	70%		
Existing Distribution Efficiency	=	95%		
Actual Thermal Load (Gallons per year)		8,714	Gallons per year	
Effectiveness Of New Heat Reclamation System	=	95%		
Actual Thermal Load Offset	=	8,278	Gallons per year	
New Fuel Usage	=	4,826	Gallons per year	
Additional Horsepower For Booster Pump(s)	=	5	HP	
Load Factor On Booster Pump(s)	=	70%		
Annual electric consumed	=	22,810	kwh	
Annual demand (monthly x 12)	=	31.3	kwd	

FORMULA:
Existing Fuel Usage = (Capacity(Mbh)) x 1,000 x (Hours of Operation/Year) x (Part Load Factor) / HHV
Actual Thermal Load = Existing Fuel Usage x Combustion Efficiency x Distribution Efficiency
Actual Thermal Load Offset = Actual Thermal Load x Effectiveness of New Heat Reclamation System
Annual Electric Consumed = Addl HP x Load Factor x 0.746 x Annual Operating Hours
Annual Electric Demand = Addl. HP x Load Factor x 0.746 x 12 months per year

CALCULATION:

	Capacity (Mbh)	Hours/Year	Part Load Factor	BTU/Mbh	HHV #2 Oil	
Existing Fuel Usage = (	1390)x(	8736) x (	15%) x (	1,000)/(	139,000) =	**13,104 Gallons**

	Exist Fuel Use	Comb. Effic.	Dist. Effic.		
Actual Thermal Load = (	13,104)x(	70%) x (	95%)	=	**8,714 Gallons**

	Actual Load	Heat Reclaim Effectiveness			
Actual Load Offset (Svgs) = (	8,714)x(	95%) = (		=	**8,278 Gallons**

	Addl. HP	Load Factor	kw/HP	Annual Oper Hrs		
New Electric Usage = (	5)x(	70%) x (	0.746) x (	8,736)	=	**22,810 kwh**

	Addl. HP	Load Factor	kw/HP	months/year	
New Electric Demand = (	5	70%)*(	0.746) x (	12)	**31.3 kwd**

Result

	Existing Annual Fuel Oil Use =	**13,104 Gallons**	**62% of total fuel**
	Proposed Annual Fuel Oil Use =	**4,826 Gallons**	
100%	**Annual Savings In Fuel Oil**	**8,278 Gallons**	**63%**
	Annual Savings (Cost) in Electric Energy =	**(22,810) kwh**	
	Annual Savings (Cost) in Electric Demand =	**(31) kwd**	

COMMENTS:

ECM: **Owner's ECM #13**

TITLE: **Boiler and DHW Heater Replace**
PROJECT: **PA Fish and Boat Commission**
SITE: **Oswayo State Fish Hatchery**

DESCRIPTION: Replace existing boiler with new efficient, dual use boiler that would also supply domestic hot water via a heat exchanger.

Boiler Plant Capacity (output)	=	326	Mbh including existing DHW heater
Operation (Hours/Week)	=	168	Hours/Week
Operation (Heating Weeks/Year)	=	28	Weeks/Year
Operation (Hours/Year)	=	4704	Hours/Year
Thermal Energy Use (heat + DHW)	=	8246	Fuel units/Year

ASSUMPTION:

Existing Efficiency (Combustion)	=	75%
Existing Efficiency (Dist./Losses)	=	95%
New Efficiency (Combustion)	=	93%
New Efficiency (Dist./Losses)	=	95%
Part Load Factor	=	39%

FORMULA:
Energy Usage = (Capacity(Mbh)) x (Hours of Operation/Year) x (Part Load Factor) / (Combustion Efficiency x Distribution Efficiency)
Fuel Use (Unit) = (Usage (Mbh)) / (Heating Value of Fuel)
Fuel Energy Cost ($) = ((Fuel Use(Unit) x Fuel Cost($/Unit))

CALCULATION:

	Capacity		Hours/Year		Part Load Factor		Efficiency (Comb.)		Efficiency (Dist.)		
Existing Energy Usage =	326	)x(	4704	)x(	39%	)/((	75%	)x(	95%	)) =	**839,392 Mbtu**
New Energy Usage =	326	)x(	4704	)x(	39%	)/((	93%	)x(	95%	)) =	**676,929 Mbtu**

	Usage (Mbtu)		Conversion(Mbu/CCF	)	
Existing Fuel Usage =	839,392	)/(	103	) =	**8,149 CCF**
New Fuel Usage =	676,929	)/(	103	) =	**6,572 CCF**

Result

	Existing Annual Use =	**8,149 CCF**	**99% of total fuel**
	Proposed Annual Use =	**6,572 CCF**	
100%	**Annual Savings =**	**1,577 CCF**	
	Savings as Percent of Existing =	**19%**	**19% of total fuel**

COMMENTS:

ECM: **Owner's ECM #14**

TITLE: **Boiler and DHW Heater Replacement**
PROJECT: **PA Fish and Boat Commission**
SITE: **Tionesta State Fish Hatchery**

DESCRIPTION: Replace existing boiler with new efficient, dual use boiler that would also supply domestic hot water via a heat exchanger.

Boiler Plant Capacity (output)	=	485	Mbh (3 boilers + DHW Htr)
Operation (Hours/Week)	=	168	Hours/Week
Operation (Heating Weeks/Year)	=	28	Weeks/Year
Operation (Hours/Year)	=	4704	Hours/Year
Thermal Energy Use (heat + DHW)	=	4100	Fuel units/Year

ASSUMPTION:

Existing Efficiency (Combustion)	=	75%
Existing Efficiency (Dist./Losses)	=	95%
New Efficiency (Combustion)	=	93%
New Efficiency (Dist./Losses)	=	95%
Part Load Factor	=	10%

FORMULA: Energy Usage = (Capacity(Mbh)) x (Hours of Operation/Year) x (Part Load Factor) / (Combustion Efficiency x Distribution Efficiency)
Fuel Use (Unit) = (Usage (Mbh)) / (Heating Value of Fuel)
Fuel Energy Cost ($) = ((Fuel Use(Unit) x Fuel Cost($/Unit))

CALCULATION:

	Capacity		Hours/Year		Part Load Factor		Efficiency (Comb.)		Efficiency (Dist.)		
Existing Energy Usage =	(485	)x(	4704	)x(	10%	)/((	75%	)x(	95%	)) =	**320,202 Mbtu**
New Energy Usage =	(485	)x(	4704	)x(	10%	)/((	93%	)x(	95%	)) =	**258,228 Mbtu**

	Usage (Mbtu)		Conversion(Mbu/CCF	)	
Existing Fuel Usage =	(320,202	)/(	103	) =	**3,109 CCF**
New Fuel Usage =	(258,228	)/(	103	) =	**2,507 CCF**

Result

	Existing Annual Use =	**3,109**	**CCF**	**76% of total fuel**
	Proposed Annual Use =	**2,507**	**CCF**	
100%	**Annual Savings =**	**602**	**CCF**	
	Savings as Percent of Existing =		**19%**	**15% of total fuel**

COMMENTS: Excludes existing electric domestic hot water heater.

ECM: **Owner's ECM #16**

Title **Convert Electric Resistance Unit Heaters to Propane**
Alternate Used: Convert to Natural Gas

Project **PA Fish and Boat Commission**
Site **Corry State Fish Hatchery**

Description Calculate savings of converting electric unit heaters to natural gas fired (in lieu of propane) unit heaters.

Given

Existing Unit Capacity	=	20	kw
Conversion factor	=	3.413	MBH/kw
New (Equivalent) Unit Capacity	=	68	MBH
Energy Heating Value	=	103	kBTU/CCF
Fuel Cost	=		$/CCF
Electric energy cost	=		$/kwh
Electric demand cost	=		$/kwd
Operating hours per year	=	4,900	hours based on 55º F balance point

Assumption

Existing Heating Efficiency	=	100%
Existing Demand Conicidence	=	100%
Average load factor	=	40%
New efficiency	=	93%

Formula

Existing Energy Use (kwh) = (Existing unit capacity) x (Average load factor) x (Operating hrs) / (efficiency)
Existing Electric Demand (kwd) = (Existing unit capacity) x (Demand coincidence factor) x 6 month/year
New Energy Use (CCF) = (Ex.unit capacity) x (Avg. load %) / (new efficiency) x (operating hrs) / (energy heating value)
Existing Cost = (Existing energy use x $/kwh rate) + (Existing demand x $/kwd rate x 6 months)
New Cost = (New energy use) x (gas rate)
Conversion Cost Savings = (existing cost - new cost)

Calculation

	Ex. Cap. (kw)		Part Load %		Op. hrs		Ex. Effic.			
Existing Energy Use	= (20	) x (	40%	) x (	4,900	) / (	100%	) =	**39,200**	**kwh**

	Ex. Cap. (kw)		Dem. Coinc.		Ex. Effic.		Months/year			
Existing Electric Demand	= (20	) x (	100%	) / (	100%	) x (	6	) =	**120**	**kwd**

	New Cap. (MBH)		Avg. Load %		New Effic.		Op. Hrs.		Heating value			
New Energy Use	= (68	) x (	40%	) / (	93%	) x (	4,900	) / (	103	) =	**1,397**	**CCF**

	Energy use		Rate				
Existing Energy Cost	= (39,200	) x (	$0.00	) =			**$0**
Existing Demand Cost	= (120	) x (	$0.00	) x (	6	) =	**$0**
New Cost	= (1,397	) x (	$0.00	) =			**$0**

Result

	kwh	kwd	CCF		Cost
Annual Existing Heating Energy	**39,200**	**120**	**-**	**=**	**$0**
Annual Proposed Heating Energy	**-**	**-**	**1,397**	**=**	**$0**
Annual Savings (Cost)	**39,200**	**120**	**(1,397)**	**=**	**$0**

Comment

Includes (4) units in garage and (2) units in pole building. Replacing with natural gas in lieu of propane as suggested since natural gas is available at the site and would be preferable from an operational standpoint.

ECM: **Owner's ECM #18**

TITLE: **Electric to Gas DHW Heater Conversion**
PROJECT: **PA Fish and Boat Commission**
SITE: **Union City State Fish Hatchery**

DESCRIPTION: When fuel costs are less expensive than electric, converting from electric to fuel heating results in reduce cost.

Water Heater Input	=	4.5	Kw
Operation (Hours/Week)	=	168	Hours/Week
Operation (Heating Weeks/Year)	=	52	Weeks/Year
Operation (Hours/Year)	=	8736	Hours/Year
Annual Electric use	=	82,069	Kwh

ASSUMPTION:

Efficiency (Fuel)	=	95%	
Efficiency (Electric)	=	98%	
Operating Months per Year	=	12	
Part Load Factor	=	5%	
Utilization Factor (Demand)	=	100%	
Domestic water supply temp	=	55	Degrees F
DHW heater set point	=	130	Degrees F
Average gallons per day	=	42	based on 5 days/wk

FORMULA:
Energy Use (Kwh) = (Capacity(Kw)) x (Hours of Operation/Year) x (Part Load Factor) / (Electric Efficiency)
Fuel Use (Unit) = (Electrical Use(Kwh)) x (3413 btu/kw) x (Electrical Efficiency) / (Fuel Efficiency) / (Heating Value of Fuel)
Energy Demand (Kw) = (Capacity (Kw)) x (Months/Year) x (Demand Utilization Factor)
Electrical Energy Cost ($) = (Energy Cost (Kwh) x ($/Kwh)) + (Demand (Kw) x ($/Kw))
Fuel Energy Cost ($) = ((Fuel Use(Unit) x Fuel Cost($/Unit))

CALCULATION:

Heating Value for Gallon of Water = 8.35 x (130 - 55) = **626.3** **btu/gal**

	Capacity		Hours/Year		Part Load Factor		Efficiency (Electric)		
Electric Usage = (	4.5	)x(	8736	)x(	5%	)/(	98%	) =	**2,006 Kwh**

	Electrical Use		Conversion		Efficiency (Electric)		Efficiency (Fuel)		Conversion		
Fuel Usage = (	2,006	)x(	3,413	) x (	98%	)/(	95%	)/(	103,000	) =	**69 CCF**

	Capacity		Months/Year		Utilization Factor		
Electric Demand =(	4.5	)*(	12	)*(	100%	) =	**54 Kw**

Result

Existing Annual Use=	**2,006**	**Kwh**	**54 Kw**	**2.4% of annual use**
Proposed Annual Use=			**69 CCF**	
Annual Savings=	**2,006**	**Kwh**	**54 Kw**	**2.4% of annual use**
Annual Added Gas Usage	**=**		**(69) CCF**	

COMMENTS:

ECM: **Owner's ECM #19**

TITLE: **Alternate: Replace Unit Heater In Lieu of Converting To Radiant**
PROJECT: **PA Fish and Boat Commission**
SITE: **Union City State Fish Hatchery**

DESCRIPTION: Replace existing unit heater in hatch house with new efficient heater.

Unit Heater Capacity (output)	=	200	Mbh including existing DHW heater
Operation (Hours/Week)	=	168	Hours/Week
Operation (Heating Weeks/Year)	=	28	Weeks/Year
Operation (Hours/Year)	=	4704	Hours/Year
Thermal Energy Use (heat + DHW)	=	22027	Fuel units/Year

ASSUMPTION:

Existing Efficiency (Combustion)	=	65%
Existing Efficiency (Dist./Losses)	=	100%
New Efficiency (Combustion)	=	93%
New Efficiency (Dist./Losses)	=	100%
Part Load Factor	=	35%

FORMULA:
Energy Usage = (Capacity(Mbh)) x (Hours of Operation/Year) x (Part Load Factor) / (Combustion Efficiency x Distribution Efficiency)
Fuel Use (Unit) = (Usage (Mbh)) / (Heating Value of Fuel)
Fuel Energy Cost ($) = ((Fuel Use(Unit) x Fuel Cost($/Unit))

CALCULATION:

	Capacity		Hours/Year		Part Load Factor		Efficiency (Comb.)		Efficiency (Dist.)		
Existing Energy Usage =	(200	)x(	4704	)x(	35%	)/((	65%	)x(	100%	)) =	**506,585 Mbtu**
New Energy Usage =	(200	)x(	4704	)x(	35%	)/((	93%	)x(	100%	)) =	**354,065 Mbtu**

	Usage (Mbtu)		Conversion(Mbu/CCF	)	
Existing Fuel Usage =	(506,585	)/(	103	) =	**4,918 CCF**
New Fuel Usage =	(354,065	)/(	103	) =	**3,438 CCF**

Result

	Existing Annual Use =	**4,918 CCF**	**22% of total fuel**
	Proposed Annual Use =	**3,438 CCF**	
100%	**Annual Savings =**	**1,481 CCF**	
	Savings as Percent of Existing =	**30%**	**7% of total fuel**

COMMENTS: Owner's ECM called for converting to radiant heat but hatch house is not a good application for that technology.

ECM: **Owner's ECM #20**

Title: **Replace Window AC and Baseboard Heat with MZ Heat Pump**

Project: **PA Fish and Boat Commission**
Site: **Linesville State Fish Hatchery**

Description Replace window unit AC and baseboard heat with multizone ductless heat pump system including programmable or occupancy based controls.

GENERAL			Symbol
Annual site electric use	591,547	kwh	A
Annual site natural gas use	60,342	CCF	B
Annual site fuel oil use	-	Gallons	C
Electric energy unit cost		$/kwh	D
Electric demand unit cost		$/kwd	E
Natural gas unit cost		$/CCF	F
Fuel oil unit cost		$/Gallon	G
HHV of natural gas	103,000	BTU/CC	H
HHV of fuel oil	139,000	BTU/Ga	I
Current hours per week in occupied mode	168		J
New hours per week in occupied mode	50		K

AIR CONDITIONING to be replaced with heat pump or VRF			
No. of window AC units to be replaced	5		L
Average capacity of window unit AC	15,000	BTUh	M
Combined capacity of all units	6.3	tons	N = L x M / 12,000
Average SEER of all units	12	BTU/watt	O
Annual hours of operation	2,700	(65º F balance pt)	P
Demand diversity factor	1.0		Q
Annual load factor	35%		R
Existing annual demand	31	kwd	S = N x (12/O) x Q x 5 (mo/yr)
Existing annual energy consumption	5,906	kwh = 1.0% of total	T = N x (12/O) x P x R
New SEER with heat pump or VRF	25	BTU/watt	U
New annual demand	15	kwd	V = S x (O/U)
Interim new annual energy consumption	2,835		W = T x (O/U)
Percent reduction in occupied hours	70%		X = (J - K) / K
Cooling diversity factor	50%		Y
New annual energy consumption	1,688	kwh	Z = W x (1 - X) / Y

HEATING to be replaced with heat pump or VRF

	Electric resistance		HW from gas boiler	HW from oil boiler		Symbol
No. of heating units to be replaced	5		-	-		A
Average capacity output of heating unit	8	kw	-	-	MBH	B
Combined capacity of all units	40	kw	-	-	MBH	C = A x B
Average system efficiency	100%		70%	70%		D
Combined input of all units	40	kw	-	-	MBH	E = C / D
Demand diversity factor	100%		100%	100%		F
Existing annual demand	240	kwd	NA	NA		G = E x F x 6 (mo/yr)
Annual hours of operation	5,000		5,000	5,000		H
Annual load factor	35%		35%	35%		I
Annual energy consumed	70,000	kwh	-	-	MBTU	J = E x H x I
		CCF	-	-	Gal	K = J / HHV of fuel
Percent of total site consumption	12%		NA	NA		
New COP with heat pump or VRF	5.3		5.3	5.3		L
New annual demand	45	kwd				M_1 = G / L
			-	-	kwd	M_2 = C / 3.413 x F / L x 6 (mo/yr)
Interim new annual energy used	13,208	kwh				N_1 = J / L
Interim new annual energy used			-	-	kwh	N_2 = J x D / L / 3.413
Percent reduction in occupied hours	70%		70%	70%		O = X from AC calcs above
Heating diversity factor	60%		60%	60%		P
New annual energy consumption	6,551	kwh	-	-	kwh	Q = N x (1 - O) / P

Result

	KWH (AC + heat)	KWD (AC + heat)	CCF	Gallons
Annual Existing Energy Use	75,906	271	-	-
Annual Proposed Energy Use	8,239	60	-	-
Annual Proposed Energy Savings	**67,667**	**211**	**-**	**-**
Percent Saved	89%	78%	NA	NA
Annual Proposed Cost Savings	**$0**	**$0**	**$0**	**$0**

Comment May rely on operable window code allowance in lieu of mechanical ventilation.

ECM: **Owner's ECM #22**

TITLE: **Optimize heat exchange with fish water boiler**
PROJECT: **PA Fish and Boat Commission**
SITE: **Linesville State Fish Hatchery**

DESCRIPTION: Add a dedicated boiler for heating fish water and use the existing boiler strictly for building heat.

Boiler Plant Capacity	=	1320	Mbh
Operation (Hours/Week)	=	168	Hours/Week
Operation (Heating Weeks/Year)	=	52	Weeks/Year
Operation (Hours/Year)	=	8736	Hours/Year
Annual Energy For Fish Water	=	49617	CCF as determined in ECM #21 calculation

ASSUMPTION:

Existing Efficiency (Combustion)	=	75%
Existing Efficiency (Dist./Losses)	=	90%
New Efficiency (Combustion)	=	93%
New Efficiency (Dist./Losses)	=	95%
Part Load Factor	=	30%

FORMULA:
Energy Usage = (Capacity(Mbh)) x (Hours of Operation/Year) x (Part Load Factor) / (Combustion Efficiency x Distribution Efficiency)
Fuel Use (Unit) = (Usage (Mbh)) / (Heating Value of Fuel)
Fuel Energy Cost ($) = ((Fuel Use(Unit) x Fuel Cost($/Unit))

CALCULATION:

	Capacity		Hours/Year		Part Load Factor		Efficiency (Comb.)		Efficiency (Dist.)		
Existing Energy Usage =	(1320	)x(	8736	)x(	30%	)/((	75%	)x(	90%	)) =	**5,125,120 Mbtu**
New Energy Usage =	(1320	)x(	8736	)x(	30%	)/((	93%	)x(	95%	)) =	**3,915,626 Mbtu**

	Usage (Mbtu)		Conversion(Mbu/CCF	)	
Existing Fuel Usage =	(5,125,120	)/(	103	) =	**49,758 CCF**
New Fuel Usage =	(3,915,626	)/(	103	) =	**38,016 CCF**

Result

	Existing Annual Use =	**49,758**	**CCF**	**100% of total fuel**
	Proposed Annual Use =	**38,016**	**CCF**	
100%	**Annual Savings =**	**11,743**	**CCF**	
	Savings as Percent of Existing =		**24%**	**24% of total fuel**

COMMENTS: Implementing owner's ECM #21 (UV system to use lake water in lieu of heating well/spring water) will impact the savings of this ECM.

ECM: **Owner's ECM #23**

Title **Add level controls to upper fish pond to avoid overflowing**
Project **PA Fish and Boat Commission**
Site **Linesville State Fish Hatchery**

Description Calculate the energy savings by adding a feedback loop to control an existing VFD rather than current practice of manually controlling the pump speed.

Total Operating Hours per Year = 8,760 hrs

Motor Horsepower = 30 HP
Motor Rated Efficiency = 90%
Existing System Control = Constant Volume
Proposed System Control = VFD w/ 2/3 press reset

Assumption
Demand Utilization Factor (DUF) = 100% (Estimate, percent of time that pump system is on during peak demand period)
Operating Months per Year = 12 Months
Pump Load Factor = 0.70

Operating Schedule

% of Flow	100%	90%	80%	70%	60%	50%	40%	Total	
% of Time (Existing)	100%	0%	0%	0%	0%	0%	0%	100%	OK
% of Time (Proposed)	0%	50%	50%	0%	0%	0%	0%	100%	OK

Formula

EXISTING CONDITIONS
*Pump kWh Used = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (Annual Op Hours x % of Time at % Flow)
*Pump kW Dem'd = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (% of Time at % Flow x DUF x Months/year)

PROPOSED CONDITIONS
*Pump kWh Used After Conversion = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (Annual Op Hours x % of Time at % Flow)
*Pump kW Dem'd After Conversion = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (% of Time at % Flow x DUF x Months/year)

*NOTE: THIS CALCULATION IS DONE AT EVERY FLOW

Calculation

EXISTING CONDITIONS

***Pump kWh Used**

	HP		Load Factor		% Flow		Exponent	Conversion (HP to kW)	Efficiency	Annual Op Hrs	% of Time at % Flow	
at 100% Airflow	= (30.00	x	0.70	x (	100%	^	1.0	) x 0.746 /	90%	) x (8,760.00	x 100%	) = 152,482
at 90% Airflow	= (30.00	x	0.70	x (	90%	^	1.0	) x 0.746 /	90%	) x (8,760.00	x 0%	) = -
at 80% Airflow	= (30.00	x	0.70	x (	80%	^	1.0	) x 0.746 /	90%	) x (8,760.00	x 0%	) = -
at 70% Airflow	= (30.00	x	0.70	x (	70%	^	1.0	) x 0.746 /	90%	) x (8,760.00	x 0%	) = -
at 60% Airflow	= (30.00	x	0.70	x (	60%	^	1.0	) x 0.746 /	90%	) x (8,760.00	x 0%	) = -
at 50% Airflow	= (30.00	x	0.70	x (	50%	^	1.0	) x 0.746 /	90%	) x (8,760.00	x 0%	) = -
at 40% Airflow	= (30.00	x	0.70	x (	40%	^	1.0	) x 0.746 /	90%	) x (8,760.00	x 0%	) = -
TOTALS (Calculations hidden for print clarity)	==========>>											152,482 kWh

***Pump kW Dem'd**

	HP		Load Factor		% Flow		Exponent	Conversion (HP to kW)	Efficiency	% of Time at % Flow	DUF	Months/Yr	
at 100% Airflow	= (30.00	x	0.70	x (	100%	^	1.0	) x 0.746 /	90%	)x(100%	x 100%	x 12	) = 208.9
at 90% Airflow	= (30.00	x	0.70	x (	90%	^	1.0	) x 0.746 /	90%	)x(0%	x 100%	x 12	) = -
at 80% Airflow	= (30.00	x	0.70	x (	80%	^	1.0	) x 0.746 /	90%	)x(0%	x 100%	x 12	) = -
at 70% Airflow	= (30.00	x	0.70	x (	70%	^	1.0	) x 0.746 /	90%	)x(0%	x 100%	x 12	) = -
at 60% Airflow	= (30.00	x	0.70	x (	60%	^	1.0	) x 0.746 /	90%	)x(0%	x 100%	x 12	) = -
at 50% Airflow	= (30.00	x	0.70	x (	50%	^	1.0	) x 0.746 /	90%	)x(0%	x 100%	x 12	) = -
at 40% Airflow	= (30.00	x	0.70	x (	40%	^	1.0	) x 0.746 /	90%	)x(0%	x 100%	x 12	) = -
TOTALS (Calculations hidden for print clarity)	==========>>												208.9 kW

PROPOSED CONDITIONS

***Pump kWh Used After Conversion**

	HP		Load Factor		% Flow		Exponent	Conversion (HP to kW)	Efficiency	Annual Op Hrs	% of Time at % Flow	
at 100% Airflow	= (30.00	x	0.70	x (	100%	^	2.9	) x 0.746 /	90%	) x (8,760	x 0%	) = -
at 90% Airflow	= (30.00	x	0.70	x (	90%	^	2.9	) x 0.746 /	90%	) x (8,760	x 50%	) = 56,169
at 80% Airflow	= (30.00	x	0.70	x (	80%	^	2.9	) x 0.746 /	90%	) x (8,760	x 50%	) = 39,916
at 70% Airflow	= (30.00	x	0.70	x (	70%	^	2.9	) x 0.746 /	90%	) x (8,760	x 0%	) = -
at 60% Airflow	= (30.00	x	0.70	x (	60%	^	2.9	) x 0.746 /	90%	) x (8,760	x 0%	) = -
at 50% Airflow	= (30.00	x	0.70	x (	50%	^	2.9	) x 0.746 /	90%	) x (8,760	x 0%	) = -
at 40% Airflow	= (30.00	x	0.70	x (	40%	^	2.9	) x 0.746 /	90%	) x (8,760	x 0%	) = -
TOTALS (Calculations hidden for print clarity)	==========>>											96,085 kWh

***Pump kW Dem'd After Conversion**

	HP		Load Factor		% Flow		Exponent	Conversion (HP to kW)	Efficiency	% of Time at % Flow	DUF	Months	
at 100% Airflow	= (30.00	x	0.70	x (	100%	^	2.9	) x 0.746 /	90%	)x(0%	x 100%	x 12	) = -
at 90% Airflow	= (30.00	x	0.70	x (	90%	^	2.9	) x 0.746 /	90%	)x(50%	x 100%	x 12	) = 76.9
at 80% Airflow	= (30.00	x	0.70	x (	80%	^	2.9	) x 0.746 /	90%	)x(50%	x 100%	x 12	) = 54.7
at 70% Airflow	= (30.00	x	0.70	x (	70%	^	2.9	) x 0.746 /	90%	)x(0%	x 100%	x 12	) = -
at 60% Airflow	= (30.00	x	0.70	x (	60%	^	2.9	) x 0.746 /	90%	)x(0%	x 100%	x 12	) = -
at 50% Airflow	= (30.00	x	0.70	x (	50%	^	2.9	) x 0.746 /	90%	)x(0%	x 100%	x 12	) = -
at 40% Airflow	= (30.00	x	0.70	x (	40%	^	2.9	) x 0.746 /	90%	)x(0%	x 100%	x 12	) = -
TOTALS (Calculations hidden for print clarity)	==========>>												131.6 kW

Result

Annual Exist. Consumption	**152,482**	**kWh**
Annual Exist. Demand	**208.9**	**kW**
TOTAL EXIST COST PER YEAR		

Annual Proposed Consumption	**96,085**	**kWh**
Annual Proposed Demand	**131.6**	**kW**
TOTAL NEW COST PER YEAR		

100%	**Annual Usage Savings**	**56,398**	**kWh**	percent saved 37.0%
	Annual Demand Savings	**77**	**kW**	percent saved 37.0%
	TOTAL SAVINGS PER YEAR			

Comments

ECM: **Owner's ECM #24**

TITLE: **Boiler Replacement, fuel switch if feasible**
PROJECT: **PA Fish and Boat Commission**
SITE: **Tylersville SFH--Hatch House/Office**

DESCRIPTION: Replace existing boiler with new efficient boiler of similar size and operation.

Boiler Plant Capacity	=	145	Mbh
Operation (Hours/Week)	=	168	Hours/Week
Operation (Heating Weeks/Year)	=	24	Weeks/Year
Operation (Hours/Year)	=	4032	Hours/Year
Annual Building Heat Energy Use	=	3660	Fuel units

ASSUMPTION:

Existing Efficiency (Combustion)	=	70%
Existing Efficiency (Dist./Losses)	=	95%
New Efficiency (Combustion)	=	86%
New Efficiency (Dist./Losses)	=	95%
Part Load Factor	=	30%

FORMULA:
Energy Usage = (Capacity(Mbh)) x (Hours of Operation/Year) x (Part Load Factor) / (Combustion Efficiency x Distribution Efficiency)
Fuel Use (Unit) = (Usage (Mbh)) / (Heating Value of Fuel)
Fuel Energy Cost ($) = ((Fuel Use(Unit) x Fuel Cost($/Unit))

CALCULATION:

	Capacity		Hours/Year		Part Load Factor		Efficiency (Comb.)		Efficiency (Dist.)		
Existing Energy Usage =	(145	)x(	4032	)x(	30%	)/((	70%	)x(	95%	)) =	**263,747 Mbtu**
New Energy Usage =	(145	)x(	4032	)x(	30%	)/((	86%	)x(	95%	)) =	**214,678 Mbtu**

	Usage (Mbtu)		Conversion(Mbtu/gallon	)	
Existing Fuel Usage =	(263,747	)/(	139	) =	**1,897 gallons**
New Fuel Usage =	(214,678	)/(	139	) =	**1,544 gallons**

Result

	Existing Annual Use =	**1,897 gallons**	**52% of total fuel**
	Proposed Annual Use =	**1,544 gallons**	
100%	**Annual Savings =**	**353 gallons**	
	Savings as Percent of Existing =	**19%**	**10% of total fuel**

COMMENTS: Natural gas not economically available to this site. Negligible economic advantage to convert to propane based on current cost/MMBTU of each.

ECM: **ESCO's ECM #01**

TITLE: **Replace Fish Water Boilers and Convert to Propane**
PROJECT: **PA Fish and Boat Commission**
SITE: **Pleasant Mount SFH--Hatch House #2**

DESCRIPTION: Replace existing oil fired boiler with high efficiency propane boiler of similar size and operation.

GIVEN:

Existing Fuel (oil) Energy Cost	=		$/Gallon
High Heating Value of Existing Fuel	=	139,000	BTU/Gallon
New Fuel (propane) Energy Cost	=		$/Gallon
High Heating Value of New Fuel	=	95,000	BTU/Gallon
Boiler Plant Capacity	=	2,085	Mbh
Operation (Hours/Week)	=	168	Hours/Week
Operation (Heating Weeks/Year)	=	52	Weeks/Year
Operation (Hours/Year)	=	8,736	Hours/Year
Annual Building Heat Energy Use	=	20,994	Fuel units

ASSUMPTION:

Existing Efficiency (Combustion)	=	70%	
Existing Efficiency (Dist./Losses)	=	95%	
New Efficiency (Combustion)	=	93%	
New Efficiency (Dist./Losses)	=	95%	
Part Load Factor	=	8%	*use to adjust model*

FORMULA: Energy Usage = (Capacity(Mbh)) x (Hours of Operation/Year) x (Part Load Factor) / (Combustion Efficiency x Distribution Efficiency)
Fuel Use (Unit) = (Usage (Mbh)) / (Heating Value of Fuel)
Fuel Energy Cost ($) = ((Fuel Use(Unit) x Fuel Cost($/Unit))

CALCULATION:

	Capacity	Hours/Year	Part Load Factor	Efficiency (Comb.)	Efficiency (Dist.)	
Existing Energy Use = (	2085)x(	8736)x(	8%)/((	70%)x(	95%)) =	**2,191,225 Mbtu**
New Energy Use = (	2085)x(	8736)x(	8%)/((	93%)x(	95%)) =	**1,649,309 Mbtu**

	Usage (Mbtu)	Conversion(Mbtu/Gallon)		
Existing Fuel Use = (	2,191,225)/(	139) =	**15,764 Gallons of oil**	75% of total site
New Fuel Use = (	1,649,309)/(	95) =	**17,361 Gallons of propane**	

	Gallons	$/fuel unit	
Existing Fuel Cost = (	**15,764**)*(	$0.000) =	**$ -**
Existing Fuel Cost = (	**17,361**)*(	$0.000) =	**$ -**

Result

	Gal of oil	Gal of propane	
Existing Annual Use =	**15,764**	**-**	**$ -**
Proposed Annual Use =	**-**	**17,361**	**$ -**
Annual Savings =	**15,764**	**(17,361)**	**$ -**

COMMENTS:

Includes fish water heaters in hatch house #2 only. Natural gas not economically available to this site. Based on an assumed 40 kbtu/sf/yr, building heat for this site is estimated at 5,130 gallons per year which is 24% of total site oil usage leaving the remaining 76% attributable to the fish water heaters.

Project Name:	State of PA Fish & Boat
Date:	2020-03-02
Version:	1

Client:

Powersmiths Transformers	
Model	**Winding Material**
E-Saver-80R	Aluminum

Facility	Include	Annual Electric Savings	
		kW (Peak)	kWh
Bellefonte	1	1.45	12,580
Benner	1	2.82	24,577
Fairview	1	1.51	13,152
HQ	1	3.61	31,524
Huntsdale	1	0.89	7,690
Linesville	1	0.31	2,704
Oswayo	1	1.23	10,729
Pleasant Gap	1	0.60	5,197
Pleasant Mount State	1	1.38	12,112
Reynoldsdale	1	0.29	2,493
Tionesta	1	1.49	12,964
Tylersville	1	5.46	47,613
Totals		**21.03**	**183,335**

The Preliminary ESP Calculator™

Energy Savings Payback Calculator

Building Name:	Bellefonte

	Building Type (Select From Pick-List)
	Commercial
Equipment Operating Days/year:	255
Operating Hours/Day:	12
% Load During Normal Operating Hours is 15 % Load Outside Normal Operating Hours is 10	
A/C Performance (kW/ton):	0.4

Building Summary:	
Total Proposed Transformer Quantity	3
Calculated Potential Rebates and Incentives	$0

Losses	kW Losses (Peak)	Annual kWh Losses
Baseline Transformers:	1.72	14,760
Powersmiths Transformers:	0.27	2,180
Savings with Powersmiths:	**1.45**	**12,580**

Building Transformer Details:			
Transformer kVA	Existing Transformer Quantity	Proposed Replacement Quantity	Comments
37.5	2	2	
25	1	1	

The Preliminary ESP Calculator™

Energy Savings Payback Calculator

Building Name:	Benner

	Building Type (Select From Pick-List)
	Commercial
Equipment Operating Days/year:	255
Operating Hours/Day:	12
% Load During Normal Operating Hours is 15 % Load Outside Normal Operating Hours is 10	
A/C Performance (kW/ton):	0.4

Building Summary:	
Total Proposed Transformer Quantity	2
Calculated Potential Rebates and Incentives	$0

Losses	kW Losses (Peak)	Annual kWh Losses
Baseline Transformers:	3.46	29,660
Powersmiths Transformers:	0.64	5,083
Savings with Powersmiths:	**2.82**	**24,577**

Building Transformer Details:			
Transformer kVA	Existing Transformer Quantity	Proposed Replacement Quantity	Comments
25	1	1	
300	1	1	

The Preliminary ESP Calculator™

Energy Savings Payback Calculator

Building Name:	Fairview

	Building Type (Select From Pick-List)
	Commercial
Equipment Operating Days/year:	255
Operating Hours/Day:	12
% Load During Normal Operating Hours is 15 % Load Outside Normal Operating Hours is 10	
A/C Performance (kW/ton):	0.75

Building Summary:	
Total Proposed Transformer Quantity	3
Calculated Potential Rebates and Incentives	$0

Losses	kW Losses (Peak)	Annual kWh Losses
Baseline Transformers:	1.83	15,680
Powersmiths Transformers:	0.32	2,528
Savings with Powersmiths:	**1.51**	**13,152**

Building Transformer Details:			
Transformer kVA	Existing Transformer Quantity	Proposed Replacement Quantity	Comments
25	1	1	
30	1	1	
50	1	1	

The Preliminary ESP Calculator™

Energy Savings Payback Calculator

Building Name:	HQ

	Building Type (Select From Pick-List)
	Commercial
Equipment Operating Days/year:	255
Operating Hours/Day:	12
% Load During Normal Operating Hours is 15 % Load Outside Normal Operating Hours is 10	
A/C Performance (kW/ton):	0.4

Building Summary:	
Total Proposed Transformer Quantity	5
Calculated Potential Rebates and Incentives	$0

Losses	kW Losses (Peak)	Annual kWh Losses
Baseline Transformers:	4.35	37,357
Powersmiths Transformers:	0.75	5,833
Savings with Powersmiths:	**3.61**	**31,524**

Building Transformer Details:			
Transformer kVA	Existing Transformer Quantity	Proposed Replacement Quantity	Comments
25	1	1	
30	1	1	
45	1	1	
75	1	1	
112.5	1	1	

The Preliminary ESP Calculator™

Energy Savings Payback Calculator

Building Name:	Huntsdale

	Building Type (Select From Pick-List)
	Commercial
Equipment Operating Days/year:	255
Operating Hours/Day:	12
% Load During Normal Operating Hours is 15 % Load Outside Normal Operating Hours is 10	
A/C Performance (kW/ton):	0.4

Building Summary:	
Total Proposed Transformer Quantity	3
Calculated Potential Rebates and Incentives	$0

Losses	kW Losses (Peak)	Annual kWh Losses
Baseline Transformers:	1.11	9,420
Powersmiths Transformers:	0.22	1,730
Savings with Powersmiths:	**0.89**	**7,690**

Building Transformer Details:			
Transformer kVA	Existing Transformer Quantity	Proposed Replacement Quantity	Comments
15	1	1	
25	2	2	

The Preliminary ESP Calculator™

Energy Savings Payback Calculator

Building Name:	Linesville

	Building Type (Select From Pick-List)
	Commercial
Equipment Operating Days/year:	255
Operating Hours/Day:	12
% Load During Normal Operating Hours is 15 % Load Outside Normal Operating Hours is 10	
A/C Performance (kW/ton):	0.4

Building Summary:	
Total Proposed Transformer Quantity	1
Calculated Potential Rebates and Incentives	$0

Losses	kW Losses (Peak)	Annual kWh Losses
Baseline Transformers:	0.37	3,149
Powersmiths Transformers:	0.06	445
Savings with Powersmiths:	**0.31**	**2,704**

Building Transformer Details:			
Transformer kVA	Existing Transformer Quantity	Proposed Replacement Quantity	Comments
15	1	1	

The Preliminary ESP Calculator™

Energy Savings Payback Calculator

Building Name:	Oswayo

	Building Type (Select From Pick-List)
	Commercial
Equipment Operating Days/year:	255
Operating Hours/Day:	12
% Load During Normal Operating Hours is 15 % Load Outside Normal Operating Hours is 10	
A/C Performance (kW/ton):	0.4

Building Summary:	
Total Proposed Transformer Quantity	2
Calculated Potential Rebates and Incentives	$0

Losses	kW Losses (Peak)	Annual kWh Losses
Baseline Transformers:	1.47	12,597
Powersmiths Transformers:	0.24	1,868
Savings with Powersmiths:	**1.23**	**10,729**

Building Transformer Details:			
Transformer kVA	Existing Transformer Quantity	Proposed Replacement Quantity	Comments
15	1	1	
75	1	1	

The Preliminary ESP Calculator™

Energy Savings Payback Calculator

Building Name:	Pleasant Gap

	Building Type (Select From Pick-List)
	Commercial
Equipment Operating Days/year:	255
Operating Hours/Day:	12
% Load During Normal Operating Hours is 15 % Load Outside Normal Operating Hours is 10	
A/C Performance (kW/ton):	0.4

Building Summary:	
Total Proposed Transformer Quantity	2
Calculated Potential Rebates and Incentives	$0

Losses	kW Losses (Peak)	Annual kWh Losses
Baseline Transformers:	0.74	6,284
Powersmiths Transformers:	0.14	1,088
Savings with Powersmiths:	**0.60**	**5,197**

Building Transformer Details:			
Transformer kVA	Existing Transformer Quantity	Proposed Replacement Quantity	Comments
15	1	1	
25	1	1	

The Preliminary ESP Calculator™

Energy Savings Payback Calculator

Building Name:	Pleasant Mount State

	Building Type (Select From Pick-List)
	Commercial
Equipment Operating Days/year:	255
Operating Hours/Day:	12
% Load During Normal Operating Hours is 15 % Load Outside Normal Operating Hours is 10	
A/C Performance (kW/ton):	0.4

Building Summary:	
Total Proposed Transformer Quantity	2
Calculated Potential Rebates and Incentives	$0

Losses	kW Losses (Peak)	Annual kWh Losses
Baseline Transformers:	1.66	14,269
Powersmiths Transformers:	0.28	2,158
Savings with Powersmiths:	**1.38**	**12,112**

Building Transformer Details:			
Transformer kVA	Existing Transformer Quantity	Proposed Replacement Quantity	Comments
30	1	1	
75	1	1	

The Preliminary ESP Calculator™

Energy Savings Payback Calculator

Building Name:	Reynoldsdale

	Building Type (Select From Pick-List)
	Commercial
Equipment Operating Days/year:	255
Operating Hours/Day:	12
% Load During Normal Operating Hours is 15 % Load Outside Normal Operating Hours is 10	
A/C Performance (kW/ton):	0.4

Building Summary:	
Total Proposed Transformer Quantity	1
Calculated Potential Rebates and Incentives	$0

Losses	kW Losses (Peak)	Annual kWh Losses
Baseline Transformers:	0.37	3,136
Powersmiths Transformers:	0.08	643
Savings with Powersmiths:	**0.29**	**2,493**

Building Transformer Details:			
Transformer kVA	Existing Transformer Quantity	Proposed Replacement Quantity	Comments
25	1	1	

The Preliminary ESP Calculator™

Energy Savings Payback Calculator

Building Name:	Tionesta

	Building Type (Select From Pick-List)
	Commercial
Equipment Operating Days/year:	255
Operating Hours/Day:	12
% Load During Normal Operating Hours is 15 % Load Outside Normal Operating Hours is 10	
A/C Performance (kW/ton):	0.4

Building Summary:	
Total Proposed Transformer Quantity	4
Calculated Potential Rebates and Incentives	$0

Losses	kW Losses (Peak)	Annual kWh Losses
Baseline Transformers:	1.77	15,209
Powersmiths Transformers:	0.29	2,245
Savings with Powersmiths:	**1.49**	**12,964**

Building Transformer Details:			
Transformer kVA	Existing Transformer Quantity	Proposed Replacement Quantity	Comments
10	2	2	
30	2	2	

The Preliminary ESP Calculator™

Energy Savings Payback Calculator

Building Name:	Tylersville

	Building Type (Select From Pick-List)
	Commercial
Equipment Operating Days/year:	255
Operating Hours/Day:	12
% Load During Normal Operating Hours is 15 % Load Outside Normal Operating Hours is 10	
A/C Performance (kW/ton):	0.4

Building Summary:	
Total Proposed Transformer Quantity	3
Calculated Potential Rebates and Incentives	$0

Losses	kW Losses (Peak)	Annual kWh Losses
Baseline Transformers:	6.65	57,096
Powersmiths Transformers:	1.19	9,482
Savings with Powersmiths:	**5.46**	**47,613**

Building Transformer Details:			
Transformer kVA	Existing Transformer Quantity	Proposed Replacement Quantity	Comments
75	1	1	
100	1	1	
500	1	1	

ECM: **ESCO's ECM #03--SUMMARY**

TITLE: **Convert Gas/Oil Unit Heaters To Radiant Heat**
PROJECT: **PA Fish and Boat Commission**
SITE: **Multiple**

Location	Description of measure	Annual CCF saved	Annual Gallons saved
Fairview	Convert Unit Heaters To Radiant Heat	1,294	
Huntsdale	Convert Unit Heaters To Radiant Heat		1,059
Linesville	Convert Unit Heaters To Radiant Heat	3,883	
Oswayo	Convert Unit Heaters To Radiant Heat	1,294	
Pleasant Mount	Convert Unit Heaters To Radiant Heat		2,878
Tionesta	Convert Unit Heaters To Radiant Heat	777	
	Total	**7,249**	**3,937**

ECM: **ESCO's ECM #03**

Title **Convert Gas/Oil Unit Heaters To**

Project **PA Fish and Boat Commission**
Site **Fairview State Fish Hatchery**

Description Calculate savings of infrared heating system vs. conventional heating system.

Given

Mounted height of infrared system	=	20	feet	
Existing Unit Capacity (output)	=	200	MBtu/hr	
Energy Heating Value	=	103	Mbh/CCF	
Operating hours per year	=	5,000	hours	*based on 50º balance point*
Annual site fuel use	=	6,398	units	

Assumption

Radiant adjustment to heat loss	=	80%
Part Load Percentage	=	25%
Existing Heating Efficiency	=	75%

Formula

Height adjustment to heat loss = ((Mounted ht - 20 ft) x (1%)) + (1)
Existing Bldg Energy Use = (Existing unit capacity) x (Part Load Percentage) x (Operating hrs) / (efficiency) / (energy heating value)
New Bldg Energy Use = (Ex.unit capacity) x (Part Load %) x (radiant adjustment) x (height adj.) x (operating hrs) / (energy heating value)
Existing Cost = (Existing bldg energy use) x (gas rate)
New Cost = (new bldg energy use) x (gas rate)
Radiant Cost Savings = (existing cost - new cost)

Calculation

	Mounted ht.			% / ft			
Height adj to heat loss	= (20	-	20) x (	0.01	) +	1.0	= **1.00**

	Ex. Capacity		Part Load %		Op. hrs		eff.		heat val		
Existing Bldg Energy Use	= (200	) x (	25%	) x (	5,000	) / (	75%	) / (	103	) =	**3,236 CCF**

	Ex. Capacity		Part Load %		radiant adj		ht. Adj		op. hrs		heat val		
New Bldg Energy Use	= (200	) x (	25%	) x (	80%	) x (	1.00	) x (	5,000	) / (	103	) =	**1,942 CCF**

Result

Annual Existing Heating Use		**3,236**	**CCF**	**=>**
Annual Proposed Heating Use		**1,942**	**CCF**	**=>**
Annual Proposed Heating Savings at	**100%**	**1,294**	**CCF**	**=>** **40% of existing**

Comment Includes 200 MBH hot water unit in garage.

ECM: **ESCO's ECM #03**

Title **Convert Gas/Oil Unit Heaters To**

Project Site **PA Fish and Boat Commission**
Huntsdale State Fish Hatchery

Description Calculate savings of infrared heating system vs. conventional heating system.

Given

Mounted height of infrared system	=	20	feet
Existing Unit Capacity (output)	=	184	MBtu/hr
Energy Heating Value	=	139	Mbh/gallon
Operating hours per year	=	5,000	hours *based on 50° balance point*
Annual site fuel use	=	5,837	units

Assumption

Radiant adjustment to heat loss	=	80%	
Part Load Percentage	=	30%	*based on typical distribution of OA temperature*
Existing Heating Efficiency	=	75%	

Formula

Height adjustment to heat loss = ((Mounted ht - 20 ft) x (1%)) + (1)
Existing Bldg Energy Use = (Existing unit capacity) x (Part Load Percentage) x (Operating hrs) / (efficiency) / (energy heating value)
New Bldg Energy Use = (Ex.unit capacity) x (Part Load %) x (radiant adjustment) x (height adj.) x (operating hrs) / (energy heating value)
Existing Cost = (Existing bldg energy use) x (gas rate)
New Cost = (new bldg energy use) x (gas rate)
Radiant Cost Savings = (existing cost - new cost)

Calculation

	Mounted ht.			% / ft			
Height adj to heat loss	= (20	-	20) x (	0.01	) +	1.0	= **1.00**

	Ex. Capacity		Part Load %		Op. hrs		eff.		heat val		
Existing Bldg Energy Use	= (184	) x (	30%	) x (	5,000	) / (	75%	) / (	139	) =	**2,647 gallons**

	Ex. Capacity		Part Load %		radiant adj		ht. Adj		op. hrs		heat val		
New Bldg Energy Use	= (184	) x (	30%	) x (	80%	) x (	1.00	) x (	5,000	) / (	139	) =	**1,588 gallons**

Result

Annual Existing Heating Use		**2,647**	**gallons**	**=>**
Annual Proposed Heating Use		**1,588**	**gallons**	**=>**
Annual Proposed Heating Savings at	**100%**	**1,059**	**gallons**	**=>** **40% of existing**

Comment Includes 184 MBH oil fired unit in administration/maintenance garage.

ECM: **ESCO's ECM #03**

Title **Convert Gas/Oil Unit Heaters To**

Project Site **PA Fish and Boat Commission**
Linesville State Fish Hatchery

Description Calculate savings of infrared heating system vs. conventional heating system.

Given

Mounted height of infrared system	=	20	feet
Existing Unit Capacity (output)	=	600	MBtu/hr
Energy Heating Value	=	103	Mbh/CCF
Operating hours per year	=	5,000	hours *based on 50º balance point*
Annual site fuel use	=	60,342	units

Assumption

Radiant adjustment to heat loss	=	80%	
Part Load Percentage	=	25%	*based on typical distribution of OA temperature*
Existing Heating Efficiency	=	75%	

Formula

Height adjustment to heat loss = ((Mounted ht - 20 ft) x (1%)) + (1)
Existing Bldg Energy Use = (Existing unit capacity) x (Part Load Percentage) x (Operating hrs) / (efficiency) / (energy heating value)
New Bldg Energy Use = (Ex.unit capacity) x (Part Load %) x (radiant adjustment) x (height adj.) x (operating hrs) / (energy heating value)
Existing Cost = (Existing bldg energy use) x (gas rate)
New Cost = (new bldg energy use) x (gas rate)
Radiant Cost Savings = (existing cost - new cost)

Calculation

	Mounted ht.			% / ft			
Height adj to heat loss	= (20	-	20) x (	0.01	) + 1.0	=	**1.00**

	Ex. Capacity		Part Load %		Op. hrs		eff.		heat val		
Existing Bldg Energy Use	= (600	) x (	25%	) x (	5,000	) / (	75%	) / (	103	) =	**9,709 CCF**

	Ex. Capacity		Part Load %		radiant adj		ht. Adj		op. hrs		heat val		
New Bldg Energy Use	= (600	) x (	25%	) x (	80%	) x (	1.00	) x (	5,000	) / (	103	) =	**5,825 CCF**

Result

Annual Existing Heating Use		**9,709**	**CCF**	**=>**
Annual Proposed Heating Use		**5,825**	**CCF**	**=>**
Annual Proposed Heating Savings at	**100%**	**3,883**	**CCF**	**=>** **40% of existing**

Comment Includes 100 MBH hot water unit in chemical room and (6) hot water units in garage totalling 500 MBH.

ECM: **ESCO's ECM #03**

Title **Convert Gas/Oil Unit Heaters To**

Project Site **PA Fish and Boat Commission**
Oswayo State Fish Hatchery

Description Calculate savings of infrared heating system vs. conventional heating system.

Given

Mounted height of infrared system	=	20	feet
Existing Unit Capacity (output)	=	250	MBtu/hr
Energy Heating Value	=	103	Mbh/CCF
Operating hours per year	=	5,000	hours *based on 50º balance point*
Annual site fuel use	=	7,455	units

Assumption

Radiant adjustment to heat loss	=	80%	
Part Load Percentage	=	20%	*based on typical distribution of OA temperature*
Existing Heating Efficiency	=	75%	

Formula

Height adjustment to heat loss = ((Mounted ht - 20 ft) x (1%)) + (1)
Existing Bldg Energy Use = (Existing unit capacity) x (Part Load Percentage) x (Operating hrs) / (efficiency) / (energy heating value)
New Bldg Energy Use = (Ex.unit capacity) x (Part Load %) x (radiant adjustment) x (height adj.) x (operating hrs) / (energy heating value)
Existing Cost = (Existing bldg energy use) x (gas rate)
New Cost = (new bldg energy use) x (gas rate)
Radiant Cost Savings = (existing cost - new cost)

Calculation

	Mounted ht.		% / ft			
Height adj to heat loss	= (20	- 20) x (	0.01	) + 1.0	=	**1.00**

	Ex. Capacity	Part Load %	Op. hrs	eff.	heat val		
Existing Bldg Energy Use	= (250) x (	20%) x (	5,000	) / (75%) / (	103) =	**3,236 CCF**	43%

	Ex. Capacity	Part Load %	radiant adj	ht. Adj	op. hrs	heat val	
New Bldg Energy Use	= (250) x (	20%) x (	80%	) x (1.00) x (	5,000	) / (103) =	**1,942 CCF**

Result

Annual Existing Heating Use		**3,236**	**CCF**	**=>**
Annual Proposed Heating Use		**1,942**	**CCF**	**=>**
Annual Proposed Heating Savings at	**100%**	**1,294**	**CCF**	**=>** **40% of existing**

Comment Includes 50 MBH hot water unit in carpenter shop and (4) 50 MBH hot water units in garage.

ECM: **ESCO's ECM #03**

Title **Convert Gas/Oil Unit Heaters To**

Project **PA Fish and Boat Commission**
Site **Pleasant Mount State Fish Hatchery**

Description Calculate savings of infrared heating system vs. conventional heating system.

Given

Mounted height of infrared system	=	20	feet
Existing Unit Capacity (output)	=	600	MBtu/hr
Energy Heating Value	=	139	Mbh/gallon
Operating hours per year	=	5,000	hours *based on 50° balance point*
Annual site fuel use	=	20,994	units

Assumption

Radiant adjustment to heat loss	=	80%	
Part Load Percentage	=	25%	*based on typical distribution of OA temperature*
Existing Heating Efficiency	=	75%	

Formula

Height adjustment to heat loss = ((Mounted ht - 20 ft) x (1%)) + (1)
Existing Bldg Energy Use = (Existing unit capacity) x (Part Load Percentage) x (Operating hrs) / (efficiency) / (energy heating value)
New Bldg Energy Use = (Ex.unit capacity) x (Part Load %) x (radiant adjustment) x (height adj.) x (operating hrs) / (energy heating value)
Existing Cost = (Existing bldg energy use) x (gas rate)
New Cost = (new bldg energy use) x (gas rate)
Radiant Cost Savings = (existing cost - new cost)

Calculation

	Mounted ht.			% / ft			
Height adj to heat loss	= (20	-	20) x (	0.01	) +	1.0	= **1.00**

	Ex. Capacity		Part Load %		Op. hrs		eff.		heat val		
Existing Bldg Energy Use	= (600	) x (	25%	) x (	5,000	) / (	75%	) / (	139	) =	**7,194 gallons**

34%

	Ex. Capacity		Part Load %		radiant adj		ht. Adj		op. hrs		heat val		
New Bldg Energy Use	= (600	) x (	25%	) x (	80%	) x (	1.00	) x (	5,000	) / (	139	) =	**4,317 gallons**

	Energy use		fuel rate		
Existing Cost	= (7,194	)*(	$0.00	) =	**$0**
New Cost	= (4,317	)*(	$0.00	) =	**$0**

Result

Annual Existing Heating Use		**7,194**	**gallons**	**=>**
Annual Proposed Heating Use		**4,317**	**gallons**	**=>**
Annual Proposed Heating Savings at	**100%**	**2,878**	**gallons**	**=>** **40% of existing**

Comment Includes (6) hot water units totalling 200 MBH in maintenance area, 200 MBH hot water unit in upper garage, and 200 MBH hot water unit in storage area.

ECM: **ESCO's ECM #03**

Title **Convert Gas/Oil Unit Heaters To**

Project **PA Fish and Boat Commission**
Site **Tionesta State Fish Hatchery**

Description Calculate savings of infrared heating system vs. conventional heating system.

Given

Mounted height of infrared system	=	20	feet
Existing Unit Capacity (output)	=	150	MBtu/hr
Energy Heating Value	=	103	Mbh/CCF
Operating hours per year	=	5,000	hours *based on 50° balance point*
Annual site fuel use	=	4,103	units

Assumption

Radiant adjustment to heat loss	=	80%	
Part Load Percentage	=	20%	*based on typical distribution of OA temperature*
Existing Heating Efficiency	=	75%	

Formula

Height adjustment to heat loss = ((Mounted ht - 20 ft) x (1%)) + (1)
Existing Bldg Energy Use = (Existing unit capacity) x (Part Load Percentage) x (Operating hrs) / (efficiency) / (energy heating value)
New Bldg Energy Use = (Ex.unit capacity) x (Part Load %) x (radiant adjustment) x (height adj.) x (operating hrs) / (energy heating value)
Existing Cost = (Existing bldg energy use) x (gas rate)
New Cost = (new bldg energy use) x (gas rate)
Radiant Cost Savings = (existing cost - new cost)

Calculation

	Mounted ht.		% / ft			
Height adj to heat loss	= (20	- 20) x (	0.01	) + 1.0	=	**1.00**

	Ex. Capacity		Part Load %		Op. hrs		eff.		heat val			
Existing Bldg Energy Use	= (150	) x (	20%	) x (	5,000	) / (	75%	) / (	103	) =	**1,942 CCF**	47%

	Ex. Capacity		Part Load %		radiant adj		ht. Adj		op. hrs		heat val		
New Bldg Energy Use	= (150	) x (	20%	) x (	80%	) x (	1.00	) x (	5,000	) / (	103	) =	**1,165 CCF**

	Energy use		fuel rate		
Existing Cost	= (1,942	)*(	$0.00	) =	**$0**
New Cost	= (1,165	)*(	$0.00	) =	**$0**

Result

Annual Existing Heating Use		**1,942**	**CCF**	**=>**
Annual Proposed Heating Use		**1,165**	**CCF**	**=>**
Annual Proposed Heating Savings at	**100%**	**777**	**CCF**	**=>** **40% of existing**

Comment Includes 150 MBH hot water unit in lower garage.

ECM: **ESCO's ECM #04--SUMMARY**

TITLE: **Add VFDs to constant volume pumps**
PROJECT: **PA Fish and Boat Commission**
SITE: **Summary**

Facility	Description of measure	Annual kwh saved	Annual kwd saved
Bellefonte	Add VFD to constant volume pump(s)	77,939	107
Benner Spring	Add VFD to constant volume pump(s)	129,898	178
Corry	Add VFD to constant volume pump(s)	90,929	125
Huntsdale	Add VFD to constant volume pump(s)	19,485	27
Linesville	Add VFD to constant volume pump(s)	123,404	169
Oswayo	Add VFD to constant volume pump(s)	25,980	36
Pleasant Mount	Add VFD to constant volume pump(s)	12,990	18
Reynoldsdale	Add VFD to constant volume pump(s)	71,444	98
	Total	**552,069**	**756**

ECM: ESCO's ECM #04

Title Add VFDs to constant volume pumps
Project PA Fish and Boat Commission
Site Bellefonte State Fish Hatchery

Description Calculate the energy savings by converting an existing pumping system control (constant volume, discharge valve, etc.) to a new, more efficient system control (variable frequency drives).

Given

Electric Energy Costs	=		$/kWh
Electric Demand Charge	=		$/kWd
Total Operating Hours per Year	=	8,760	hrs
Motor Horsepower	=	30	HP
Motor Rated Efficiency	=	90%	
Existing System Control	=	Constant Volume	
Proposed System Control	=	VFD w/ no press reset	

Assumption

Demand Utilization Factor (DUF)	=	100%	(Estimate, percent of time that pump system is on during peak demand period)
Operating Months per Year	=	12	Months
Pump Load Factor	=	0.70	

Operating Schedule

% of Flow	100%	90%	80%	70%	60%	50%	40%	Total	
% of Time (Existing)	100%	0%	0%	0%	0%	0%	0%	100%	OK
% of Time (Proposed)	5%	15%	35%	20%	20%	5%	0%	100%	OK

Formula

EXISTING CONDITIONS
*Pump kWh Used = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (Annual Op Hours x % of Time at % Flow)
*Pump kW Dem'd = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (% of Time at % Flow x DUF x Months/year)

PROPOSED CONDITIONS
*Pump kWh Used After Conversion = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (Annual Op Hours x % of Time at % Flow)
*Pump kW Dem'd After Conversion = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (% of Time at % Flow x DUF x Months/year)

*NOTE: THIS CALCULATION IS DONE AT EVERY FLOW

Calculation

EXISTING CONDITIONS

***Pump kWh Used**

	HP		Load Factor		% Flow		Exponent	Conversion (HP to kW)	Efficiency	Annual Op Hrs		% of Time at % Flow		
at 100% Airflow	= (30.00	x	0.70	x (	100%	^	1.0	) x 0.746	/ 90%	) x (8,760.00	x	100%	) =	152,482
at 90% Airflow	= (30.00	x	0.70	x (	90%	^	1.0	) x 0.746	/ 90%	) x (8,760.00	x	0%	) =	-
at 80% Airflow	= (30.00	x	0.70	x (	80%	^	1.0	) x 0.746	/ 90%	) x (8,760.00	x	0%	) =	-
at 70% Airflow	= (30.00	x	0.70	x (	70%	^	1.0	) x 0.746	/ 90%	) x (8,760.00	x	0%	) =	-
at 60% Airflow	= (30.00	x	0.70	x (	60%	^	1.0	) x 0.746	/ 90%	) x (8,760.00	x	0%	) =	-
at 50% Airflow	= (30.00	x	0.70	x (	50%	^	1.0	) x 0.746	/ 90%	) x (8,760.00	x	0%	) =	-
at 40% Airflow	= (30.00	x	0.70	x (	40%	^	1.0	) x 0.746	/ 90%	) x (8,760.00	x	0%	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>													152,482 kWh

***Pump kW Dem'd**

	HP		Load Factor		% Flow		Exponent	Conversion (HP to kW)	Efficiency	% of Time at % Flow		DUF		Months/Yr	
at 100% Airflow	= (30.00	x	0.70	x (	100%	^	1.0	) x 0.746	/ 90%	)x(100%	x	100%	x	12) =	208.9
at 90% Airflow	= (30.00	x	0.70	x (	90%	^	1.0	) x 0.746	/ 90%	)x(0%	x	100%	x	12) =	-
at 80% Airflow	= (30.00	x	0.70	x (	80%	^	1.0	) x 0.746	/ 90%	)x(0%	x	100%	x	12) =	-
at 70% Airflow	= (30.00	x	0.70	x (	70%	^	1.0	) x 0.746	/ 90%	)x(0%	x	100%	x	12) =	-
at 60% Airflow	= (30.00	x	0.70	x (	60%	^	1.0	) x 0.746	/ 90%	)x(0%	x	100%	x	12) =	-
at 50% Airflow	= (30.00	x	0.70	x (	50%	^	1.0	) x 0.746	/ 90%	)x(0%	x	100%	x	12) =	-
at 40% Airflow	= (30.00	x	0.70	x (	40%	^	1.0	) x 0.746	/ 90%	)x(0%	x	100%	x	12) =	-
TOTALS (Calculations hidden for print clarity)	==========>>														208.9 kW

PROPOSED CONDITIONS

***Pump kWh Used After Conversion**

	HP		Load Factor		% Flow		Exponent	Conversion (HP to kW)	Efficiency	Annual Op Hrs		% of Time at % Flow		
at 100% Airflow	= (30.00	x	0.70	x (	100%	^	2.7	) x 0.746	/ 90%	) x (8,760	x	5%	) =	7,624
at 90% Airflow	= (30.00	x	0.70	x (	90%	^	2.7	) x 0.746	/ 90%	) x (8,760	x	15%	) =	17,209
at 80% Airflow	= (30.00	x	0.70	x (	80%	^	2.7	) x 0.746	/ 90%	) x (8,760	x	35%	) =	29,217
at 70% Airflow	= (30.00	x	0.70	x (	70%	^	2.7	) x 0.746	/ 90%	) x (8,760	x	20%	) =	11,642
at 60% Airflow	= (30.00	x	0.70	x (	60%	^	2.7	) x 0.746	/ 90%	) x (8,760	x	20%	) =	7,678
at 50% Airflow	= (30.00	x	0.70	x (	50%	^	2.7	) x 0.746	/ 90%	) x (8,760	x	5%	) =	1,173
at 40% Airflow	= (30.00	x	0.70	x (	40%	^	2.7	) x 0.746	/ 90%	) x (8,760	x	0%	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>													74,543 kWh

***Pump kW Dem'd After Conversion**

	HP		Load Factor		% Flow		Exponent	Conversion (HP to kW)	Efficiency	% of Time at % Flow		DUF		Months	
at 100% Airflow	= (30.00	x	0.70	x (	100%	^	2.7	) x 0.746	/ 90%	)x(5%	x	100%	x	12) =	10.4
at 90% Airflow	= (30.00	x	0.70	x (	90%	^	2.7	) x 0.746	/ 90%	)x(15%	x	100%	x	12) =	23.6
at 80% Airflow	= (30.00	x	0.70	x (	80%	^	2.7	) x 0.746	/ 90%	)x(35%	x	100%	x	12) =	40.0
at 70% Airflow	= (30.00	x	0.70	x (	70%	^	2.7	) x 0.746	/ 90%	)x(20%	x	100%	x	12) =	15.9
at 60% Airflow	= (30.00	x	0.70	x (	60%	^	2.7	) x 0.746	/ 90%	)x(20%	x	100%	x	12) =	10.5
at 50% Airflow	= (30.00	x	0.70	x (	50%	^	2.7	) x 0.746	/ 90%	)x(5%	x	100%	x	12) =	1.6
at 40% Airflow	= (30.00	x	0.70	x (	40%	^	2.7	) x 0.746	/ 90%	)x(0%	x	100%	x	12) =	-
TOTALS (Calculations hidden for print clarity)	==========>>														102.1 kW

Result

Annual Exist. Consumption	**152,482**	**kWh**	**=>**	$	-		
Annual Exist. Demand	**208.9**	**kW**	**=>**	$	-		
TOTAL EXIST COST PER YEAR				$	-		
Annual Proposed Consumption	**74,543**	**kWh**	**=>**	$	-		
Annual Proposed Demand	**102.1**	**kW**	**=>**	$	-		
TOTAL NEW COST PER YEAR				$	-		
100% **Annual Usage Savings**	**77,939**	**kWh**	**=>**	$	-	percent saved	51%
Annual Demand Savings	**107**	**kW**	**=>**	$	-	percent saved	51%
TOTAL SAVINGS PER YEAR				**$**	**-**		

Comments Includes 30 HP well #1.

ECM: ESCO's ECM #04

Title Add VFDs to constant volume pumps
Project PA Fish and Boat Commission
Site Benner Springs State Fish Hatchery

Description Calculate the energy savings by converting an existing pumping system control (constant volume, discharge valve, etc.) to a new, more efficient system control (variable frequency drives).

Given

Electric Energy Costs	=		$/kWh
Electric Demand Charge	=		$/kWd
Total Operating Hours per Year	=	8,760	hrs
Motor Horsepower	=	50	HP
Motor Rated Efficiency	=	90%	
Existing System Control	=	Constant Volume	
Proposed System Control	=	VFD w/ no press reset	

Assumption

Demand Utilization Factor (DUF)	=	100%	(Estimate, percent of time that pump system is on during peak demand period)
Operating Months per Year	=	12	Months
Pump Load Factor	=	0.70	

Operating Schedule

% of Flow	100%	90%	80%	70%	60%	50%	40%	Total	
% of Time (Existing)	100%	0%	0%	0%	0%	0%	0%	100%	OK
% of Time (Proposed)	5%	15%	35%	20%	20%	5%	0%	100%	OK

Formula

EXISTING CONDITIONS
*Pump kWh Used = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (Annual Op Hours x % of Time at % Flow)
*Pump kW Dem'd = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (% of Time at % Flow x DUF x Months/year)

PROPOSED CONDITIONS
*Pump kWh Used After Conversion = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (Annual Op Hours x % of Time at % Flow)
*Pump kW Dem'd After Conversion = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (% of Time at % Flow x DUF x Months/year)

*NOTE: THIS CALCULATION IS DONE AT EVERY FLOW

Calculation

EXISTING CONDITIONS

***Pump kWh Used**

	HP		Load Factor		% Flow		Exponent	Conversion (HP to kW)	Efficiency		Annual Op Hrs		% of Time at % Flow		
at 100% Airflow	= (50.00	x	0.70	x (	100%	^	1.0	) x 0.746	/ 90%	) x (	8,760.00	x	100%	) =	254,137
at 90% Airflow	= (50.00	x	0.70	x (	90%	^	1.0	) x 0.746	/ 90%	) x (	8,760.00	x	0%	) =	-
at 80% Airflow	= (50.00	x	0.70	x (	80%	^	1.0	) x 0.746	/ 90%	) x (	8,760.00	x	0%	) =	-
at 70% Airflow	= (50.00	x	0.70	x (	70%	^	1.0	) x 0.746	/ 90%	) x (	8,760.00	x	0%	) =	-
at 60% Airflow	= (50.00	x	0.70	x (	60%	^	1.0	) x 0.746	/ 90%	) x (	8,760.00	x	0%	) =	-
at 50% Airflow	= (50.00	x	0.70	x (	50%	^	1.0	) x 0.746	/ 90%	) x (	8,760.00	x	0%	) =	-
at 40% Airflow	= (50.00	x	0.70	x (	40%	^	1.0	) x 0.746	/ 90%	) x (	8,760.00	x	0%	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>														254,137 kWh

***Pump kW Dem'd**

	HP		Load Factor		% Flow		Exponent	Conversion (HP to kW)	Efficiency		% of Time at % Flow		DUF		Months/Yr		
at 100% Airflow	= (50.00	x	0.70	x (	100%	^	1.0	) x 0.746	/ 90%	)x(	100%	x	100%	x	12	) =	348.1
at 90% Airflow	= (50.00	x	0.70	x (	90%	^	1.0	) x 0.746	/ 90%	)x(	0%	x	100%	x	12	) =	-
at 80% Airflow	= (50.00	x	0.70	x (	80%	^	1.0	) x 0.746	/ 90%	)x(	0%	x	100%	x	12	) =	-
at 70% Airflow	= (50.00	x	0.70	x (	70%	^	1.0	) x 0.746	/ 90%	)x(	0%	x	100%	x	12	) =	-
at 60% Airflow	= (50.00	x	0.70	x (	60%	^	1.0	) x 0.746	/ 90%	)x(	0%	x	100%	x	12	) =	-
at 50% Airflow	= (50.00	x	0.70	x (	50%	^	1.0	) x 0.746	/ 90%	)x(	0%	x	100%	x	12	) =	-
at 40% Airflow	= (50.00	x	0.70	x (	40%	^	1.0	) x 0.746	/ 90%	)x(	0%	x	100%	x	12	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>																348.1 kW

PROPOSED CONDITIONS

***Pump kWh Used After Conversion**

	HP		Load Factor		% Flow		Exponent	Conversion (HP to kW)	Efficiency		Annual Op Hrs		% of Time at % Flow		
at 100% Airflow	= (50.00	x	0.70	x (	100%	^	2.7	) x 0.746	/ 90%	) x (	8,760	x	5%	) =	12,707
at 90% Airflow	= (50.00	x	0.70	x (	90%	^	2.7	) x 0.746	/ 90%	) x (	8,760	x	15%	) =	28,682
at 80% Airflow	= (50.00	x	0.70	x (	80%	^	2.7	) x 0.746	/ 90%	) x (	8,760	x	35%	) =	48,694
at 70% Airflow	= (50.00	x	0.70	x (	70%	^	2.7	) x 0.746	/ 90%	) x (	8,760	x	20%	) =	19,403
at 60% Airflow	= (50.00	x	0.70	x (	60%	^	2.7	) x 0.746	/ 90%	) x (	8,760	x	20%	) =	12,797
at 50% Airflow	= (50.00	x	0.70	x (	50%	^	2.7	) x 0.746	/ 90%	) x (	8,760	x	5%	) =	1,955
at 40% Airflow	= (50.00	x	0.70	x (	40%	^	2.7	) x 0.746	/ 90%	) x (	8,760	x	0%	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>														124,239 kWh

***Pump kW Dem'd After Conversion**

	HP		Load Factor		% Flow		Exponent	Conversion (HP to kW)	Efficiency		% of Time at % Flow		DUF		Months		
at 100% Airflow	= (50.00	x	0.70	x (	100%	^	2.7	) x 0.746	/ 90%	)x(	5%	x	100%	x	12	) =	17.4
at 90% Airflow	= (50.00	x	0.70	x (	90%	^	2.7	) x 0.746	/ 90%	)x(	15%	x	100%	x	12	) =	39.3
at 80% Airflow	= (50.00	x	0.70	x (	80%	^	2.7	) x 0.746	/ 90%	)x(	35%	x	100%	x	12	) =	66.7
at 70% Airflow	= (50.00	x	0.70	x (	70%	^	2.7	) x 0.746	/ 90%	)x(	20%	x	100%	x	12	) =	26.6
at 60% Airflow	= (50.00	x	0.70	x (	60%	^	2.7	) x 0.746	/ 90%	)x(	20%	x	100%	x	12	) =	17.5
at 50% Airflow	= (50.00	x	0.70	x (	50%	^	2.7	) x 0.746	/ 90%	)x(	5%	x	100%	x	12	) =	2.7
at 40% Airflow	= (50.00	x	0.70	x (	40%	^	2.7	) x 0.746	/ 90%	)x(	0%	x	100%	x	12	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>																170.2 kW

Result

Annual Exist. Consumption	**254,137**	**kWh**	**=>**	$	-		
Annual Exist. Demand	**348.1**	**kW**	**=>**	$	-		
TOTAL EXIST COST PER YEAR				$	-		
Annual Proposed Consumption	**124,239**	**kWh**	**=>**	$	-		
Annual Proposed Demand	**170.2**	**kW**	**=>**	$	-		
TOTAL NEW COST PER YEAR				$	-		
100% **Annual Usage Savings**	**129,898**	**kWh**	**=>**	$	-	percent saved	51%
Annual Demand Savings	**178**	**kW**	**=>**	$	-	percent saved	51%
TOTAL SAVINGS PER YEAR				**$**	**-**		

Comments Includes 50 HP well #2.

ECM: ESCO's ECM #04

Title Add VFDs to constant volume pumps
Project PA Fish and Boat Commission
Site Corry State Fish Hatchery

Description Calculate the energy savings by converting an existing pumping system control (constant volume, discharge valve, etc.) to a new, more efficient system control (variable frequency drives).

Given

Electric Energy Costs	=		$/kWh
Electric Demand Charge	=		$/kWd
Total Operating Hours per Year	=	8,760	hrs
Motor Horsepower	=	35	HP
Motor Rated Efficiency	=	90%	
Existing System Control	=	Constant Volume	
Proposed System Control	=	VFD w/ no press reset	

Assumption

Demand Utilization Factor (DUF)	=	100%	(Estimate, percent of time that pump system is on during peak demand period)
Operating Months per Year	=	12	Months
Pump Load Factor	=	0.70	

Operating Schedule

% of Flow	100%	90%	80%	70%	60%	50%	40%	Total	
% of Time (Existing)	100%	0%	0%	0%	0%	0%	0%	100%	OK
% of Time (Proposed)	5%	15%	35%	20%	20%	5%	0%	100%	OK

Formula

EXISTING CONDITIONS
*Pump kWh Used = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (Annual Op Hours x % of Time at % Flow)
*Pump kW Dem'd = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (% of Time at % Flow x DUF x Months/year)

PROPOSED CONDITIONS
*Pump kWh Used After Conversion = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (Annual Op Hours x % of Time at % Flow)
*Pump kW Dem'd After Conversion = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (% of Time at % Flow x DUF x Months/year)

*NOTE: THIS CALCULATION IS DONE AT EVERY FLOW

Calculation

EXISTING CONDITIONS

***Pump kWh Used**

	HP		Load Factor		% Flow		Exponent		Conversion (HP to kW)		Efficiency		Annual Op Hrs		% of Time at % Flow		
at 100% Airflow	= (35.00	x	0.70	x (	100%	^	1.0	) x	0.746	/	90%	) x (	8,760.00	x	100%	) =	177,896
at 90% Airflow	= (35.00	x	0.70	x (	90%	^	1.0	) x	0.746	/	90%	) x (	8,760.00	x	0%	) =	-
at 80% Airflow	= (35.00	x	0.70	x (	80%	^	1.0	) x	0.746	/	90%	) x (	8,760.00	x	0%	) =	-
at 70% Airflow	= (35.00	x	0.70	x (	70%	^	1.0	) x	0.746	/	90%	) x (	8,760.00	x	0%	) =	-
at 60% Airflow	= (35.00	x	0.70	x (	60%	^	1.0	) x	0.746	/	90%	) x (	8,760.00	x	0%	) =	-
at 50% Airflow	= (35.00	x	0.70	x (	50%	^	1.0	) x	0.746	/	90%	) x (	8,760.00	x	0%	) =	-
at 40% Airflow	= (35.00	x	0.70	x (	40%	^	1.0	) x	0.746	/	90%	) x (	8,760.00	x	0%	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>																177,896 kWh

***Pump kW Dem'd**

	HP		Load Factor		% Flow		Exponent		Conversion (HP to kW)		Efficiency		% of Time at % Flow		DUF		Months/Yr		
at 100% Airflow	= (35.00	x	0.70	x (	100%	^	1.0	) x	0.746	/	90%	)x(	100%	x	100%	x	12	) =	243.7
at 90% Airflow	= (35.00	x	0.70	x (	90%	^	1.0	) x	0.746	/	90%	)x(	0%	x	100%	x	12	) =	-
at 80% Airflow	= (35.00	x	0.70	x (	80%	^	1.0	) x	0.746	/	90%	)x(	0%	x	100%	x	12	) =	-
at 70% Airflow	= (35.00	x	0.70	x (	70%	^	1.0	) x	0.746	/	90%	)x(	0%	x	100%	x	12	) =	-
at 60% Airflow	= (35.00	x	0.70	x (	60%	^	1.0	) x	0.746	/	90%	)x(	0%	x	100%	x	12	) =	-
at 50% Airflow	= (35.00	x	0.70	x (	50%	^	1.0	) x	0.746	/	90%	)x(	0%	x	100%	x	12	) =	-
at 40% Airflow	= (35.00	x	0.70	x (	40%	^	1.0	) x	0.746	/	90%	)x(	0%	x	100%	x	12	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>																		243.7 kW

PROPOSED CONDITIONS

***Pump kWh Used After Conversion**

	HP		Load Factor		% Flow		Exponent		Conversion (HP to kW)		Efficiency		Annual Op Hrs		% of Time at % Flow		
at 100% Airflow	= (35.00	x	0.70	x (	100%	^	2.7	) x	0.746	/	90%	) x (	8,760	x	5%	) =	8,895
at 90% Airflow	= (35.00	x	0.70	x (	90%	^	2.7	) x	0.746	/	90%	) x (	8,760	x	15%	) =	20,078
at 80% Airflow	= (35.00	x	0.70	x (	80%	^	2.7	) x	0.746	/	90%	) x (	8,760	x	35%	) =	34,086
at 70% Airflow	= (35.00	x	0.70	x (	70%	^	2.7	) x	0.746	/	90%	) x (	8,760	x	20%	) =	13,582
at 60% Airflow	= (35.00	x	0.70	x (	60%	^	2.7	) x	0.746	/	90%	) x (	8,760	x	20%	) =	8,958
at 50% Airflow	= (35.00	x	0.70	x (	50%	^	2.7	) x	0.746	/	90%	) x (	8,760	x	5%	) =	1,369
at 40% Airflow	= (35.00	x	0.70	x (	40%	^	2.7	) x	0.746	/	90%	) x (	8,760	x	0%	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>																86,967 kWh

***Pump kW Dem'd After Conversion**

	HP		Load Factor		% Flow		Exponent		Conversion (HP to kW)		Efficiency		% of Time at % Flow		DUF		Months		
at 100% Airflow	= (35.00	x	0.70	x (	100%	^	2.7	) x	0.746	/	90%	)x(	5%	x	100%	x	12	) =	12.2
at 90% Airflow	= (35.00	x	0.70	x (	90%	^	2.7	) x	0.746	/	90%	)x(	15%	x	100%	x	12	) =	27.5
at 80% Airflow	= (35.00	x	0.70	x (	80%	^	2.7	) x	0.746	/	90%	)x(	35%	x	100%	x	12	) =	46.7
at 70% Airflow	= (35.00	x	0.70	x (	70%	^	2.7	) x	0.746	/	90%	)x(	20%	x	100%	x	12	) =	18.6
at 60% Airflow	= (35.00	x	0.70	x (	60%	^	2.7	) x	0.746	/	90%	)x(	20%	x	100%	x	12	) =	12.3
at 50% Airflow	= (35.00	x	0.70	x (	50%	^	2.7	) x	0.746	/	90%	)x(	5%	x	100%	x	12	) =	1.9
at 40% Airflow	= (35.00	x	0.70	x (	40%	^	2.7	) x	0.746	/	90%	)x(	0%	x	100%	x	12	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>																		119.1 kW

Result

Annual Exist. Consumption	**177,896**	**kWh**	**=>**	$	-		
Annual Exist. Demand	**243.7**	**kW**	**=>**	$	-		
TOTAL EXIST COST PER YEAR				$	-		
Annual Proposed Consumption	**86,967**	**kWh**	**=>**	$	-		
Annual Proposed Demand	**119.1**	**kW**	**=>**	$	-		
TOTAL NEW COST PER YEAR				$	-		
100% **Annual Usage Savings**	**90,929**	**kWh**	**=>**	$	-	percent saved	51%
Annual Demand Savings	**125**	**kW**	**=>**	$	-	percent saved	51%
TOTAL SAVINGS PER YEAR				**$**	**-**		

Comments Includes 20 HP hatch house recirculating pump and 15 HP well #4.

ECM: ESCO's ECM #04

Title Add VFDs to constant volume pumps
Project PA Fish and Boat Commission
Site Huntsdale State Fish Hatchery

Description Calculate the energy savings by converting an existing pumping system control (constant volume, discharge valve, etc.) to a new, more efficient system control (variable frequency drives).

Given

Electric Energy Costs	=		$/kWh
Electric Demand Charge	=		$/kWd
Total Operating Hours per Year	=	8,760	hrs
Motor Horsepower	=	7.5	HP
Motor Rated Efficiency	=	90%	
Existing System Control	=	Constant Volume	
Proposed System Control	=	VFD w/ no press reset	

Assumption

Demand Utilization Factor (DUF)	=	100%	(Estimate, percent of time that pump system is on during peak demand period)
Operating Months per Year	=	12	Months
Pump Load Factor	=	0.70	

Operating Schedule

% of Flow	100%	90%	80%	70%	60%	50%	40%	Total	
% of Time (Existing)	100%	0%	0%	0%	0%	0%	0%	100%	OK
% of Time (Proposed)	5%	15%	35%	20%	20%	5%	0%	100%	OK

Formula

EXISTING CONDITIONS
*Pump kWh Used = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (Annual Op Hours x % of Time at % Flow)
*Pump kW Dem'd = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (% of Time at % Flow x DUF x Months/year)

PROPOSED CONDITIONS
*Pump kWh Used After Conversion = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (Annual Op Hours x % of Time at % Flow)
*Pump kW Dem'd After Conversion = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (% of Time at % Flow x DUF x Months/year)

*NOTE: THIS CALCULATION IS DONE AT EVERY FLOW

Calculation

EXISTING CONDITIONS

***Pump kWh Used**

	HP		Load Factor		% Flow		Exponent		Conversion (HP to kW)		Efficiency		Annual Op Hrs		% of Time at % Flow		
at 100% Airflow	= (7.50	x	0.70	x (	100%	^	1.0	) x	0.746	/	90%	) x (	8,760.00	x	100%	) =	38,121
at 90% Airflow	= (7.50	x	0.70	x (	90%	^	1.0	) x	0.746	/	90%	) x (	8,760.00	x	0%	) =	-
at 80% Airflow	= (7.50	x	0.70	x (	80%	^	1.0	) x	0.746	/	90%	) x (	8,760.00	x	0%	) =	-
at 70% Airflow	= (7.50	x	0.70	x (	70%	^	1.0	) x	0.746	/	90%	) x (	8,760.00	x	0%	) =	-
at 60% Airflow	= (7.50	x	0.70	x (	60%	^	1.0	) x	0.746	/	90%	) x (	8,760.00	x	0%	) =	-
at 50% Airflow	= (7.50	x	0.70	x (	50%	^	1.0	) x	0.746	/	90%	) x (	8,760.00	x	0%	) =	-
at 40% Airflow	= (7.50	x	0.70	x (	40%	^	1.0	) x	0.746	/	90%	) x (	8,760.00	x	0%	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>																38,121 kWh

***Pump kW Dem'd**

	HP		Load Factor		% Flow		Exponent		Conversion (HP to kW)		Efficiency		% of Time at % Flow		DUF		Months/Yr		
at 100% Airflow	= (7.50	x	0.70	x (	100%	^	1.0	) x	0.746	/	90%	)x(	100%	x	100%	x	12	) =	52.2
at 90% Airflow	= (7.50	x	0.70	x (	90%	^	1.0	) x	0.746	/	90%	)x(	0%	x	100%	x	12	) =	-
at 80% Airflow	= (7.50	x	0.70	x (	80%	^	1.0	) x	0.746	/	90%	)x(	0%	x	100%	x	12	) =	-
at 70% Airflow	= (7.50	x	0.70	x (	70%	^	1.0	) x	0.746	/	90%	)x(	0%	x	100%	x	12	) =	-
at 60% Airflow	= (7.50	x	0.70	x (	60%	^	1.0	) x	0.746	/	90%	)x(	0%	x	100%	x	12	) =	-
at 50% Airflow	= (7.50	x	0.70	x (	50%	^	1.0	) x	0.746	/	90%	)x(	0%	x	100%	x	12	) =	-
at 40% Airflow	= (7.50	x	0.70	x (	40%	^	1.0	) x	0.746	/	90%	)x(	0%	x	100%	x	12	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>																		52.2 kW

PROPOSED CONDITIONS

***Pump kWh Used After Conversion**

	HP		Load Factor		% Flow		Exponent		Conversion (HP to kW)		Efficiency		Annual Op Hrs		% of Time at % Flow		
at 100% Airflow	= (7.50	x	0.70	x (	100%	^	2.7	) x	0.746	/	90%	) x (	8,760	x	5%	) =	1,906
at 90% Airflow	= (7.50	x	0.70	x (	90%	^	2.7	) x	0.746	/	90%	) x (	8,760	x	15%	) =	4,302
at 80% Airflow	= (7.50	x	0.70	x (	80%	^	2.7	) x	0.746	/	90%	) x (	8,760	x	35%	) =	7,304
at 70% Airflow	= (7.50	x	0.70	x (	70%	^	2.7	) x	0.746	/	90%	) x (	8,760	x	20%	) =	2,910
at 60% Airflow	= (7.50	x	0.70	x (	60%	^	2.7	) x	0.746	/	90%	) x (	8,760	x	20%	) =	1,920
at 50% Airflow	= (7.50	x	0.70	x (	50%	^	2.7	) x	0.746	/	90%	) x (	8,760	x	5%	) =	293
at 40% Airflow	= (7.50	x	0.70	x (	40%	^	2.7	) x	0.746	/	90%	) x (	8,760	x	0%	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>																18,636 kWh

***Pump kW Dem'd After Conversion**

	HP		Load Factor		% Flow		Exponent		Conversion (HP to kW)		Efficiency		% of Time at % Flow		DUF		Months		
at 100% Airflow	= (7.50	x	0.70	x (	100%	^	2.7	) x	0.746	/	90%	)x(	5%	x	100%	x	12	) =	2.6
at 90% Airflow	= (7.50	x	0.70	x (	90%	^	2.7	) x	0.746	/	90%	)x(	15%	x	100%	x	12	) =	5.9
at 80% Airflow	= (7.50	x	0.70	x (	80%	^	2.7	) x	0.746	/	90%	)x(	35%	x	100%	x	12	) =	10.0
at 70% Airflow	= (7.50	x	0.70	x (	70%	^	2.7	) x	0.746	/	90%	)x(	20%	x	100%	x	12	) =	4.0
at 60% Airflow	= (7.50	x	0.70	x (	60%	^	2.7	) x	0.746	/	90%	)x(	20%	x	100%	x	12	) =	2.6
at 50% Airflow	= (7.50	x	0.70	x (	50%	^	2.7	) x	0.746	/	90%	)x(	5%	x	100%	x	12	) =	0.4
at 40% Airflow	= (7.50	x	0.70	x (	40%	^	2.7	) x	0.746	/	90%	)x(	0%	x	100%	x	12	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>																		25.5 kW

Result

Annual Exist. Consumption	**38,121**	**kWh**	**=>**	$	-		
Annual Exist. Demand	**52.2**	**kW**	**=>**	$	-		
TOTAL EXIST COST PER YEAR				$	-		
Annual Proposed Consumption	**18,636**	**kWh**	**=>**	$	-		
Annual Proposed Demand	**25.5**	**kW**	**=>**	$	-		
TOTAL NEW COST PER YEAR				$	-		
100% **Annual Usage Savings**	**19,485**	**kWh**	**=>**	$	-	percent saved	51%
Annual Demand Savings	**27**	**kW**	**=>**	$	-	percent saved	51%
TOTAL SAVINGS PER YEAR				**$**	**-**		

Comments Includes 7.5 HP raceway spring pump.

ECM: ESCO's ECM #04

Title Add VFDs to constant volume pumps
Project PA Fish and Boat Commission
Site Linesville State Fish Hatchery

Description Calculate the energy savings by converting an existing pumping system control (constant volume, discharge valve, etc.) to a new, more efficient system control (variable frequency drives).

Given

Electric Energy Costs	=		$/kWh
Electric Demand Charge	=		$/kWd
Total Operating Hours per Year	=	8,760	hrs
Motor Horsepower	=	47.5	HP
Motor Rated Efficiency	=	90%	
Existing System Control	=	Constant Volume	
Proposed System Control	=	VFD w/ no press reset	

Assumption

Demand Utilization Factor (DUF)	=	100%	(Estimate, percent of time that pump system is on during peak demand period)
Operating Months per Year	=	12	Months
Pump Load Factor	=	0.70	

Operating Schedule

% of Flow	100%	90%	80%	70%	60%	50%	40%	Total	
% of Time (Existing)	100%	0%	0%	0%	0%	0%	0%	100%	OK
% of Time (Proposed)	5%	15%	35%	20%	20%	5%	0%	100%	OK

Formula

EXISTING CONDITIONS
*Pump kWh Used = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (Annual Op Hours x % of Time at % Flow)
*Pump kW Dem'd = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (% of Time at % Flow x DUF x Months/year)

PROPOSED CONDITIONS
*Pump kWh Used After Conversion = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (Annual Op Hours x % of Time at % Flow)
*Pump kW Dem'd After Conversion = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (% of Time at % Flow x DUF x Months/year)

*NOTE: THIS CALCULATION IS DONE AT EVERY FLOW

Calculation

EXISTING CONDITIONS

***Pump kWh Used**

	HP		Load Factor		% Flow		Exponent		Conversion (HP to kW)		Efficiency		Annual Op Hrs		% of Time at % Flow		
at 100% Airflow	= (47.50	x	0.70	x (	100%	^	1.0	) x	0.746	/	90%	) x (	8,760.00	x	100%	) =	241,430
at 90% Airflow	= (47.50	x	0.70	x (	90%	^	1.0	) x	0.746	/	90%	) x (	8,760.00	x	0%	) =	-
at 80% Airflow	= (47.50	x	0.70	x (	80%	^	1.0	) x	0.746	/	90%	) x (	8,760.00	x	0%	) =	-
at 70% Airflow	= (47.50	x	0.70	x (	70%	^	1.0	) x	0.746	/	90%	) x (	8,760.00	x	0%	) =	-
at 60% Airflow	= (47.50	x	0.70	x (	60%	^	1.0	) x	0.746	/	90%	) x (	8,760.00	x	0%	) =	-
at 50% Airflow	= (47.50	x	0.70	x (	50%	^	1.0	) x	0.746	/	90%	) x (	8,760.00	x	0%	) =	-
at 40% Airflow	= (47.50	x	0.70	x (	40%	^	1.0	) x	0.746	/	90%	) x (	8,760.00	x	0%	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>																241,430 kWh

***Pump kW Dem'd**

	HP		Load Factor		% Flow		Exponent		Conversion (HP to kW)		Efficiency		% of Time at % Flow		DUF		Months/Yr		
at 100% Airflow	= (47.50	x	0.70	x (	100%	^	1.0	) x	0.746	/	90%	)x(	100%	x	100%	x	12	) =	330.7
at 90% Airflow	= (47.50	x	0.70	x (	90%	^	1.0	) x	0.746	/	90%	)x(	0%	x	100%	x	12	) =	-
at 80% Airflow	= (47.50	x	0.70	x (	80%	^	1.0	) x	0.746	/	90%	)x(	0%	x	100%	x	12	) =	-
at 70% Airflow	= (47.50	x	0.70	x (	70%	^	1.0	) x	0.746	/	90%	)x(	0%	x	100%	x	12	) =	-
at 60% Airflow	= (47.50	x	0.70	x (	60%	^	1.0	) x	0.746	/	90%	)x(	0%	x	100%	x	12	) =	-
at 50% Airflow	= (47.50	x	0.70	x (	50%	^	1.0	) x	0.746	/	90%	)x(	0%	x	100%	x	12	) =	-
at 40% Airflow	= (47.50	x	0.70	x (	40%	^	1.0	) x	0.746	/	90%	)x(	0%	x	100%	x	12	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>																		330.7 kW

PROPOSED CONDITIONS

***Pump kWh Used After Conversion**

	HP		Load Factor		% Flow		Exponent		Conversion (HP to kW)		Efficiency		Annual Op Hrs		% of Time at % Flow		
at 100% Airflow	= (47.50	x	0.70	x (	100%	^	2.7	) x	0.746	/	90%	) x (	8,760	x	5%	) =	12,072
at 90% Airflow	= (47.50	x	0.70	x (	90%	^	2.7	) x	0.746	/	90%	) x (	8,760	x	15%	) =	27,248
at 80% Airflow	= (47.50	x	0.70	x (	80%	^	2.7	) x	0.746	/	90%	) x (	8,760	x	35%	) =	46,260
at 70% Airflow	= (47.50	x	0.70	x (	70%	^	2.7	) x	0.746	/	90%	) x (	8,760	x	20%	) =	18,433
at 60% Airflow	= (47.50	x	0.70	x (	60%	^	2.7	) x	0.746	/	90%	) x (	8,760	x	20%	) =	12,157
at 50% Airflow	= (47.50	x	0.70	x (	50%	^	2.7	) x	0.746	/	90%	) x (	8,760	x	5%	) =	1,858
at 40% Airflow	= (47.50	x	0.70	x (	40%	^	2.7	) x	0.746	/	90%	) x (	8,760	x	0%	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>																118,027 kWh

***Pump kW Dem'd After Conversion**

	HP		Load Factor		% Flow		Exponent		Conversion (HP to kW)		Efficiency		% of Time at % Flow		DUF		Months		
at 100% Airflow	= (47.50	x	0.70	x (	100%	^	2.7	) x	0.746	/	90%	)x(	5%	x	100%	x	12	) =	16.5
at 90% Airflow	= (47.50	x	0.70	x (	90%	^	2.7	) x	0.746	/	90%	)x(	15%	x	100%	x	12	) =	37.3
at 80% Airflow	= (47.50	x	0.70	x (	80%	^	2.7	) x	0.746	/	90%	)x(	35%	x	100%	x	12	) =	63.4
at 70% Airflow	= (47.50	x	0.70	x (	70%	^	2.7	) x	0.746	/	90%	)x(	20%	x	100%	x	12	) =	25.3
at 60% Airflow	= (47.50	x	0.70	x (	60%	^	2.7	) x	0.746	/	90%	)x(	20%	x	100%	x	12	) =	16.7
at 50% Airflow	= (47.50	x	0.70	x (	50%	^	2.7	) x	0.746	/	90%	)x(	5%	x	100%	x	12	) =	2.5
at 40% Airflow	= (47.50	x	0.70	x (	40%	^	2.7	) x	0.746	/	90%	)x(	0%	x	100%	x	12	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>																		161.7 kW

Result

Annual Exist. Consumption	**241,430**	**kWh**	**=>**	$	-	
Annual Exist. Demand	**330.7**	**kW**	**=>**	$	-	
TOTAL EXIST COST PER YEAR				$	-	
Annual Proposed Consumption	**118,027**	**kWh**	**=>**	$	-	
Annual Proposed Demand	**161.7**	**kW**	**=>**	$	-	
TOTAL NEW COST PER YEAR				$	-	
100% **Annual Usage Savings**	**123,404**	**kWh**	**=>**	$	-	percent saved 51%
Annual Demand Savings	**169**	**kW**	**=>**	$	-	percent saved 51%
TOTAL SAVINGS PER YEAR				**$**	**-**	

Comments Includes 25 HP well #3, (1) 7.5 HP south pond pump, and 15 HP well #5.

ECM: ESCO's ECM #04

Title Add VFDs to constant volume pumps
Project PA Fish and Boat Commission
Site Oswayo State Fish Hatchery

Description Calculate the energy savings by converting an existing pumping system control (constant volume, discharge valve, etc.) to a new, more efficient system control (variable frequency drives).

Given

Electric Energy Costs	=		$/kWh
Electric Demand Charge	=		$/kWd
Total Operating Hours per Year	=	8,760	hrs
Motor Horsepower	=	10	HP
Motor Rated Efficiency	=	90%	
Existing System Control	=	Constant Volume	
Proposed System Control	=	VFD w/ no press reset	

Assumption

Demand Utilization Factor (DUF)	=	100%	(Estimate, percent of time that pump system is on during peak demand period)
Operating Months per Year	=	12	Months
Pump Load Factor	=	0.70	

Operating Schedule

% of Flow	100%	90%	80%	70%	60%	50%	40%	Total	
% of Time (Existing)	100%	0%	0%	0%	0%	0%	0%	100%	OK
% of Time (Proposed)	5%	15%	35%	20%	20%	5%	0%	100%	OK

Formula

EXISTING CONDITIONS
*Pump kWh Used = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (Annual Op Hours x % of Time at % Flow)
*Pump kW Dem'd = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (% of Time at % Flow x DUF x Months/year)

PROPOSED CONDITIONS
*Pump kWh Used After Conversion = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (Annual Op Hours x % of Time at % Flow)
*Pump kW Dem'd After Conversion = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (% of Time at % Flow x DUF x Months/year)

*NOTE: THIS CALCULATION IS DONE AT EVERY FLOW

Calculation

EXISTING CONDITIONS

***Pump kWh Used**

	HP		Load Factor		% Flow		Exponent		Conversion (HP to kW)		Efficiency		Annual Op Hrs		% of Time at % Flow		
at 100% Airflow	= (10.00	x	0.70	x (	100%	^	1.0	) x	0.746	/	90%	) x (	8,760.00	x	100%	) =	50,827
at 90% Airflow	= (10.00	x	0.70	x (	90%	^	1.0	) x	0.746	/	90%	) x (	8,760.00	x	0%	) =	-
at 80% Airflow	= (10.00	x	0.70	x (	80%	^	1.0	) x	0.746	/	90%	) x (	8,760.00	x	0%	) =	-
at 70% Airflow	= (10.00	x	0.70	x (	70%	^	1.0	) x	0.746	/	90%	) x (	8,760.00	x	0%	) =	-
at 60% Airflow	= (10.00	x	0.70	x (	60%	^	1.0	) x	0.746	/	90%	) x (	8,760.00	x	0%	) =	-
at 50% Airflow	= (10.00	x	0.70	x (	50%	^	1.0	) x	0.746	/	90%	) x (	8,760.00	x	0%	) =	-
at 40% Airflow	= (10.00	x	0.70	x (	40%	^	1.0	) x	0.746	/	90%	) x (	8,760.00	x	0%	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>																50,827 kWh

***Pump kW Dem'd**

	HP		Load Factor		% Flow		Exponent		Conversion (HP to kW)		Efficiency		% of Time at % Flow		DUF		Months/Yr		
at 100% Airflow	= (10.00	x	0.70	x (	100%	^	1.0	) x	0.746	/	90%	)x(	100%	x	100%	x	12	) =	69.6
at 90% Airflow	= (10.00	x	0.70	x (	90%	^	1.0	) x	0.746	/	90%	)x(	0%	x	100%	x	12	) =	-
at 80% Airflow	= (10.00	x	0.70	x (	80%	^	1.0	) x	0.746	/	90%	)x(	0%	x	100%	x	12	) =	-
at 70% Airflow	= (10.00	x	0.70	x (	70%	^	1.0	) x	0.746	/	90%	)x(	0%	x	100%	x	12	) =	-
at 60% Airflow	= (10.00	x	0.70	x (	60%	^	1.0	) x	0.746	/	90%	)x(	0%	x	100%	x	12	) =	-
at 50% Airflow	= (10.00	x	0.70	x (	50%	^	1.0	) x	0.746	/	90%	)x(	0%	x	100%	x	12	) =	-
at 40% Airflow	= (10.00	x	0.70	x (	40%	^	1.0	) x	0.746	/	90%	)x(	0%	x	100%	x	12	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>																		69.6 kW

PROPOSED CONDITIONS

***Pump kWh Used After Conversion**

	HP		Load Factor		% Flow		Exponent		Conversion (HP to kW)		Efficiency		Annual Op Hrs		% of Time at % Flow		
at 100% Airflow	= (10.00	x	0.70	x (	100%	^	2.7	) x	0.746	/	90%	) x (	8,760	x	5%	) =	2,541
at 90% Airflow	= (10.00	x	0.70	x (	90%	^	2.7	) x	0.746	/	90%	) x (	8,760	x	15%	) =	5,736
at 80% Airflow	= (10.00	x	0.70	x (	80%	^	2.7	) x	0.746	/	90%	) x (	8,760	x	35%	) =	9,739
at 70% Airflow	= (10.00	x	0.70	x (	70%	^	2.7	) x	0.746	/	90%	) x (	8,760	x	20%	) =	3,881
at 60% Airflow	= (10.00	x	0.70	x (	60%	^	2.7	) x	0.746	/	90%	) x (	8,760	x	20%	) =	2,559
at 50% Airflow	= (10.00	x	0.70	x (	50%	^	2.7	) x	0.746	/	90%	) x (	8,760	x	5%	) =	391
at 40% Airflow	= (10.00	x	0.70	x (	40%	^	2.7	) x	0.746	/	90%	) x (	8,760	x	0%	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>																24,848 kWh

***Pump kW Dem'd After Conversion**

	HP		Load Factor		% Flow		Exponent		Conversion (HP to kW)		Efficiency		% of Time at % Flow		DUF		Months		
at 100% Airflow	= (10.00	x	0.70	x (	100%	^	2.7	) x	0.746	/	90%	)x(	5%	x	100%	x	12	) =	3.5
at 90% Airflow	= (10.00	x	0.70	x (	90%	^	2.7	) x	0.746	/	90%	)x(	15%	x	100%	x	12	) =	7.9
at 80% Airflow	= (10.00	x	0.70	x (	80%	^	2.7	) x	0.746	/	90%	)x(	35%	x	100%	x	12	) =	13.3
at 70% Airflow	= (10.00	x	0.70	x (	70%	^	2.7	) x	0.746	/	90%	)x(	20%	x	100%	x	12	) =	5.3
at 60% Airflow	= (10.00	x	0.70	x (	60%	^	2.7	) x	0.746	/	90%	)x(	20%	x	100%	x	12	) =	3.5
at 50% Airflow	= (10.00	x	0.70	x (	50%	^	2.7	) x	0.746	/	90%	)x(	5%	x	100%	x	12	) =	0.5
at 40% Airflow	= (10.00	x	0.70	x (	40%	^	2.7	) x	0.746	/	90%	)x(	0%	x	100%	x	12	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>																		34.0 kW

Result

Annual Exist. Consumption	**50,827**	**kWh**	**=>**	$	-	
Annual Exist. Demand	**69.6**	**kW**	**=>**	$	-	
TOTAL EXIST COST PER YEAR				$	-	
Annual Proposed Consumption	**24,848**	**kWh**	**=>**	$	-	
Annual Proposed Demand	**34.0**	**kW**	**=>**	$	-	
TOTAL NEW COST PER YEAR				$	-	
100% **Annual Usage Savings**	**25,980**	**kWh**	**=>**	$	-	percent saved 51%
Annual Demand Savings	**36**	**kW**	**=>**	$	-	percent saved 51%
TOTAL SAVINGS PER YEAR				**$**	**-**	

Comments Includes (1) 5 HP spring building pump and (1) 5 HP hatch house pump.

ECM: ESCO's ECM #04

Title Add VFDs to constant volume pumps
Project PA Fish and Boat Commission
Site Pleasant Mount State Fish Hatchery

Description Calculate the energy savings by converting an existing pumping system control (constant volume, discharge valve, etc.) to a new, more efficient system control (variable frequency drives).

Given

Electric Energy Costs	=		$/kWh
Electric Demand Charge	=		$/kWd
Total Operating Hours per Year	=	8,760	hrs
Motor Horsepower	=	5	HP
Motor Rated Efficiency	=	90%	
Existing System Control	=	Constant Volume	
Proposed System Control	=	VFD w/ no press reset	

Assumption

Demand Utilization Factor (DUF)	=	100%	(Estimate, percent of time that pump system is on during peak demand period)
Operating Months per Year	=	12	Months
Pump Load Factor	=	0.70	

Operating Schedule

% of Flow	100%	90%	80%	70%	60%	50%	40%	Total	
% of Time (Existing)	100%	0%	0%	0%	0%	0%	0%	100%	OK
% of Time (Proposed)	5%	15%	35%	20%	20%	5%	0%	100%	OK

Formula

EXISTING CONDITIONS
*Pump kWh Used = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (Annual Op Hours x % of Time at % Flow)
*Pump kW Dem'd = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (% of Time at % Flow x DUF x Months/year)

PROPOSED CONDITIONS
*Pump kWh Used After Conversion = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (Annual Op Hours x % of Time at % Flow)
*Pump kW Dem'd After Conversion = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (% of Time at % Flow x DUF x Months/year)

*NOTE: THIS CALCULATION IS DONE AT EVERY FLOW

Calculation

EXISTING CONDITIONS

***Pump kWh Used**

	HP		Load Factor		% Flow		Exponent	Conversion (HP to kW)	Efficiency	Annual Op Hrs		% of Time at % Flow		
at 100% Airflow	= (5.00	x	0.70	x (	100%	^	1.0	) x 0.746	/ 90%	) x (8,760.00	x	100%	) =	25,414
at 90% Airflow	= (5.00	x	0.70	x (	90%	^	1.0	) x 0.746	/ 90%	) x (8,760.00	x	0%	) =	-
at 80% Airflow	= (5.00	x	0.70	x (	80%	^	1.0	) x 0.746	/ 90%	) x (8,760.00	x	0%	) =	-
at 70% Airflow	= (5.00	x	0.70	x (	70%	^	1.0	) x 0.746	/ 90%	) x (8,760.00	x	0%	) =	-
at 60% Airflow	= (5.00	x	0.70	x (	60%	^	1.0	) x 0.746	/ 90%	) x (8,760.00	x	0%	) =	-
at 50% Airflow	= (5.00	x	0.70	x (	50%	^	1.0	) x 0.746	/ 90%	) x (8,760.00	x	0%	) =	-
at 40% Airflow	= (5.00	x	0.70	x (	40%	^	1.0	) x 0.746	/ 90%	) x (8,760.00	x	0%	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>													25,414 kWh

***Pump kW Dem'd**

	HP		Load Factor		% Flow		Exponent	Conversion (HP to kW)	Efficiency	% of Time at % Flow		DUF		Months/Yr		
at 100% Airflow	= (5.00	x	0.70	x (	100%	^	1.0	) x 0.746	/ 90%	)x(100%	x	100%	x	12	) =	34.8
at 90% Airflow	= (5.00	x	0.70	x (	90%	^	1.0	) x 0.746	/ 90%	)x(0%	x	100%	x	12	) =	-
at 80% Airflow	= (5.00	x	0.70	x (	80%	^	1.0	) x 0.746	/ 90%	)x(0%	x	100%	x	12	) =	-
at 70% Airflow	= (5.00	x	0.70	x (	70%	^	1.0	) x 0.746	/ 90%	)x(0%	x	100%	x	12	) =	-
at 60% Airflow	= (5.00	x	0.70	x (	60%	^	1.0	) x 0.746	/ 90%	)x(0%	x	100%	x	12	) =	-
at 50% Airflow	= (5.00	x	0.70	x (	50%	^	1.0	) x 0.746	/ 90%	)x(0%	x	100%	x	12	) =	-
at 40% Airflow	= (5.00	x	0.70	x (	40%	^	1.0	) x 0.746	/ 90%	)x(0%	x	100%	x	12	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>															34.8 kW

PROPOSED CONDITIONS

***Pump kWh Used After Conversion**

	HP		Load Factor		% Flow		Exponent	Conversion (HP to kW)	Efficiency	Annual Op Hrs		% of Time at % Flow		
at 100% Airflow	= (5.00	x	0.70	x (	100%	^	2.7	) x 0.746	/ 90%	) x (8,760	x	5%	) =	1,271
at 90% Airflow	= (5.00	x	0.70	x (	90%	^	2.7	) x 0.746	/ 90%	) x (8,760	x	15%	) =	2,868
at 80% Airflow	= (5.00	x	0.70	x (	80%	^	2.7	) x 0.746	/ 90%	) x (8,760	x	35%	) =	4,869
at 70% Airflow	= (5.00	x	0.70	x (	70%	^	2.7	) x 0.746	/ 90%	) x (8,760	x	20%	) =	1,940
at 60% Airflow	= (5.00	x	0.70	x (	60%	^	2.7	) x 0.746	/ 90%	) x (8,760	x	20%	) =	1,280
at 50% Airflow	= (5.00	x	0.70	x (	50%	^	2.7	) x 0.746	/ 90%	) x (8,760	x	5%	) =	196
at 40% Airflow	= (5.00	x	0.70	x (	40%	^	2.7	) x 0.746	/ 90%	) x (8,760	x	0%	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>													12,424 kWh

***Pump kW Dem'd After Conversion**

	HP		Load Factor		% Flow		Exponent	Conversion (HP to kW)	Efficiency	% of Time at % Flow		DUF		Months		
at 100% Airflow	= (5.00	x	0.70	x (	100%	^	2.7	) x 0.746	/ 90%	)x(5%	x	100%	x	12	) =	1.7
at 90% Airflow	= (5.00	x	0.70	x (	90%	^	2.7	) x 0.746	/ 90%	)x(15%	x	100%	x	12	) =	3.9
at 80% Airflow	= (5.00	x	0.70	x (	80%	^	2.7	) x 0.746	/ 90%	)x(35%	x	100%	x	12	) =	6.7
at 70% Airflow	= (5.00	x	0.70	x (	70%	^	2.7	) x 0.746	/ 90%	)x(20%	x	100%	x	12	) =	2.7
at 60% Airflow	= (5.00	x	0.70	x (	60%	^	2.7	) x 0.746	/ 90%	)x(20%	x	100%	x	12	) =	1.8
at 50% Airflow	= (5.00	x	0.70	x (	50%	^	2.7	) x 0.746	/ 90%	)x(5%	x	100%	x	12	) =	0.3
at 40% Airflow	= (5.00	x	0.70	x (	40%	^	2.7	) x 0.746	/ 90%	)x(0%	x	100%	x	12	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>															17.0 kW

Result

Annual Exist. Consumption	**25,414**	**kWh**	**=>**	$	-		
Annual Exist. Demand	**34.8**	**kW**	**=>**	$	-		
TOTAL EXIST COST PER YEAR				$	-		
Annual Proposed Consumption	**12,424**	**kWh**	**=>**	$	-		
Annual Proposed Demand	**17.0**	**kW**	**=>**	$	-		
TOTAL NEW COST PER YEAR				$	-		
100% **Annual Usage Savings**	**12,990**	**kWh**	**=>**	$	-	percent saved	51%
Annual Demand Savings	**18**	**kW**	**=>**	$	-	percent saved	51%
TOTAL SAVINGS PER YEAR				**$**	**-**		

Comments Includes 5 HP well pump.

ECM: ESCO's ECM #04

Title Add VFDs to constant volume pumps
Project PA Fish and Boat Commission
Site Bellefonte State Fish Hatchery

Description Calculate the energy savings by converting an existing pumping system control (constant volume, discharge valve, etc.) to a new, more efficient system control (variable frequency drives).

Given

Electric Energy Costs	=		$/kWh
Electric Demand Charge	=		$/kWd
Total Operating Hours per Year	=	8,760	hrs
Motor Horsepower	=	27.5	HP
Motor Rated Efficiency	=	90%	
Existing System Control	=	Constant Volume	
Proposed System Control	=	VFD w/ no press reset	

Assumption

Demand Utilization Factor (DUF)	=	100%	(Estimate, percent of time that pump system is on during peak demand period)
Operating Months per Year	=	12	Months
Pump Load Factor	=	0.70	

Operating Schedule

% of Flow	100%	90%	80%	70%	60%	50%	40%	Total	
% of Time (Existing)	100%	0%	0%	0%	0%	0%	0%	100%	OK
% of Time (Proposed)	5%	15%	35%	20%	20%	5%	0%	100%	OK

Formula

EXISTING CONDITIONS
*Pump kWh Used = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (Annual Op Hours x % of Time at % Flow)
*Pump kW Dem'd = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (% of Time at % Flow x DUF x Months/year)

PROPOSED CONDITIONS
*Pump kWh Used After Conversion = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (Annual Op Hours x % of Time at % Flow)
*Pump kW Dem'd After Conversion = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (% of Time at % Flow x DUF x Months/year)

*NOTE: THIS CALCULATION IS DONE AT EVERY FLOW

Calculation

EXISTING CONDITIONS

***Pump kWh Used**

	HP		Load Factor		% Flow		Exponent		Conversion (HP to kW)		Efficiency		Annual Op Hrs		% of Time at % Flow		
at 100% Airflow	= (27.50	x	0.70	x (	100%	^	1.0	) x	0.746	/	90%	) x (	8,760.00	x	100%	) =	139,776
at 90% Airflow	= (27.50	x	0.70	x (	90%	^	1.0	) x	0.746	/	90%	) x (	8,760.00	x	0%	) =	-
at 80% Airflow	= (27.50	x	0.70	x (	80%	^	1.0	) x	0.746	/	90%	) x (	8,760.00	x	0%	) =	-
at 70% Airflow	= (27.50	x	0.70	x (	70%	^	1.0	) x	0.746	/	90%	) x (	8,760.00	x	0%	) =	-
at 60% Airflow	= (27.50	x	0.70	x (	60%	^	1.0	) x	0.746	/	90%	) x (	8,760.00	x	0%	) =	-
at 50% Airflow	= (27.50	x	0.70	x (	50%	^	1.0	) x	0.746	/	90%	) x (	8,760.00	x	0%	) =	-
at 40% Airflow	= (27.50	x	0.70	x (	40%	^	1.0	) x	0.746	/	90%	) x (	8,760.00	x	0%	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>																139,776 kWh

***Pump kW Dem'd**

	HP		Load Factor		% Flow		Exponent		Conversion (HP to kW)		Efficiency		% of Time at % Flow		DUF		Months/Yr		
at 100% Airflow	= (27.50	x	0.70	x (	100%	^	1.0	) x	0.746	/	90%	)x(	100%	x	100%	x	12	) =	191.5
at 90% Airflow	= (27.50	x	0.70	x (	90%	^	1.0	) x	0.746	/	90%	)x(	0%	x	100%	x	12	) =	-
at 80% Airflow	= (27.50	x	0.70	x (	80%	^	1.0	) x	0.746	/	90%	)x(	0%	x	100%	x	12	) =	-
at 70% Airflow	= (27.50	x	0.70	x (	70%	^	1.0	) x	0.746	/	90%	)x(	0%	x	100%	x	12	) =	-
at 60% Airflow	= (27.50	x	0.70	x (	60%	^	1.0	) x	0.746	/	90%	)x(	0%	x	100%	x	12	) =	-
at 50% Airflow	= (27.50	x	0.70	x (	50%	^	1.0	) x	0.746	/	90%	)x(	0%	x	100%	x	12	) =	-
at 40% Airflow	= (27.50	x	0.70	x (	40%	^	1.0	) x	0.746	/	90%	)x(	0%	x	100%	x	12	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>																		191.5 kW

PROPOSED CONDITIONS

***Pump kWh Used After Conversion**

	HP		Load Factor		% Flow		Exponent		Conversion (HP to kW)		Efficiency		Annual Op Hrs		% of Time at % Flow		
at 100% Airflow	= (27.50	x	0.70	x (	100%	^	2.7	) x	0.746	/	90%	) x (	8,760	x	5%	) =	6,989
at 90% Airflow	= (27.50	x	0.70	x (	90%	^	2.7	) x	0.746	/	90%	) x (	8,760	x	15%	) =	15,775
at 80% Airflow	= (27.50	x	0.70	x (	80%	^	2.7	) x	0.746	/	90%	) x (	8,760	x	35%	) =	26,782
at 70% Airflow	= (27.50	x	0.70	x (	70%	^	2.7	) x	0.746	/	90%	) x (	8,760	x	20%	) =	10,672
at 60% Airflow	= (27.50	x	0.70	x (	60%	^	2.7	) x	0.746	/	90%	) x (	8,760	x	20%	) =	7,038
at 50% Airflow	= (27.50	x	0.70	x (	50%	^	2.7	) x	0.746	/	90%	) x (	8,760	x	5%	) =	1,076
at 40% Airflow	= (27.50	x	0.70	x (	40%	^	2.7	) x	0.746	/	90%	) x (	8,760	x	0%	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>																68,331 kWh

***Pump kW Dem'd After Conversion**

	HP		Load Factor		% Flow		Exponent		Conversion (HP to kW)		Efficiency		% of Time at % Flow		DUF		Months		
at 100% Airflow	= (27.50	x	0.70	x (	100%	^	2.7	) x	0.746	/	90%	)x(	5%	x	100%	x	12	) =	9.6
at 90% Airflow	= (27.50	x	0.70	x (	90%	^	2.7	) x	0.746	/	90%	)x(	15%	x	100%	x	12	) =	21.6
at 80% Airflow	= (27.50	x	0.70	x (	80%	^	2.7	) x	0.746	/	90%	)x(	35%	x	100%	x	12	) =	36.7
at 70% Airflow	= (27.50	x	0.70	x (	70%	^	2.7	) x	0.746	/	90%	)x(	20%	x	100%	x	12	) =	14.6
at 60% Airflow	= (27.50	x	0.70	x (	60%	^	2.7	) x	0.746	/	90%	)x(	20%	x	100%	x	12	) =	9.6
at 50% Airflow	= (27.50	x	0.70	x (	50%	^	2.7	) x	0.746	/	90%	)x(	5%	x	100%	x	12	) =	1.5
at 40% Airflow	= (27.50	x	0.70	x (	40%	^	2.7	) x	0.746	/	90%	)x(	0%	x	100%	x	12	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>																		93.6 kW

Result

Annual Exist. Consumption	**139,776**	**kWh**	**=>**	$	-		
Annual Exist. Demand	**191.5**	**kW**	**=>**	$	-		
TOTAL EXIST COST PER YEAR				$	-		
Annual Proposed Consumption	**68,331**	**kWh**	**=>**	$	-		
Annual Proposed Demand	**93.6**	**kW**	**=>**	$	-		
TOTAL NEW COST PER YEAR				$	-		
100% **Annual Usage Savings**	**71,444**	**kWh**	**=>**	$	-	percent saved	51%
Annual Demand Savings	**98**	**kW**	**=>**	$	-	percent saved	51%
TOTAL SAVINGS PER YEAR				**$**	**-**		

Comments Includes 7.5 HP aquarium pump and 20 HP de-gassing pump.

ENERGY CONSERVATION MEASURES

Heating Diesel Generator Engine Blocks With An Air-Source Heat Pump

Project Site: **PA Fish and Boat**

Quote Date: **3/6/2020**

Assessor: N/A

Your stand-by Diesel Generator must be kept hot at all times so that it can start instantaneously during a power outage. This heating process costs money. Using a patented process, a Geo-Thermal Systems, Inc (GTS) Heat Pump is the most efficient way to heat emergency diesel generators.

GTS Heat Pump users have experienced power savings as high as 84% versus heating with resistance block heaters that come installed with emergency diesel generators as standard equipment.

GTS Heat Pumps are installed in series with the existing block heater(s). This adds extra redundancy to further prevent cold start wear or failure of the generator. Resistance block heaters typically fail before 5 years of use, while the life expectancy of a GTS Heat Pump is over 20 years.

GTS Heat Pumps will increase the reliability of your critical backup generators and provide a quick return on investment.

Project Scope:

GTS Heat Pumps will be installed in series with the resistance block heaters for the generators listed on the **Line Items** page.

Schedule:

Turnkey installation of a Generator Heat Pump typically takes only 6-8 hours

	Generator			Annual Savings			
Building	Make	Model	Engine Size (kW)	kWh			
Bellefonte SFH	Kohler	180REOZJG	180	25,368.96			
Bellefonte SFH	Kohler	180REOZJG	180	25,368.96			
Benner Spring SFH	Kohler	250REOZJE	250	25,368.96			
Benner Spring SFH	Kohler	150REOZJF	150	25,368.96			
Corry SFH	Kohler	Unreadable	180	25,368.96			
Fairview SFH	Kohler	175	175	25,368.96			
Huntsdale SFH	Kohler	100R0ZJ	100	25,368.96			
Huntsdale SFH	Kohler	100R0ZJ	100	25,368.96			
Huntsdale SFH	Kohler	100R0ZJ	100	25,368.96			
Huntsdale SFH	Generac	10775590200	350	25,368.96			
PFBC HQ Harrisburg	CAT	No Tag Pic	250	25,368.96			
Linesville SFH	Kohler	80REZGD	80	25,368.96			
Oswayo SFH	Kohler	180R0ZJ71	180	25,368.96			
Pleasant Gap SFH	Kohler	300R0Z71	300	25,368.96			
Pleasant Mount SFH	Kohler	260R0Z71	260	25,368.96			
Reynoldsdale SFH	Kohler	175R0Z71	175	25,368.96			
Tionesta SFH	Kohler	80	80	25,368.96			
Tionesta SFH	Kohler	150R0ZJT1	150	25,368.96			
Tylersville SFH	Generac	6521530100	600	40,260.96			

Total Project:	**496,902.24**			

ENERGY CONSERVATION MEASURES

GTS Installation Description

Project Scope:

Installation of the GTS system involves the following…

Mount heat pump within approximately 10 ft. of the block heaters

Electrical service provided to the heat pump from nearby panel or disconnect

Install breaker or disconnect (if not existing)

Plumb silicone hose from the engine, through the heat pump, and back into the line side of the block heater so that the heat pump and block heater are "in series" related to the coolant flow.

Set temperature thermostat in order to create redundant controls between heat pump and block heater

Install PVC from condensate line to nearest drain or similar appropriate location.

Location of heat pumps will be located in the best possible position to allow a complete installation and allow access to the generator for service and testing. The condensation tubing will be directed as to not interfere or pose a hazard to daily operations or the environment.

All installations will be performed during normal business hours (0730 to 1630) and will involve reasonable access to each generator. Please provide contractors passes and keys if possible to bypass check in and allow the jobs to start on time. This installation will not involve an interruption of power to any emergency circuits or unnecessary operation of the generator set. Please call to coordinate a work schedule that will allow us to complete this project with a minimum of interruptions or re-scheduling.

General Material List and Deliverables

1. All necessary conduit and wiring from electric panel to heat pumps
2. Fusible disconnect with circuit breakers and relays as necessary
3. ¾ PVC (condensation tubing)
4. ¾" Copper tubing insulation (where applicable)
5. ¾" Copper tubing (where applicable)
6. Sweated copper fittings (where applicable)
7. Brass pipe fittings
8. Silicone heater hose (3/4" and 5/8")
9. Mounting base
10. Startup, commissioning and user training (O&M manuals included)
11. One Year Warranty on materials and workmanship

ECM: **ESCO's ECM #08--SUMMARY**

TITLE: **Retro-commissioning including unoccupied setback**
PROJECT: **PA Fish and Boat Commission**
SITE: **Multiple State Fish Hatcheries**

Location	Description of measure	Annual kwh in electric saved	Annual CCF in natural gas saved	Annual gallons of fuel oil saved
Bellefonte	Retro-commission electric (HVAC) and fuel burning equipment	25,289	354	-
Benner Spring	Retro-commission electric (HVAC) and fuel burning equipment	17,622	-	115
Corry	Retro-commission electric (HVAC) and fuel burning equipment	13,648	113	-
Fairview	Retro-commission electric (HVAC) and fuel burning equipment	1,524	128	-
Huntsdale	Retro-commission electric (HVAC) and fuel burning equipment	23,080	-	117
Linesville	Retro-commission electric (HVAC) and fuel burning equipment	11,831	1,207	-
Oswayo	Retro-commission electric (HVAC) and fuel burning equipment	3,697	149	-
Pleasant Gap	Retro-commission electric (HVAC) and fuel burning equipment	4,215	194	-
Pleasant Mount	Retro-commission electric (HVAC) and fuel burning equipment	4,818	-	420
Reynoldsdale	Retro-commission electric (HVAC) and fuel burning equipment	12,722	-	59
Tionesta	Retro-commission electric (HVAC) and fuel burning equipment	8,611	82	-
Tylersville	Retro-commission electric (HVAC) and fuel burning equipment	11,933	-	73
Union City	Retro-commission electric (HVAC) and fuel burning equipment	1,641	428	-
	Total	**140,631**	**2,655**	**784**

ECM: **ESCO's ECM #08**

TITLE: **Retro-commissioning**
PROJECT: **PA Fish and Boat Commission**
SITE: **Bellefonte State Fish Hatchery**

DESCRIPTION: Retro-commission building HVAC equipment

METHODOLOGY: Includes tuning of boilers, servicing air conditioners, adjusting occupied set points, etc.

ASSUMPTIONS:		**UNITS**	**SYMBOL:**	**SOURCE NOTES:**
Annual site electric consumption	1,264,446	kwh	A	Utility data
Percent saved with retro-commissioning	2%		B	Engineering estimate
Annual electric saved	25,289	kwh	C = A x B	Calculation
Annual site natural gas consumption	17,723	CCF	F	Utility data
Percent saved with retro-commissioning	2%		G	Engineering estimate
Annual natural gas saved	354	CCF	H = F x G	Calculation

COMMENTS: Assumes a negligible impact on electric demand.

ECM: **ESCO's ECM #08**

TITLE: **Retro-commissioning**
PROJECT: **PA Fish and Boat Commission**
SITE: **Benner Springs State Fish Hatchery**

DESCRIPTION: Retro-commission building HVAC equipment

METHODOLOGY: Includes tuning of boilers, servicing air conditioners, adjusting occupied set points, etc.

ASSUMPTIONS:		**UNITS**	**SYMBOL:**	**SOURCE NOTES:**
Annual site electric consumption	881,113	kwh	A	Utility data
Percent saved with retro-commissioning	2%		B	Engineering estimate
Annual electric saved	17,622	kwh	C = A x B	Calculation
Annual site fuel oil consumption	5,732	Gallons	F	Utility data
Percent saved with retro-commissioning	2%		G	Engineering estimate
Annual fuel oil saved	115	Gallons	H = F x G	Calculation

COMMENTS: Assumes a negligible impact on electric demand.

ECM: **ESCO's ECM #08**

TITLE: **Retro-commissioning**
PROJECT: **PA Fish and Boat Commission**
SITE: **Corry State Fish Hatchery**

DESCRIPTION: Retro-commission building HVAC equipment

METHODOLOGY: Includes tuning of boilers, servicing air conditioners, adjusting occupied set points, etc.

ASSUMPTIONS:		**UNITS**	**SYMBOL:**	**SOURCE NOTES:**
Annual site electric consumption	682,406	kwh	A	Utility data
Percent saved with retro-commissioning	2%		B	Engineering estimate
Annual electric saved	13,648	kwh	C = A x B	Calculation
Annual site natural gas consumption	5,650	CCF	F	Utility data
Percent saved with retro-commissioning	2%		G	Engineering estimate
Annual natural gas saved	113	CCF	H = F x G	Calculation

COMMENTS: Assumes a negligible impact on electric demand.

ECM: **ESCO's ECM #08**

TITLE: **Retro-commissioning**
PROJECT: **PA Fish and Boat Commission**
SITE: **Fairview State Fish Hatchery**

DESCRIPTION: Retro-commission building HVAC equipment

METHODOLOGY: Includes tuning of boilers, servicing air conditioners, adjusting occupied set points, etc.

ASSUMPTIONS:		**UNITS**	**SYMBOL:**	**SOURCE NOTES:**
Annual site electric consumption	76,203	kwh	A	Utility data
Percent saved with retro-commissioning	2%		B	Engineering estimate
Annual electric saved	1,524	kwh	C = A x B	Calculation
Annual site natural gas consumption	6,398	CCF	F	Utility data
Percent saved with retro-commissioning	2%		G	Engineering estimate
Annual natural gas saved	128	CCF	H = F x G	Calculation

COMMENTS: Assumes a negligible impact on electric demand.

ECM: **ESCO's ECM #08**

TITLE: **Retro-commissioning**
PROJECT: **PA Fish and Boat Commission**
SITE: **Huntsdale State Fish Hatchery**

DESCRIPTION: Retro-commission building HVAC equipment

METHODOLOGY: Includes tuning of boilers, servicing air conditioners, adjusting occupied set points, etc.

ASSUMPTIONS:		**UNITS**	**SYMBOL:**	**SOURCE NOTES:**
Annual site electric consumption	1,153,980	kwh	A	Utility data
Percent saved with retro-commissioning	2%		B	Engineering estimate
Annual electric saved	23,080	kwh	C = A x B	Calculation
Annual site fuel oil consumption	5,837	Gallons	F	Utility data
Percent saved with retro-commissioning	2%		G	Engineering estimate
Annual fuel oil saved	117	Gallons	H = F x G	Calculation

COMMENTS: Assumes a negligible impact on electric demand.

ECM: **ESCO's ECM #08**

TITLE: **Retro-commissioning**
PROJECT: **PA Fish and Boat Commission**
SITE: **Linesville State Fish Hatchery**

DESCRIPTION: Retro-commission building HVAC equipment

METHODOLOGY: Includes tuning of boilers, servicing air conditioners, adjusting occupied set points, etc.

ASSUMPTIONS:		**UNITS**	**SYMBOL:**	**SOURCE NOTES:**
Annual site electric consumption	591,547	kwh	A	Utility data
Percent saved with retro-commissioning	2%		B	Engineering estimate
Annual electric saved	11,831	kwh	C = A x B	Calculation
Annual site natural gas consumption	60,342	CCF	F	Utility data
Percent saved with retro-commissioning	2%		G	Engineering estimate
Annual natural gas saved	1,207	CCF	H = F x G	Calculation

COMMENTS: Assumes a negligible impact on electric demand.

ECM: **ESCO's ECM #08**

TITLE: **Retro-commissioning**
PROJECT: **PA Fish and Boat Commission**
SITE: **Oswayo State Fish Hatchery**

DESCRIPTION: Retro-commission building HVAC equipment

METHODOLOGY: Includes tuning of boilers, servicing air conditioners, adjusting occupied set points, etc.

ASSUMPTIONS:		**UNITS**	**SYMBOL:**	**SOURCE NOTES:**
Annual site electric consumption	184,852	kwh	A	Utility data
Percent saved with retro-commissioning	2%		B	Engineering estimate
Annual electric saved	3,697	kwh	C = A x B	Calculation
Annual site natural gas consumption	7,455	CCF	F	Utility data
Percent saved with retro-commissioning	2%		G	Engineering estimate
Annual natural gas saved	149	CCF	H = F x G	Calculation

COMMENTS: Assumes a negligible impact on electric demand.

ECM: **ESCO's ECM #08**

TITLE: **Retro-commissioning**
PROJECT: **PA Fish and Boat Commission**
SITE: **Pleasant Gap State Fish Hatchery**

DESCRIPTION: Retro-commission building HVAC equipment

METHODOLOGY: Includes tuning of boilers, servicing air conditioners, adjusting occupied set points, etc.

ASSUMPTIONS:		**UNITS**	**SYMBOL:**	**SOURCE NOTES:**
Annual site electric consumption	210,736	kwh	A	Utility data
Percent saved with retro-commissioning	2%		B	Engineering estimate
Annual electric saved	4,215	kwh	C = A x B	Calculation
Annual site natural gas consumption	9,694	CCF	F	Utility data
Percent saved with retro-commissioning	2%		G	Engineering estimate
Annual natural gas saved	194	CCF	H = F x G	Calculation

COMMENTS: Assumes a negligible impact on electric demand.

ECM: **ESCO's ECM #08**

TITLE: **Retro-commissioning**
PROJECT: **PA Fish and Boat Commission**
SITE: **Pleasant Mount State Fish Hatchery**

DESCRIPTION: Retro-commission building HVAC equipment

METHODOLOGY: Includes tuning of boilers, servicing air conditioners, adjusting occupied set points, etc.

ASSUMPTIONS:		**UNITS**	**SYMBOL:**	**SOURCE NOTES:**
Annual site electric consumption	240,900	kwh	A	Utility data
Percent saved with retro-commissioning	2%		B	Engineering estimate
Annual electric saved	4,818	kwh	C = A x B	Calculation
Annual site fuel oil consumption	20,994	Gallons	F	Utility data
Percent saved with retro-commissioning	2%		G	Engineering estimate
Annual fuel oil saved	420	Gallons	H = F x G	Calculation

COMMENTS: Assumes a negligible impact on electric demand.

ECM: **ESCO's ECM #08**

TITLE: **Retro-commissioning**
PROJECT: **PA Fish and Boat Commission**
SITE: **Reynoldsdale State Fish Hatchery**

DESCRIPTION: Retro-commission building HVAC equipment

METHODOLOGY: Includes tuning of boilers, servicing air conditioners, adjusting occupied set points, etc.

ASSUMPTIONS:		**UNITS**	**SYMBOL:**	**SOURCE NOTES:**
Annual site electric consumption	636,091	kwh	A	Utility data
Percent saved with retro-commissioning	2%		B	Engineering estimate
Annual electric saved	12,722	kwh	C = A x B	Calculation
Annual site fuel oil consumption	2,961	Gallons	F	Utility data
Percent saved with retro-commissioning	2%		G	Engineering estimate
Annual fuel oil saved	59	Gallons	H = F x G	Calculation

COMMENTS: Assumes a negligible impact on electric demand.

ECM: **ESCO's ECM #08**

TITLE: **Retro-commissioning**
PROJECT: **PA Fish and Boat Commission**
SITE: **Tionest State Fish Hatchery**

DESCRIPTION: Retro-commission building HVAC equipment

METHODOLOGY: Includes tuning of boilers, servicing air conditioners, adjusting occupied set points, etc.

ASSUMPTIONS:		**UNITS**	**SYMBOL:**	**SOURCE NOTES:**
Annual site electric consumption	430,553	kwh	A	Utility data
Percent saved with retro-commissioning	2%		B	Engineering estimate
Annual electric saved	8,611	kwh	C = A x B	Calculation
Annual site natural gas consumption	4,103	CCF	F	Utility data
Percent saved with retro-commissioning	2%		G	Engineering estimate
Annual natural gas saved	82	CCF	H = F x G	Calculation

COMMENTS: Assumes a negligible impact on electric demand.

ECM: **ESCO's ECM #08**

TITLE: **Retro-commissioning**
PROJECT: **PA Fish and Boat Commission**
SITE: **Tylersville State Fish Hatchery**

DESCRIPTION: Retro-commission building HVAC equipment

METHODOLOGY: Includes tuning of boilers, servicing air conditioners, adjusting occupied set points, etc.

ASSUMPTIONS:		**UNITS**	**SYMBOL:**	**SOURCE NOTES:**
Annual site electric consumption	596,640	kwh	A	Utility data
Percent saved with retro-commissioning	2%		B	Engineering estimate
Annual electric saved	11,933	kwh	C = A x B	Calculation
Annual site fuel oil consumption	3,660	Gallons	F	Utility data
Percent saved with retro-commissioning	2%		G	Engineering estimate
Annual fuel oil saved	73	Gallons	H = F x G	Calculation

COMMENTS: Assumes a negligible impact on electric demand.

ECM: **ESCO's ECM #08**

TITLE: **Retro-commissioning**
PROJECT: **PA Fish and Boat Commission**
SITE: **Union City State Fish Hatchery**

DESCRIPTION: Retro-commission building HVAC equipment

METHODOLOGY: Includes tuning of boilers, servicing air conditioners, adjusting occupied set points, etc.

ASSUMPTIONS:		**UNITS**	**SYMBOL:**	**SOURCE NOTES:**
Annual site electric consumption	82,069	kwh	A	Utility data
Percent saved with retro-commissioning	2%		B	Engineering estimate
Annual electric saved	1,641	kwh	C = A x B	Calculation
Annual site natural gas consumption	21,385	CCF	F	Utility data
Percent saved with retro-commissioning	2%		G	Engineering estimate
Annual natural gas saved	428	CCF	H = F x G	Calculation

COMMENTS: Assumes a negligible impact on electric demand.

ECM: **ESCO's ECM #09--SUMMARY**

TITLE: **Install Programmable Thermostats On Heating Units**
PROJECT: **PA Fish and Boat Commission**
SITE: **Summary**

Location	Description of measure	Annual CCF saved	Annual fuel oil saved	Annual kwh saved
Bellefonte	Replace existing thermostat with programmable style	-	-	1,333
Corry	Replace existing thermostat with programmable style	967	-	1,269
Fairview	Replace existing thermostat with programmable style	736	-	-
Huntsdale	Replace existing thermostat with programmable style	-	502	-
Linesville	Replace existing thermostat with programmable style	3,312	-	-
Oswayo	Replace existing thermostat with programmable style	1,419	-	-
Pleasant Gap	Replace existing thermostat with programmable style	2,497	-	-
Pleasant Mount	Replace existing thermostat with programmable style	-	2,337	-
Reynoldsdale	Replace existing thermostat with programmable style	-	701	-
Tionesta	Replace existing thermostat with programmable style	1,104	-	476
Tylersville	Replace existing thermostat with programmable style	-	717	-
Union City	Replace existing thermostat with programmable style	2,891	-	952
	Total	**12,926**	**4,257**	**4,029**

ECM: **ESCO's ECM #09**

Title **Install Programmable Thermostats On Heating Units**

Project Site **PA Fish and Boat Commission**
Bellefonte State Fish Hatchery

Description Programmable thermostats will allow for reduced space temperatures during times when area(s) is not occupied.

Given

Number of stats to be installed at site	=	3	
Combined capacity of gas fired units	=	-	MBtu/hr
Combined capacity of oil fired units	=	-	MBtu/hr
Combined capacity of electric units	=	12	kw
Annual site natural gas use	=	17,723	CCF
Annual site fuel oil use	=	-	Gallons
Annual site electric use	=	1,264,446	kwh

Assumption

Duration of heating season	=	24	weeks/year
Current hours/week at occupied set pt	=	168	hours/week
Current hours/year at occupied set pt	=	4,032	
New hours/week at occupied set pt	=	50	hours/week
New hours/year at occupied set pt	=	1,200	
Existing occupied set point	=	68	degrees F
New unoccupied set point	=	55	degrees F
Avg outside temp during heating season	=	34	degrees F
Average load factor of all units	=	35%	

Formula

Current energy use = Heating unit capacity x hours/year of heating season x load factor / conversion from BTUs to units of energy
Temperature reduction factor = Temp. differential (inside - outside) when unoccupied / Temp. differential (inside - outside) when occupied
New Energy Use = (current energy use x % of time occupied) + (current energy use x % unoccupied x temp reduction factor)
There is no reduction in electric demand as a result of this ECM
Current energy cost = current energy use (units of energy) x cost per unit of energy
Future energy cost = future energy use (units of energy) x cost per unit of energy

Calculation

	Unit capacity		Hrs/yr		Load factor		Mbtu/CCF			
Current gas use (CCF/Yr)	= (-	)x(	4,032	) x (	35%	) / (	103	) =	**-**	CCF

0% of site gas used

	Unit capacity		Hrs/yr		Load factor		Mbtu/Gal			
Current oil use (Gal/Yr)	= (-	)x(	4,032	) x (	35%	) / (	139	) =	**-**	Gal

NA of site oil used

	Unit capacity		Hrs/yr		Load factor		Mbtu/kwh			
Current elec use (kwh)	= (12	)x(	4,032	) x (	35%	) / (	3.413	) =	**4,962**	kwh

0.4% of site elec used

	Unocc temp		OA temp		Occ temp		OA temp		
Temp. reduction factor	= (55	-	34	)/(	68	-	34	) =	62%

	Current use		New % occup		Current use		New % unocc		Temp reduction factor			
Future gas use (CCF/Yr)	= (-	x	30%	)+(	-	x	70%	x	62%	) =	**-**	CCF

	Current use		New % occup		Current use		New % unocc		Temp reduction factor			
Future oil use (Gal/Yr)	= (-	x	30%	)+(	-	x	70%	x	62%	) =	**-**	Gal

	Current use		New % occup		Current use		New % unocc		Temp reduction factor			
Future elec use (kwh/Yr)	= (4,962	x	30%	)+(	4,962	x	70%	x	62%	) =	**3,629**	kwh

Result

	CCF	Gallons	kwh
Annual Existing Energy Use	-	-	4,962
Annual Proposed Energy Use	-	-	3,629
Annual Proposed Energy Savings	**-**	**-**	**1,333**
Percent Saved	NA	NA	27%

Comment

ECM: **ESCO's ECM #09**

Title **Install Programmable Thermostats On Heating Units**

Project Site **PA Fish and Boat Commission**
Corry State Fish Hatchery

Description Programmable thermostats will allow for reduced space temperatures during times when area(s) is not occupied.

Given

Number of stats to be installed at site	=	9	
Combined capacity of gas fired units	=	460	MBtu/hr
Combined capacity of oil fired units	=	-	MBtu/hr
Combined capacity of electric units	=	20	kw
Annual site natural gas use	=	5,650	CCF
Annual site fuel oil use	=	-	Gallons
Annual site electric use	=	682,406	kwh

Assumption

Duration of heating season	=	24	weeks/year
Current hours/week at occupied set pt	=	168	hours/week
Current hours/year at occupied set pt	=	4,032	
New hours/week at occupied set pt	=	50	hours/week
New hours/year at occupied set pt	=	1,200	
Existing occupied set point	=	68	degrees F
New unoccupied set point	=	55	degrees F
Avg outside temp during heating season	=	34	degrees F
Average load factor of all units	=	20%	

Formula

Current energy use = Heating unit capacity x hours/year of heating season x load factor / conversion from BTUs to units of energy
Temperature reduction factor = Temp. differential (inside - outside) when unoccupied / Temp. differential (inside - outside) when occupied
New Energy Use = (current energy use x % of time occupied) + (current energy use x % unoccupied x temp reduction factor)
There is no reduction in electric demand as a result of this ECM
Current energy cost = current energy use (units of energy) x cost per unit of energy
Future energy cost = future energy use (units of energy) x cost per unit of energy

Calculation

	Unit capacity		Hrs/yr		Load factor		Mbtu/CCF			
Current gas use (CCF/Yr)	= (460	)x(	4,032	) x (	20%	) / (	103	) =	**3,601** CCF	64% of site gas used

	Unit capacity		Hrs/yr		Load factor		Mbtu/Gal			
Current oil use (Gal/Yr)	= (-	)x(	4,032	) x (	20%	) / (	139	) =	**-** Gal	NA of site oil used

	Unit capacity		Hrs/yr		Load factor		Mbtu/kwh			
Current elec use (kwh)	= (20	)x(	4,032	) x (	20%	) / (	3.413	) =	**4,725** kwh	1% of site elec used

	Unocc temp		OA temp		Occ temp		OA temp		
Temp. reduction factor	= (55	-	34	)/(	68	-	34	) =	62%

	Current use		New % occup		Current use		New % unocc		Temp reduction factor		
Future gas use (CCF/Yr)	= (3,601	x	30%	)+(	3,601	x	70%	x	62%	) =	**2,634** CCF

	Current use		New % occup		Current use		New % unocc		Temp reduction factor		
Future oil use (Gal/Yr)	= (-	x	30%	)+(	-	x	70%	x	62%	) =	**-** Gal

	Current use		New % occup		Current use		New % unocc		Temp reduction factor		
Future elec use (kwh/Yr)	= (4,725	x	30%	)+(	4,725	x	70%	x	62%	) =	**3,456** kwh

Result

	CCF	Gallons	kwh
Annual Existing Energy Use	3,601	-	4,725
Annual Proposed Energy Use	2,634	-	3,456
Annual Proposed Energy Savings	**967**	**-**	**1,269**
Percent Saved	27%	NA	27%

Comment

ECM: **ESCO's ECM #09**

Title **Install Programmable Thermostats On Heating Units**

Project Site **PA Fish and Boat Commission**
Fairview State Fish Hatchery

Description Programmable thermostats will allow for reduced space temperatures during times when area(s) is not occupied.

Given

Number of stats to be installed at site	=	3	
Combined capacity of gas fired units	=	200	MBtu/hr
Combined capacity of oil fired units	=	-	MBtu/hr
Combined capacity of electric units	=	-	kw
Annual site natural gas use	=	6,398	CCF
Annual site fuel oil use	=	-	Gallons
Annual site electric use	=	76,203	kwh

Assumption

Duration of heating season	=	24	weeks/year
Current hours/week at occupied set pt	=	168	hours/week
Current hours/year at occupied set pt	=	4,032	
New hours/week at occupied set pt	=	50	hours/week
New hours/year at occupied set pt	=	1,200	
Existing occupied set point	=	68	degrees F
New unoccupied set point	=	55	degrees F
Avg outside temp during heating season	=	34	degrees F
Average load factor of all units	=	35%	

Formula

Current energy use = Heating unit capacity x hours/year of heating season x load factor / conversion from BTUs to units of energy
Temperature reduction factor = Temp. differential (inside - outside) when unoccupied / Temp. differential (inside - outside) when occupied
New Energy Use = (current energy use x % of time occupied) + (current energy use x % unoccupied x temp reduction factor)
There is no reduction in electric demand as a result of this ECM
Current energy cost = current energy use (units of energy) x cost per unit of energy
Future energy cost = future energy use (units of energy) x cost per unit of energy

Calculation

	Unit capacity		Hrs/yr		Load factor		Mbtu/CCF			
Current gas use (CCF/Yr)	= (200	)x(	4,032	) x (	35%	) / (	103	) =	**2,740** CCF	43% of site gas used

	Unit capacity		Hrs/yr		Load factor		Mbtu/Gal			
Current oil use (Gal/Yr)	= (-	)x(	4,032	) x (	35%	) / (	139	) =	**-** Gal	NA of site oil used

	Unit capacity		Hrs/yr		Load factor		Mbtu/kwh			
Current elec use (kwh)	= (-	)x(	4,032	) x (	35%	) / (	3.413	) =	**-** kwh	0% of site elec used

	Unocc temp		OA temp		Occ temp		OA temp		
Temp. reduction factor	= (55	-	34	)/(	68	-	34	) =	62%

	Current use		New % occup		Current use		New % unocc		Temp reduction factor		
Future gas use (CCF/Yr)	= (2,740	x	30%	)+(	2,740	x	70%	x	62%	) =	**2,004** CCF

	Current use		New % occup		Current use		New % unocc		Temp reduction factor		
Future oil use (Gal/Yr)	= (-	x	30%	)+(	-	x	70%	x	62%	) =	**-** Gal

	Current use		New % occup		Current use		New % unocc		Temp reduction factor		
Future elec use (kwh/Yr)	= (-	x	30%	)+(	-	x	70%	x	62%	) =	**-** kwh

Result

	CCF	Gallons	kwh
Annual Existing Energy Use	2,740	-	-
Annual Proposed Energy Use	2,004	-	-
Annual Proposed Energy Savings	**736**	**-**	**-**
Percent Saved	27%	NA	NA

Comment

ECM: **ESCO's ECM #09**

Title **Install Programmable Thermostats On Heating Units**

Project Site **PA Fish and Boat Commission**
Huntsdale State Fish Hatchery

Description Programmable thermostats will allow for reduced space temperatures during times when area(s) is not occupied.

Given

Number of stats to be installed at site	=	3	
Combined capacity of gas fired units	=	-	MBtu/hr
Combined capacity of oil fired units	=	184	MBtu/hr
Combined capacity of electric units	=	-	kw
Annual site natural gas use	=	-	CCF
Annual site fuel oil use	=	5,837	Gallons
Annual site electric use	=	1,153,980	kwh

Assumption

Duration of heating season	=	24	weeks/year
Current hours/week at occupied set pt	=	168	hours/week
Current hours/year at occupied set pt	=	4,032	
New hours/week at occupied set pt	=	50	hours/week
New hours/year at occupied set pt	=	1,200	
Existing occupied set point	=	68	degrees F
New unoccupied set point	=	55	degrees F
Avg outside temp during heating season	=	34	degrees F
Average load factor of all units	=	35%	

Formula

Current energy use = Heating unit capacity x hours/year of heating season x load factor / conversion from BTUs to units of energy
Temperature reduction factor = Temp. differential (inside - outside) when unoccupied / Temp. differential (inside - outside) when occupied
New Energy Use = (current energy use x % of time occupied) + (current energy use x % unoccupied x temp reduction factor)
There is no reduction in electric demand as a result of this ECM
Current energy cost = current energy use (units of energy) x cost per unit of energy
Future energy cost = future energy use (units of energy) x cost per unit of energy

Calculation

	Unit capacity		Hrs/yr		Load factor		Mbtu/CCF				
Current gas use (CCF/Yr)	= (-	)x(	4,032	) x (	35%	) / (	103	) =	-	CCF	NA of site gas used

	Unit capacity		Hrs/yr		Load factor		Mbtu/Gal				
Current oil use (Gal/Yr)	= (184	)x(	4,032	) x (	35%	) / (	139	) =	**1,868**	Gal	32% of site oil used

	Unit capacity		Hrs/yr		Load factor		Mbtu/kwh				
Current elec use (kwh)	= (-	)x(	4,032	) x (	35%	) / (	3.413	) =	-	kwh	0% of site elec used

	Unocc temp		OA temp		Occ temp		OA temp		
Temp. reduction factor	= (55	-	34	)/(	68	-	34	) =	62%

	Current use		New % occup		Current use		New % unocc		Temp reduction factor		
Future gas use (CCF/Yr)	= (-	x	30%	)+(	-	x	70%	x	62%	) =	- CCF

	Current use		New % occup		Current use		New % unocc		Temp reduction factor		
Future oil use (Gal/Yr)	= (1,868	x	30%	)+(	1,868	x	70%	x	62%	) =	**1,366** Gal

	Current use		New % occup		Current use		New % unocc		Temp reduction factor		
Future elec use (kwh/Yr)	= (-	x	30%	)+(	-	x	70%	x	62%	) =	- kwh

Result

	CCF	Gallons	kwh
Annual Existing Energy Use	-	1,868	-
Annual Proposed Energy Use	-	1,366	-
Annual Proposed Energy Savings	**-**	**502**	**-**
Percent Saved	NA	27%	NA

Comment

ECM: **ESCO's ECM #09**

Title **Install Programmable Thermostats On Heating Units**

Project Site **PA Fish and Boat Commission**
Linesville State Fish Hatchery

Description Programmable thermostats will allow for reduced space temperatures during times when area(s) is not occupied.

Given

Number of stats to be installed at site	=	12	
Combined capacity of gas fired units	=	900	MBtu/hr
Combined capacity of oil fired units	=	-	MBtu/hr
Combined capacity of electric units	=	-	kw
Annual site natural gas use	=	60,342	CCF
Annual site fuel oil use	=	-	Gallons
Annual site electric use	=	591,547	kwh

Assumption

Duration of heating season	=	24	weeks/year
Current hours/week at occupied set pt	=	168	hours/week
Current hours/year at occupied set pt	=	4,032	
New hours/week at occupied set pt	=	50	hours/week
New hours/year at occupied set pt	=	1,200	
Existing occupied set point	=	68	degrees F
New unoccupied set point	=	55	degrees F
Avg outside temp during heating season	=	34	degrees F
Average load factor of all units	=	35%	

Formula

Current energy use = Heating unit capacity x hours/year of heating season x load factor / conversion from BTUs to units of energy
Temperature reduction factor = Temp. differential (inside - outside) when unoccupied / Temp. differential (inside - outside) when occupied
New Energy Use = (current energy use x % of time occupied) + (current energy use x % unoccupied x temp reduction factor)
There is no reduction in electric demand as a result of this ECM
Current energy cost = current energy use (units of energy) x cost per unit of energy
Future energy cost = future energy use (units of energy) x cost per unit of energy

Calculation

	Unit capacity		Hrs/yr		Load factor		Mbtu/CCF			
Current gas use (CCF/Yr)	= (900	)x(	4,032	) x (	35%	) / (	103	) =	**12,331**	CCF

20% of site gas used

	Unit capacity		Hrs/yr		Load factor		Mbtu/Gal			
Current oil use (Gal/Yr)	= (-	)x(	4,032	) x (	35%	) / (	139	) =	**-**	Gal

NA of site oil used

	Unit capacity		Hrs/yr		Load factor		Mbtu/kwh			
Current elec use (kwh)	= (-	)x(	4,032	) x (	35%	) / (	3.413	) =	**-**	kwh

0% of site elec used

	Unocc temp		OA temp		Occ temp		OA temp		
Temp. reduction factor	= (55	-	34	)/(	68	-	34	) =	62%

	Current use		New % occup		Current use		New % unocc		Temp reduction factor			
Future gas use (CCF/Yr)	= (12,331	x	30%	)+(	12,331	x	70%	x	62%	) =	**9,019**	CCF
Future oil use (Gal/Yr)	= (-	x	30%	)+(	-	x	70%	x	62%	) =	**-**	Gal
Future elec use (kwh/Yr)	= (-	x	30%	)+(	-	x	70%	x	62%	) =	**-**	kwh

Result

	CCF	Gallons	kwh
Annual Existing Energy Use	12,331	-	-
Annual Proposed Energy Use	9,019	-	-
Annual Proposed Energy Savings	**3,312**	**-**	**-**
Percent Saved	27%	NA	NA

Comment

ECM: **ESCO's ECM #09**

Title **Install Programmable Thermostats On Heating Units**

Project Site **PA Fish and Boat Commission**
Oswayo State Fish Hatchery

Description Programmable thermostats will allow for reduced space temperatures during times when area(s) is not occupied.

Given

Number of stats to be installed at site	=	9	
Combined capacity of gas fired units	=	450	MBtu/hr
Combined capacity of oil fired units	=	-	MBtu/hr
Combined capacity of electric units	=	-	kw
Annual site natural gas use	=	7,455	CCF
Annual site fuel oil use	=	-	Gallons
Annual site electric use	=	184,852	kwh

Assumption

Duration of heating season	=	24	weeks/year
Current hours/week at occupied set pt	=	168	hours/week
Current hours/year at occupied set pt	=	4,032	
New hours/week at occupied set pt	=	50	hours/week
New hours/year at occupied set pt	=	1,200	
Existing occupied set point	=	68	degrees F
New unoccupied set point	=	55	degrees F
Avg outside temp during heating season	=	34	degrees F
Average load factor of all units	=	30%	

Formula

Current energy use = Heating unit capacity x hours/year of heating season x load factor / conversion from BTUs to units of energy
Temperature reduction factor = Temp. differential (inside - outside) when unoccupied / Temp. differential (inside - outside) when occupied
New Energy Use = (current energy use x % of time occupied) + (current energy use x % unoccupied x temp reduction factor)
There is no reduction in electric demand as a result of this ECM
Current energy cost = current energy use (units of energy) x cost per unit of energy
Future energy cost = future energy use (units of energy) x cost per unit of energy

Calculation

	Unit capacity		Hrs/yr		Load factor		Mbtu/CCF			
Current gas use (CCF/Yr)	= (450	)x(	4,032	) x (	30%	) / (	103	) =	**5,285**	CCF

71% of site gas used

	Unit capacity		Hrs/yr		Load factor		Mbtu/Gal			
Current oil use (Gal/Yr)	= (-	)x(	4,032	) x (	30%	) / (	139	) =	-	Gal

NA of site oil used

	Unit capacity		Hrs/yr		Load factor		Mbtu/kwh			
Current elec use (kwh)	= (-	)x(	4,032	) x (	30%	) / (	3.413	) =	-	kwh

0% of site elec used

	Unocc temp		OA temp		Occ temp		OA temp		
Temp. reduction factor	= (55	-	34	)/(	68	-	34	) =	62%

	Current use		New % occup		Current use		New % unocc		Temp reduction factor			
Future gas use (CCF/Yr)	= (5,285	x	30%	)+(	5,285	x	70%	x	62%	) =	**3,865**	CCF

	Current use		New % occup		Current use		New % unocc		Temp reduction factor			
Future oil use (Gal/Yr)	= (-	x	30%	)+(	-	x	70%	x	62%	) =	-	Gal

	Current use		New % occup		Current use		New % unocc		Temp reduction factor			
Future elec use (kwh/Yr)	= (-	x	30%	)+(	-	x	70%	x	62%	) =	-	kwh

Result

	CCF	Gallons	kwh
Annual Existing Energy Use	5,285	-	-
Annual Proposed Energy Use	3,865	-	-
Annual Proposed Energy Savings	**1,419**	**-**	**-**
Percent Saved	27%	NA	NA

Comment

ECM: **ESCO's ECM #09**

Title **Install Programmable Thermostats On Heating Units**

Project Site **PA Fish and Boat Commission**
Pleasant Gap State Fish Hatchery

Description Programmable thermostats will allow for reduced space temperatures during times when area(s) is not occupied.

Given

Number of stats to be installed at site	=	9	
Combined capacity of gas fired units	=	950	MBtu/hr
Combined capacity of oil fired units	=	-	MBtu/hr
Combined capacity of electric units	=	-	kw
Annual site natural gas use	=	9,694	CCF
Annual site fuel oil use	=	-	Gallons
Annual site electric use	=	210,736	kwh

Assumption

Duration of heating season	=	24	weeks/year
Current hours/week at occupied set pt	=	168	hours/week
Current hours/year at occupied set pt	=	4,032	
New hours/week at occupied set pt	=	50	hours/week
New hours/year at occupied set pt	=	1,200	
Existing occupied set point	=	68	degrees F
New unoccupied set point	=	55	degrees F
Avg outside temp during heating season	=	34	degrees F
Average load factor of all units	=	25%	

Formula

Current energy use = Heating unit capacity x hours/year of heating season x load factor / conversion from BTUs to units of energy
Temperature reduction factor = Temp. differential (inside - outside) when unoccupied / Temp. differential (inside - outside) when occupied
New Energy Use = (current energy use x % of time occupied) + (current energy use x % unoccupied x temp reduction factor)
There is no reduction in electric demand as a result of this ECM
Current energy cost = current energy use (units of energy) x cost per unit of energy
Future energy cost = future energy use (units of energy) x cost per unit of energy

Calculation

	Unit capacity		Hrs/yr		Load factor		Mbtu/CCF			
Current gas use (CCF/Yr)	= (950	)x(	4,032	) x (	25%	) / (	103	) =	**9,297**	CCF

96% of site gas used

	Unit capacity		Hrs/yr		Load factor		Mbtu/Gal			
Current oil use (Gal/Yr)	= (-	)x(	4,032	) x (	25%	) / (	139	) =	-	Gal

NA of site oil used

	Unit capacity		Hrs/yr		Load factor		Mbtu/kwh			
Current elec use (kwh)	= (-	)x(	4,032	) x (	25%	) / (	3.413	) =	-	kwh

0% of site elec used

	Unocc temp		OA temp		Occ temp		OA temp		
Temp. reduction factor	= (55	-	34	)/(	68	-	34	) =	62%

	Current use		New % occup		Current use		New % unocc		Temp reduction factor			
Future gas use (CCF/Yr)	= (9,297	x	30%	)+(	9,297	x	70%	x	62%	) =	**6,800**	CCF

	Current use		New % occup		Current use		New % unocc		Temp reduction factor			
Future oil use (Gal/Yr)	= (-	x	30%	)+(	-	x	70%	x	62%	) =	-	Gal

	Current use		New % occup		Current use		New % unocc		Temp reduction factor			
Future elec use (kwh/Yr)	= (-	x	30%	)+(	-	x	70%	x	62%	) =	-	kwh

Result

	CCF	Gallons	kwh
Annual Existing Energy Use	9,297	-	-
Annual Proposed Energy Use	6,800	-	-
Annual Proposed Energy Savings	**2,497**	**-**	**-**
Percent Saved	27%	NA	NA

Comment

ECM: **ESCO's ECM #09**

Title **Install Programmable Thermostats On Heating Units**

Project Site **PA Fish and Boat Commission**
Pleasant Mount State Fish Hatchery

Description Programmable thermostats will allow for reduced space temperatures during times when area(s) is not occupied.

Given

Number of stats to be installed at site	=	17	
Combined capacity of gas fired units	=	-	MBtu/hr
Combined capacity of oil fired units	=	1,000	MBtu/hr
Combined capacity of electric units	=	-	kw
Annual site natural gas use	=	-	CCF
Annual site fuel oil use	=	20,994	Gallons
Annual site electric use	=	240,900	kwh

Assumption

Duration of heating season	=	24	weeks/year
Current hours/week at occupied set pt	=	168	hours/week
Current hours/year at occupied set pt	=	4,032	
New hours/week at occupied set pt	=	50	hours/week
New hours/year at occupied set pt	=	1,200	
Existing occupied set point	=	68	degrees F
New unoccupied set point	=	55	degrees F
Avg outside temp during heating season	=	34	degrees F
Average load factor of all units	=	30%	

Formula

Current energy use = Heating unit capacity x hours/year of heating season x load factor / conversion from BTUs to units of energy
Temperature reduction factor = Temp. differential (inside - outside) when unoccupied / Temp. differential (inside - outside) when occupied
New Energy Use = (current energy use x % of time occupied) + (current energy use x % unoccupied x temp reduction factor)
There is no reduction in electric demand as a result of this ECM
Current energy cost = current energy use (units of energy) x cost per unit of energy
Future energy cost = future energy use (units of energy) x cost per unit of energy

Calculation

	Unit capacity		Hrs/yr		Load factor		Mbtu/CCF				
Current gas use (CCF/Yr)	= (-	)x(	4,032	) x (	30%	) / (	103	) =	-	CCF	NA of site gas used

	Unit capacity		Hrs/yr		Load factor		Mbtu/Gal				
Current oil use (Gal/Yr)	= (1,000	)x(	4,032	) x (	30%	) / (	139	) =	**8,702**	Gal	41% of site oil used

	Unit capacity		Hrs/yr		Load factor		Mbtu/kwh				
Current elec use (kwh)	= (-	)x(	4,032	) x (	30%	) / (	3.413	) =	-	kwh	0% of site elec used

	Unocc temp		OA temp		Occ temp		OA temp		
Temp. reduction factor	= (55	-	34	)/(	68	-	34	) =	62%

	Current use		New % occup		Current use		New % unocc		Temp reduction factor		
Future gas use (CCF/Yr)	= (-	x	30%	)+(	-	x	70%	x	62%	) =	- CCF

	Current use		New % occup		Current use		New % unocc		Temp reduction factor		
Future oil use (Gal/Yr)	= (8,702	x	30%	)+(	8,702	x	70%	x	62%	) =	**6,365** Gal

	Current use		New % occup		Current use		New % unocc		Temp reduction factor		
Future elec use (kwh/Yr)	= (-	x	30%	)+(	-	x	70%	x	62%	) =	- kwh

Result

	CCF	Gallons	kwh
Annual Existing Energy Use	-	8,702	-
Annual Proposed Energy Use	-	6,365	-
Annual Proposed Energy Savings	**-**	**2,337**	**-**
Percent Saved	NA	27%	NA

Comment

ECM: **ESCO's ECM #09**

Title **Install Programmable Thermostats On Heating Units**

Project Site **PA Fish and Boat Commission**
Reynoldsdale State Fish Hatchery

Description Programmable thermostats will allow for reduced space temperatures during times when area(s) is not occupied.

Given

Number of stats to be installed at site	=	3	
Combined capacity of gas fired units	=	-	MBtu/hr
Combined capacity of oil fired units	=	450	MBtu/hr
Combined capacity of electric units	=	-	kw
Annual site natural gas use	=	-	CCF
Annual site fuel oil use	=	2,961	Gallons
Annual site electric use	=	636,091	kwh

Assumption

Duration of heating season	=	24	weeks/year
Current hours/week at occupied set pt	=	168	hours/week
Current hours/year at occupied set pt	=	4,032	
New hours/week at occupied set pt	=	50	hours/week
New hours/year at occupied set pt	=	1,200	
Existing occupied set point	=	68	degrees F
New unoccupied set point	=	55	degrees F
Avg outside temp during heating season	=	34	degrees F
Average load factor of all units	=	20%	

Formula

Current energy use = Heating unit capacity x hours/year of heating season x load factor / conversion from BTUs to units of energy
Temperature reduction factor = Temp. differential (inside - outside) when unoccupied / Temp. differential (inside - outside) when occupied
New Energy Use = (current energy use x % of time occupied) + (current energy use x % unoccupied x temp reduction factor)
There is no reduction in electric demand as a result of this ECM
Current energy cost = current energy use (units of energy) x cost per unit of energy
Future energy cost = future energy use (units of energy) x cost per unit of energy

Calculation

	Unit capacity		Hrs/yr		Load factor		Mbtu/CCF				
Current gas use (CCF/Yr)	= (-	)x(	4,032	) x (	20%	) / (	103	) =	-	CCF	NA of site gas used

	Unit capacity		Hrs/yr		Load factor		Mbtu/Gal				
Current oil use (Gal/Yr)	= (450	)x(	4,032	) x (	20%	) / (	139	) =	**2,611**	Gal	88% of site oil used

	Unit capacity		Hrs/yr		Load factor		Mbtu/kwh				
Current elec use (kwh)	= (-	)x(	4,032	) x (	20%	) / (	3.413	) =	-	kwh	0% of site elec used

	Unocc temp		OA temp		Occ temp		OA temp		
Temp. reduction factor	= (55	-	34	)/(	68	-	34	) =	62%

	Current use		New % occup		Current use		New % unocc		Temp reduction factor		
Future gas use (CCF/Yr)	= (-	x	30%	)+(	-	x	70%	x	62%	) =	- CCF

	Current use		New % occup		Current use		New % unocc		Temp reduction factor		
Future oil use (Gal/Yr)	= (2,611	x	30%	)+(	2,611	x	70%	x	62%	) =	**1,910** Gal

	Current use		New % occup		Current use		New % unocc		Temp reduction factor		
Future elec use (kwh/Yr)	= (-	x	30%	)+(	-	x	70%	x	62%	) =	- kwh

Result

	CCF	Gallons	kwh
Annual Existing Energy Use	-	2,611	-
Annual Proposed Energy Use	-	1,910	-
Annual Proposed Energy Savings	**-**	**701**	**-**
Percent Saved	NA	27%	NA

Comment

ECM: **ESCO's ECM #09**

Title **Install Programmable Thermostats On Heating Units**

Project **PA Fish and Boat Commission**
Site **Tionesta State Fish Hatchery**

Description Programmable thermostats will allow for reduced space temperatures during times when area(s) is not occupied.

Given

Number of stats to be installed at site	=	9	
Combined capacity of gas fired units	=	700	MBtu/hr
Combined capacity of oil fired units	=	-	MBtu/hr
Combined capacity of electric units	=	10	kw
Annual site natural gas use	=	4,103	CCF
Annual site fuel oil use	=	-	Gallons
Annual site electric use	=	430,553	kwh

Assumption

Duration of heating season	=	24	weeks/year
Current hours/week at occupied set pt	=	168	hours/week
Current hours/year at occupied set pt	=	4,032	
New hours/week at occupied set pt	=	50	hours/week
New hours/year at occupied set pt	=	1,200	
Existing occupied set point	=	68	degrees F
New unoccupied set point	=	55	degrees F
Avg outside temp during heating season	=	34	degrees F
Average load factor of all units	=	15%	

Formula

Current energy use = Heating unit capacity x hours/year of heating season x load factor / conversion from BTUs to units of energy
Temperature reduction factor = Temp. differential (inside - outside) when unoccupied / Temp. differential (inside - outside) when occupied
New Energy Use = (current energy use x % of time occupied) + (current energy use x % unoccupied x temp reduction factor)
There is no reduction in electric demand as a result of this ECM
Current energy cost = current energy use (units of energy) x cost per unit of energy
Future energy cost = future energy use (units of energy) x cost per unit of energy

Calculation

	Unit capacity		Hrs/yr		Load factor		Mbtu/CCF			
Current gas use (CCF/Yr)	= (700	)x(	4,032	) x (	15%	) / (	103	) =	**4,110**	CCF

100% of site gas used

	Unit capacity		Hrs/yr		Load factor		Mbtu/Gal			
Current oil use (Gal/Yr)	= (-	)x(	4,032	) x (	15%	) / (	139	) =	**-**	Gal

NA of site oil used

	Unit capacity		Hrs/yr		Load factor		Mbtu/kwh			
Current elec use (kwh)	= (10	)x(	4,032	) x (	15%	) / (	3.413	) =	**1,772**	kwh

0% of site elec used

	Unocc temp		OA temp		Occ temp		OA temp		
Temp. reduction factor	= (55	-	34	)/(	68	-	34	) =	62%

	Current use		New % occup		Current use		New % unocc		Temp reduction factor			
Future gas use (CCF/Yr)	= (4,110	x	30%	)+(	4,110	x	70%	x	62%	) =	**3,006**	CCF

	Current use		New % occup		Current use		New % unocc		Temp reduction factor			
Future oil use (Gal/Yr)	= (-	x	30%	)+(	-	x	70%	x	62%	) =	**-**	Gal

	Current use		New % occup		Current use		New % unocc		Temp reduction factor			
Future elec use (kwh/Yr)	= (1,772	x	30%	)+(	1,772	x	70%	x	62%	) =	**1,296**	kwh

Result

	CCF	Gallons	kwh
Annual Existing Energy Use	4,110	-	1,772
Annual Proposed Energy Use	3,006	-	1,296
Annual Proposed Energy Savings	**1,104**	**-**	**476**
Percent Saved	27%	NA	27%

Comment

ECM: **ESCO's ECM #09**

Title **Install Programmable Thermostats On Heating Units**

Project **PA Fish and Boat Commission**
Site **Tylersville State Fish Hatchery**

Description Programmable thermostats will allow for reduced space temperatures during times when area(s) is not occupied.

Given

Number of stats to be installed at site	=	8	
Combined capacity of gas fired units	=	-	MBtu/hr
Combined capacity of oil fired units	=	230	MBtu/hr
Combined capacity of electric units	=		kw
Annual site natural gas use	=	-	CCF
Annual site fuel oil use	=	3,660	Gallons
Annual site electric use	=	596,640	kwh

Assumption

Duration of heating season	=	24	weeks/year
Current hours/week at occupied set pt	=	168	hours/week
Current hours/year at occupied set pt	=	4,032	
New hours/week at occupied set pt	=	50	hours/week
New hours/year at occupied set pt	=	1,200	
Existing occupied set point	=	68	degrees F
New unoccupied set point	=	55	degrees F
Avg outside temp during heating season	=	34	degrees F
Average load factor of all units	=	40%	

Formula

Current energy use = Heating unit capacity x hours/year of heating season x load factor / conversion from BTUs to units of energy
Temperature reduction factor = Temp. differential (inside - outside) when unoccupied / Temp. differential (inside - outside) when occupied
New Energy Use = (current energy use x % of time occupied) + (current energy use x % unoccupied x temp reduction factor)
There is no reduction in electric demand as a result of this ECM
Current energy cost = current energy use (units of energy) x cost per unit of energy
Future energy cost = future energy use (units of energy) x cost per unit of energy

Calculation

	Unit capacity		Hrs/yr		Load factor		Mbtu/CCF				
Current gas use (CCF/Yr)	= (-	)x(	4,032	) x (	40%	) / (	103	) =	**-**	CCF	NA of site gas used

	Unit capacity		Hrs/yr		Load factor		Mbtu/Gal				
Current oil use (Gal/Yr)	= (230	)x(	4,032	) x (	40%	) / (	139	) =	**2,669**	Gal	73% of site oil used

	Unit capacity		Hrs/yr		Load factor		Mbtu/kwh				
Current elec use (kwh)	= (-	)x(	4,032	) x (	40%	) / (	3.413	) =	**-**	kwh	0% of site elec used

	Unocc temp		OA temp		Occ temp		OA temp		
Temp. reduction factor	= (55	-	34	)/(	68	-	34	) =	62%

	Current use		New % occup		Current use		New % unocc		Temp reduction factor		
Future gas use (CCF/Yr)	= (-	x	30%	)+(	-	x	70%	x	62%	) =	**-** CCF

	Current use		New % occup		Current use		New % unocc		Temp reduction factor		
Future oil use (Gal/Yr)	= (2,669	x	30%	)+(	2,669	x	70%	x	62%	) =	**1,952** Gal

	Current use		New % occup		Current use		New % unocc		Temp reduction factor		
Future elec use (kwh/Yr)	= (-	x	30%	)+(	-	x	70%	x	62%	) =	**-** kwh

Result

	CCF	Gallons	kwh
Annual Existing Energy Use	-	2,669	-
Annual Proposed Energy Use	-	1,952	-
Annual Proposed Energy Savings	**-**	**717**	**-**
Percent Saved	NA	27%	NA

Comment

ECM: **ESCO's ECM #09**

Title **Install Programmable Thermostats On Heating Units**

Project Site **PA Fish and Boat Commission**
Union City State Fish Hatchery

Description Programmable thermostats will allow for reduced space temperatures during times when area(s) is not occupied.

Given

Number of stats to be installed at site	=	5	
Combined capacity of gas fired units	=	550	MBtu/hr
Combined capacity of oil fired units	=	-	MBtu/hr
Combined capacity of electric units	=	6	kw
Annual site natural gas use	=	21,385	CCF
Annual site fuel oil use	=	-	Gallons
Annual site electric use	=	82,069	kwh

Assumption

Duration of heating season	=	24	weeks/year
Current hours/week at occupied set pt	=	168	hours/week
Current hours/year at occupied set pt	=	4,032	
New hours/week at occupied set pt	=	50	hours/week
New hours/year at occupied set pt	=	1,200	
Existing occupied set point	=	68	degrees F
New unoccupied set point	=	55	degrees F
Avg outside temp during heating season	=	34	degrees F
Average load factor of all units	=	50%	

Formula

Current energy use = Heating unit capacity x hours/year of heating season x load factor / conversion from BTUs to units of energy
Temperature reduction factor = Temp. differential (inside - outside) when unoccupied / Temp. differential (inside - outside) when occupied
New Energy Use = (current energy use x % of time occupied) + (current energy use x % unoccupied x temp reduction factor)
There is no reduction in electric demand as a result of this ECM
Current energy cost = current energy use (units of energy) x cost per unit of energy
Future energy cost = future energy use (units of energy) x cost per unit of energy

Calculation

	Unit capacity		Hrs/yr		Load factor		Mbtu/CCF			
Current gas use (CCF/Yr)	= (550	)x(	4,032	) x (	50%	) / (	103	) =	**10,765**	CCF

50% of site gas used

	Unit capacity		Hrs/yr		Load factor		Mbtu/Gal			
Current oil use (Gal/Yr)	= (-	)x(	4,032	) x (	50%	) / (	139	) =	**-**	Gal

NA of site oil used

	Unit capacity		Hrs/yr		Load factor		Mbtu/kwh			
Current elec use (kwh)	= (6	)x(	4,032	) x (	50%	) / (	3.413	) =	**3,544**	kwh

4% of site elec used

	Unocc temp		OA temp		Occ temp		OA temp		
Temp. reduction factor	= (55	-	34	)/(	68	-	34	) =	62%

	Current use		New % occup		Current use		New % unocc		Temp reduction factor		
Future gas use (CCF/Yr)	= (10,765	x	30%	)+(	10,765	x	70%	x	62%	) =	**7,874** CCF

	Current use		New % occup		Current use		New % unocc		Temp reduction factor		
Future oil use (Gal/Yr)	= (-	x	30%	)+(	-	x	70%	x	62%	) =	**-** Gal

	Current use		New % occup		Current use		New % unocc		Temp reduction factor		
Future elec use (kwh/Yr)	= (3,544	x	30%	)+(	3,544	x	70%	x	62%	) =	**2,592** kwh

Result

	CCF	Gallons	kwh
Annual Existing Energy Use	10,765	-	3,544
Annual Proposed Energy Use	7,874	-	2,592
Annual Proposed Energy Savings	**2,891**	**-**	**952**
Percent Saved	27%	NA	27%

Comment

ECM: **ESCO's ECM #10**
Title BERT Plug Load Controllers
Project PA Fish & Boat Commission
Site All Facilities

	Device Type	Watts	Qty	Total Watts	Current Hours of Operation	Controlled On Hours	Annual kWh Savings
Bellefonte SFH	Large Copier	40	1	40	8760	2580	247.2
	H/C Water Dispenser	62	1	62	8760	2580	383.16
Benner Spring SFH	Large Copier	40	1	40	8760	2580	247.2
	H/C Water Dispenser	62	1	62	8760	2580	383.16
Corry SFH	Large Copier	40	1	40	8760	2580	247.2
	H/C Water Dispenser	62	1	62	8760	2580	383.16
Fairview SFH	Large Copier	40	1	40	8760	2580	247.2
	H/C Water Dispenser	62	1	62	8760	2580	383.16
Huntsdale SFH	Large Copier	40	1	40	8760	2580	247.2
	H/C Water Dispenser	62	1	62	8760	2580	383.16
Linesville SFH	Large Copier	40	1	40	8760	2580	247.2
	H/C Water Dispenser	62	1	62	8760	2580	383.16
Oswayo SFH	Large Copier	40	1	40	8760	2580	247.2
	H/C Water Dispenser	62	1	62	8760	2580	383.16
PFBC HQ Harrisburg	Large Copier	40	3	120	8760	2580	741.6
	H/C Water Dispenser	62	3	186	8760	2580	1149.48
Pleasant Gap SFH	Large Copier	40	1	40	8760	2580	247.2
	H/C Water Dispenser	62	1	62	8760	2580	383.16
Pleasant Mount SFH	Large Copier	40	1	40	8760	2580	247.2
	H/C Water Dispenser	62	1	62	8760	2580	383.16
Reynoldsdale SFH	Large Copier	40	1	40	8760	2580	247.2
	H/C Water Dispenser	62	1	62	8760	2580	383.16
Tionesta SFH	Large Copier	40	1	40	8760	2580	247.2
	H/C Water Dispenser	62	1	62	8760	2580	383.16
Tylersville SFH	Large Copier	40	1	40	8760	2580	247.2
	H/C Water Dispenser	62	1	62	8760	2580	383.16
Union City SFH	Large Copier	40	1	40	8760	2580	247.2
	H/C Water Dispenser	62	1	62	8760	2580	383.16
						Total	**10085.76**

ECM: **ESCO's ECM #12--SUMMARY**

TITLE: **Demand based Oxygen injection**
PROJECT: **PA Fish and Boat Commission**
SITE: **Multiple State Fish Hatcheries**

Location	Description of measure	Annual savings in purchased oxygen cost
Bellefonte	Inject purchased oxygen based on demand	$6,000
Benner Spring	Inject purchased oxygen based on demand	$6,000
Corry	Inject purchased oxygen based on demand	$6,000
Fairview	Inject purchased oxygen based on demand	$6,000
Huntsdale	Inject purchased oxygen based on demand	$6,000
Linesville	Inject purchased oxygen based on demand	$6,000
Oswayo	Inject purchased oxygen based on demand	$6,000
Pleasant Gap	Inject purchased oxygen based on demand	$6,000
Pleasant Mount	Inject purchased oxygen based on demand	$6,000
Reynoldsdale	Inject purchased oxygen based on demand	$6,000
Tionesta	Inject purchased oxygen based on demand	$6,000
Tylersville	Inject purchased oxygen based on demand	$6,000
Union City	Inject purchased oxygen based on demand	$6,000
	Total	**$78,000**

ECM: **ESCO's ECM #12**

TITLE: **Demand based Oxygen injection**
PROJECT: **PA Fish and Boat Commission**
SITE: **Bellefonte State Fish Hatchery**

DESCRIPTION: Add sensors and controls as necessary to inject purchased Oxygen on an as needed basis rather than at a fixed or manually adjusted rate as it is currently done.

GIVEN: Annual cost of purchased liquid oxygen = $30,000

ASSUMPTION: Percent assumed saved with adjustment = 20% averaged annually

FORMULA: Savings in purchased oxygen cost = Existing cost x Assumed annual % saved

CALCULATION:

	Existing cost		Pct. Saved		Annual cost savings
Savings in oxygen cost =	($30,000	)x(	20%	)=(	$6,000)

Result

	Existing Annual Use =		**$30,000**
	Proposed Annual Use =		**$24,000**
100%	**Annual Savings =**		**$6,000**
	Savings as Percent of Existing	**=**	**20%**

COMMENTS:

ECM: **ESCO's ECM #12**

TITLE: **Demand based Oxygen injection**
PROJECT: **PA Fish and Boat Commission**
SITE: **Benner Springs State Fish Hatchery**

DESCRIPTION: Add sensors and controls as necessary to inject purchased Oxygen on an as needed basis rather than at a fixed or manually adjusted rate as it is currently done.

GIVEN: Annual cost of purchased liquid oxygen = $30,000

ASSUMPTION: Percent assumed saved with adjustment = 20% averaged annually

FORMULA: Savings in purchased oxygen cost = Existing cost x Assumed annual % saved

CALCULATION:

	Existing cost		Pct. Saved		Annual cost savings
Savings in oxygen cost =	($30,000	)x(	20%	)=(	$6,000)

Result

	Existing Annual Use =		**$30,000**
	Proposed Annual Use =		**$24,000**
100%	**Annual Savings =**		**$6,000**
	Savings as Percent of Existing	**=**	**20%**

COMMENTS:

ECM: **ESCO's ECM #12**

TITLE: **Demand based Oxygen injection**
PROJECT: **PA Fish and Boat Commission**
SITE: **Corry State Fish Hatchery**

DESCRIPTION: Add sensors and controls as necessary to inject purchased Oxygen on an as needed basis rather than at a fixed or manually adjusted rate as it is currently done.

GIVEN: Annual cost of purchased liquid oxygen = $30,000

ASSUMPTION: Percent assumed saved with adjustment = 20% averaged annually

FORMULA: Savings in purchased oxygen cost = Existing cost x Assumed annual % saved

CALCULATION:

	Existing cost		Pct. Saved		Annual cost savings
Savings in oxygen cost =	($30,000	)x(	20%	)=(	$6,000)

Result

	Existing Annual Use =		**$30,000**
	Proposed Annual Use =		**$24,000**
100%	**Annual Savings =**		**$6,000**
	Savings as Percent of Existing	**=**	**20%**

COMMENTS:

ECM: **ESCO's ECM #12**

TITLE: **Demand based Oxygen injection**
PROJECT: **PA Fish and Boat Commission**
SITE: **Fairview State Fish Hatchery**

DESCRIPTION: Add sensors and controls as necessary to inject purchased Oxygen on an as needed basis rather than at a fixed or manually adjusted rate as it is currently done.

GIVEN: Annual cost of purchased liquid oxygen = $30,000

ASSUMPTION: Percent assumed saved with adjustment = 20% averaged annually

FORMULA: Savings in purchased oxygen cost = Existing cost x Assumed annual % saved

CALCULATION:

	Existing cost		Pct. Saved		Annual cost savings
Savings in oxygen cost =	($30,000	)x(	20%	)=(	$6,000)

Result

	Existing Annual Use =		**$30,000**
	Proposed Annual Use =		**$24,000**
100%	**Annual Savings =**		**$6,000**
	Savings as Percent of Existing	**=**	**20%**

COMMENTS:

ECM: **ESCO's ECM #12**

TITLE: **Demand based Oxygen injection**
PROJECT: **PA Fish and Boat Commission**
SITE: **Huntsdale State Fish Hatchery**

DESCRIPTION: Add sensors and controls as necessary to inject purchased Oxygen on an as needed basis rather than at a fixed or manually adjusted rate as it is currently done.

GIVEN: Annual cost of purchased liquid oxygen = $30,000

ASSUMPTION: Percent assumed saved with adjustment = 20% averaged annually

FORMULA: Savings in purchased oxygen cost = Existing cost x Assumed annual % saved

CALCULATION:

	Existing cost		Pct. Saved		Annual cost savings
Savings in oxygen cost =	($30,000	)x(	20%	)=(	$6,000)

Result

	Existing Annual Use =		**$30,000**
	Proposed Annual Use =		**$24,000**
100%	**Annual Savings =**		**$6,000**
	Savings as Percent of Existing	**=**	**20%**

COMMENTS:

ECM: **ESCO's ECM #12**

TITLE: **Demand based Oxygen injection**
PROJECT: **PA Fish and Boat Commission**
SITE: **Linesville State Fish Hatchery**

DESCRIPTION: Add sensors and controls as necessary to inject purchased Oxygen on an as needed basis rather than at a fixed or manually adjusted rate as it is currently done.

GIVEN: Annual cost of purchased liquid oxygen = $30,000

ASSUMPTION: Percent assumed saved with adjustment = 20% averaged annually

FORMULA: Savings in purchased oxygen cost = Existing cost x Assumed annual % saved

CALCULATION:

	Existing cost		Pct. Saved		Annual cost savings
Savings in oxygen cost =	($30,000	)x(	20%	)=(	$6,000)

Result

	Existing Annual Use =		**$30,000**
	Proposed Annual Use =		**$24,000**
100%	**Annual Savings =**		**$6,000**
	Savings as Percent of Existing	**=**	**20%**

COMMENTS:

ECM: **ESCO's ECM #12**

TITLE: **Demand based Oxygen injection**
PROJECT: **PA Fish and Boat Commission**
SITE: **Oswayo State Fish Hatchery**

DESCRIPTION: Add sensors and controls as necessary to inject purchased Oxygen on an as needed basis rather than at a fixed or manually adjusted rate as it is currently done.

GIVEN: Annual cost of purchased liquid oxygen = $30,000

ASSUMPTION: Percent assumed saved with adjustment = 20% averaged annually

FORMULA: Savings in purchased oxygen cost = Existing cost x Assumed annual % saved

CALCULATION:

	Existing cost		Pct. Saved		Annual cost savings
Savings in oxygen cost =	($30,000	)x(	20%	)=(	$6,000)

Result

	Existing Annual Use =		**$30,000**
	Proposed Annual Use =		**$24,000**
100%	**Annual Savings =**		**$6,000**
	Savings as Percent of Existing	**=**	**20%**

COMMENTS:

ECM: **ESCO's ECM #12**

TITLE: **Demand based Oxygen injection**
PROJECT: **PA Fish and Boat Commission**
SITE: **Pleasant Gap State Fish Hatchery**

DESCRIPTION: Add sensors and controls as necessary to inject purchased Oxygen on an as needed basis rather than at a fixed or manually adjusted rate as it is currently done.

GIVEN: Annual cost of purchased liquid oxygen = $30,000

ASSUMPTION: Percent assumed saved with adjustment = 20% averaged annually

FORMULA: Savings in purchased oxygen cost = Existing cost x Assumed annual % saved

CALCULATION:

	Existing cost		Pct. Saved		Annual cost savings
Savings in oxygen cost =	($30,000	)x(	20%	)=(	$6,000)

Result

	Existing Annual Use =		**$30,000**
	Proposed Annual Use =		**$24,000**
100%	**Annual Savings =**		**$6,000**
	Savings as Percent of Existing	**=**	**20%**

COMMENTS:

ECM: **ESCO's ECM #12**

TITLE: **Demand based Oxygen injection**
PROJECT: **PA Fish and Boat Commission**
SITE: **Pleasant Mount State Fish Hatchery**

DESCRIPTION: Add sensors and controls as necessary to inject purchased Oxygen on an as needed basis rather than at a fixed or manually adjusted rate as it is currently done.

GIVEN: Annual cost of purchased liquid oxygen = $30,000

ASSUMPTION: Percent assumed saved with adjustment = 20% averaged annually

FORMULA: Savings in purchased oxygen cost = Existing cost x Assumed annual % saved

CALCULATION:

	Existing cost		Pct. Saved		Annual cost savings
Savings in oxygen cost =	($30,000	)x(	20%	)=(	$6,000)

Result

	Existing Annual Use =		**$30,000**
	Proposed Annual Use =		**$24,000**
100%	**Annual Savings =**		**$6,000**
	Savings as Percent of Existing	**=**	**20%**

COMMENTS:

ECM: **ESCO's ECM #12**

TITLE: **Demand based Oxygen injection**
PROJECT: **PA Fish and Boat Commission**
SITE: **Reynoldsdale State Fish Hatchery**

DESCRIPTION: Add sensors and controls as necessary to inject purchased Oxygen on an as needed basis rather than at a fixed or manually adjusted rate as it is currently done.

GIVEN: Annual cost of purchased liquid oxygen = $30,000

ASSUMPTION: Percent assumed saved with adjustment = 20% averaged annually

FORMULA: Savings in purchased oxygen cost = Existing cost x Assumed annual % saved

CALCULATION:

	Existing cost		Pct. Saved		Annual cost savings
Savings in oxygen cost =	($30,000	)x(	20%	)=(	$6,000)

Result

	Existing Annual Use =		**$30,000**
	Proposed Annual Use =		**$24,000**
100%	**Annual Savings =**		**$6,000**
	Savings as Percent of Existing	**=**	**20%**

COMMENTS:

ECM: **ESCO's ECM #12**

TITLE: **Demand based Oxygen injection**
PROJECT: **PA Fish and Boat Commission**
SITE: **Tionesta State Fish Hatchery**

DESCRIPTION: Add sensors and controls as necessary to inject purchased Oxygen on an as needed basis rather than at a fixed or manually adjusted rate as it is currently done.

GIVEN: Annual cost of purchased liquid oxygen = $30,000

ASSUMPTION: Percent assumed saved with adjustment = 20% averaged annually

FORMULA: Savings in purchased oxygen cost = Existing cost x Assumed annual % saved

CALCULATION:

	Existing cost		Pct. Saved		Annual cost savings
Savings in oxygen cost =	($30,000	)x(	20%	)=(	$6,000)

Result

	Existing Annual Use =		**$30,000**
	Proposed Annual Use =		**$24,000**
100%	**Annual Savings =**		**$6,000**
	Savings as Percent of Existing	**=**	**20%**

COMMENTS:

ECM: **ESCO's ECM #12**

TITLE: **Demand based Oxygen injection**
PROJECT: **PA Fish and Boat Commission**
SITE: **Tylersville State Fish Hatchery**

DESCRIPTION: Add sensors and controls as necessary to inject purchased Oxygen on an as needed basis rather than at a fixed or manually adjusted rate as it is currently done.

GIVEN: Annual cost of purchased liquid oxygen = $30,000

ASSUMPTION: Percent assumed saved with adjustment = 20% averaged annually

FORMULA: Savings in purchased oxygen cost = Existing cost x Assumed annual % saved

CALCULATION:

	Existing cost		Pct. Saved		Annual cost savings
Savings in oxygen cost =	($30,000	)x(	20%	)=(	$6,000)

Result

	Existing Annual Use =		**$30,000**
	Proposed Annual Use =		**$24,000**
100%	**Annual Savings =**		**$6,000**
	Savings as Percent of Existing	**=**	**20%**

COMMENTS:

ECM: **ESCO's ECM #12**

TITLE: **Demand based Oxygen injection**
PROJECT: **PA Fish and Boat Commission**
SITE: **Union City State Fish Hatchery**

DESCRIPTION: Add sensors and controls as necessary to inject purchased Oxygen on an as needed basis rather than at a fixed or manually adjusted rate as it is currently done.

GIVEN: Annual cost of purchased liquid oxygen = $30,000

ASSUMPTION: Percent assumed saved with adjustment = 20% averaged annually

FORMULA: Savings in purchased oxygen cost = Existing cost x Assumed annual % saved

CALCULATION:

	Existing cost		Pct. Saved		Annual cost savings
Savings in oxygen cost =	($30,000	)x(	20%	)=(	$6,000)

Result

	Existing Annual Use =		**$30,000**
	Proposed Annual Use =		**$24,000**
100%	**Annual Savings =**		**$6,000**
	Savings as Percent of Existing	**=**	**20%**

COMMENTS:

ECM: **ESCO's ECM #13--SUMMARY**

TITLE: **Retro-commissioning including unoccupied setback**
PROJECT: **PA Fish and Boat Commission**
SITE: **Benner Springs & Pleasant Mount**

Description of measure	Annual kwh saved	Annual kw saved	Annual Gallons (oil) saved
Replace boiler at Benner Springs Administration Building	-	-	821
Replace boiler at Pleasant Mount Administration Building	-	-	768
Replace boiler at Pleasant Mount Storage Building	-	-	325
Total	**-**	**-**	**1,913**

ECM: **ESCO's ECM #13**

TITLE: **Boiler Replacement**
PROJECT: **PA Fish and Boat Commission**
SITE: **Benner Springs--Administration**

DESCRIPTION: Replace existing boiler with new efficient boiler of similar size and operation.

Boiler Plant Capacity	=	778	Mbh
Operation (Hours/Week)	=	168	Hours/Week
Operation (Heating Weeks/Year)	=	24	Weeks/Year
Operation (Hours/Year)	=	4032	Hours/Year
Annual Building Heat Energy Use	=	5732	Fuel units

ASSUMPTION:

Existing Efficiency (Combustion)	=	70%
Existing Efficiency (Dist./Losses)	=	95%
New Efficiency (Combustion)	=	86%
New Efficiency (Dist./Losses)	=	95%
Part Load Factor	=	13%

FORMULA: Energy Usage = (Capacity(Mbh)) x (Hours of Operation/Year) x (Part Load Factor) / (Combustion Efficiency x Distribution Efficiency)
Fuel Use (Unit) = (Usage (Mbh)) / (Heating Value of Fuel)
Fuel Energy Cost ($) = ((Fuel Use(Unit) x Fuel Cost($/Unit))

CALCULATION:

	Capacity		Hours/Year		Part Load Factor		Efficiency (Comb.)		Efficiency (Dist.)		
Existing Energy Usage =	(778	)x(	4032	)x(	13%	)/((	70%	)x(	95%	)) =	**613,228 Mbtu**
New Energy Usage =	(778	)x(	4032	)x(	13%	)/((	86%	)x(	95%	)) =	**499,139 Mbtu**

	Usage (Mbtu)		Conversion(Mbtu/gallon	)	
Existing Fuel Usage =	(613,228	)/(	139	) =	**4,412 gallons**
New Fuel Usage =	(499,139	)/(	139	) =	**3,591 gallons**

Result

	Existing Annual Use =	**4,412**	**gallons**	**77% of Bldg. heat**
	Proposed Annual Use =	**3,591**	**gallons**	
100%	**Annual Savings =**	**821**	**gallons**	
	Savings as Percent of Existing =		**19%**	**14% of Bldg. heat**

COMMENTS: Annual fuel oil consumption has been estimated since utility data not made available by owner.

ECM: **ESCO's ECM #13**

TITLE: **Boiler Replacement**
PROJECT: **PA Fish and Boat Commission**
SITE: **Pleasant Mount--Admin/Hatch House #1**

DESCRIPTION: Replace existing boiler with new efficient boiler of similar size and operation.

Boiler Plant Capacity	=	473	Mbh
Operation (Hours/Week)	=	168	Hours/Week
Operation (Heating Weeks/Year)	=	24	Weeks/Year
Operation (Hours/Year)	=	4032	Hours/Year
Annual Building Heat Energy Use	=	20994	Fuel units

ASSUMPTION:

Existing Efficiency (Combustion)	=	70%
Existing Efficiency (Dist./Losses)	=	95%
New Efficiency (Combustion)	=	86%
New Efficiency (Dist./Losses)	=	95%
Part Load Factor	=	20%

FORMULA: Energy Usage = (Capacity(Mbh)) x (Hours of Operation/Year) x (Part Load Factor) / (Combustion Efficiency x Distribution Efficiency)
Fuel Use (Unit) = (Usage (Mbh)) / (Heating Value of Fuel)
Fuel Energy Cost ($) = ((Fuel Use(Unit) x Fuel Cost($/Unit))

CALCULATION:

	Capacity		Hours/Year		Part Load Factor		Efficiency (Comb.)		Efficiency (Dist.)		
Existing Energy Usage =	473	)x(	4032	)x(	20%	)/((	70%	)x(	95%	)) =	**573,575 Mbtu**
New Energy Usage =	473	)x(	4032	)x(	20%	)/((	86%	)x(	95%	)) =	**466,863 Mbtu**

	Usage (Mbtu)		Conversion(Mbtu/gallon	)	
Existing Fuel Usage =	573,575	)/(	139	) =	**4,126 gallons**
New Fuel Usage =	466,863	)/(	139	) =	**3,359 gallons**

Result

	Existing Annual Use =	**4,126**	**gallons**	**20% of total fuel**
	Proposed Annual Use =	**3,359**	**gallons**	
100%	**Annual Savings =**	**768**	**gallons**	
	Savings as Percent of Existing =	**19%**		**4% of total fuel**

COMMENTS:

ECM: **ESCO's ECM #13**

TITLE: **Boiler Replacement**
PROJECT: **PA Fish and Boat Commission**
SITE: **Pleasant Mount--Manager/Storage**

DESCRIPTION: Replace existing boiler with new efficient boiler of similar size and operation.

Boiler Plant Capacity	=	200	Mbh
Operation (Hours/Week)	=	168	Hours/Week
Operation (Heating Weeks/Year)	=	24	Weeks/Year
Operation (Hours/Year)	=	4032	Hours/Year
Annual Building Heat Energy Use	=	21671	Fuel units

ASSUMPTION:

Existing Efficiency (Combustion)	=	70%
Existing Efficiency (Dist./Losses)	=	95%
New Efficiency (Combustion)	=	86%
New Efficiency (Dist./Losses)	=	95%
Part Load Factor	=	20%

FORMULA: Energy Usage = (Capacity(Mbh)) x (Hours of Operation/Year) x (Part Load Factor) / (Combustion Efficiency x Distribution Efficiency)
Fuel Use (Unit) = (Usage (Mbh)) / (Heating Value of Fuel)
Fuel Energy Cost ($) = ((Fuel Use(Unit) x Fuel Cost($/Unit))

CALCULATION:

	Capacity		Hours/Year		Part Load Factor		Efficiency (Comb.)		Efficiency (Dist.)		
Existing Energy Usage =	200	)x(	4032	)x(	20%	)/((	70%	)x(	95%	)) =	**242,526 Mbtu**
New Energy Usage =	200	)x(	4032	)x(	20%	)/((	86%	)x(	95%	)) =	**197,405 Mbtu**

	Usage (Mbtu)		Conversion(Mbtu/gallon	)	
Existing Fuel Usage = (	242,526	)/(	139	) =	**1,745 gallons**
New Fuel Usage = (	197,405	)/(	139	) =	**1,420 gallons**

Result

	Existing Annual Use =	**1,745**	**gallons**	**8% of total fuel**
	Proposed Annual Use =	**1,420**	**gallons**	
100%	**Annual Savings =**	**325**	**gallons**	
	Savings as Percent of Existing =	**19%**		**1% of total fuel**

COMMENTS:

ECM: ESCO's ECM #21

Title Add VFDs to constant volume chilled water pumps
Project PA Fish and Boat Commission
Site Headquarters Building

Description Calculate the energy savings by converting an existing pumping system control (constant volume, discharge valve, etc.) to a new, more efficient system control (variable frequency drives).

Total Operating Hours per Year = 4,032 hrs

Motor Horsepower = 15 HP
Motor Rated Efficiency = 90%
Existing System Control = Constant Volume
Proposed System Control = VFD w/ 2/3 press reset

Assumption
Demand Utilization Factor (DUF) = 100% (Estimate, percent of time that pump system is on during peak demand period)
Operating Months per Year = 5 Months
Pump Load Factor = 0.70

Operating Schedule

% of Flow	100%	90%	80%	70%	60%	50%	40%	Total	
% of Time (Existing)	100%	0%	0%	0%	0%	0%	0%	100%	OK
% of Time (Proposed)	5%	15%	15%	30%	30%	5%	0%	100%	OK

Formula

EXISTING CONDITIONS
*Pump kWh Used = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (Annual Op Hours x % of Time at % Flow)
*Pump kW Dem'd = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (% of Time at % Flow x DUF x Months/year)

PROPOSED CONDITIONS
*Pump kWh Used After Conversion = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (Annual Op Hours x % of Time at % Flow)
*Pump kW Dem'd After Conversion = (HP x Load Factor x (% Flow^Exponent) x 0.746 / Motor Efficiency) x (% of Time at % Flow x DUF x Months/year)

*NOTE: THIS CALCULATION IS DONE AT EVERY FLOW

Calculation

EXISTING CONDITIONS

***Pump kWh Used**

	HP		Load Factor		% Flow		Exponent	Conversion (HP to kW)		Efficiency		Annual Op Hrs		% of Time at % Flow		
at 100% Airflow	= (15.00	x	0.70	x (	100%	^	1.0	) x 0.746	/	90%	) x (	4,032.00	x	100%	) =	35,092
at 90% Airflow	= (15.00	x	0.70	x (	90%	^	1.0	) x 0.746	/	90%	) x (	4,032.00	x	0%	) =	-
at 80% Airflow	= (15.00	x	0.70	x (	80%	^	1.0	) x 0.746	/	90%	) x (	4,032.00	x	0%	) =	-
at 70% Airflow	= (15.00	x	0.70	x (	70%	^	1.0	) x 0.746	/	90%	) x (	4,032.00	x	0%	) =	-
at 60% Airflow	= (15.00	x	0.70	x (	60%	^	1.0	) x 0.746	/	90%	) x (	4,032.00	x	0%	) =	-
at 50% Airflow	= (15.00	x	0.70	x (	50%	^	1.0	) x 0.746	/	90%	) x (	4,032.00	x	0%	) =	-
at 40% Airflow	= (15.00	x	0.70	x (	40%	^	1.0	) x 0.746	/	90%	) x (	4,032.00	x	0%	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>															35,092 kWh

***Pump kW Dem'd**

	HP		Load Factor		% Flow		Exponent	Conversion (HP to kW)		Efficiency		% of Time at % Flow		DUF		Months/Yr		
at 100% Airflow	= (15.00	x	0.70	x (	100%	^	1.0	) x 0.746	/	90%	)x(	100%	x	100%	x	5	) =	43.5
at 90% Airflow	= (15.00	x	0.70	x (	90%	^	1.0	) x 0.746	/	90%	)x(	0%	x	100%	x	5	) =	-
at 80% Airflow	= (15.00	x	0.70	x (	80%	^	1.0	) x 0.746	/	90%	)x(	0%	x	100%	x	5	) =	-
at 70% Airflow	= (15.00	x	0.70	x (	70%	^	1.0	) x 0.746	/	90%	)x(	0%	x	100%	x	5	) =	-
at 60% Airflow	= (15.00	x	0.70	x (	60%	^	1.0	) x 0.746	/	90%	)x(	0%	x	100%	x	5	) =	-
at 50% Airflow	= (15.00	x	0.70	x (	50%	^	1.0	) x 0.746	/	90%	)x(	0%	x	100%	x	5	) =	-
at 40% Airflow	= (15.00	x	0.70	x (	40%	^	1.0	) x 0.746	/	90%	)x(	0%	x	100%	x	5	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>																	43.5 kW

PROPOSED CONDITIONS

***Pump kWh Used After Conversion**

	HP		Load Factor		% Flow		Exponent	Conversion (HP to kW)		Efficiency		Annual Op Hrs		% of Time at % Flow		
at 100% Airflow	= (15.00	x	0.70	x (	100%	^	2.9	) x 0.746	/	90%	) x (	4,032	x	5%	) =	1,755
at 90% Airflow	= (15.00	x	0.70	x (	90%	^	2.9	) x 0.746	/	90%	) x (	4,032	x	15%	) =	3,878
at 80% Airflow	= (15.00	x	0.70	x (	80%	^	2.9	) x 0.746	/	90%	) x (	4,032	x	15%	) =	2,756
at 70% Airflow	= (15.00	x	0.70	x (	70%	^	2.9	) x 0.746	/	90%	) x (	4,032	x	30%	) =	3,742
at 60% Airflow	= (15.00	x	0.70	x (	60%	^	2.9	) x 0.746	/	90%	) x (	4,032	x	30%	) =	2,393
at 50% Airflow	= (15.00	x	0.70	x (	50%	^	2.9	) x 0.746	/	90%	) x (	4,032	x	5%	) =	235
at 40% Airflow	= (15.00	x	0.70	x (	40%	^	2.9	) x 0.746	/	90%	) x (	4,032	x	0%	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>															14,759 kWh

***Pump kW Dem'd After Conversion**

	HP		Load Factor		% Flow		Exponent	Conversion (HP to kW)		Efficiency		% of Time at % Flow		DUF		Months		
at 100% Airflow	= (15.00	x	0.70	x (	100%	^	2.9	) x 0.746	/	90%	)x(	5%	x	100%	x	5	) =	2.2
at 90% Airflow	= (15.00	x	0.70	x (	90%	^	2.9	) x 0.746	/	90%	)x(	15%	x	100%	x	5	) =	4.8
at 80% Airflow	= (15.00	x	0.70	x (	80%	^	2.9	) x 0.746	/	90%	)x(	15%	x	100%	x	5	) =	3.4
at 70% Airflow	= (15.00	x	0.70	x (	70%	^	2.9	) x 0.746	/	90%	)x(	30%	x	100%	x	5	) =	4.6
at 60% Airflow	= (15.00	x	0.70	x (	60%	^	2.9	) x 0.746	/	90%	)x(	30%	x	100%	x	5	) =	3.0
at 50% Airflow	= (15.00	x	0.70	x (	50%	^	2.9	) x 0.746	/	90%	)x(	5%	x	100%	x	5	) =	0.3
at 40% Airflow	= (15.00	x	0.70	x (	40%	^	2.9	) x 0.746	/	90%	)x(	0%	x	100%	x	5	) =	-
TOTALS (Calculations hidden for print clarity)	==========>>																	18.3 kW

Result

Annual Exist. Consumption	**35,092**	**kWh**
Annual Exist. Demand	**43.5**	**kW**
TOTAL EXIST COST PER YEAR		

Annual Proposed Consumption	**14,759**	**kWh**
Annual Proposed Demand	**18.3**	**kW**
TOTAL NEW COST PER YEAR		

Annual Usage Savings	**20,333**	**kWh**	**100%**
Annual Demand Savings	**N/A**		
TOTAL SAVINGS PER YEAR			percent saved

Comments

ECM - ESCO ECM #15		
Site: Fairview SFH		
Billing Period/Month	**Charges**	**kWh Usage**
1-Nov	$ 67.54	0
Oct-19	$ 94.60	0
Sep-19	$ 37.70	0
Aug-19	$ 16.79	0
Jul-19	$ 16.87	0
Jun-19	$ 16.77	0
May-19	$ 16.85	0
Apr-19	$ 18.01	0
Mar-19	$ 16.74	0
Feb-19	$ 16.78	0
Jan-19	$ 47.91	0
Dec-18	$ 70.93	0
Total	**$ 437.49**	0

Annual Savings **$ 437.49**

There will be no billling after the account is cancelled.

ECM: **ESCO's ECM #16--SUMMARY**

TITLE: **Replace gas fired water heaters with high efficiency**
PROJECT: **PA Fish and Boat Commission**
SITE: **Summary**

Location	Description of measure	Annual CCF saved
Fairview	Replace standard efficiency gas DHW with high efficiency	75
Linesville	Replace standard efficiency gas DHW with high efficiency	62
PFBC HQ	Replace standard efficiency gas DHW with high efficiency	235
	Total	**372**

ECM: **ESCO's ECM #16**

TITLE: **Replace gas fired water heaters with high efficiency**
PROJECT: **PA Fish and Boat Commission**
SITE: **Fairview State Fish Hatchery**

DESCRIPTION: Replace existing natural gas domestic hot water heater with high efficiency condensing gas fired heater.

DHW Heater Capacity (output)	=	30	Mbh
Operation (Hours/Week)	=	168	Hours/Week
Operation (Heating Weeks/Year)	=	52	Weeks/Year
Operation (Hours/Year)	=	8736	Hours/Year
Thermal Energy Use (heat + DHW)	=	6398	Fuel units/Year

ASSUMPTION:

Existing Efficiency (Combustion)	=	75%
Existing Efficiency (Dist./Losses)	=	95%
New Efficiency (Combustion)	=	95%
New Efficiency (Dist./Losses)	=	95%
Part Load Factor	=	10%

FORMULA:
Energy Usage = (Capacity(Mbh)) x (Hours of Operation/Year) x (Part Load Factor) / (Combustion Efficiency x Distribution Efficiency)
Fuel Use (Unit) = (Usage (Mbh)) / (Heating Value of Fuel)
Fuel Energy Cost ($) = ((Fuel Use(Unit) x Fuel Cost($/Unit))

CALCULATION:

	Capacity		Hours/Year		Part Load Factor		Efficiency (Comb.)		Efficiency (Dist.)		
Existing Energy Usage =	30	)x(	8736	)x(	10%	)/((	75%	)x(	95%	)) =	**36,783 Mbtu**
New Energy Usage =	30	)x(	8736	)x(	10%	)/((	95%	)x(	95%	)) =	**29,039 Mbtu**

	Usage (Mbtu)		Conversion(Mbu/CCF	)	
Existing Fuel Usage = (	36,783	)/(	103	) =	**357 CCF**
New Fuel Usage = (	29,039	)/(	103	) =	**282 CCF**

Result

	Existing Annual Use =	**357**	**CCF**	**6% of total fuel**
	Proposed Annual Use =	**282**	**CCF**	
100%	**Annual Savings =**	**75**	**CCF**	
	Savings as Percent of Existing	**=**	**21%**	**1% of total fuel**

COMMENTS:

ECM: **ESCO's ECM #16**

TITLE: **Replace gas fired water heaters with high efficiency**
PROJECT: **PA Fish and Boat Commission**
SITE: **Linesville State Fish Hatchery**

DESCRIPTION: Replace existing natural gas domestic hot water heater with high efficiency condensing gas fired heater.

DHW Heater Capacity (output)	=	25	Mbh
Operation (Hours/Week)	=	168	Hours/Week
Operation (Heating Weeks/Year)	=	52	Weeks/Year
Operation (Hours/Year)	=	8736	Hours/Year
Thermal Energy Use (heat + DHW)	=	60342	Fuel units/Year

ASSUMPTION:

Existing Efficiency (Combustion)	=	75%
Existing Efficiency (Dist./Losses)	=	95%
New Efficiency (Combustion)	=	95%
New Efficiency (Dist./Losses)	=	95%
Part Load Factor	=	10%

FORMULA:
Energy Usage = (Capacity(Mbh)) x (Hours of Operation/Year) x (Part Load Factor) / (Combustion Efficiency x Distribution Efficiency)
Fuel Use (Unit) = (Usage (Mbh)) / (Heating Value of Fuel)
Fuel Energy Cost ($) = ((Fuel Use(Unit) x Fuel Cost($/Unit))

CALCULATION:

	Capacity		Hours/Year		Part Load Factor		Efficiency (Comb.)		Efficiency (Dist.)		
Existing Energy Usage =	24.75	)x(	8736	)x(	10%	)/((	75%	)x(	95%	)) =	**30,346 Mbtu**
New Energy Usage =	24.75	)x(	8736	)x(	10%	)/((	95%	)x(	95%	)) =	**23,957 Mbtu**

	Usage (Mbtu)		Conversion(Mbu/CCF	)	
Existing Fuel Usage =	30,346	)/(	103	) =	**295 CCF**
New Fuel Usage =	23,957	)/(	103	) =	**233 CCF**

Result

	Existing Annual Use =	**295 CCF**	**0.5% of total fuel**
	Proposed Annual Use =	**233 CCF**	
100%	**Annual Savings =**	**62 CCF**	
	Savings as Percent of Existing =	**21%**	**0.1% of total fuel**

COMMENTS: This ECM applies to the gas fired unit in the maintenance area. Conversion of the electric unit in the administration building is covered under owner's ECM #07.

ECM: **ESCO's ECM #16**

TITLE: **Replace gas fired water heaters with high efficiency**
PROJECT: **PA Fish and Boat Commission**
SITE: **Headquarters**

DESCRIPTION: Replace existing natural gas domestic hot water heater with high efficiency condensing gas fired heater.

DHW Heater Capacity (output)	=	188	Mbh
Operation (Hours/Week)	=	168	Hours/Week
Operation (Heating Weeks/Year)	=	52	Weeks/Year
Operation (Hours/Year)	=	8736	Hours/Year
Thermal Energy Use (heat + DHW)	=	17727	Fuel units/Year

ASSUMPTION:

Existing Efficiency (Combustion)	=	75%
Existing Efficiency (Dist./Losses)	=	95%
New Efficiency (Combustion)	=	95%
New Efficiency (Dist./Losses)	=	95%
Part Load Factor	=	5%

FORMULA:
Energy Usage = (Capacity(Mbh)) x (Hours of Operation/Year) x (Part Load Factor) / (Combustion Efficiency x Distribution Efficiency)
Fuel Use (Unit) = (Usage (Mbh)) / (Heating Value of Fuel)
Fuel Energy Cost ($) = ((Fuel Use(Unit) x Fuel Cost($/Unit))

CALCULATION:

	Capacity		Hours/Year		Part Load Factor		Efficiency (Comb.)		Efficiency (Dist.)		
Existing Energy Usage =	187.5	)x(	8736	)x(	5%	)/((	75%	)x(	95%	)) =	**114,947 Mbtu**
New Energy Usage =	187.5	)x(	8736	)x(	5%	)/((	95%	)x(	95%	)) =	**90,748 Mbtu**

	Usage (Mbtu)		Conversion(Mbu/CCF	)	
Existing Fuel Usage = (	114,947	)/(	103	) =	**1,116 CCF**
New Fuel Usage = (	90,748	)/(	103	) =	**881 CCF**

Result

	Existing Annual Use =	**1,116 CCF**	**6% of total fuel**
	Proposed Annual Use =	**881 CCF**	
100%	**Annual Savings =**	**235 CCF**	
	Savings as Percent of Existing =	**21%**	**1% of total fuel**

COMMENTS:

ECM: **ESCO ECM #17--SUMMARY**

TITLE: **Convert electric DHW heaters to heat pump style**
PROJECT: **PA Fish and Boat Commission**
SITE: **Summary**

Location	Description of measure	Annual kwh saved	Annual kw saved
Huntsdale	Convert electric DHW heaters to heat pump	866	39
Pleasant Mount	Convert electric DHW heaters to heat pump	866	39
Reynoldsdale	Convert electric DHW heaters to heat pump	866	39
Tylersville	Convert electric DHW heaters to heat pump	1,155	77
	Total	**3,755**	**193**

ECM: **ESCO's ECM #17**

TITLE: **Convert electric DHW heaters to heat pump style**
PROJECT: **PA Fish and Boat Commission**
SITE: **Huntsdale State Fish Hatchery**

DESCRIPTION: When fuel costs are less expensive than electric, converting from electric to heat pump heating results in reduce cost.

Water Heater Input	=	4.5	Kw
Operation (Hours/Week)	=	168	Hours/Week
Operation (Heating Weeks/Year)	=	52	Weeks/Year
Operation (Hours/Year)	=	8736	Hours/Year
Annual Electric use	=	1,153,980	Kwh

ASSUMPTION:

Existing Efficiency	=	98%	
Proposed COP	=	3.5	
Operating Months per Year	=	12	
Part Load Factor	=	3%	
Utilization Factor (Demand)	=	100%	
Domestic water supply temp	=	55	Degrees F
DHW heater set point	=	130	Degrees F
Average gallons per day	=	25	based on 5 days/wk

FORMULA:
Existing Electric Use (Kwh) = (Capacity(Kw)) x (Hours of Operation/Year) x (Part Load Factor) / (Electric Efficiency)
New Electric Use (Kwh) = (Existing electric use (kwh)) x (Efficiency of existing electric unit) / (COP of new heat pump style unit)
Existing Electric Demand (Kw) = (Capacity (Kw)) x (Months/Year) x (Demand Utilization Factor)
New Electric Demand (Kw) = (Capacity (Kw)) / (COP) x (Months/Year) x (Demand Utilization Factor)
Energy Cost ($) = ((Electric Use(Unit) x Electric Cost($/Unit))

CALCULATION:

Heating Value for Gallon of Water = 8.35 x (130 - 55) = **626.3** **btu/gal**

	Capacity		Hours/Year		Part Load Factor		Efficiency (Electric)			
Exist. Elec Usage = (	4.5	)x(	8736	)x(	3%	)/(	98%	) =	**1,203**	**Kwh**

	Electrical Use		Exist. Effic.		COP			
New Elec Usage = (	1,203	)x(	98%	) / (	3.50	) =	**337**	**Kwh**

	Capacity		Months/Year		Utilization Factor			
Exist Elec Demand =(	4.5	)*(	12	)*(	100%	) =	**54**	**Kw**

	Capacity		COP		Months/Year		Utiliz. Factor			
New Elec Demand =(	4.5	) / (	3.50	) x (	12	)x(	100%	) =	**15**	**Kw**

Result

Existing Annual Use=	**1,203**	**kwh**	**54**	**kwd**	**0.10% of annual use**
Proposed Annual Use=	**337**	**kwh**	**15**	**kwd**	
100% **Annual Savings=**	**866**	**kwh**	**39**	**kwd**	**0.08% of annual use**
Savings as Percent of Existing	**72%**		**71%**		

COMMENTS:

ECM: **ESCO's ECM #17**

TITLE: **Convert electric DHW heaters to heat pump style**
PROJECT: **PA Fish and Boat Commission**
SITE: **Pleasant Mount State Fish Hatchery**

DESCRIPTION: When fuel costs are less expensive than electric, converting from electric to heat pump heating results in reduce cost.

Water Heater Input	=	4.5	Kw
Operation (Hours/Week)	=	168	Hours/Week
Operation (Heating Weeks/Year)	=	52	Weeks/Year
Operation (Hours/Year)	=	8736	Hours/Year
Annual Electric use	=	240,900	Kwh

ASSUMPTION:

Existing Efficiency	=	98%	
Proposed COP	=	3.5	
Operating Months per Year	=	12	
Part Load Factor	=	3%	
Utilization Factor (Demand)	=	100%	
Domestic water supply temp	=	55	Degrees F
DHW heater set point	=	130	Degrees F
Average gallons per day	=	25	based on 5 days/wk

FORMULA:
Existing Electric Use (Kwh) = (Capacity(Kw)) x (Hours of Operation/Year) x (Part Load Factor) / (Electric Efficiency)
New Electric Use (Kwh) = (Existing electric use (kwh)) x (Efficiency of existing electric unit) / (COP of new heat pump style unit)
Existing Electric Demand (Kw) = (Capacity (Kw)) x (Months/Year) x (Demand Utilization Factor)
New Electric Demand (Kw) = (Capacity (Kw)) / (COP) x (Months/Year) x (Demand Utilization Factor)
Energy Cost ($) = ((Electric Use(Unit) x Electric Cost($/Unit))

CALCULATION:

Heating Value for Gallon of Water = 8.35 x (130 - 55) = **626.3** **btu/gal**

	Capacity		Hours/Year		Part Load Factor		Efficiency (Electric)		
Exist. Elec Usage = (	4.5	)x(	8736	)x(	3%	)/(	98%	) =	**1,203** **Kwh**

	Electrical Use		Exist. Effic.		COP		
New Elec Usage = (	1,203	)x(	98%	) / (	3.50	) =	**337** **Kwh**

	Capacity		Months/Year		Utilization Factor		
Exist Elec Demand =(	4.5	)*(	12	)*(	100%	) =	**54** **Kw**

	Capacity		COP		Months/Year		Utiliz. Factor		
New Elec Demand =(	4.5	) / (	3.50	) x (	12	)x(	100%	) =	**15** **Kw**

Result

Existing Annual Use=	**1,203**	**kwh**	**54**	**kwd**	**0.50% of annual use**
Proposed Annual Use=	**337**	**kwh**	**15**	**kwd**	
100% **Annual Savings=**	**866**	**kwh**	**39**	**kwd**	**0.36% of annual use**
Savings as Percent of Existing	**72%**		**71%**		

COMMENTS:

ECM: **ESCO's ECM #17**

TITLE: **Convert electric DHW heaters to heat pump style**
PROJECT: **PA Fish and Boat Commission**
SITE: **Reynoldsdale State Fish Hatchery**

DESCRIPTION: When fuel costs are less expensive than electric, converting from electric to heat pump heating results in reduce cost.

Water Heater Input	=	4.5	Kw
Operation (Hours/Week)	=	168	Hours/Week
Operation (Heating Weeks/Year)	=	52	Weeks/Year
Operation (Hours/Year)	=	8736	Hours/Year
Annual Electric use	=	636,091	Kwh

ASSUMPTION:

Existing Efficiency	=	98%	
Proposed COP	=	3.5	
Operating Months per Year	=	12	
Part Load Factor	=	3%	
Utilization Factor (Demand)	=	100%	
Domestic water supply temp	=	55	Degrees F
DHW heater set point	=	130	Degrees F
Average gallons per day	=	25	based on 5 days/wk

FORMULA:
Existing Electric Use (Kwh) = (Capacity(Kw)) x (Hours of Operation/Year) x (Part Load Factor) / (Electric Efficiency)
New Electric Use (Kwh) = (Existing electric use (kwh)) x (Efficiency of existing electric unit) / (COP of new heat pump style unit)
Existing Electric Demand (Kw) = (Capacity (Kw)) x (Months/Year) x (Demand Utilization Factor)
New Electric Demand (Kw) = (Capacity (Kw)) / (COP) x (Months/Year) x (Demand Utilization Factor)
Energy Cost ($) = ((Electric Use(Unit) x Electric Cost($/Unit))

CALCULATION:

Heating Value for Gallon of Water = 8.35 x (130 - 55) = **626.3** **btu/gal**

	Capacity		Hours/Year		Part Load Factor		Efficiency (Electric)		
Exist. Elec Usage = (	4.5	)x(	8736	)x(	3%	)/(	98%	) =	**1,203** **Kwh**

	Electrical Use		Exist. Effic.		COP		
New Elec Usage = (	1,203	)x(	98%	) / (	3.50	) =	**337** **Kwh**

	Capacity		Months/Year		Utilization Factor		
Exist Elec Demand =(	4.5	)*(	12	)*(	100%	) =	**54** **Kw**

	Capacity		COP		Months/Year		Utiliz. Factor		
New Elec Demand =(	4.5	) / (	3.50	) x (	12	)x(	100%	) =	**15** **Kw**

Result

Existing Annual Use=	**1,203**	**kwh**	**54**	**kwd**	**0.19% of annual use**
Proposed Annual Use=	**337**	**kwh**	**15**	**kwd**	
100% **Annual Savings=**	**866**	**kwh**	**39**	**kwd**	**0.14% of annual use**
Savings as Percent of Existing	**72%**		**71%**		

COMMENTS:

ECM: **ESCO's ECM #17**

TITLE: **Convert electric DHW heaters to heat pump style**
PROJECT: **PA Fish and Boat Commission**
SITE: **Tylersville State Fish Hatchery**

DESCRIPTION: When fuel costs are less expensive than electric, converting from electric to heat pump heating results in reduce cost.

Water Heater Input	=	9	Kw
Operation (Hours/Week)	=	168	Hours/Week
Operation (Heating Weeks/Year)	=	52	Weeks/Year
Operation (Hours/Year)	=	8736	Hours/Year
Annual Electric use	=	596,640	Kwh

ASSUMPTION:

Existing Efficiency	=	98%	
Proposed COP	=	3.5	
Operating Months per Year	=	12	
Part Load Factor	=	2%	
Utilization Factor (Demand)	=	100%	
Domestic water supply temp	=	55	Degrees F
DHW heater set point	=	130	Degrees F
Average gallons per day	=	34	based on 5 days/wk

FORMULA:
Existing Electric Use (Kwh) = (Capacity(Kw)) x (Hours of Operation/Year) x (Part Load Factor) / (Electric Efficiency)
New Electric Use (Kwh) = (Existing electric use (kwh)) x (Efficiency of existing electric unit) / (COP of new heat pump style unit)
Existing Electric Demand (Kw) = (Capacity (Kw)) x (Months/Year) x (Demand Utilization Factor)
New Electric Demand (Kw) = (Capacity (Kw)) / (COP) x (Months/Year) x (Demand Utilization Factor)
Energy Cost ($) = ((Electric Use(Unit) x Electric Cost($/Unit))

CALCULATION:

Heating Value for Gallon of Water = 8.35 x (130 - 55) = **626.3** **btu/gal**

	Capacity		Hours/Year		Part Load Factor		Efficiency (Electric)		
Exist. Elec Usage =	9	)x(	8736	)x(	2%	)/(	98%	) =	**1,605** **Kwh**

	Electrical Use		Exist. Effic.		COP		
New Elec Usage = (	1,605	)x(	98%	) / (	3.50	) =	**449** **Kwh**

	Capacity		Months/Year		Utilization Factor		
Exist Elec Demand =(	9	)*(	12	)*(	100%	) =	**108** **Kw**

	Capacity		COP		Months/Year		Utiliz. Factor		
New Elec Demand =(	9	) / (	3.50	) x (	12	)x(	100%	) =	**31** **Kw**

Result

Existing Annual Use=	**1,605**	**kwh**	**108**	**kwd**	**0.27% of annual use**
Proposed Annual Use=	**449**	**kwh**	**31**	**kwd**	
100% **Annual Savings=**	**1,155**	**kwh**	**77**	**kwd**	**0.19% of annual use**
Savings as Percent of Existing	**72%**		**71%**		

COMMENTS: Includes 80 gallon unit in administration building as well as 80 gallon unit in hatchery.

Design 1 PAFBC Bellefonte SFH, 1150 Spring Creek Rd, Bellefonte, PA 16823

Report

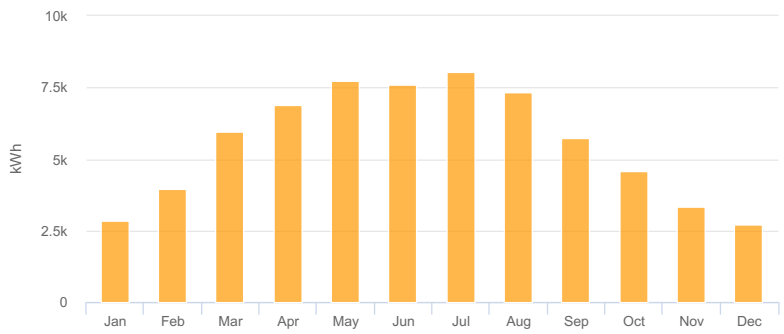
Project Name	PAFBC Bellefonte SFH
Project Address	1150 Spring Creek Rd, Bellefonte, PA 16823
Prepared By	ESG Solar helioscopene@energysystemsgroup.com

System Metrics

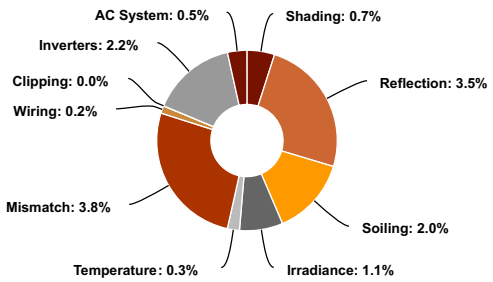
Design	Design 1
Module DC Nameplate	51.6 kW
Inverter AC Nameplate	48.1 kW Load Ratio: 1.07
Annual Production	66.79 MWh
Performance Ratio	86.5%
kWh/kWp	1,294.3
Weather Dataset	TMY, 10km Grid (40.85,-77.75), NREL (prospector)
Simulator Version	6b385920b3-277a9f933b-c48577c590-678150ca98

Project Location

Monthly Production



Sources of System Loss



Annual Production

	Description	Output	% Delta
Irradiance (kWh/m²)	Annual Global Horizontal Irradiance	1,391.1	
	POA Irradiance	1,496.2	7.6%
	Shaded Irradiance	1,485.6	-0.7%
	Irradiance after Reflection	1,432.9	-3.5%
	Irradiance after Soiling	1,404.3	-2.0%
	Total Collector Irradiance	**1,404.3**	**0.0%**
Energy (kWh)	Nameplate	72,497.3	
	Output at Irradiance Levels	71,690.2	-1.1%
	Output at Cell Temperature Derate	71,466.7	-0.3%
	Output After Mismatch	68,756.5	-3.8%
	Optimal DC Output	68,623.2	-0.2%
	Constrained DC Output	68,622.8	0.0%
	Inverter Output	67,122.2	-2.2%
	Energy to Grid	**66,786.6**	**-0.5%**
Temperature Metrics			
	Avg. Operating Ambient Temp		10.9 °C
	Avg. Operating Cell Temp		17.9 °C
Simulation Metrics			
	Operating Hours		4673
	Solved Hours		4673

Condition Set

Description	Condition Set 1											
Weather Dataset	TMY, 10km Grid (40.85,-77.75), NREL (prospector)											
Solar Angle Location	Meteo Lat/Lng											
Transposition Model	Perez Model											
Temperature Model	Sandia Model											
Temperature Model Parameters	Rack Type	a	b	Temperature Delta								
	Fixed Tilt	-3.56	-0.075	3°C								
	Flush Mount	-2.81	-0.0455	0°C								
Soiling (%)	J	F	M	A	M	J	J	A	S	O	N	D
	2	2	2	2	2	2	2	2	2	2	2	2
Irradiation Variance	5%											
Cell Temperature Spread	4° C											
Module Binning Range	-2.5% to 2.5%											
AC System Derate	0.50%											
Module Characterizations	Module	Uploaded By	Characterization									
	JKM 400M-72H-BDVP (Jinkosolar)	Folsom Labs	Jinko_JKM_400M_72H_BDVP (G2.5_F40).PAN, PAN									
Component Characterizations	Device	Uploaded By	Characterization									
	Sunny Tripower 24000TL-US (SMA)	Folsom Labs	Modified CEC									

Components

Component	Name	Count
Inverters	Sunny Tripower 24000TL-US (SMA)	2 (48.1 kW)
Strings	10 AWG (Copper)	9 (440.8 ft)
Module	Jinkosolar, JKM 400M-72H-BDVP (400W)	129 (51.6 kW)

Wiring Zones

Description	Combiner Poles	String Size	Stringing Strategy
Wiring Zone	12	4-18	Along Racking

Field Segments

Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
Field Segment 1	Fixed Tilt	Landscape (Horizontal)	10°	182°	2.0 ft	1x1	129	129	51.6 kW

Detailed Layout

Design 1 PAFBC Corry SFH, 13365 US-6, Corry, PA 16407

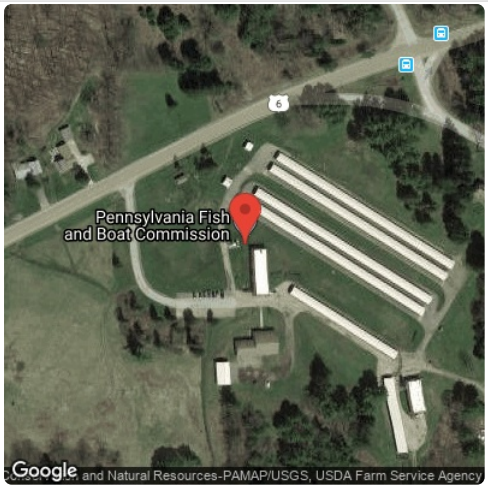
Report

Project Name	PAFBC Corry SFH
Project Address	13365 US-6, Corry, PA 16407
Prepared By	ESG Solar helioscopene@energysystemsgroup.com

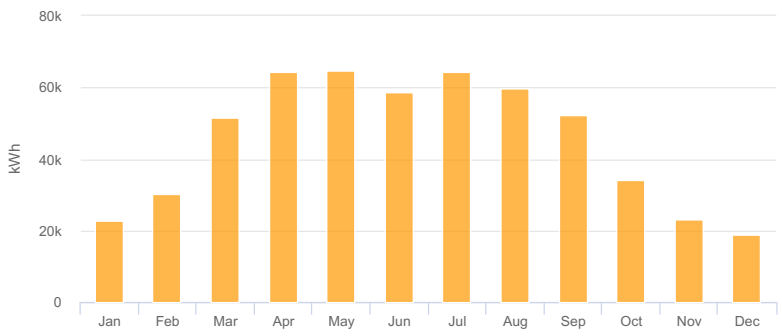
System Metrics

Design	Design 1
Module DC Nameplate	472.0 kW
Inverter AC Nameplate	385.0 kW Load Ratio: 1.23
Annual Production	544.7 MWh
Performance Ratio	74.1%
kWh/kWp	1,154.0
Weather Dataset	TMY, 10km Grid (41.95,-79.65), NREL (prospector)
Simulator Version	6b385920b3-277a9f933b-c48577c590-678150ca98

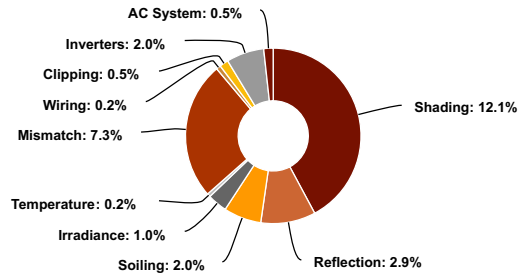
Project Location



Monthly Production



Sources of System Loss



Annual Production

	Description	Output	% Delta
Irradiance (kWh/m²)	Annual Global Horizontal Irradiance	1,365.2	
	POA Irradiance	1,557.6	14.1%
	Shaded Irradiance	1,368.4	-12.1%
	Irradiance after Reflection	1,328.5	-2.9%
	Irradiance after Soiling	1,302.0	-2.0%
	Total Collector Irradiance	**1,301.1**	**-0.1%**
Energy (kWh)	Nameplate	614,410.8	
	Output at Irradiance Levels	608,000.7	-1.0%
	Output at Cell Temperature Derate	606,914.7	-0.2%
	Output After Mismatch	562,549.6	-7.3%
	Optimal DC Output	561,214.8	-0.2%
	Constrained DC Output	558,564.0	-0.5%
	Inverter Output	547,402.0	-2.0%
	Energy to Grid	**544,665.0**	**-0.5%**
Temperature Metrics			
	Avg. Operating Ambient Temp		10.4 °C
	Avg. Operating Cell Temp		16.8 °C
Simulation Metrics			
	Operating Hours		4667
	Solved Hours		4667

Condition Set

Description	Condition Set 1											
Weather Dataset	TMY, 10km Grid (41.95,-79.65), NREL (prospector)											
Solar Angle Location	Meteo Lat/Lng											
Transposition Model	Perez Model											
Temperature Model	Sandia Model											
Temperature Model Parameters	Rack Type	a	b	Temperature Delta								
	Fixed Tilt	-3.56	-0.075	3°C								
	Flush Mount	-2.81	-0.0455	0°C								
Soiling (%)	J	F	M	A	M	J	J	A	S	O	N	D
	2	2	2	2	2	2	2	2	2	2	2	2
Irradiation Variance	5%											
Cell Temperature Spread	4° C											
Module Binning Range	-2.5% to 2.5%											
AC System Derate	0.50%											
Module Characterizations	Module	Uploaded By	Characterization									
	CS6U 345M (Canadian Solar)	Folsom Labs	Spec Sheet Characterization, PAN									
Component Characterizations	Device	Uploaded By	Characterization									
	Sunny Tripower 24000TL-US (SMA)	Folsom Labs	Modified CEC									

Components

Component	Name	Count
Inverters	Sunny Tripower 24000TL-US (SMA)	16 (385.0 kW)
Strings	10 AWG (Copper)	80 (8,513.6 ft)
Module	Canadian Solar, CS6U 345M (345W)	1,368 (472.0 kW)

Wiring Zones

Description	Combiner Poles	String Size	Stringing Strategy
Wiring Zone	12	5-18	Along Racking

Field Segments

Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
Field Segment 1	Fixed Tilt	Landscape (Horizontal)	40°	180°	8.0 ft	4x1	286	1,144	394.7 kW
Field Segment 2	Fixed Tilt	Landscape (Horizontal)	40°	180°	8.0 ft	4x1	56	224	77.3 kW

Detailed Layout

Design 1 PAFBC Fairview SFH, 2000 Lohrer Rd, Fairview, PA 16415

Report

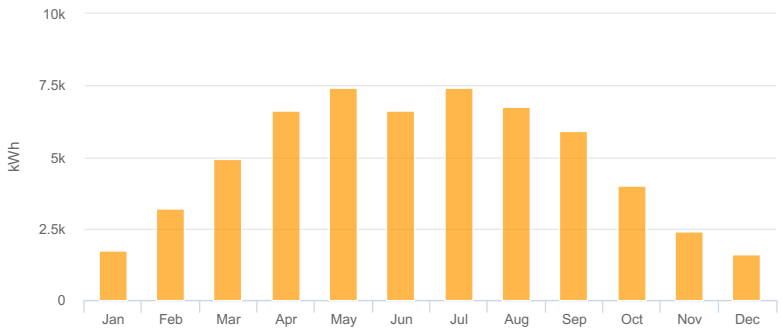
Project Name	PAFBC Fairview SFH
Project Address	2000 Lohrer Rd, Fairview, PA 16415
Prepared By	ESG Solar helioscopene@energysystemsgroup.com

System Metrics

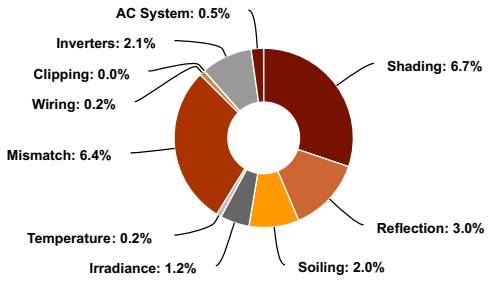
Design	Design 1
Module DC Nameplate	49.6 kW
Inverter AC Nameplate	48.1 kW Load Ratio: 1.03
Annual Production	58.61 MWh
Performance Ratio	79.7%
kWh/kWp	1,181.7
Weather Dataset	TMY, 10km Grid (42.05,-80.25), NREL (prospector)
Simulator Version	6b385920b3-277a9f933b-c48577c590-678150ca98

Project Location

Monthly Production



Sources of System Loss



Annual Production

	Description	Output	% Delta
Irradiance (kWh/m²)	Annual Global Horizontal Irradiance	1,342.7	
	POA Irradiance	1,482.7	10.4%
	Shaded Irradiance	1,383.4	-6.7%
	Irradiance after Reflection	1,342.3	-3.0%
	Irradiance after Soiling	1,315.4	-2.0%
	Total Collector Irradiance	**1,315.2**	**0.0%**
Energy (kWh)	Nameplate	65,255.8	
	Output at Irradiance Levels	64,494.7	-1.2%
	Output at Cell Temperature Derate	64,369.7	-0.2%
	Output After Mismatch	60,277.2	-6.4%
	Optimal DC Output	60,144.0	-0.2%
	Constrained DC Output	60,142.2	0.0%
	Inverter Output	58,907.3	-2.1%
	Energy to Grid	**58,612.7**	**-0.5%**
Temperature Metrics			
	Avg. Operating Ambient Temp		11.0 °C
	Avg. Operating Cell Temp		17.2 °C
Simulation Metrics			
	Operating Hours		4635
	Solved Hours		4635

Condition Set

Description	Condition Set 1											
Weather Dataset	TMY, 10km Grid (42.05,-80.25), NREL (prospector)											
Solar Angle Location	Meteo Lat/Lng											
Transposition Model	Perez Model											
Temperature Model	Sandia Model											
Temperature Model Parameters	Rack Type	a	b	Temperature Delta								
	Fixed Tilt	-3.56	-0.075	3°C								
	Flush Mount	-2.81	-0.0455	0°C								
Soiling (%)	J	F	M	A	M	J	J	A	S	O	N	D
	2	2	2	2	2	2	2	2	2	2	2	2
Irradiation Variance	5%											
Cell Temperature Spread	4° C											
Module Binning Range	-2.5% to 2.5%											
AC System Derate	0.50%											
Module Characterizations	Module	Uploaded By	Characterization									
	JKM 400M-72H-BDVP (Jinkosolar)	Folsom Labs	Jinko_JKM_400M_72H_BDVP (G2.5_F40).PAN, PAN									
Component Characterizations	Device	Uploaded By	Characterization									
	Sunny Tripower 24000TL-US (SMA)	Folsom Labs	Modified CEC									

Components

Component	Name	Count
Inverters	Sunny Tripower 24000TL-US (SMA)	2 (48.1 kW)
Strings	10 AWG (Copper)	8 (648.9 ft)
Module	Jinkosolar, JKM 400M-72H-BDVP (400W)	124 (49.6 kW)

Wiring Zones

Description	Combiner Poles	String Size	Stringing Strategy
Wiring Zone	12	4-18	Along Racking

Field Segments

Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
Field Segment 1	Fixed Tilt	Landscape (Horizontal)	40°	180°	8.0 ft	4x1	31	124	49.6 kW

Detailed Layout

Design 1 PAFBC HQ Harrisburg, 1601 Elmerton Avenue Harrisburg, PA 17106-7000

Report

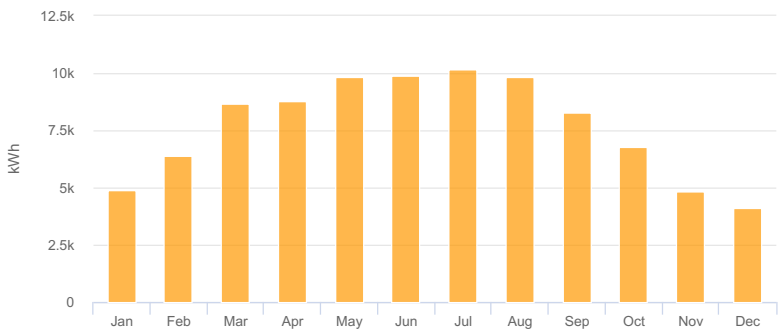
Project Name	PAFBC HQ Harrisburg
Project Address	1601 Elmerton Avenue Harrisburg, PA 17106-7000
Prepared By	ESG Solar helioscopene@energysystemsgroup.com

System Metrics

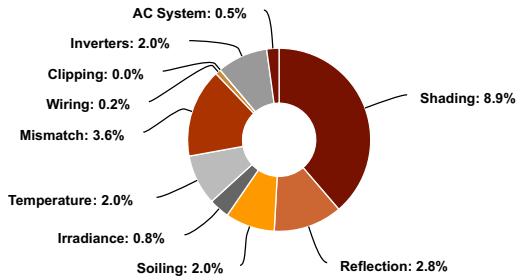
Design	Design 1
Module DC Nameplate	68.8 kW
Inverter AC Nameplate	72.2 kW Load Ratio: 0.95
Annual Production	92.55 MWh
Performance Ratio	79.1%
kWh/kWp	1,345.2
Weather Dataset	TMY, 10km grid (40.25,-76.85), NREL (prospector)
Simulator Version	a5e9f671a8-cd916aabc3-0fbc2a7e07-53a675c491

Project Location

Monthly Production



Sources of System Loss



Annual Production

	Description	Output	% Delta
Irradiance (kWh/m²)	Annual Global Horizontal Irradiance	1,459.6	
	POA Irradiance	1,699.6	16.4%
	Shaded Irradiance	1,549.1	-8.9%
	Irradiance after Reflection	1,506.1	-2.8%
	Irradiance after Soiling	1,476.0	-2.0%
	Total Collector Irradiance	**1,476.2**	**0.0%**
Energy (kWh)	Nameplate	101,621.0	
	Output at Irradiance Levels	100,777.3	-0.8%
	Output at Cell Temperature Derate	98,724.6	-2.0%
	Output After Mismatch	95,173.4	-3.6%
	Optimal DC Output	94,959.3	-0.2%
	Constrained DC Output	94,958.6	0.0%
	Inverter Output	93,014.6	-2.0%
	Energy to Grid	**92,549.5**	**-0.5%**
Temperature Metrics			
	Avg. Operating Ambient Temp		13.8 °C
	Avg. Operating Cell Temp		21.6 °C
Simulation Metrics			
	Operating Hours		4672
	Solved Hours		4672

Condition Set

Description	Condition Set 1											
Weather Dataset	TMY, 10km grid (40.25,-76.85), NREL (prospector)											
Solar Angle Location	Meteo Lat/Lng											
Transposition Model	Perez Model											
Temperature Model	Sandia Model											
Temperature Model Parameters	Rack Type	a	b	Temperature Delta								
	Fixed Tilt	-3.56	-0.075	3°C								
	Flush Mount	-2.81	-0.0455	0°C								
Soiling (%)	J	F	M	A	M	J	J	A	S	O	N	D
	2	2	2	2	2	2	2	2	2	2	2	2
Irradiation Variance	5%											
Cell Temperature Spread	4° C											
Module Binning Range	-2.5% to 2.5%											
AC System Derate	0.50%											
Module Characterizations	Module	Uploaded By	Characterization									
	TSM-PD14 320 (May16) (Trina Solar)	Folsom Labs	Spec Sheet Characterization, PAN									
Component Characterizations	Device	Uploaded By	Characterization									
	Sunny Tripower 24000TL-US (SMA)	Folsom Labs	Modified CEC									

Components

Component	Name	Count
Inverters	Sunny Tripower 24000TL-US (SMA)	3 (72.2 kW)
Strings	10 AWG (Copper)	13 (1,100.1 ft)
Module	Trina Solar, TSM-PD14 320 (May16) (320W)	215 (68.8 kW)

Wiring Zones

Description	Combiner Poles	String Size	Stringing Strategy
Wiring Zone	12	5-19	Along Racking

Field Segments

Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
Field Segment 1	Fixed Tilt	Landscape (Horizontal)	30°	188°	2.0 ft	1x1	53	53	17.0 kW
Field Segment 2	Fixed Tilt	Landscape (Horizontal)	30°	189°	2.0 ft	1x1	162	162	51.8 kW

Detailed Layout

Design 1 PAFBC Huntsdale SFH, 195 Lebo Rd Carlisle, PA 17015

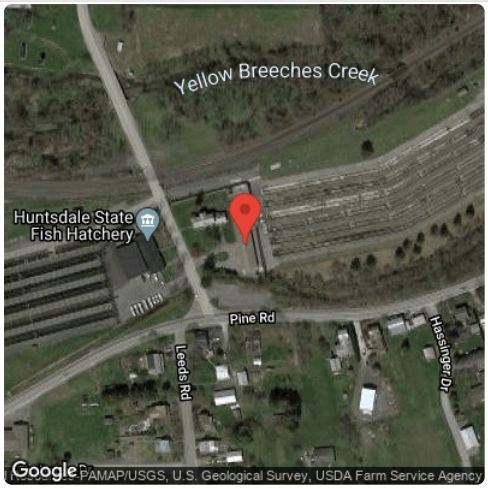
Report

Project Name	PAFBC Huntsdale SFH
Project Address	195 Lebo Rd Carlisle, PA 17015
Prepared By	ESG Solar helioscopene@energysystemsgroup.com

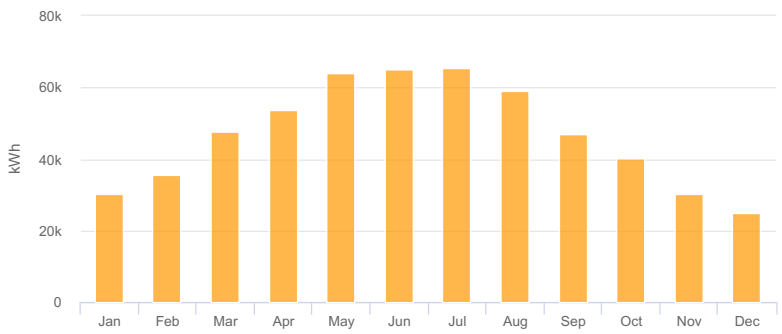
System Metrics

Design	Design 1
Module DC Nameplate	418.2 kW
Inverter AC Nameplate	336.8 kW Load Ratio: 1.24
Annual Production	563.4 MWh
Performance Ratio	86.2%
kWh/kWp	1,347.1
Weather Dataset	TMY, 10km Grid (40.15,-77.35), NREL (prospector)
Simulator Version	f6d2dcc17d-2ae007fd15-c76d4d47b8-ebcb3ee7fb

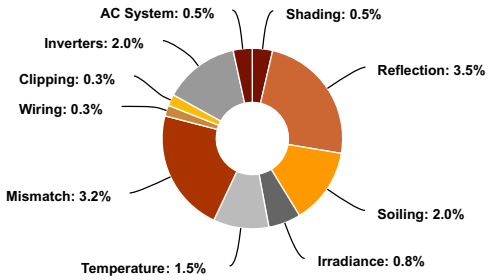
Project Location



Monthly Production



Sources of System Loss



Annual Production

	Description	Output	% Delta
Irradiance (kWh/m²)	Annual Global Horizontal Irradiance	1,453.7	
	POA Irradiance	1,561.8	7.4%
	Shaded Irradiance	1,553.6	-0.5%
	Irradiance after Reflection	1,498.8	-3.5%
	Irradiance after Soiling	1,468.8	-2.0%
	Total Collector Irradiance	**1,468.8**	**0.0%**
Energy (kWh)	Nameplate	614,644.8	
	Output at Irradiance Levels	609,424.7	-0.8%
	Output at Cell Temperature Derate	600,517.7	-1.5%
	Output After Mismatch	581,114.7	-3.2%
	Optimal DC Output	579,452.1	-0.3%
	Constrained DC Output	577,716.7	-0.3%
	Inverter Output	566,227.0	-2.0%
	Energy to Grid	**563,396.0**	**-0.5%**
Temperature Metrics			
	Avg. Operating Ambient Temp		13.3 °C
	Avg. Operating Cell Temp		20.8 °C
Simulation Metrics			
	Operating Hours		4680
	Solved Hours		4680

Condition Set

Description	Condition Set 1											
Weather Dataset	TMY, 10km Grid (40.15,-77.35), NREL (prospector)											
Solar Angle Location	Meteo Lat/Lng											
Transposition Model	Perez Model											
Temperature Model	Sandia Model											
Temperature Model Parameters	Rack Type	a	b	Temperature Delta								
	Fixed Tilt	-3.56	-0.075	3°C								
	Flush Mount	-2.81	-0.0455	0°C								
Soiling (%)	J	F	M	A	M	J	J	A	S	O	N	D
	2	2	2	2	2	2	2	2	2	2	2	2
Irradiation Variance	5%											
Cell Temperature Spread	4° C											
Module Binning Range	-2.5% to 2.5%											
AC System Derate	0.50%											
Module Characterizations	Module	Uploaded By	Characterization									
	TSM-PD14 320 (May16) (Trina Solar)	Folsom Labs	Spec Sheet Characterization, PAN									
Component Characterizations	Device	Uploaded By	Characterization									
	Sunny Tripower 24000TL-US (SMA)	Folsom Labs	Modified CEC									

Components

Component	Name	Count
Inverters	Sunny Tripower 24000TL-US (SMA)	14 (336.8 kW)
Strings	10 AWG (Copper)	75 (14,357.6 ft)
Module	Trina Solar, TSM-PD14 320 (May16) (320W)	1,307 (418.2 kW)

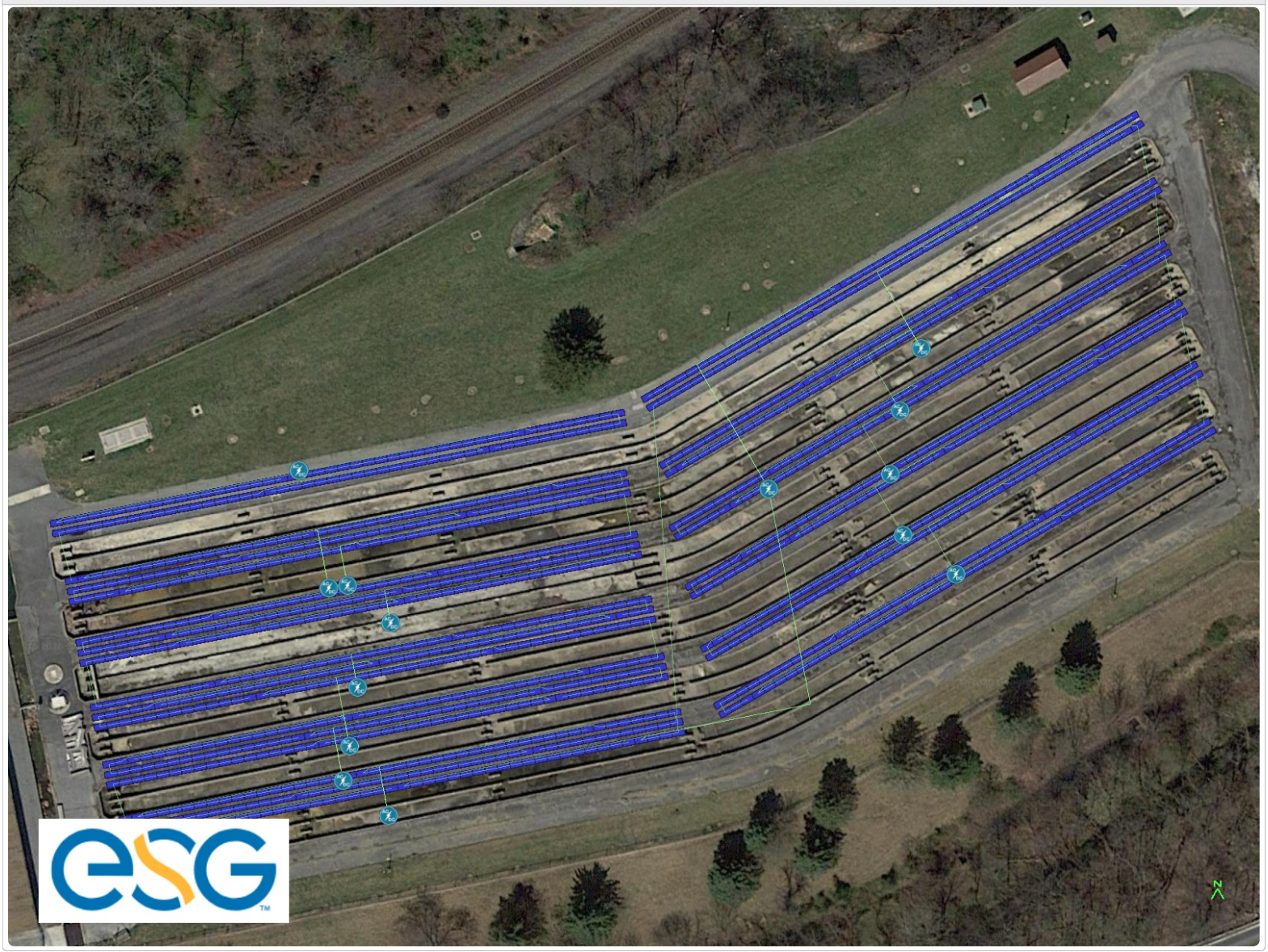
Wiring Zones

Description	Combiner Poles	String Size	Stringing Strategy
Wiring Zone	12	5-19	Along Racking

Field Segments

Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
Field Segment 1	Fixed Tilt	Landscape (Horizontal)	10°	169°	2.0 ft	1x1	92	92	29.4 kW
Field Segment 1 (copy)	Fixed Tilt	Landscape (Horizontal)	10°	169°	2.0 ft	1x1	135	135	43.2 kW
Field Segment 1 (copy 1)	Fixed Tilt	Landscape (Horizontal)	10°	169°	2.0 ft	1x1	135	135	43.2 kW
Field Segment 1 (copy 2)	Fixed Tilt	Landscape (Horizontal)	10°	169°	2.0 ft	1x1	135	135	43.2 kW
Field Segment 1 (copy 3)	Fixed Tilt	Landscape (Horizontal)	10°	169°	2.0 ft	1x1	135	135	43.2 kW
Field Segment 1 (copy 4)	Fixed Tilt	Landscape (Horizontal)	10°	169°	2.0 ft	1x1	135	135	43.2 kW
Field Segment 7	Fixed Tilt	Landscape (Horizontal)	10°	150°	2.0 ft	1x1	90	90	28.8 kW
Field Segment 7 (copy)	Fixed Tilt	Landscape (Horizontal)	10°	150°	2.0 ft	1x1	90	90	28.8 kW
Field Segment 7 (copy 1)	Fixed Tilt	Landscape (Horizontal)	10°	150°	2.0 ft	1x1	90	90	28.8 kW
Field Segment 7 (copy 2)	Fixed Tilt	Landscape (Horizontal)	10°	150°	2.0 ft	1x1	90	90	28.8 kW
Field Segment 7 (copy 3)	Fixed Tilt	Landscape (Horizontal)	10°	150°	2.0 ft	1x1	90	90	28.8 kW
Field Segment 7 (copy 4)	Fixed Tilt	Landscape (Horizontal)	10°	150°	2.0 ft	1x1	90	90	28.8 kW

Detailed Layout



Design 1 PAFBC Linesville SFH, 13300 Hartstown Rd, Linesville, PA 16424

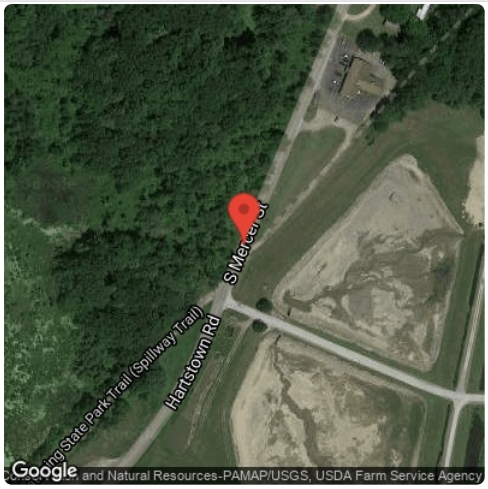
Report

Project Name	PAFBC Linesville SFH
Project Address	13300 Hartstown Rd, Linesville, PA 16424
Prepared By	ESG Solar helioscopene@energysystemsgroup.com

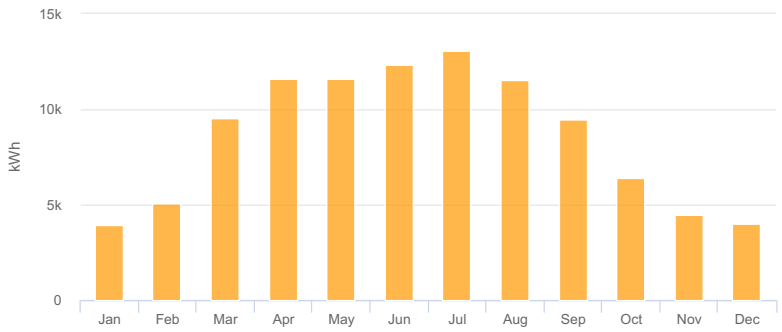
System Metrics

Design	Design 1
Module DC Nameplate	81.2 kW
Inverter AC Nameplate	72.2 kW Load Ratio: 1.12
Annual Production	103.0 MWh
Performance Ratio	85.8%
kWh/kWp	1,267.9
Weather Dataset	TMY, 10km Grid (41.65,-80.45), NREL (prospector)
Simulator Version	a5e9f671a8-cd916aabc3-0fbc2a7e07-53a675c491

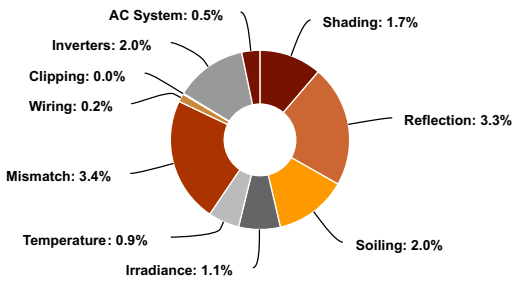
Project Location



Monthly Production



Sources of System Loss



Annual Production

	Description	Output	% Delta
Irradiance (kWh/m²)	Annual Global Horizontal Irradiance	1,362.5	
	POA Irradiance	1,478.6	8.5%
	Shaded Irradiance	1,453.2	-1.7%
	Irradiance after Reflection	1,404.7	-3.3%
	Irradiance after Soiling	1,376.6	-2.0%
	Total Collector Irradiance	**1,376.7**	**0.0%**
Energy (kWh)	Nameplate	111,823.0	
	Output at Irradiance Levels	110,545.5	-1.1%
	Output at Cell Temperature Derate	109,598.6	-0.9%
	Output After Mismatch	105,829.3	-3.4%
	Optimal DC Output	105,589.3	-0.2%
	Constrained DC Output	105,566.4	0.0%
	Inverter Output	103,474.0	-2.0%
	Energy to Grid	**102,957.0**	**-0.5%**
Temperature Metrics			
	Avg. Operating Ambient Temp		11.8 °C
	Avg. Operating Cell Temp		18.7 °C
Simulation Metrics			
	Operating Hours		4643
	Solved Hours		4643

Condition Set

Description	Condition Set 1											
Weather Dataset	TMY, 10km Grid (41.65,-80.45), NREL (prospector)											
Solar Angle Location	Meteo Lat/Lng											
Transposition Model	Perez Model											
Temperature Model	Sandia Model											
Temperature Model Parameters	Rack Type	a	b	Temperature Delta								
	Fixed Tilt	-3.56	-0.075	3°C								
	Flush Mount	-2.81	-0.0455	0°C								
Soiling (%)	J	F	M	A	M	J	J	A	S	O	N	D
	2	2	2	2	2	2	2	2	2	2	2	2
Irradiation Variance	5%											
Cell Temperature Spread	4° C											
Module Binning Range	-2.5% to 2.5%											
AC System Derate	0.50%											
Module Characterizations	Module	Uploaded By	Characterization									
	JKM 400M-72H-BDVP (Jinkosolar)	Folsom Labs	Jinko_JKM_400M_72H_BDVP (G2.5_F40).PAN, PAN									
Component Characterizations	Device	Uploaded By	Characterization									
	Sunny Tripower 24000TL-US (SMA)	Folsom Labs	Modified CEC									

Components

Component	Name	Count
Inverters	Sunny Tripower 24000TL-US (SMA)	3 (72.2 kW)
Strings	10 AWG (Copper)	13 (655.1 ft)
Module	Jinkosolar, JKM 400M-72H-BDVP (400W)	203 (81.2 kW)

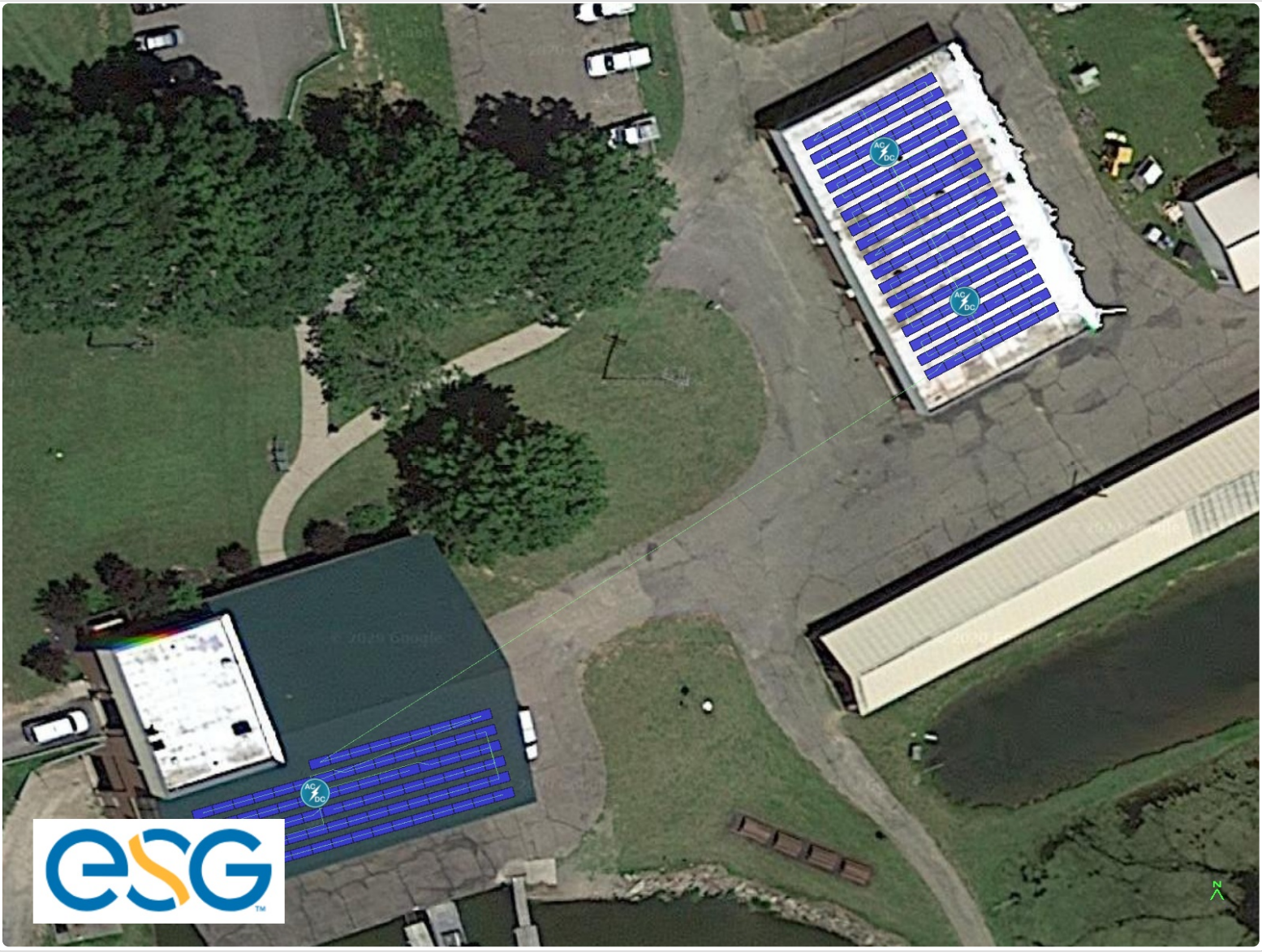
Wiring Zones

Description	Combiner Poles	String Size	Stringing Strategy
Wiring Zone	12	4-17	Along Racking

Field Segments

Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
Field Segment 1	Fixed Tilt	Landscape (Horizontal)	15°	152°	2.0 ft	1x1	119	119	47.6 kW
Field Segment 2	Fixed Tilt	Landscape (Horizontal)	15°	164°	2.0 ft	1x1	84	84	33.6 kW

Detailed Layout



Design 1 PAFBC Oswayo SFH, 96 PA-244 E, Coudersport, PA 16915

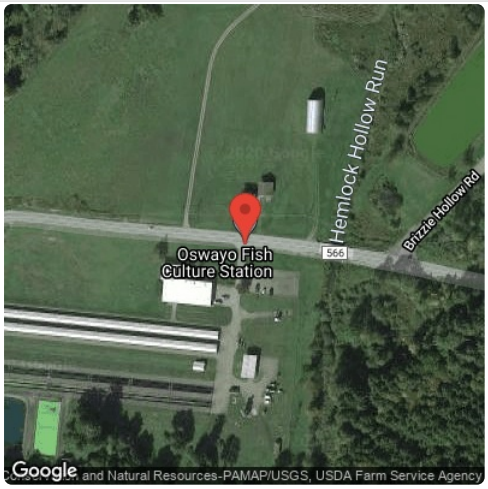
Report

Project Name	PAFBC Oswayo SFH
Project Address	96 PA-244 E, Coudersport, PA 16915
Prepared By	ESG Solar helioscopene@energysystemsgroup.com

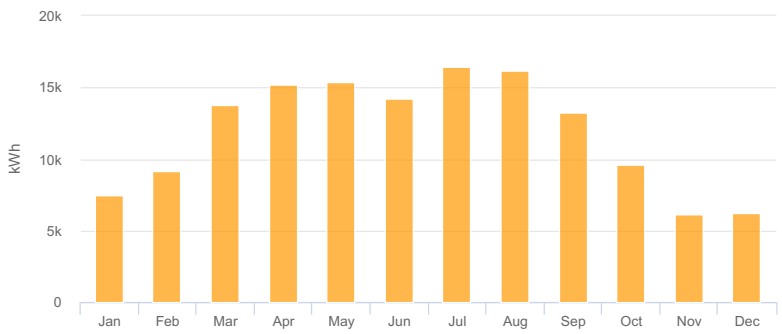
System Metrics

Design	Design 1
Module DC Nameplate	120.0 kW
Inverter AC Nameplate	96.2 kW Load Ratio: 1.25
Annual Production	143.0 MWh
Performance Ratio	76.3%
kWh/kWp	1,191.5
Weather Dataset	TMY, 10km Grid (41.95,-78.05), NREL (prospector)
Simulator Version	6b385920b3-277a9f933b-c48577c590-678150ca98

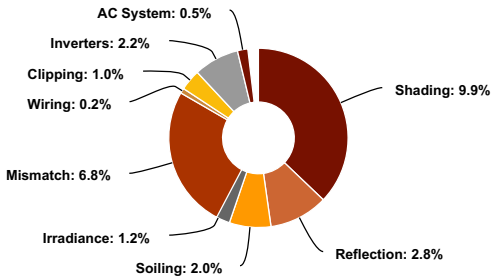
Project Location



Monthly Production



Sources of System Loss



Annual Production

	Description	Output	% Delta
Irradiance (kWh/m²)	Annual Global Horizontal Irradiance	1,350.5	
	POA Irradiance	1,561.7	15.6%
	Shaded Irradiance	1,407.0	-9.9%
	Irradiance after Reflection	1,367.1	-2.8%
	Irradiance after Soiling	1,339.7	-2.0%
	Total Collector Irradiance	**1,339.2**	**0.0%**
Energy (kWh)	Nameplate	160,756.9	
	Output at Irradiance Levels	158,898.3	-1.2%
	Output at Cell Temperature Derate	159,695.4	0.5%
	Output After Mismatch	148,765.0	-6.8%
	Optimal DC Output	148,401.7	-0.2%
	Constrained DC Output	146,899.7	-1.0%
	Inverter Output	143,693.0	-2.2%
	Energy to Grid	**142,974.0**	**-0.5%**
Temperature Metrics			
	Avg. Operating Ambient Temp		9.4 °C
	Avg. Operating Cell Temp		15.8 °C
Simulation Metrics			
	Operating Hours		4675
	Solved Hours		4675

Condition Set

Description	Condition Set 1											
Weather Dataset	TMY, 10km Grid (41.95,-78.05), NREL (prospector)											
Solar Angle Location	Meteo Lat/Lng											
Transposition Model	Perez Model											
Temperature Model	Sandia Model											
Temperature Model Parameters	Rack Type	a	b	Temperature Delta								
	Fixed Tilt	-3.56	-0.075	3°C								
	Flush Mount	-2.81	-0.0455	0°C								
Soiling (%)	J	F	M	A	M	J	J	A	S	O	N	D
	2	2	2	2	2	2	2	2	2	2	2	2
Irradiation Variance	5%											
Cell Temperature Spread	4° C											
Module Binning Range	-2.5% to 2.5%											
AC System Derate	0.50%											

Module Characterizations	Module	Uploaded By	Characterization
	JKM 400M-72H-BDVP (Jinkosolar)	Folsom Labs	Jinko_JKM_400M_72H_BDVP (G2.5_F40).PAN, PAN

Component Characterizations	Device	Uploaded By	Characterization
	Sunny Tripower 24000TL-US (SMA)	Folsom Labs	Modified CEC

Components

Component	Name	Count
Inverters	Sunny Tripower 24000TL-US (SMA)	4 (96.2 kW)
Strings	10 AWG (Copper)	20 (1,946.4 ft)
Module	Jinkosolar, JKM 400M-72H-BDVP (400W)	300 (120.0 kW)

Wiring Zones

Description	Combiner Poles	String Size	Stringing Strategy
Wiring Zone	12	4-17	Along Racking

Field Segments

Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
Field Segment 1	Fixed Tilt	Landscape (Horizontal)	40°	186°	8.0 ft	4x1	75	300	120.0 kW

Detailed Layout

Design 1 PAFBC Pleasant Gap SFH, 450 Robinson Ln, Pleasant Gap, PA 16823

Report

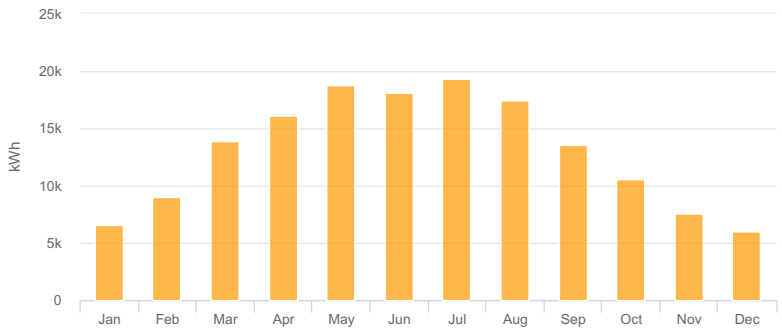
Project Name	PAFBC Pleasant Gap SFH
Project Address	450 Robinson Ln, Pleasant Gap, PA 16823
Prepared By	ESG Solar helioscopene@energysystemsgroup.com

System Metrics

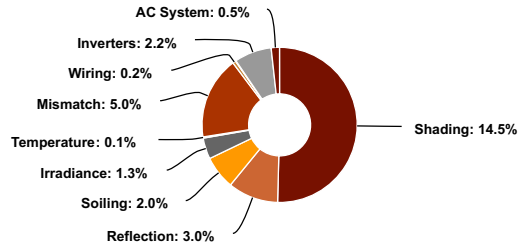
Design	Design 1
Module DC Nameplate	134.4 kW
Inverter AC Nameplate	120.3 kW Load Ratio: 1.12
Annual Production	156.9 MWh
Performance Ratio	74.0%
kWh/kWp	1,167.1
Weather Dataset	TMY, 10km Grid (40.85,-77.75), NREL (prospector)
Simulator Version	6b385920b3-277a9f933b-c48577c590-678150ca98

Project Location

Monthly Production



Sources of System Loss



Annual Production

	Description	Output	% Delta
Irradiance (kWh/m²)	Annual Global Horizontal Irradiance	1,391.1	
	POA Irradiance	1,577.1	13.4%
	Shaded Irradiance	1,348.4	-14.5%
	Irradiance after Reflection	1,307.7	-3.0%
	Irradiance after Soiling	1,281.5	-2.0%
	Total Collector Irradiance	**1,281.8**	**0.0%**
Energy (kWh)	Nameplate	172,322.8	
	Output at Irradiance Levels	170,142.1	-1.3%
	Output at Cell Temperature Derate	170,018.7	-0.1%
	Output After Mismatch	161,601.6	-5.0%
	Optimal DC Output	161,298.1	-0.2%
	Constrained DC Output	161,247.3	0.0%
	Inverter Output	157,645.0	-2.2%
	Energy to Grid	**156,857.0**	**-0.5%**
Temperature Metrics			
	Avg. Operating Ambient Temp		10.9 °C
	Avg. Operating Cell Temp		17.3 °C
Simulation Metrics			
	Operating Hours		4673
	Solved Hours		4673

Condition Set

Description	Condition Set 1											
Weather Dataset	TMY, 10km Grid (40.85,-77.75), NREL (prospector)											
Solar Angle Location	Meteo Lat/Lng											
Transposition Model	Perez Model											
Temperature Model	Sandia Model											
Temperature Model Parameters	Rack Type	a	b	Temperature Delta								
	Fixed Tilt	-3.56	-0.075	3°C								
	Flush Mount	-2.81	-0.0455	0°C								
Soiling (%)	J	F	M	A	M	J	J	A	S	O	N	D
	2	2	2	2	2	2	2	2	2	2	2	2
Irradiation Variance	5%											
Cell Temperature Spread	4° C											
Module Binning Range	-2.5% to 2.5%											
AC System Derate	0.50%											

Module Characterizations	Module	Uploaded By	Characterization
	JKM 400M-72H-BDVP (Jinkosolar)	Folsom Labs	Jinko_JKM_400M_72H_BDVP (G2.5_F40).PAN, PAN

Component Characterizations	Device	Uploaded By	Characterization
	Sunny Tripower 24000TL-US (SMA)	Folsom Labs	Modified CEC

Components

Component	Name	Count
Inverters	Sunny Tripower 24000TL-US (SMA)	5 (120.3 kW)
Strings	10 AWG (Copper)	24 (1,831.4 ft)
Module	Jinkosolar, JKM 400M-72H-BDVP (400W)	336 (134.4 kW)

Wiring Zones

Description	Combiner Poles	String Size	Stringing Strategy
Wiring Zone	12	4-18	Along Racking

Field Segments

Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
Field Segment 1	Fixed Tilt	Portrait (Vertical)	30°	157°	2.0 ft	1x1	98	98	39.2 kW
Field Segment 2	Fixed Tilt	Portrait (Vertical)	30°	157°	2.0 ft	1x1	98	98	39.2 kW
Field Segment 3	Fixed Tilt	Portrait (Vertical)	30°	157°	2.0 ft	1x1	70	70	28.0 kW
Field Segment 4	Fixed Tilt	Portrait (Vertical)	30°	157°	2.0 ft	1x1	70	70	28.0 kW

Detailed Layout

Design 1 PAFBC Reynoldsdale SFH, 162 Fish Hatchery Rd, New Paris, PA 15554

Report

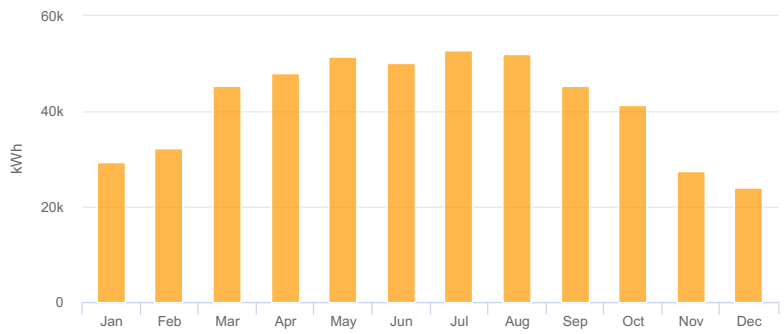
Project Name	PAFBC Reynoldsdale SFH
Project Address	162 Fish Hatchery Rd, New Paris, PA 15554
Prepared By	ESG Solar helioscopene@energysystemsgroup.com

System Metrics

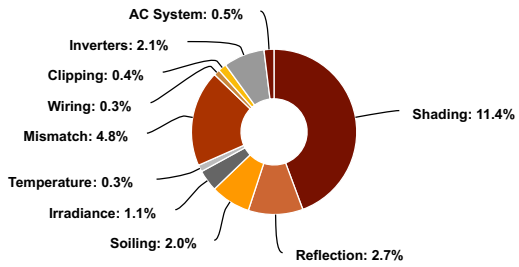
Design	Design 1
Module DC Nameplate	400.0 kW
Inverter AC Nameplate	336.8 kW Load Ratio: 1.19
Annual Production	499.5 MWh
Performance Ratio	76.6%
kWh/kWp	1,248.8
Weather Dataset	TMY, 10km Grid (40.15,-78.55), NREL (prospector)
Simulator Version	6b385920b3-277a9f933b-c48577c590-678150ca98

Project Location

Monthly Production



Sources of System Loss



Annual Production

	Description	Output	% Delta
Irradiance (kWh/m²)	Annual Global Horizontal Irradiance	1,409.8	
	Adjusted Global Horizontal Irradiance	1,409.8	0.0%
	POA Irradiance	1,629.9	15.6%
	Shaded Irradiance	1,444.2	-11.4%
	Irradiance after Reflection	1,404.5	-2.7%
	Irradiance after Soiling	1,376.4	-2.0%
	Total Collector Irradiance	**1,375.4**	**-0.1%**
Energy (kWh)	Nameplate	550,397.8	
	Output at Irradiance Levels	544,447.8	-1.1%
	Output at Cell Temperature Derate	542,576.2	-0.3%
	Output After Mismatch	516,348.6	-4.8%
	Optimal DC Output	514,764.2	-0.3%
	Constrained DC Output	512,619.5	-0.4%
	Inverter Output	502,039.0	-2.1%
	Energy to Grid	**499,529.0**	**-0.5%**
Temperature Metrics			
	Avg. Operating Ambient Temp	11.2 °C	
	Avg. Operating Cell Temp	18.0 °C	
Simulation Metrics			
	Operating Hours	4661	
	Solved Hours	4661	

Condition Set

Description	Condition Set 1											
Weather Dataset	TMY, 10km Grid (40.15,-78.55), NREL (prospector)											
Solar Angle Location	Meteo Lat/Lng											
Transposition Model	Perez Model											
Temperature Model	Sandia Model											
Temperature Model Parameters	Rack Type	a	b	Temperature Delta								
	Fixed Tilt	-3.56	-0.075	3°C								
	Flush Mount	-2.81	-0.0455	0°C								
Soiling (%)	J	F	M	A	M	J	J	A	S	O	N	D
	2	2	2	2	2	2	2	2	2	2	2	2
Irradiation Variance	5%											
Cell Temperature Spread	4° C											
Module Binning Range	-2.5% to 2.5%											
AC System Derate	0.50%											
Module Characterizations	Module	Uploaded By	Characterization									
	JKM 400M-72H-BDVP (Jinkosolar)	Folsom Labs	Jinko_JKM_400M_72H_BDVP (G2.5_F40).PAN, PAN									
Component Characterizations	Device	Uploaded By	Characterization									
	Sunny Tripower 24000TL-US (SMA)	Folsom Labs	Modified CEC									

Components

Component	Name	Count
Inverters	Sunny Tripower 24000TL-US (SMA)	14 (336.8 kW)
Strings	10 AWG (Copper)	64 (10,048.2 ft)
Module	Jinkosolar, JKM 400M-72H-BDVP (400W)	1,000 (400.0 kW)

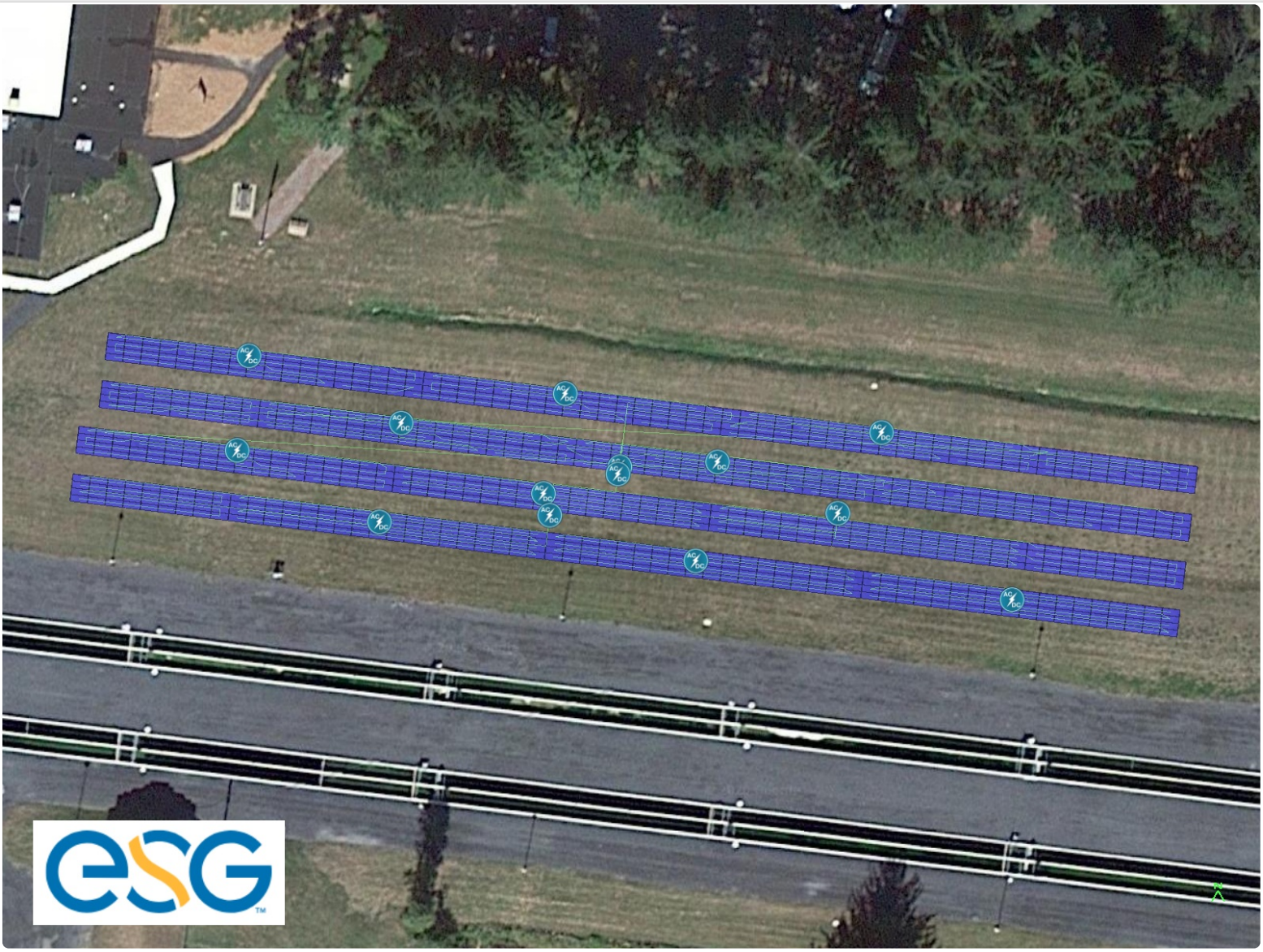
Wiring Zones

Description	Combiner Poles	String Size	Stringing Strategy
Wiring Zone	12	4-18	Along Racking

Field Segments

Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
Field Segment 1	Fixed Tilt	Landscape (Horizontal)	40°	187°	8.0 ft	4x1	250	1,000	400.0 kW

Detailed Layout



Design 1 PAFBC Tylersville SFH, 43 Hatchery Lane, Loganton, PA 17747

Report

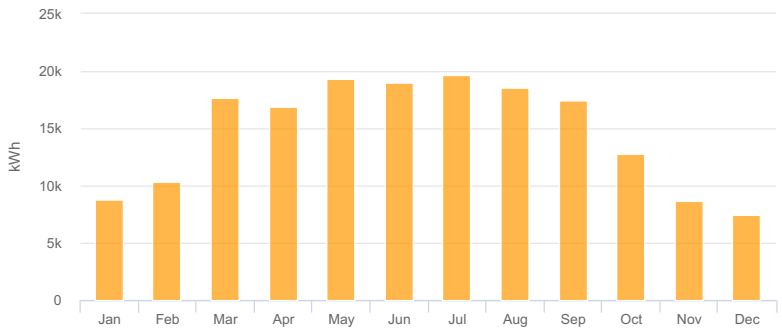
Project Name	PAFBC Tylersville SFH
Project Address	43 Hatchery Lane, Loganton, PA 17747
Prepared By	ESG Solar helioscopene@energysystemsgroup.com

System Metrics

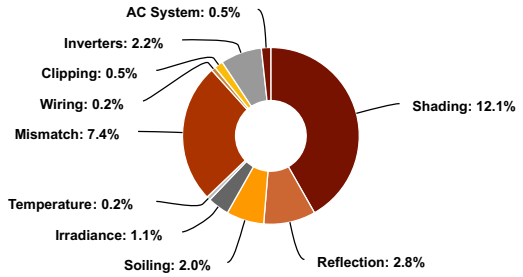
Design	Design 1
Module DC Nameplate	148.8 kW
Inverter AC Nameplate	120.3 kW Load Ratio: 1.24
Annual Production	176.4 MWh
Performance Ratio	74.0%
kWh/kWp	1,185.8
Weather Dataset	TMY, 10km Grid (40.95,-77.45), NREL (prospector)
Simulator Version	6b385920b3-277a9f933b-c48577c590-678150ca98

Project Location

Monthly Production



Sources of System Loss



Annual Production

	Description	Output	% Delta
Irradiance (kWh/m²)	Annual Global Horizontal Irradiance	1,401.3	
	POA Irradiance	1,602.9	14.4%
	Shaded Irradiance	1,408.7	-12.1%
	Irradiance after Reflection	1,369.9	-2.8%
	Irradiance after Soiling	1,342.5	-2.0%
	Total Collector Irradiance	**1,342.2**	**0.0%**
Energy (kWh)	Nameplate	199,805.3	
	Output at Irradiance Levels	197,522.6	-1.1%
	Output at Cell Temperature Derate	197,121.0	-0.2%
	Output After Mismatch	182,554.1	-7.4%
	Optimal DC Output	182,155.3	-0.2%
	Constrained DC Output	181,302.0	-0.5%
	Inverter Output	177,331.0	-2.2%
	Energy to Grid	**176,445.0**	**-0.5%**
Temperature Metrics			
	Avg. Operating Ambient Temp		11.3 °C
	Avg. Operating Cell Temp		17.8 °C
Simulation Metrics			
	Operating Hours		4675
	Solved Hours		4675

Condition Set

Description	Condition Set 1											
Weather Dataset	TMY, 10km Grid (40.95,-77.45), NREL (prospector)											
Solar Angle Location	Meteo Lat/Lng											
Transposition Model	Perez Model											
Temperature Model	Sandia Model											
Temperature Model Parameters	Rack Type	a	b	Temperature Delta								
	Fixed Tilt	-3.56	-0.075	3°C								
	Flush Mount	-2.81	-0.0455	0°C								
Soiling (%)	J	F	M	A	M	J	J	A	S	O	N	D
	2	2	2	2	2	2	2	2	2	2	2	2
Irradiation Variance	5%											
Cell Temperature Spread	4° C											
Module Binning Range	-2.5% to 2.5%											
AC System Derate	0.50%											

Module Characterizations	Module	Uploaded By	Characterization
	JKM 400M-72H-BDVP (Jinkosolar)	Folsom Labs	Jinko_JKM_400M_72H_BDVP (G2.5_F40).PAN, PAN

Component Characterizations	Device	Uploaded By	Characterization
	Sunny Tripower 24000TL-US (SMA)	Folsom Labs	Modified CEC

Components

Component	Name	Count
Inverters	Sunny Tripower 24000TL-US (SMA)	5 (120.3 kW)
Strings	10 AWG (Copper)	25 (1,628.4 ft)
Module	Jinkosolar, JKM 400M-72H-BDVP (400W)	372 (148.8 kW)

Wiring Zones

Description	Combiner Poles	String Size	Stringing Strategy
Wiring Zone	12	4-18	Along Racking

Field Segments

Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
Field Segment 1	Fixed Tilt	Landscape (Horizontal)	40°	160°	8.0 ft	4x1	93	372	148.8 kW

Detailed Layout

Equipment Cutsheets

Pennsylvania Fish & Boat Commission

Equipment Catalog Sheets

ALED3T78/PCT

Specification grade area lights available in IES Type III distributions. For use for roadway, general parking and other area lighting applications where a larger pool of lighting is required. Patent pending thermal management system. 5 Year Warranty.

Color: Bronze Weight: 30.4 lbs

Project:	Type:
Prepared By:	Date:

Driver Info

Type:	Constant Current
120V:	0.66A
208V:	0.41A
240V:	0.35A
277V:	0.30A
Input Watts:	77W
Efficiency:	N/A

LED Info

Watts:	78W
Color Temp:	5000K
Color Accuracy:	71 CRI
L70 Lifespan:	100000
Lumens:	9263
Efficacy:	121 LPW

Technical Specifications

Electrical

Photocell:

120-277V twistlock photocell included. Photocell is compatible with 120-277V.

Driver:

Constant Current, Class 2, 2000mA, 100-277V, 50-60Hz, 1.1A, Power Factor 99%

THD:

5.3% at 120V, 13.3% at 277V

Surge Protection:

4kV

Surge Protector:

ALED78 is available with a 6kV surge protector (SP6). SP6 available .

Listings

DLC Listed:

This product is on the Design Lights Consortium (DLC) Qualified Products List and is eligible for rebates from DLC Member Utilities.
DLC Product Code: P0000179S

UL Listing:

Suitable for wet locations as a downlight.

IESNA LM-79 & IESNA LM-80 Testing:

RAB LED luminaires have been tested by an independent laboratory in accordance with IESNA LM-79 and 80, and have received the Department of Energy "Lighting Facts" label.

Dark Sky Approved:

The International Dark Sky Association has approved this product as a full cutoff, fully shielded luminaire.

LED Characteristics

Lifespan:

100,000-hour LED lifespan based on IES LM-80 results and TM-21 calculations.

LEDs:

Six (6) multi-chip, 13W, high-output, long-life LEDs.

Color Consistency:

3-step MacAdam Ellipse binning to achieve consistent fixture-to-fixture color.

Color Stability:

LED color temperature is warrantied to shift no more than 200K in CCT over a 5 year period.

Color Uniformity:

RAB's range of CCT (Correlated Color Temperature) follows the guidelines of the American National Standard for Specifications for the Chromaticity of Solid State Lighting (SSL) Products, ANSI C78.377-2017.

Construction

IES Classification:

The Type III distribution is ideal for roadway, general parking and other area lighting applications where a larger pool of lighting is required. It is intended to be located near the side of the area, allowing the light to project outward and fill the area.

IP Rating:

Ingress Protection rating of IP66 for dust and water

Ambient Temperature:

SuitableFor use in 40°C (104°F) ambient temperatures.

Cold Weather Starting:

Minimum starting temperature is -40°C (-40°F)

Thermal Management:

Superior heat sinking with external Air-Flow fins.

Effective Projected Area:

EPA = 0.75

Lens:

Tempered glass lens.

Housing:

Die cast aluminum housing, lens frame and mounting arm.

Mounting:

Universal mounting arm compatible for hole spacing patterns from 1" to 5 1/2" center to center. Round Pole Adaptor plate included as a standard. Easy slide and lock to mount fixture with ease.

Reflector:

Specular vacuum-metallized polycarbonate

Gaskets:

High temperature silicone gaskets.

Finish:

Formulated for high-durability and long lasting color.

Technical Specifications (continued)

Construction

Green Technology:

Mercury and UV free. RoHS compliant components. Polyester powder coat finish formulated without the use of VOC or toxic heavy metals.

For use on LEED Buildings:

IDA Dark Sky Approval means that this fixture can be used to achieve LEED Credits for Light Pollution Reduction.

Other

Compatibility:

Compatible with Round Poles with a diameter of 2.5" to 6"

Warranty:

RAB warrants that our LED products will be free from defects in materials and workmanship for a period of five (5) years from the date of delivery to the end user, including coverage of light output, color stability, driver performance and fixture finish.

Patents:

The ALED design is protected by patents in the U.S. Pat. 668,370, Canada Pat. 144956, China ZL201230100154.X, and Mexico Pat. 38423. Pending patents in Taiwan.

Replacement:

Replaces 250W Metal Halide.

Buy American Act Compliance:

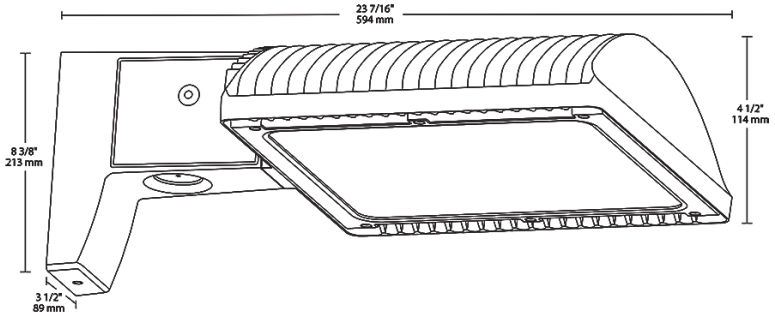
RAB values USA manufacturing! Upon request, RAB may be able to manufacture this product to be compliant with the Buy American Act (BAA). Please contact customer service to request a quote for the product to be made BAA compliant.

Optical

BUG Rating:

B1 U0 G2

Dimensions



Features

- 66% energy cost savings vs. HID
- 100,000-hour LED lifespan
- Type III distribution
- 5-year warranty

Ordering Matrix

Family	Optics	Wattage	Mounting	Color Temp	Finish	Driver Options	Photocell Options
ALED	3T	78					
	2T = Type II **3T** = Type III **4T** = Type IV	**50** = 50W **78** = 78W **105** = 105W **125** = 125W **150** = 150W	**Blank** = Pole mount **SF** = Slipfitter	**Blank** = 5000K (Cool) **N** = 4000K (Neutral) **Y** = 3000K (Warm)	**Blank** = Bronze **RG** = Roadway Gray **W** = White	**Blank** = 120-277V **/480** = 480V (not available for 150W) **/BL** = Bi-Level **/D10** = 0-10V Dimming	**Blank** = No Option **/PC** = 120V Button Photocell (Pole mount models only) **/PC2** = 277V Button Photocell (Pole mount models only) **/PCT** = 120-277V Twistlock Photocell (Pole mount models only) **/PCT4** = 480V Twistlock Photocell (Pole mount models only) **/PCS** = 120V Swivel Photocell **/PCS2** = 277V Swivel Photocell **/PCS4** = 480V Swivel Photocell **/WS2** = Multi-Level Motion Sensor 20 ft. (Only available 0-10V dimming models) **/WS4** = Multi-Level Motion Sensor 40 ft. (Only available 0-10V dimming models)

ALED3T78/ FCr T

Specification grade area lights available in IES Type III distributions. For use for roadway, general parking and other area lighting applications where a larger pool of lighting is required. Patent pending thermal management system. 5 Year Warranty.

Color: Bronze Weight: 32.0 lbs

Cj ect :y	Tpacy
Cocadocd i py	Dd:cy

Dol corf lj

Type:	Constant Current
120V:	1.31A
208V:	0.80A
240V:	0.69A
277V:	0.60A
Input Watts:	155W
Efficiency:	97%

LED rf lj

Watts:	150W
Color Temp:	5000K
Color Accuracy:	71 CRI
L70 Lifespan:	100000
Lumens:	16839
Efficacy:	108 LPW

Tct l f vt dSs act vht d:vj f H

ESst :ot dS

Cl j :j t cSy

120-277V twistlock photocell included. Photocell is compatible with 120-277V.

Dol cdHy

Two Drivers, Constant Current, Class 2, 2000mA, 100-277V, 50-60Hz, Power Factor 99%

s ucgc Cj :ct :vj f y

4kV

LvHt:vf gH

DLr LvHt:cdy

This product is on the Design Lights Consortium (DLC) Qualified Products List and is eligible for rebates from DLC Member Utilities.
DLC Product Code: P0000175C

UL LvHt:vf gy

Suitable for wet locations.

rEs NA LM-9&0 LM-k/ TcHt:vf gy

RAB LED luminaries have been tested by an independent laboratory in accordance with IESNA LM-79 and LM-80, and have been received the Department of Energy "Lighting Facts" label.

Ddcb s bp Aaaqj l cdy

The International Dark Sky Association has approved this product as a full cutoff, fully shielded luminaire.

LED r l dodt :coHt:vt H

LvhcHadf y

100,000-hour LED lifespan based on IES LM-80 results and TM-21 calculations.

LEDHy

Multi-chip, high-output, long-life LEDs

r j $ or j f HvHt:cf t py

7-step MacAdam Ellipse binning to achieve consistent fixture-to-fixture color.

r j $ os :dm&py

LED color temperature is warrantied to shift no more than 200K in CCT over a 5 year period.

r j $ oUf vj cR vpy

RAB's range of CCT (Correlated Color Temperature) follows the guidelines of the American National Standard for Specifications for the Chromaticity of Solid State Lighting (SSL) Products, ANSI C78.377-2017.

r j f Ht:out :vj f

EHrct :vl c Cj ect :cd Accdy

EPA = 0.75

MdWR uR AR mcf : TcR acod:uccy

Suitable for use in 40°C (104°F) ambient temperatures

r j $l G cd:l cos :dcvf gy

Minimum starting temperature is -40°C (-40°F)

Tl cdR dSMdf dgcR cf :y

Superior thermal management with external "Air-Flow" fins.

Lcf Hy

Tempered glass lens.

Fj uHvf gy

Die-cast aluminum housing, lens frame and mounting arm.

rC (d:vf gy

Ingress Protection rating of IP66 for dust and water

Mj uf :vf gy

Universal mounting arm compatible for hole spacing patterns from 1" to 5 1/2" center to center. Round Pole Adaptor plate included as a standard. Easy slide and lock to mount fixture with ease.

(chSct :j cy

Specular vacuum-metallized polycarbonate

) dHbc:Hy

High-temperature silicone gaskets

1vf vHl y

Formulated for high-durability and long lasting color.

) occf Tct l f j $ gpy

Mercury and UV free. RoHS compliant components. Polyester powder coat finish formulated without the use of VOC or toxic heavy metals.

1j ouHc j f LEED i uv&lvf gHy

IDA Dark Sky Approval means that this fixture can be used to achieve LEED Credits for Light Pollution Reduction.

@l co

r j R ad:vm&py

Compatible with Round Poles with a diameter of 2.5" to 6"

ALED3T78/ PCr T

Tct l f vt dSs act vht d:vj f Hwt j f :vf ucd.

@l co

G dcodf :py

RAB warrants that our LED products will be free from defects in materials and workmanship for a period of five (5) years from the date of delivery to the end user, including coverage of light output, color stability, driver performance and fixture finish.

(caSlt cR cf :y

Replaces 400W Metal Halide

i up AR cot df At : r j R aSdf t cy

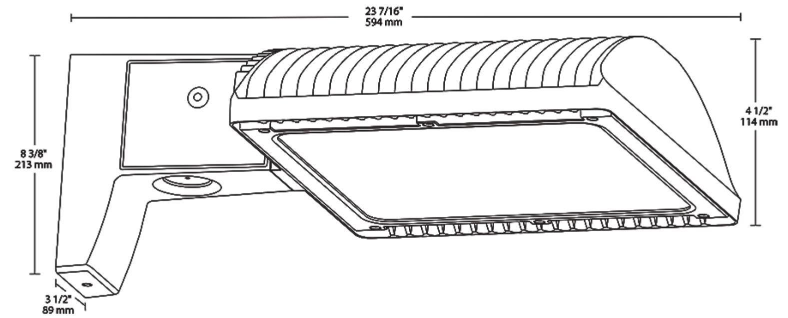
RAB values USA manufacturing! Upon request, RAB may be able to manufacture this product to be compliant with the Buy American Act (BAA). Please contact customer service to request a quote for the product to be made BAA compliant.

@a:vt dS

i U) (d:vf gy

B1 U0 G2

DvR cf Hvj f H



1cd:uccH

- 66% energy cost savings vs. HID
- 100,000-hour LED lifespan
- Type III distribution
- 5-year warranty

@odcof g Md:ovW

1dR vSp	@a:vt H	G d::dgc	Mj uf :vf g	r j Sj oTcR a	1vf vHI	DoI co@a:vj f H	CI j :j t cSS@a:vj f H
ALED	3T	150					
	4T = Type II **3T** = Type III **5T** = Type IV	**8/** = 50W **9k** = 78W **7/ 8** = 105W **748** = 125W **78/** = 150W	**i Stlf b** = Pole mount **s 1** = Slipfitter	**i Stlf b** = 5000K (Cool) **N** = 4000K (Neutral) **Y** = 3000K (Warm)	**i Stlf b** = Bronze **( )** = Roadway Gray **G** = White	**i Stlf b** = 120-277V **P5k/** = 480V (not available for 150W) **P L** = Bi-Level **PD7/** = 0-10V Dimming	**i Stlf b** = No Option **PCr** = 120V Button Photocell (Pole mount models only) **PCr 4** = 277V Button Photocell (Pole mount models only) **PCr T** = 120-277V Twistlock Photocell (Pole mount models only) **PCr T5** = 480V Twistlock Photocell (Pole mount models only) **PCr s** = 120V Swivel Photocell **PCr s 4** = 277V Swivel Photocell **PCr s 5** = 480V Swivel Photocell **PG s 4** = Multi-Level Motion Sensor 20 ft. (Only available 0-10V dimming models) **PG s 5** = Multi-Level Motion Sensor 40 ft. (Only available 0-10V dimming models)

FFLED18

Rectangular shaped LED floodlight designed to replace 70W Metal Halide. Patent Pending airflow technology ensures long LED and driver lifespan. Use for building facade lighting, sign lighting, LED landscape lighting and instant-on security lighting.

Color: Bronze Weight: 4.8 lbs

Project:	Type:
Prepared By:	Date:

Driver Info		LED Info	
Type:	Constant Current	Watts:	18W
120V:	0.2A	Color Temp:	5000K
208V:	0.15A	Color Accuracy:	72 CRI
240V:	0.13A	L70 Lifespan:	100000
277V:	0.11A	Lumens:	2310
Input Watts:	23W	Efficacy:	100 LPW
Efficiency:	78%		

Technical Specifications

Listings

UL Listing:

Suitable For Wet Locations. Suitable for ground mounting.

DLC Listed:

This product is on the Design Lights Consortium (DLC) Qualified Products List and is eligible for rebates from DLC Member Utilities.
DLC Product Code: P0000170B

IESNA LM-79 & LM-80 Testing:

RAB LED luminaires have been tested by an independent laboratory in accordance with IESNA LM-79 and LM-80, and have received the Department of Energy "Lighting Facts" label.

LED Characteristics

Lifespan:

100,000-hour LED lifespan based on IES LM-80 results and TM-21 calculations.

LEDs:

Multi-chip, high-output, long-life LEDs

Color Consistency:

7-step MacAdam Ellipse binning to achieve consistent fixture-to-fixture color.

Color Stability:

LED color temperature is warrantied to shift no more than 200K in CCT over a 5 year period.

Color Uniformity:

RAB's range of CCT (Correlated Color Temperature) follows the guidelines of the American National Standard for (SSL) Products, ANSI C78.377-2017.

Construction

IP Rating:

Ingress Protection rating of IP66 for dust and water

Airflow:

Airflow technology heat sink for superior cooling.

Ambient Temperature:

SuitableFor use in 40°C (104°F) ambient temperatures.

Cold Weather Starting:

Minimum starting temperature is -40°C (-40°F)

Thermal Management Housing:

Die-cast aluminum housing, lens frame and mounting arm.

Mounting:

Heavy-duty mounting arm with "O" ring seal & stainless steel screw.

Reflector:

Semi-specular anodized aluminum.

Gaskets:

High-temperature silicone gaskets

Finish:

Formulated for high-durability and long lasting color.

Green Technology:

Mercury and UV free. RoHS compliant components. Polyester powder coat finish formulated without the use of VOC or toxic heavy metals.

Optical

NEMA Type:

NEMA Beam Spread of 7H x 6V

Electrical

Driver:

Constant Current, Class 2, 100 - 277V, 50 - 60 Hz, 100 - 277VAC 0.4 Amps.

Surge Protection:

6kV

Other

Warranty:

RAB warrants that our LED products will be free from defects in materials and workmanship for a period of five (5) years from the date of delivery to the end user, including coverage of light output, color stability, driver performance and fixture finish.

Patents:

The FFLED design is protected by U.S. Pat. D643,147, Canada Pat. 140798, China Pat. ZL201130171304.1, Mexico Pat. 36757 and pending patent in Taiwan.

American Bureau of Shipping (ABS) :

For use on Mobile Offshore Drilling Units (MODU) and shipping vessels.

Equivalency:

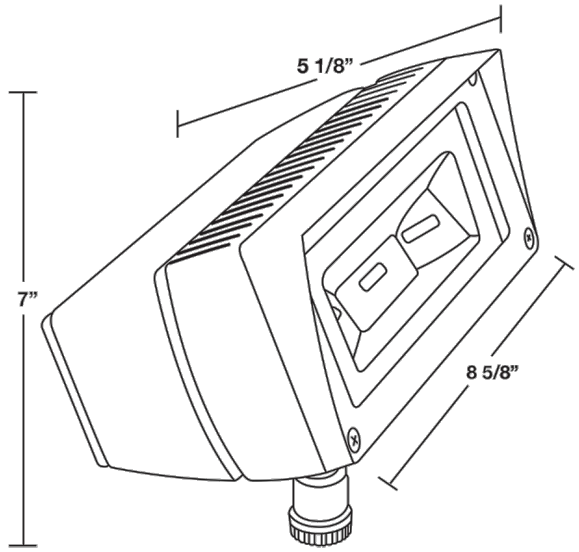
Equivalent to 70W Metal Halide.

Buy American Act Compliance:

RAB values USA manufacturing! Upon request, RAB may be able to manufacture this product to be compliant with the Buy American Act (BAA). Please contact customer service to request a quote for the product to be made BAA compliant.

FFLED18

Dimensions



Features

- Ultra efficient LED and optical design
- Replaces 70W MH floodlights
- 100,000 hour life based on LM-80 tests
- NEMA type - 7H x 6V
- Air-flow technology heatsink
- 5-year warranty

Ordering Matrix

Family	Wattage	Mounting	Color Temp	NEMA Type	Finish	Photocell Options
FFLED	18					
	18 = 18W	**Blank** = Swivel Arm	**Blank** = 5000K (Cool) **N** = 4000K (Neutral) **Y** = 3000K (Warm)	**Blank** = 7H x 6V	**Blank** = Bronze **W** = White	**Blank** = No Option **/PC** = 120V Photocell **/PC2** = 277V Photocell **/PCS** = 120V Swivel Photocell **/PCS2** = 277V Swivel Photocell

FFLED26

Rectangular shaped LED floodlight designed to replace 100W Metal Halide. Patent Pending airflow technology ensures long LED and driver lifespan. Use for building facade lighting, sign lighting, LED landscape lighting and instant-on security lighting.

Color: Bronze Weight: 12.5 lbs

Project:	**Type:**
Prepared By:	**Date:**

Driver Info		LED Info	
Type:	Constant Current	Watts:	26W
120V:	0.24A	Color Temp:	5000K
208V:	0.15A	Color Accuracy:	71 CRI
240V:	0.13A	L70 Lifespan:	100000
277V:	0.11A	Lumens:	4131
Input Watts:	29W	Efficacy:	142 LPW
Efficiency:	89%		

Technical Specifications

Listings

UL Listing:

Suitable For Wet Locations. Suitable for mounting within 1.2M(4FT) of the ground.

DLC Listed:

This product is listed by Design Lights Consortium (DLC) as an ultra-efficient premium product that qualifies for the highest tier of rebates from DLC Member Utilities.
DLC Product Code: PAXKT39NP

IESNA LM-79 & LM-80 Testing:

RAB LED luminaires have been tested by an independent laboratory in accordance with IESNA LM-79 and LM-80, and have received the Department of Energy "Lighting Facts" label.

LED Characteristics

Lifespan:

100,000-hour LED lifespan based on IES LM-80 results and TM-21 calculations.

LEDs:

Multi-chip 26W high output long life LED

Color Consistency:

7-step MacAdam Ellipse binning to achieve consistent fixture-to-fixture color.

Color Stability:

LED color temperature is warrantied to shift no more than 200K in CCT over a 5 year period.

Color Uniformity:

RAB's range of CCT (Correlated Color Temperature) follows the guidelines of the American National Standard for (SSL) Products, ANSI C78.377-2017.

Construction

IP Rating:

Ingress Protection rating of IP66 for dust and water

Ambient Temperature:

SuitableFor use in 40°C (104°F) ambient temperatures.

Cold Weather Starting:

Minimum starting temperature is -40°C (-40°F)

Thermal Management Housing:

Superior heat sinking with external Air-Flow fins.

Housing:

Die-cast aluminum housing, lens frame and mounting arm.

Threaded Size:

1/2" threaded arm.

Mounting:

Heavy-duty mounting arm with "O" ring seal & stainless steel screw.

Effective Projected Area:

EPA = 0.65

Reflector:

Specular polycarbonate

Gaskets:

High-temperature silicone gaskets

Finish:

Formulated for high-durability and long lasting color.

Green Technology:

Mercury and UV free. RoHS compliant components. Polyester powder coat finish formulated without the use of VOC or toxic heavy metals.

Optical

NEMA Type:

NEMA Beam Spread of 7H x 6V

Electrical

THD:

8.2% at 120V, 17.7% at 277V

Power Factor:

99.1% at 120V, 90.7% at 277V

Driver:

Constant Current, Class 2, 100-277V, 50/60 Hz, 6 kV surge protection, 120V: 0.24A, 208V: 0.15A, 240V: 0.13A, 277V: 0.11A.

Other

Warranty:

RAB warrants that our LED products will be free from defects in materials and workmanship for a period of five (5) years from the date of delivery to the end user, including coverage of light output, color stability, driver performance and fixture finish.

Patents:

The FFLED design is protected by U.S. Pat. D643,147, Canada Pat. 140798, China Pat. ZL201130171304.1, Mexico Pat. 36757 and pending patent in Taiwan.

Technical Specifications (continued)

Other

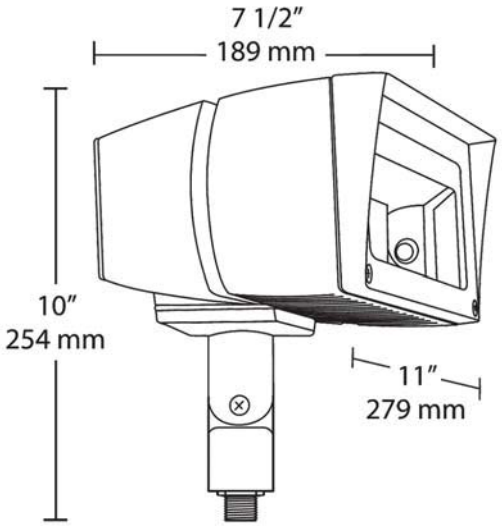
Equivalency:

Equivalent to 100W Metal Halide.

Buy American Act Compliance:

RAB values USA manufacturing! Upon request, RAB may be able to manufacture this product to be compliant with the Buy American Act (BAA). Please contact customer service to request a quote for the product to be made BAA compliant.

Dimensions



Features

- Ultra efficient LED and optical design
- Replaces 100W MH floodlights
- 100,000 hour life based on LM-80 tests
- Air-flow technology heatsink
- 5-year warranty

Ordering Matrix

Family	Wattage	Mounting	Color Temp	NEMA Type	Finish	Driver	Photocell Options
FFLED	26						
	80 = 80W **52** = 52W **39** = 39W **26** = 26W	**Blank** = Swivel Arm **SF** = Slipfitter **T** = Trunnion	**Blank** = 5000K (Cool) **N** = 4000K (Neutral) **Y** = 3000K (Warm)	**Blank** = 7H x 6V **B55** = 5H x 5V **B44** = 4H x 4V	**Blank** = Bronze **W** = White	**Blank** = On/Off **/D10** = 0-10V Dimming **/480** = 480V On/Off (not available for 80W models)	**Blank** = No Option **/PC** = 120V Photocell **/PC2** = 277V Photocell **/PCS** = 120V Swivel Photocell **/PCS2** = 277V Swivel Photocell **/PCS4** = 480V Swivel Photocell

FFLED26

Rectangular shaped LED floodlight designed to replace 175W Metal Halide. Patent Pending airflow technology ensures long LED and driver lifespan. Use for building facade lighting, sign lighting, LED landscape lighting and instant-on security lighting.

Color: Bronze Weight: 12.5 lbs

Project:	Type:
Prepared By:	Date:

Driver Info		LED Info	
Type:	Constant Current	Watts:	52W
120V:	0.45A	Color Temp:	5000K
208V:	0.27A	Color Accuracy:	71 CRI
240V:	0.24A	L70 Lifespan:	100000
277V:	0.21A	Lumens:	6935
Input Watts:	55W	Efficacy:	125 LPW
Efficiency:	94%		

Technical Specifications

Listings

UL Listing:

Suitable For Wet Locations. Suitable for mounting within 1.2M(4FT) of the ground.

DLC Listed:

This product is on the Design Lights Consortium (DLC) Qualified Products List and is eligible for rebates from DLC Member Utilities.
DLC Product Code: P2CRRKPHQ

IESNA LM-79 & LM-80 Testing:

RAB LED luminaires have been tested by an independent laboratory in accordance with IESNA LM-79 and LM-80, and have received the Department of Energy "Lighting Facts" label.

LED Characteristics

Lifespan:

100,000-hour LED lifespan based on IES LM-80 results and TM-21 calculations.

LEDs:

Two multi-chip, 26Watt high performance LEDs.

Color Consistency:

7-step MacAdam Ellipse binning to achieve consistent fixture-to-fixture color.

Color Stability:

LED color temperature is warrantied to shift no more than 200K in CCT over a 5 year period.

Color Uniformity:

RAB's range of CCT (Correlated Color Temperature) follows the guidelines of the American National Standard for (SSL) Products, ANSI C78.377-2017.

Construction

IP Rating:

Ingress Protection rating of IP66 for dust and water

Ambient Temperature:

SuitableFor use in 40°C (104°F) ambient temperatures.

Cold Weather Starting:

Minimum starting temperature is -40°C (-40°F)

Thermal Management Housing:

Superior heat sinking with external Air-Flow fins.

Housing:

Die-cast aluminum housing, lens frame and mounting arm.

Threaded Size:

1/2" threaded arm.

Mounting:

Heavy-duty mounting arm with "O" ring seal & stainless steel screw.

Effective Projected Area:

EPA = 0.65

Reflector:

Specular polycarbonate

Gaskets:

High-temperature silicone gaskets

Finish:

Formulated for high-durability and long lasting color.

Green Technology:

Mercury and UV free. RoHS compliant components. Polyester powder coat finish formulated without the use of VOC or toxic heavy metals.

Optical

NEMA Type:

NEMA Beam Spread of 7H x 6V

Electrical

Driver:

Constant Current, Class 2, 100-277V, 50/60 Hz, 4 kV surge protection, 120V: 0.45A, 208V: 0.27A, 240V: 0.24A, 277V: 0.21A

Other

Warranty:

RAB warrants that our LED products will be free from defects in materials and workmanship for a period of five (5) years from the date of delivery to the end user, including coverage of light output, color stability, driver performance and fixture finish.

Patents:

The FFLED design is protected by U.S. Pat. D643,147, Canada Pat. 140798, China Pat. ZL201130171304.1, Mexico Pat. 36757 and pending patent in Taiwan.

American Bureau of Shipping vABS(:

For use on Mobile Offshore Drilling Units (MODU) and shipping vessels.

E) uivalency:

Equivalent to 175W Metal Halide.

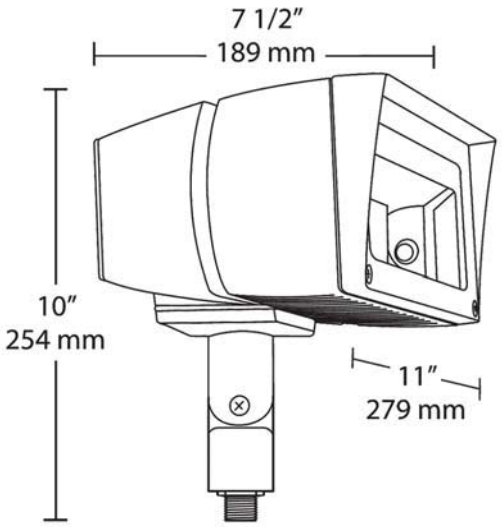
Technical Specifications (continued)

Other

Buy American Act Compliance:

RAB values USA manufacturing! Upon request, RAB may be able to manufacture this product to be compliant with the Buy American Act (BAA). Please contact customer service to request a quote for the product to be made BAA compliant.

Dimensions



Features

- Ultra efficient LED and optical design
- Replaces 175W MH floodlights
- 100,000 hour life based on LM-80 tests
- Air-flow technology heatsink
- 5-year warranty

Ordering Matrix

Family	Wattage	Mounting	Color Temp	NEMA Type	Finish	Driver	Photocell Options
FFLED	52						
	80 = 80W **26** = 52W **59** = 39W **63** = 26W	**Blank** = Swivel Arm **SF** = Slipfitter **T** = Trunnion	**Blank** = 5000K (Cool) **N** = 4000K (Neutral) **Y** = 3000K (Warm)	**Blank** = 7H x 6V **B22** = 5H x 5V **B44** = 4H x 4V	**Blank** = Bronze **W** = White	**Blank** = On/Off **/D10** = 0-10V Dimming **/480** = 480V On/Off (not available for 80W models)	**Blank** = No Option **/PC** = 120V Photocell **/PC6** = 277V Photocell **/PCS** = 120V Swivel Photocell **/PCS6** = 277V Swivel Photocell **/PCS4** = 480V Swivel Photocell

8" CIRCULAR LED KITS
1600 AND 2200 LUMEN OPTIONS

FUTURE FIT LED KITS

DESCRIPTION
Pre-assembled UL 1598C Classified LED retrofit kit. Includes the following components:
• (1) LED Driver • (1) LED Module • (1) Metal Pan • Mounting Accessories (Threaded Rod, Mounting Hardware, and Wiring Hardware)

APPLICATION
Upgrade circular surface-mount fluorescent-style luminaires to an LED solution. Suitable for after-market or OEM installation. (OEM must have UL LED Luminaire General Coverage file.)

TYPICAL INSTALLATION APPLICATION

SYSTEM FEATURES

Module Features
- For Use in Class 2 Lighting Systems
- Highly Reflective White Soldermask
- Low Profile WAGO Push Connectors
- UL Recognized Components
- Single-Sided CEM3 Substrate
- 3-Step MacAdam Color Binning
- LM80 Tested LEDs by Samsung
- Beam Angle: 120º
- Reported Life Expectancy: L70 > 54,000 hours at Tc <85ºC
- Calculated Life Expectancy: L70 = 160,000 hours at Tc <85ºC
- Maximum Board Temperature at Tc Point: 85ºC

Driver Features
- Dimming Options: 120V Phase Control or 120-277V 0-10V
- High Power Factor
- UL 8750 Recognized Component LED Power Unit
- Meets FCC Part 15 Class B (Consumer) Limit for EMI
- Over Current, Short Circuit, and Open Circuit Protection
- Class 2 Output
- Type 1 Outdoor, Suitable for Dry and Damp Locations
- Up to 194ºF/90ºC Maximum Case Temperature
- THD: <20%

8” CIRCULAR LED KITS
1600 AND 2200 LUMEN OPTIONS

PERFORMANCE SPECIFICATIONS

8”, 1600 LUMEN CIRCULAR

Dimming Type: Phase Control

KIT CONTENTS:
Driver: KTLD-20-1-560-FDIM-AQ7
Module: (1) KTLM-960-C2-8xx-64B
Metal Pan: Yes
Mounting Hardware and Accessories

Color Temp	Input Voltage	LED Retrofit Kit Catalog Number	No. of Modules	Total System Drive Current	Drive Current per Module	Total System Lumens	Total Module Power	Module Efficacy	Driver Efficiency	Total System Power	Total System Efficacy
3000K	120V	KT-RKIT-CP-8-1600-830-FDIM /G2	1	560mA	560mA	1700	12.5W	136 lm/W	80%	15.6W	109 lm/W
4000K	120V	KT-RKIT-CP-8-1600-840-FDIM /G2	1	560mA	560mA	1750	12.5W	140 lm/W	80%	15.6W	112 lm/W
5000K	120V	KT-RKIT-CP-8-1600-850-FDIM /G2	1	560mA	560mA	1800	12.5W	144 lm/W	80%	15.6W	115 lm/W

Dimming Type: 0-10V

KIT CONTENTS:
Driver: KTLD-20-UV-560-VDIM-AQ7
Module: (1) KTLM-900-C2-8xx-48A
Metal Pan: Yes
Mounting Hardware and Accessories

Color Temp	Input Voltage	LED Retrofit Kit Catalog Number	No. of Modules	Total System Drive Current	Drive Current per Module	Total System Lumens	Total Module Power	Module Efficacy	Driver Efficiency	Total System Power	Total System Efficacy
3000K	120-277V	KT-RKIT-CP-8-1600-830-VDIM /G2	1	560mA	560mA	1700	12.5W	136 lm/W	80%	15.6W	109 lm/W
4000K	120-277V	KT-RKIT-CP-8-1600-840-VDIM /G2	1	560mA	560mA	1750	12.5W	140 lm/W	80%	15.6W	112 lm/W
5000K	120-277V	KT-RKIT-CP-8-1600-850-VDIM /G2	1	560mA	560mA	1800	12.5W	144 lm/W	80%	15.6W	115 lm/W

8”, 2200 LUMEN CIRCULAR

Dimming Type: Phase Control

KIT CONTENTS:
Driver: KTLD-20-1-560-FDIM-AQ7
Module: (1) KTLM-960-C2-8xx-80B
Metal Pan: Yes
Mounting Hardware and Accessories

Color Temp	Input Voltage	LED Retrofit Kit Catalog Number	No. of Modules	Total System Drive Current	Drive Current per Module	Total System Lumens	Total Module Power	Module Efficacy	Driver Efficiency	Total System Power	Total System Efficacy
3000K	120V	KT-RKIT-CP-8-2200-830-FDIM /G2	1	560mA	560mA	2110	15.5W	136 lm/W	80%	19.3W	109 lm/W
4000K	120V	KT-RKIT-CP-8-2200-840-FDIM /G2	1	560mA	560mA	2180	15.5W	141 lm/W	80%	19.3W	113 lm/W
5000K	120V	KT-RKIT-CP-8-2200-850-FDIM /G2	1	560mA	560mA	2240	15.5W	145 lm/W	80%	19.3W	116 lm/W

Dimming Type: 0-10V

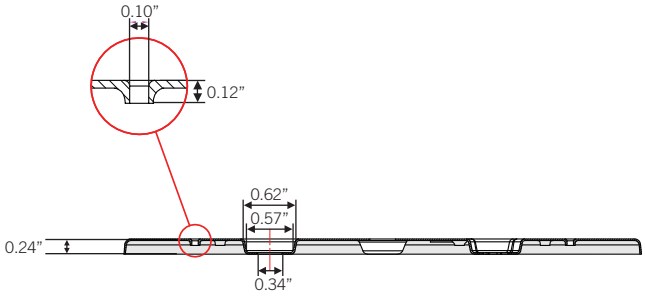
KIT CONTENTS:
Driver: KTLD-20-UV-560-VDIM-AQ7
Module: (1) KTLM-960-C2-8xx-80B
Metal Pan: Yes
Mounting Hardware and Accessories

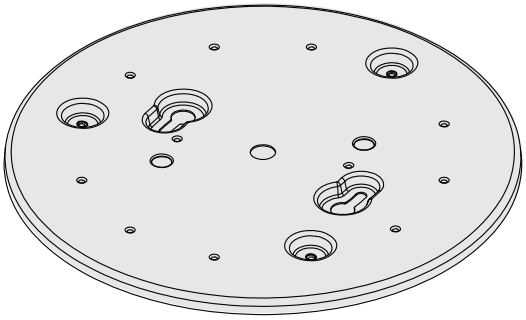
Color Temp	Input Voltage	LED Retrofit Kit Catalog Number	No. of Modules	Total System Drive Current	Drive Current per Module	Total System Lumens	Total Module Power	Module Efficacy	Driver Efficiency	Total System Power	Total System Efficacy
3000K	120-277V	KT-RKIT-CP-8-2200-830-VDIM /G2	1	560mA	560mA	2110	15.5W	136 lm/W	80%	19.3W	109 lm/W
4000K	120-277V	KT-RKIT-CP-8-2200-840-VDIM /G2	1	560mA	560mA	2180	15.5W	141 lm/W	80%	19.3W	113 lm/W
5000K	120-277V	KT-RKIT-CP-8-2200-850-VDIM /G2	1	560mA	560mA	2240	15.5W	145 lm/W	80%	19.3W	116 lm/W

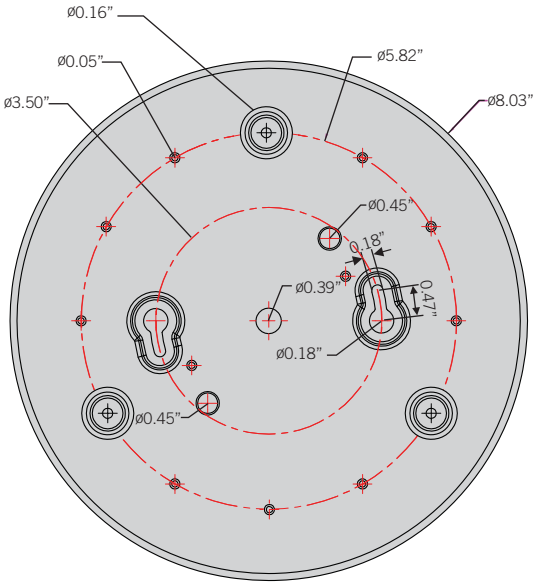
8” CIRCULAR LED KITS
1600 AND 2200 LUMEN OPTIONS

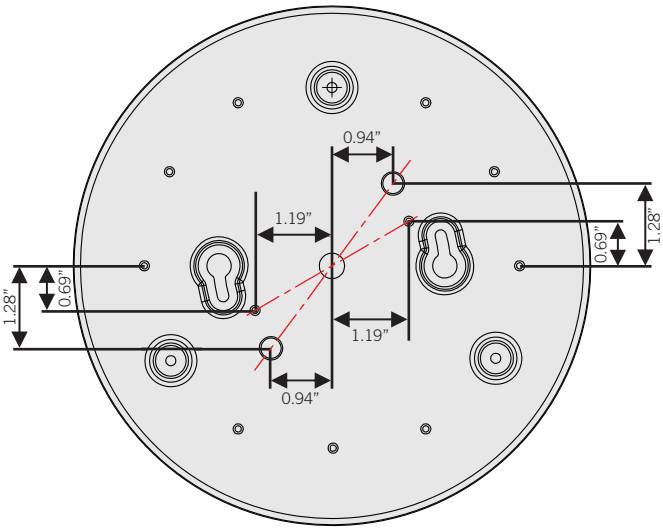
PHYSICAL SPECIFICATIONS

METAL PAN

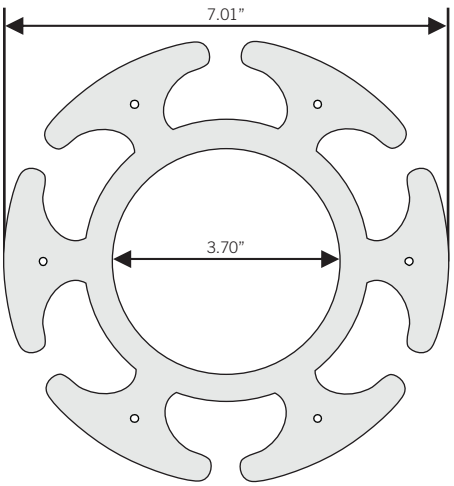




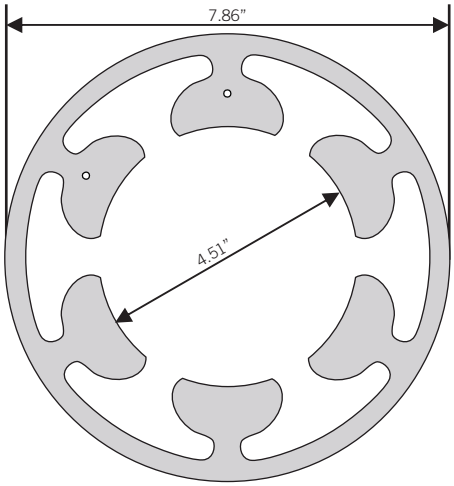




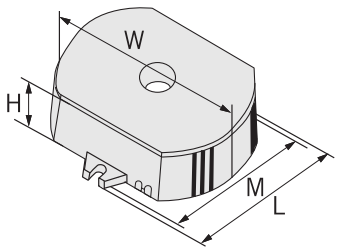
LED MODULE A
FOR 1600 LUMEN KITS



LED MODULE B
FOR 2200 LUMEN KITS



LED DRIVER



LENGTH	6.46”
WIDTH	1.32”
HEIGHT	1.00”
MOUNTING	6.00”

FXLED78SF/PCT

RAB Outdoor

Color: Bronze

Weight: 25.0 lbs

Project:	Type:
Prepared By:	Date:

Driver Info		LED Info	
Type:	Constant Current	Watts:	78W
120V:	0.66A	Color Temp:	5100K (Cool)
208V:	0.41A	Color Accuracy:	71 CRI
240V:	0.35A	L70 Lifespan:	100,000
277V:	0.30A	Lumens:	10,230
Input Watts:	76W	Efficacy:	134 LPW
Efficiency:	N/A		

Technical Specifications

Listings

UL Listing:

Suitable for wet locations. Suitable for ground mounting.

IESNA LM-79 & LM-80 Testing:

RAB LED luminaires and LED components have been tested by an independent laboratory in accordance with IESNA LM-79 and LM-80.

DLC Listed:

This product is on the Design Lights Consortium (DLC) Qualified Products List and is eligible for rebates from DLC Member Utilities.
DLC Product Code: P00001761

LED Characteristics

Lifespan:

100,000-hour LED lifespan based on IES LM-80 results and TM-21 calculations

Note:

All values are typical (tolerance +/- 10%)

Color Consistency:

7-step MacAdam Ellipse binning to achieve consistent fixture-to-fixture color

Color Stability:

LED color temperature is warrantied to shift no more than 200K in CCT over a 5 year period

Color Uniformity:

RAB's range of CCT (Correlated Color Temperature) follows the guidelines of the American National Standard for (SSL) Products, ANSI C78.377-2017.

Construction

IP Rating:

Ingress Protection rating of IP66 for dust and water

EPA:

2

Ambient Temperature:

Suitable For use in 40°C (104°F)

Cold Weather Starting:

Minimum starting temperature is -40°C (-40°F)

Thermal Management:

Superior heat sinking with external Air-Flow fins

Lens:

Tempered glass lens

Housing:

Die-cast aluminum housing and door frame

Mounting:

Heavy-duty Slip Fitter for 2 3/8"OD pipe

Gaskets:

High-temperature silicone gaskets

Finish:

Formulated for high-durability and long lasting color

Green Technology:

Mercury and UV-free. RoHS compliant components.

Optical

NEMA Type:

NEMA Beam Spread of 6H x 6V

Electrical

Driver:

Constant Current, Class 2, 2000mA, 100-277V, 50-60Hz, 1.1A, Power Factor 99%

Surge Protection:

4kV

Photocell:

120-277V twistlock photocell included. Photocell is compatible with 120V - 277V.

THD:

5.51% at 120V, 9.14% at 277V

Power Factor:

99.5% at 120V, 93.3% at 277V

Other

Warranty:

RAB warrants that our LED products will be free from defects in materials and workmanship for a period of five (5) years from the date of delivery to the end user, including coverage of light output, color stability, driver performance and fixture finish. RAB's warranty is subject to all terms and conditions found at

Technical Specifications (continued)

Other

Patents:

The FXLED78 design is protected by U.S. Pat. D659,280, Canada Pat. 143155, China Pat. ZL201130443125.9, Mexico Pat. 36558 and pending patent in Taiwan.

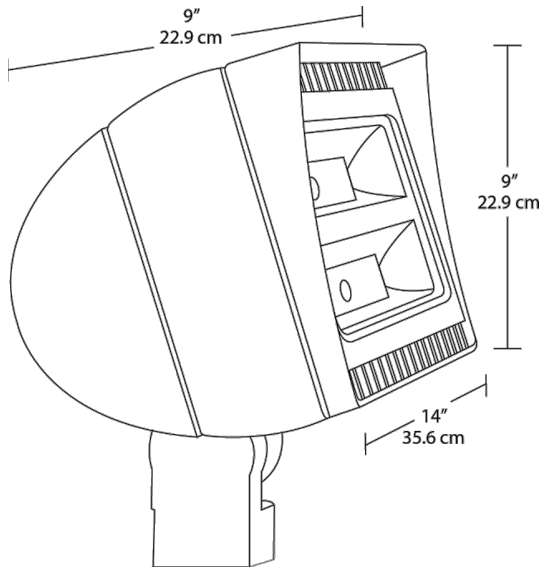
Equivalency:

Equivalent to 250W Metal Halide

Buy American Act Compliance:

RAB values USA manufacturing! Upon request, RAB may be able to manufacture this product to be compliant with the Buy American Act (BAA). Please contact customer service to request a quote for the product to be made BAA compliant.

Dimensions



Features

- 66% energy cost savings vs. HID
- NEMA Type - 6H x 6V
- Air-Flow technology heat dissipation
- 100,000-hour LED lifespan
- 5-year warranty

Ordering Matrix

Family	Wattage	Mounting	Color Temp	Finish	Driver	Options	Other Option
FXLED	78	SF	^	^	^	/PCT	^
	78 = 78W **105** = 105W **125** = 125W **150** = 150W	**SF** = Slipfitter **T** = Trunnion	**Blank** = 5000K (Cool) **N** = 4000K (Neutral) **Y** = 3000K (Warm)	**Blank** = Bronze **W** = White	**Blank** = Standard **/D10** = 0-10V Dimming **/BL** = Bi-Level **/480** = 480V	**Blank** = No Option **/LC** = Lightcloud Control **/PCT** = 100-277V Twistlock **/PCT4** = 480V Twistlock	**Blank** = Standard **USA** = BAA Compliant

FXLED78S/ FRCTr

RAB Outdoor

Color: Bronze

Weight: 25.0 lbs

Cj ect :y	rpacy
Cocadcc i py	Dd:cy

Dol corf lj		LED rf lj	
Type:	Constant Current	Watts:	150W
120V:	1.31A	Color Temp:	5000K (Cool)
208V:	0.80A	Color Accuracy:	71 CRI
240V:	0.69A	L70 Lifespan:	100,000
277V:	0.60A	Lumens:	20,868
Input Watts:	164W	Efficacy:	127 LPW
Efficiency:	91%		

rct l f vt ds/ act vhvt d:vj f g

Lvg:vf Ug

NL Lvg:vf Uy

Suitable for wet locations. Suitable for ground mounting.

rE/ AM L- 980 b L- 9nS rcg:vf Uy

RAB LED luminaires and LED components have been tested by an independent laboratory in accordance with IESNA LM-79 and LM-80.

DLT Lvg:c y

This product is on the Design Lights Consortium (DLC) Qualified Products List and is eligible for rebates from DLC Member Utilities.
DLC Product Code: P0000170A

Esct :otds

Dol coy

One Driver, Constant Current, Class 2, 2100mA 100-277V, 50-60Hz, Power Factor 99%

Cl j :j t csy

120-277V twistlock photocell included. Photocell is compatible with 120V - 277V.

ruDy

8.77% at 120V, 11.18% at 277V

Cj RcoFdt :j oy

99.4% at 120V, 96.8% at 277V

LED Tl dodt :cog:vt g

Lvhcgadf y

100,000-hour LED lifespan based on IES LM-80 results and TM-21 calculations

Aj :cy

All values are typical (tolerance +/- 10%)

LEDgy

Multip-chip, high-output, long-life LEDs

Tj sj oTj f gvg:cf t py

7-step MacAdam Ellipse binning to achieve consistent fixture-to-fixture color

Tj sj o/ :dWtv«py

LED color temperature is warrantied to shift no more than 200K in CCT over a 5 year period

Tj sj oNf vj cHvpy

RAB's range of CCT (Correlated Color Temperature) follows the guidelines of the American National Standard for Specifications for the Chromaticity of Solid State Lighting (SSL) Products, ANSI C78.377-2017.

Tj f g:cGt :vj f

rC k d:vf Uy

Ingress Protection rating of IP66 for dust and water

- dOvHGH MH Wvcf : rcHacod:Gocy

Suitable for use in 40°C (104°F)

EHrct :vl c Cj ect :c Mocdy

EPA = 2

Tj s wcd:l co/ :dcvf Uy

Minimum starting temperature is -40°C (-40°F)

rl cdHds- df dUcH cf :y

Superior thermal management with external "Air-Flow" fins

Lcf gy

Tempered glass lens

uj Ggvf Uy

Die-cast aluminum housing and door frame

- j Gf :vf Uy

Heavy-duty Slipfitter for 2 3/8"OD pipe

k chsct :j oy

Specular, vacuum-metalized polycarbonate

(dg) c:gy

High-temperature silicone gaskets

Fvf vgl y

Formulated for high-durability and long lasting color

(occf rct l f j sj Upy

Mercury and UV-free. RoHS compliant components.

1 a:vt ds

AE- Mrpacy

NEMA Beam Spread of 6H x 6V

FXLED78S/ FPCTr

rct l f vt dsB act vht d:vj f gB@j f :vf Gc .

/ cf gj dBT l dodt :covg:vt g

Fvcs BbB cdH BMf Uscgy

Horizontal Beam Angle (50%): 91.8°, Vertical Beam Angle (50%): 73.5° Horizontal Field Angle (10%): 121.0°, Vertical Field Angle (10%): 108.0°

1 :l co

Cd:cf :gy

The design of FXLED150 is protected by patents pending in US, Canada, China, Taiwan and Mexico

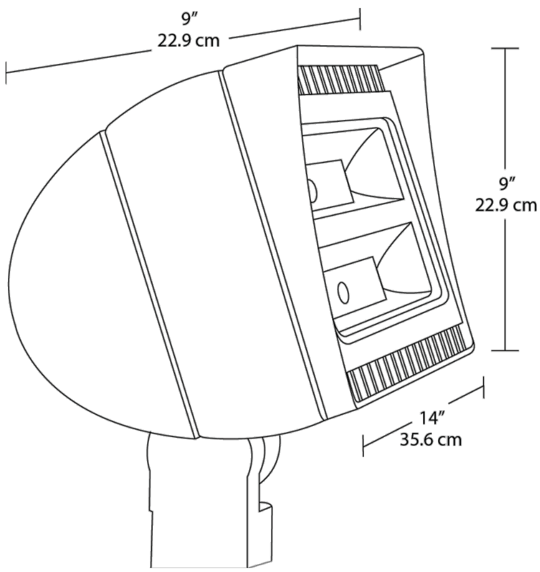
E5GV dscf t py

Equivalent to 400W Metal Halide

i GpBMH cot df BMt :BT j H asdf t cy

RAB values USA manufacturing! Upon request, RAB may be able to manufacture this product to be compliant with the Buy American Act (BAA). Please contact customer service to request a quote for the product to be made BAA compliant.

DvH cf gyj f g



Fcd:Gocg

- 66% energy cost savings vs. HID
- NEMA Type - 6H x 6V
- Air-Flow technology heat dissipation
- 100,000-hour LED lifespan
- 5-year warranty

1 o covf UB d:ovO

FdH vsp	wd::dUc	- j Gf :vf U	Tj sj dBcH a	Fvf vgl	DoJ co	1 a:vj f g	1 :l coB a:vj f
FXLED	150	SF	^	^	^	/PCT	^
	&m = 78W	**/ F** = Slipfitter	**i sdf)** = 5000K (Cool)	**i sdf)** = Bronze	**i sdf)** = Standard	**i sdf)** = No Option	**i sdf)** = Standard
	7S8 = 105W	**r** = Trunnion	**A** = 4000K (Neutral)	**w** = White	**PD7S** = 0-10V Dimming	**PLT** = Lightcloud Control	**N/ M** = BAA Compliant
	728 = 125W		**Y** = 3000K (Warm)		**P L** = Bi-Level	**PCTr** = 100-277V Twistlock	
	78S = 150W				**P4mS** = 480V	**PCTr4** = 480V Twistlock	

FXLED150T

Ultra high output, high efficiency LED floodlight with wide NEMA type 6H x 6V beam spread. Patent Pending airflow technology ensures long LED and driver lifespan. Use for general and security lighting for large areas, building facades, signs and landscapes.

Color: Bronze

Weight: 25.0 lbs

Project:	Type:
Prepared By:	Date:

Driver Info

Type:	Constant Current
120V:	1.31A
208V:	0.80A
240V:	0.69A
277V:	0.60A
Input Watts:	154W
Efficiency:	97%

LED Info

Watts:	150W
Color Temp:	5000K
Color Accuracy:	72 CRI
L70 Lifespan:	100000
Lumens:	18755
Efficacy:	122 LPW

Technical Specifications

Listings

UL Listing:

Suitable for wet locations. Suitable for ground mounting.

IESNA LM-79 & LM-80 Testing:

RAB LED luminaries have been tested by an independent laboratory in accordance with IESNA LM-79 and LM-80, and have been received the Department of Energy "Lighting Facts" label.

DLC Listed:

This product is on the Design Lights Consortium (DLC) Qualified Products List and is eligible for rebates from DLC Member Utilities.
DLC Product Code: P0000173K

LED Characteristics

Lifespan:

100,000-hour LED lifespan based on IES LM-80 results and TM-21 calculations.

LEDs:

Multip-chip, high-output, long-life LEDs

Color Consistency:

7-step MacAdam Ellipse binning to achieve consistent fixture-to-fixture color.

Color Stability:

LED color temperature is warrantied to shift no more than 200K in CCT over a 5 year period.

Color Uniformity:

RAB's range of CCT (Correlated Color Temperature) follows the guidelines of the American National Standard for Specifications for the Chromaticity of Solid State Lighting (SSL) Products, ANSI C78.377-2017.

Construction

IP Rating:

Ingress Protection rating of IP66 for dust and water

Maximum Ambient Temperature:

Suitable for use in 40°C (104°F) ambient temperatures

Effective Projected Area:

EPA = 2

Cold Weather Starting:

Minimum starting temperature is -40°C (-40°F)

Thermal Management:

Superior thermal management with external "Air-Flow" fins.

Lens:

Tempered glass lens.

Housing:

Die-cast aluminum housing and door frame

Mounting:

Heavy-duty Trunnion mount with stainless steel hardware

Reflector:

Specular, vacuum-metalized polycarbonate

Gaskets:

High-temperature silicone gaskets

Finish:

Formulated for high-durability and long lasting color.

Green Technology:

Mercury and UV free. RoHS compliant components. Polyester powder coat finish formulated without the use of VOC or toxic heavy metals.

Electrical

Drivers:

Two Drivers, Constant Current, Class 2, 2000mA, 100-277V, 50-60Hz, Power Factor 99%

THD:

4.9% at 120V, 13.9% at 277V

Power Factor:

99.5% at 120V, 93.7% at 277V

Optical

NEMA Type:

NEMA Beam Spread of 6H x 6V

Sensor Characteristics

Field & Beam Angles:

Horizontal Beam Angle (50%): 91.8°, Vertical Beam Angle (50%): 73.5° Horizontal Field Angle (10%): 121.0°, Vertical Field Angle (10%): 108.0°

Other

Warranty:

RAB warrants that our LED products will be free from defects in materials and workmanship for a period of five (5) years from the date of delivery to the end user, including coverage of light output, color stability, driver performance and fixture finish.

Technical Specifications (continued)

Other

Patents:

The design of FXLED150 is protected by patents pending in US, Canada, China, Taiwan and Mexico.

American Bureau of Shipping (ABS) :

For use on Mobile Offshore Drilling Units (MODU) and shipping vessels.

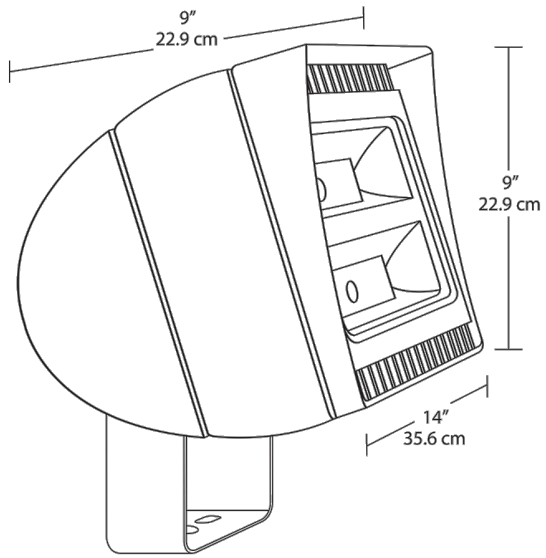
Replacement:

Replaces 400W Metal Halide

Buy American Act Compliance:

RAB values USA manufacturing! Upon request, RAB may be able to manufacture this product to be compliant with the Buy American Act (BAA). Please contact customer service to request a quote for the product to be made BAA compliant.

Dimensions



Features

- 66% energy cost savings vs. HID
- NEMA Type - 6H x 6V
- Air-Flow technology heat dissipation
- 100,000-hour LED lifespan
- 5-year warranty

Ordering Matrix

Family	Wattage	Mounting	Color Temp	Finish	Driver	Photocell Options
FXLED	150	T				
	78 = 78W **105** = 105W **125** = 125W **150** = 150W	**SF** = Slipfitter **T** = Trunnion	**Blank** = 5000K (Cool) **N** = 4000K (Neutral) **Y** = 3000K (Warm)	**Blank** = Bronze **W** = White	**/480** = 480V **/BL** = Bi-Level (Slipfitter models only) **/D10** = 0-10V Dimming (78W, 125W and 150W only)	**Blank** = No Option **/PCT** = 100-277V Twistlock **/PCT4** = 480V Twistlock

SINCE 1945 KEYSTONE | DIRECTDRIVE LED
LINE VOLTAGE T8 TUBES

KT-LED7T8-18GC-840-D

T8 LED LAMP

DESCRIPTION

7W T8 LED | 4000K | >83 CRI | High Efficiency

LAMP TYPE: Linear
BULB TYPE: T8 LED
BASE TYPE: G13 (Medium Bi-Pin)
WATTAGE: 7W
COLOR TEMPERATURE: 4000K
COLOR RENDERING INDEX (CRI): >83
WARRANTY: 5 Years

PRODUCT FEATURES

- Replacement for Conventional Fluorescent Lamp
- 50,000+ Hour Lifetime
- Environmentally Friendly: No Mercury Used
- Instant Startup
- Frosted Lens Eliminates Pixelation
- UL Classified
- Operating Temperature: -20ºC/-4ºF to 45ºC/113ºF
- Integral Driver (Isolated), Eliminates the Need for External Driver or Ballast
- 100+ Lumens per Watt
- Improved Lamp Durability with Shatterproof Coated Glass

OPERATING SPECIFICATIONS

ELECTRICAL CHARACTERISTICS

Input Voltage	Power Consumption	Power Factor	THD	Input Current
120-277Vac	7W	>0.9	<20%	0.06A @ 120V 0.03A @ 277V

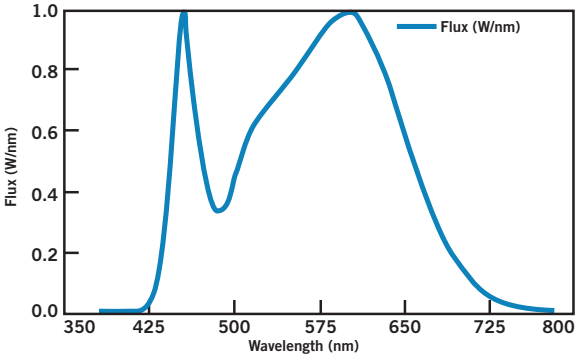
PHOTOMETRIC CHARACTERISTICS

Color Temperature (CCT)	4000K
Luminous Flux	750 lm
Color Rendering Index (CRI)	>83
Efficacy	107 lm/W
Beam Angle	240º
Visible Light Area	325º

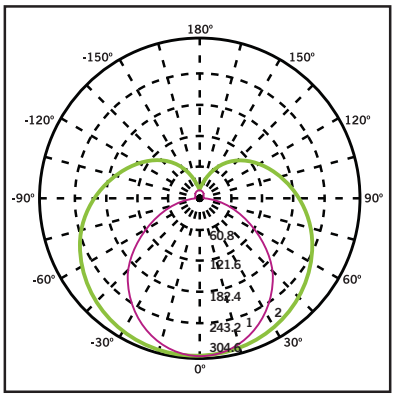
RATED LIFE

L70 (Hours)	50,000

SPECTRAL DISTRIBUTION



POLAR CANDELA DISTRIBUTION



Maximum Candela = 1248.55
Located at Horizontal Angle = 0, Vertical Angle 0

1. **Violet** Vertical Plane through Horizontal Angles (90-270)
2. **Green** Vertical Plane through Horizontal Angles (0-180)

SINCE 1945 KEYSTONE | DIRECTDRIVE LED LINE VOLTAGE T8 TUBES

KT-LED7T8-18GC-840-D

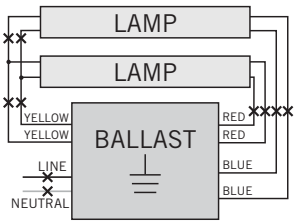
T8 LED LAMP

WIRING DIAGRAMS

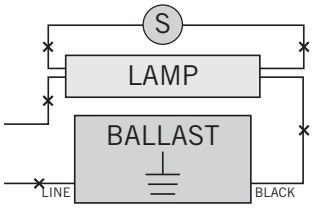
1. Cut all existing connections to ballast as shown below and remove ballast.

Typical Ballast Configurations:

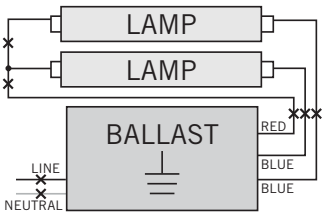
PROGAM START



PREHEAT WITH STARTER

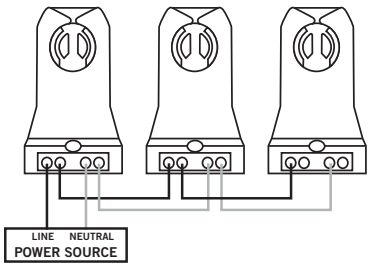


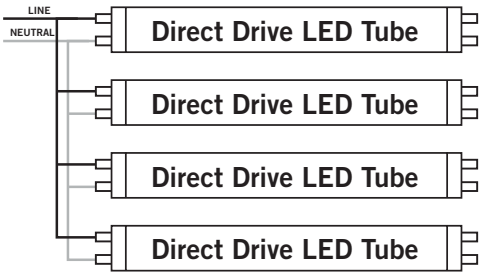
INSTANT START



CAUTION: INSTANT START BALLAST WITH SHUNTED SOCKETS.

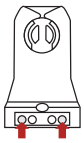
2. Re-wire fixture as shown below.





No Live Connection

Typical Non-Shunted Lampholder



Connect wires directly to these terminals

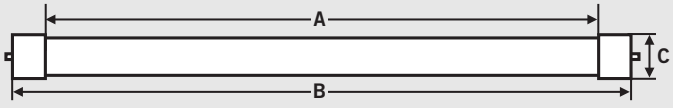
CAUTION: Use only non-shunted lampholders.

Do not install product in a fixture with shunted lampholders (found in all fixtures using instant start ballasts). If the current lampholders are shunted, remove them and replace them with non-shunted lampholders. Make new connections directly to terminals as indicated above.

Keystone can provide any style replacement lampholders. Call us at 800-464-2680.

PHYSICAL CHARACTERISTICS

LAMP DIMENSIONS



A (Illuminated Length)	14.24”
B (Body Length)	17.12”
C (Diameter)	1.10”

NOMINAL LENGTH: 18” **BASE TYPE:** G13 (Medium Bi-Pin)

ORDERING INFORMATION

ORDER CODE	PACKAGING STYLE	PACK QTY.	ITEM STATUS
KT-LED7T8-18GC-840-D-CP	Carton Pack (Egg Crate Packaging)	25	Quick Ship
KT-LED7T8-18GC-840-D-DP	Distributor Pack (Individual Cartons)	12	Quick Ship

CATALOG NUMBER BREAKDOWN

KT-LED7T8-18GC-840-D-CP

- KT — Keystone Technologies
- LED — LED Lamp
- 7T8 — Wattage
- 18 — Lamp Type
- GC — Nominal Length (Inches)
- 840 — Shatter-Proof Coated Glass
- D — 800 Series
- CP — Color Temp., Direct Drive Series, Packaging Style

Keystone Technologies • 208 Progress Drive, Montgomeryville, PA 18936 • Phone (800) 464-2680 • Fax (888) 966-0556 • **www.keystonelamp.com**

Specifications subject to change. Last revised on 6.14.18

KEYSTONE SINCE 1945

DIRECTDRIVE LED
LINE VOLTAGE T8 TUBES

KT-LED7T8-24GC-840-D

T8 LED LAMP

DESCRIPTION

7W T8 LED | 4000K | >83 CRI | High Efficiency

RoHS Compliant

5 YEAR WARRANTY

LAMP TYPE: Linear
BULB TYPE: T8 LED
BASE TYPE: G13 (Medium Bi-Pin)
WATTAGE: 7W
COLOR TEMPERATURE: 4000K
COLOR RENDERING INDEX (CRI): >83
WARRANTY: 5 Years

PRODUCT FEATURES

- Replacement for Conventional Fluorescent Lamp
- 50,000+ Hour Lifetime
- Environmentally Friendly: No Mercury Used
- Instant Startup
- Frosted Lens Eliminates Pixelation
- UL Classified; Listed on DLC Qualified Product List
- Operating Temperature: -20ºC/-4ºF to 45ºC/113ºF
- Integral Driver (Isolated), Eliminates the Need for External Driver or Ballast
- 110+ Lumens per Watt
- Improved Lamp Durability with Shatterproof Coated Glass
- ETL Sanitation Listed NSF/ANSI Standard 2 - Food Equipment

OPERATING SPECIFICATIONS

ELECTRICAL CHARACTERISTICS

Input Voltage	Power Consumption	Power Factor	Input Current
120-277Vac	7W	>0.9	0.06A @ 120V 0.03A @ 277V

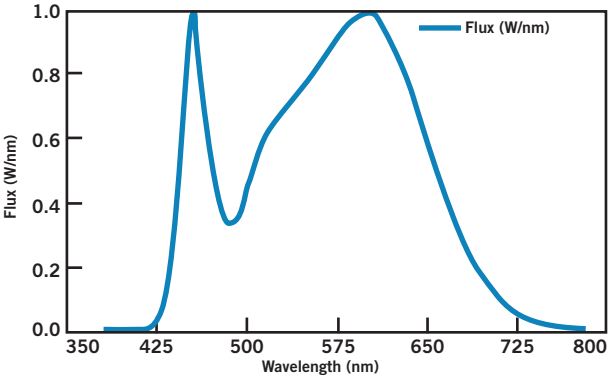
PHOTOMETRIC CHARACTERISTICS

Color Temperature (CCT)	4000K
Luminous Flux	900 lm
Color Rendering Index (CRI)	>83
Efficacy	129 lm/W
Beam Angle	240º
Visible Light Area	325º

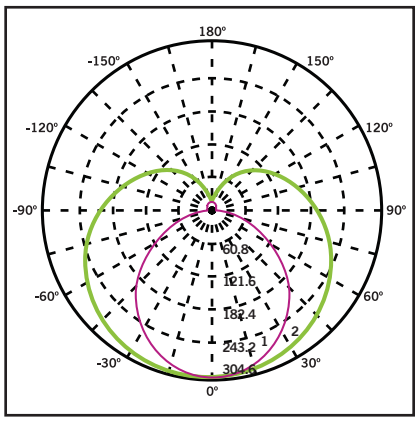
RATED LIFE

L70 (Hours)	50,000

SPECTRAL DISTRIBUTION



POLAR CANDELA DISTRIBUTION



Maximum Candela = 1248.55
Located at Horizontal Angle = 0, Vertical Angle 0

1. **Violet** Vertical Plane through Horizontal Angles (90-270)
2. **Green** Vertical Plane through Horizontal Angles (0-180)

SINCE 1945 KEYSTONE | DIRECTDRIVE LED
LINE VOLTAGE T8 TUBES

KT-LED7T8-24GC-840-D

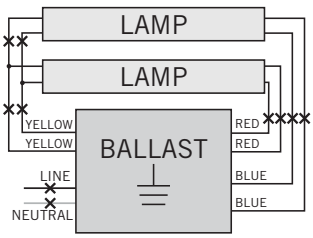
T8 LED LAMP

WIRING DIAGRAMS

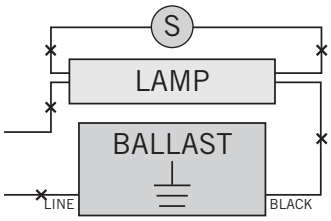
1. Cut all existing connections to ballast as shown below and remove ballast.

Typical Ballast Configurations:

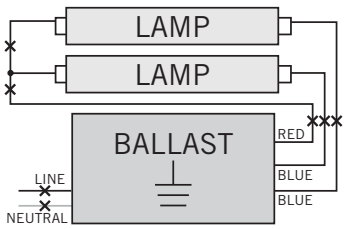
PROGAM START



PREHEAT WITH STARTER

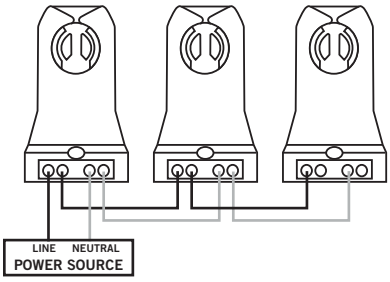


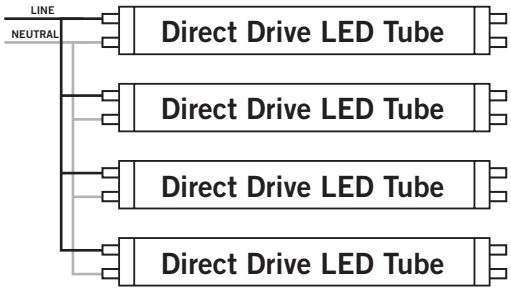
INSTANT START



CAUTION: INSTANT START BALLAST WITH SHUNTED SOCKETS.

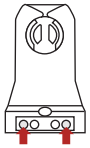
2. Re-wire fixture as shown below.





No Live Connection

Typical Non-Shunted Lampholder



Connect wires directly to these terminals

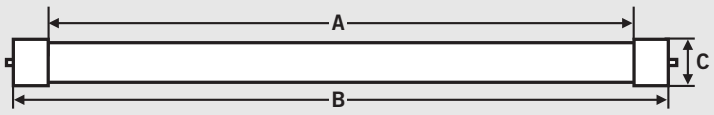
CAUTION: Use only non-shunted lampholders.

Do not install product in a fixture with shunted lampholders (found in all fixtures using instant start ballasts). If the current lampholders are shunted, remove them and replace them with non-shunted lampholders. Make new connections directly to terminals as indicated above.

Keystone can provide any style replacement lampholders. Call us at 800-464-2680.

PHYSICAL CHARACTERISTICS

LAMP DIMENSIONS



A (Illuminated Length)	20.31”
B (Body Length)	23.19”
C (Diameter)	1.10”

NOMINAL LENGTH: 24” **BASE TYPE:** G13 (Medium Bi-Pin)

ORDERING INFORMATION

ORDER CODE	PACKAGING STYLE	PACK QTY.	ITEM STATUS
KT-LED7T8-24GC-840-D-CP	Carton Pack (Egg Crate Packaging)	25	Quick Ship
KT-LED7T8-24GC-840-D-DP	Distributor Pack (Individual Cartons)	12	Quick Ship

CATALOG NUMBER BREAKDOWN

KT-LED7T8-24GC-840-D-CP

KT	LED7T8	24	GC	840	D	CP
Keystone Technologies	LED Lamp	Wattage	Lamp Type	Nominal Length (Inches)	Shatter-Proof Coated Glass	800 Series	Color Temp.	Direct Drive Series	Packaging Style

SINCE 1945 KEYSTONE

DIRECTDRIVE LED
LINE VOLTAGE T8 TUBES

KT-LED10.5T8-48G-840-D
T8 LED LAMP

DESCRIPTION
10.5W T8 LED | 4000K | >83 CRI | High Efficiency

RoHS Compliant | 5 YEAR WARRANTY

LAMP TYPE: Linear
BULB TYPE: T8 LED
BASE TYPE: G13 (Medium Bi-Pin)
WATTAGE: 10.5W
COLOR TEMPERATURE: 4000K
COLOR RENDERING INDEX (CRI): >83
WARRANTY: 5 Years

PRODUCT FEATURES
- Replacement for Conventional Fluorescent Lamp
- 50,000+ Hour Lifetime
- Approximately 40% More Energy Efficient that Standard F32T8 Lamps
- Environmentally Friendly: No Mercury Used
- UL Classified
- Operating Temperature: -20ºC/-4ºF to 45ºC/113ºF
- Listed on DLC Qualified Product List
- Integral Driver (Isolated), Eliminates the Need for External Driver or Ballast
- 100+ Lumens per Watt
- Instant Startup
- Frosted Lens Eliminates Pixelation

OPERATING SPECIFICATIONS

ELECTRICAL CHARACTERISTICS

Input Voltage	Power Consumption	Power Factor	Input Current
120-277Vac	10.5W	>0.9	.094A @ 120V .040A @ 277V

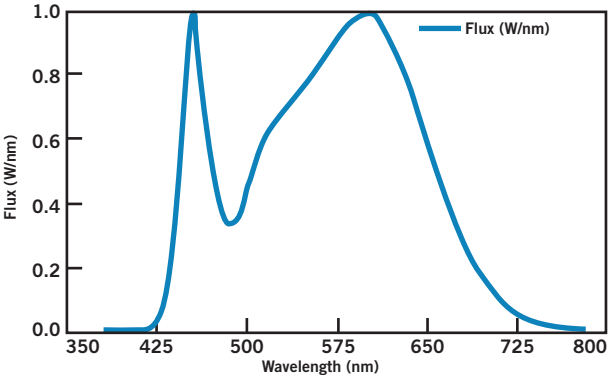
PHOTOMETRIC CHARACTERISTICS

Color Temperature (CCT)	4000K
Luminous Flux	1730 lm
Color Rendering Index (CRI)	>83
Efficacy	160 lm/W
Beam Angle	240º
Visible Light Area	325º

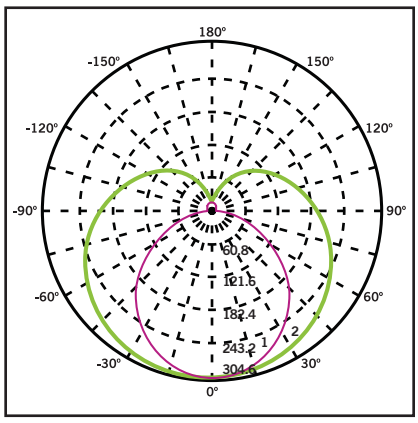
RATED LIFE

L70 (Hours)	50,000

SPECTRAL DISTRIBUTION



POLAR CANDELA DISTRIBUTION



Maximum Candela = 1248.55
Located at Horizontal Angle = 0, Vertical Angle 0

1. **Violet** Vertical Plane through Horizontal Angles (90-270)
2. **Green** Vertical Plane through Horizontal Angles (0-180)

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SINCE 1945 KEYSTONE

DIRECT DRIVE LED
LINE VOLTAGE T8 TUBES

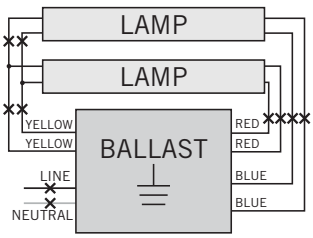
KT-LED10.5T8-48G-840-D
T8 LED LAMP

WIRING DIAGRAMS

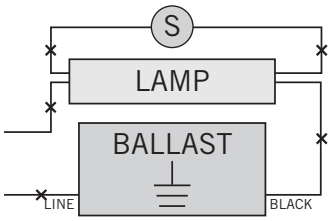
1. Cut all existing connections to ballast as shown below and remove ballast.

Typical Ballast Configurations:

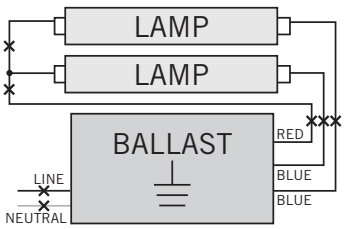
PROGAM START



PREHEAT WITH STARTER

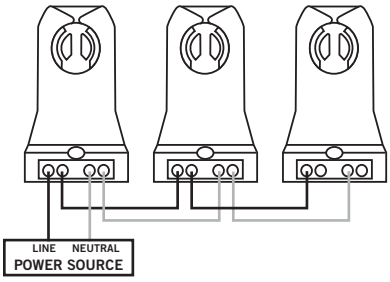


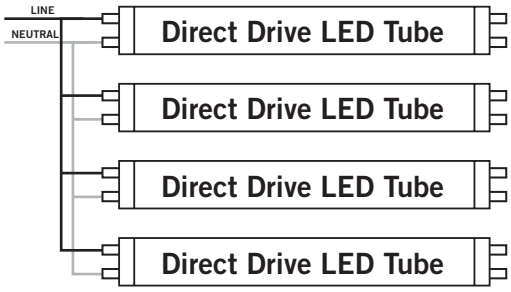
INSTANT START



CAUTION: INSTANT START BALLAST WITH SHUNTED SOCKETS.

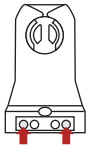
2. Re-wire fixture as shown below.





No Live Connection

Typical Non-Shunted Lampholder



Connect wires directly to these terminals

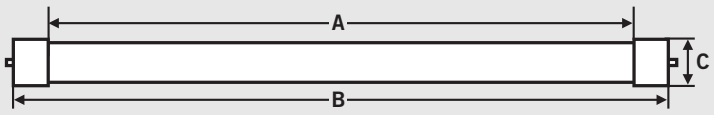
CAUTION: Use only non-shunted lampholders.

Do not install product in a fixture with shunted lampholders (found in all fixtures using instant start ballasts). If the current lampholders are shunted, remove them and replace them with non-shunted lampholders. Make new connections directly to terminals as indicated above.

Keystone can provide any style replacement lampholders. Call us at 800-464-2680.

PHYSICAL CHARACTERISTICS

LAMP DIMENSIONS



A (Illuminated Length)	44.38”
B (Body Length)	47.15”
C (Diameter)	1.10”

NOMINAL LENGTH: 48” **BASE TYPE:** G13 (Medium Bi-Pin)

ORDERING INFORMATION

ORDER CODE	PACKAGING STYLE	PACK QTY.	ITEM STATUS
KT-LED10.5T8-48G-840-D-CP	Carton Pack (Egg Crate Packaging)	25	Quick Ship

CATALOG NUMBER BREAKDOWN

KT-LED10.5T8-48G-840-D-CP

Keystone Technologies	LED Lamp	Wattage	Lamp Type	Nominal Length (Inches)	Glass	800 Series	Color Temp.	Direct Drive Series	Packaging Style

SINCE 1945 KEYSTONE | DIRECT DRIVE HID LED

KT-LED12HID-E26-850-D

HID REPLACEMENT LED LAMP

DESCRIPTION

12W HID Replacement LED Lamp | 5000K | >80 CRI | IP64 Rated

c UL us LISTED | RoHS Compliant | 5 YEAR WARRANTY

- **LAMP TYPE:** HID Replacement LED
- **BASE TYPE:** E26 (Medium)
- **WATTAGE:** 12W
- **COLOR TEMPERATURE:** 5000K
- **METAL HALIDE EQUIVALENT:** 50W
- **COLOR RENDERING INDEX (CRI):** >80
- **WARRANTY:** 5 Years

PRODUCT FEATURES

- Replacement for conventional metal halide lamp
- Non-dimmable; do not dim
- 50,000+ hour lifetime
- Environmentally friendly: No mercury used
- Instant startup
- UL listed
- Operating temperature: –40ºC/–40ºF to 60ºC/140ºF
- Integral driver, eliminates the need for external driver or ballast; includes 4kV surge protection
- IP64 rated; integrated heat sink quickly dissipates heat and guides water intrusion out of the lamp
- Suitable for use in fully enclosed fixture

Lamp does not meet CEC T20 requirements. Not to be sold or offered for sale in California, except when sold wholesale in California for final retail sale outside the state.

OPERATING SPECIFICATIONS

ELECTRICAL CHARACTERISTICS

Input Voltage	Power Consumption	Power Factor	Input Current
120–277Vac	12W	>0.9	0.10A @ 120V 0.04A @ 277V

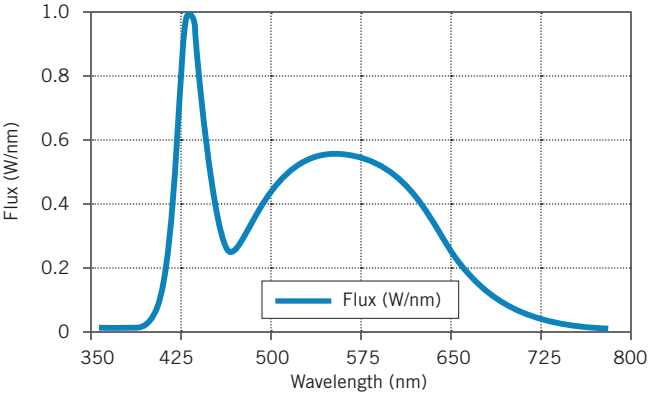
PHOTOMETRIC CHARACTERISTICS

Color Temperature (CCT)	5000K
Luminous Flux	1740 lm
Color Rendering Index (CRI)	>80
Efficacy	145 lm/W
Visible Light Area	360º

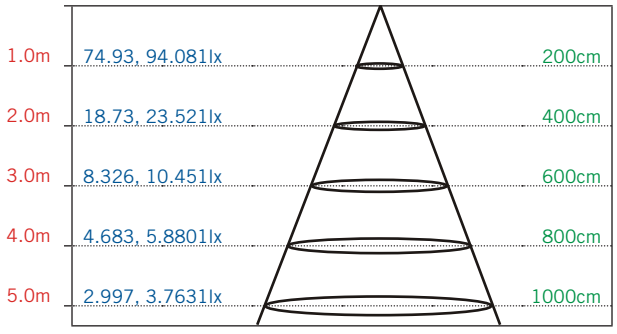
RATED LIFE

L70 (Hours)	50,000

SPECTRAL DISTRIBUTION



LUX DISTANCE CURVE



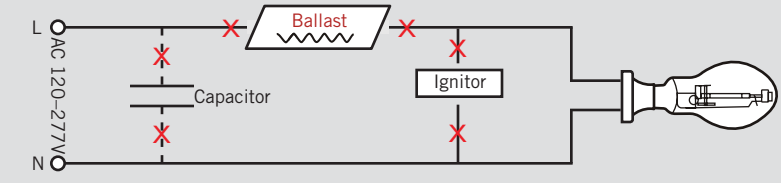
Beam Angle of C90 Plane: 126.58

KT-LED12HID-E26-850-D

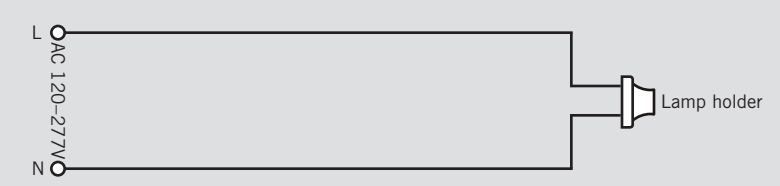
HID REPLACEMENT LED LAMP

WIRING DIAGRAM

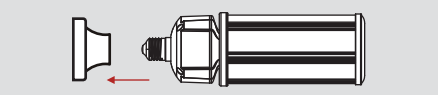
STEP 1
Disconnect power. Disconnect and remove existing ballast, capacitor, and/or ignitor (where applicable) from fixture.

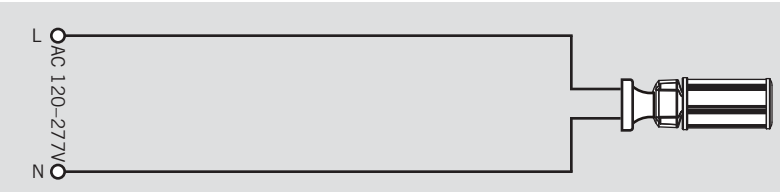


STEP 2
Rewire for line voltage to the lamp socket.

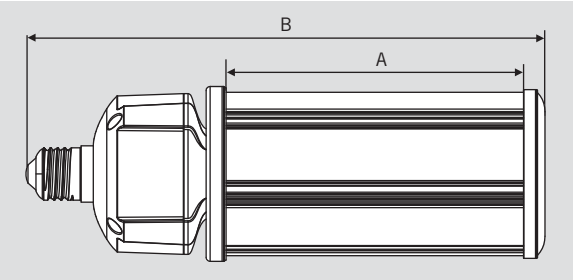


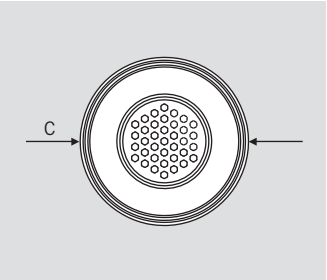
STEP 3
Install new LED replacement lamp. Ensure lamp is operating properly when power is turned on.





PHYSICAL CHARACTERISTICS





LAMP DIMENSIONS

A (Illuminated Length)	1.65"
B (Body Length)	4.92"
C (Diameter)	2.36"

BASE TYPE: E26 (Medium)

ORDERING INFORMATION

ORDER CODE	PACKAGING STYLE	PACK QTY.	ITEM STATUS
KT-LED12HID-E26-850-D-DP	Distributor Pack (Individual Cartons)	16	Quick Ship

CATALOG NUMBER BREAKDOWN

KT-LED12HID-E26-850-D-DP

1 2 3 4 5 6 7 8 9

1 Keystone Technologies
2 LED Lamp
3 Wattage
4 Lamp Type
5 Base Type
6 800 Series
7 Color Temperature
8 Direct-Drive Series
9 Packaging Style

KT-LED19HID-E26-850-D

HID REPLACEMENT LED LAMP

DESCRIPTION

19W HID Replacement LED Lamp | 5000K | >83 CRI | IP64 Rated

LAMP TYPE: HID Replacement LED
BASE TYPE: E26 (Medium)
WATTAGE: 19W
COLOR TEMPERATURE: 5000K
METAL HALIDE EQUIVALENT: 75W
COLOR RENDERING INDEX (CRI): >83
WARRANTY: 5 Years

PRODUCT FEATURES

- Replacement for Conventional Metal Halide Lamp
- Non-Dimmable; Do Not Dim
- 50,000+ Hour Lifetime
- Environmentally Friendly: No Mercury Used
- Instant Startup
- UL Listed
- Operating Temperature: -40ºC/-40ºF to 60ºC/140ºF
- Integral Driver, Eliminates the Need for External Driver or Ballast; Includes 4kV Surge Protection
- IP64 Rated; Integrated Heat Sink Quickly Dissipates Heat and Guides Water Intrusion Out of the Lamp

OPERATING SPECIFICATIONS

ELECTRICAL CHARACTERISTICS

Input Voltage	Power Consumption	Power Factor	Input Current
120-277Vac	19W	>0.9	0.16A @ 120V 0.07A @ 277V

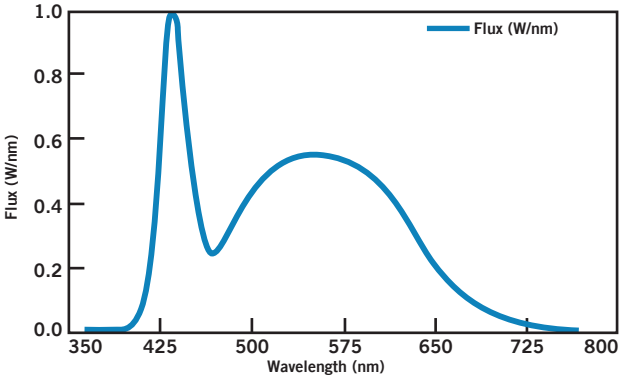
RATED LIFE

L70 (Hours)	50,000

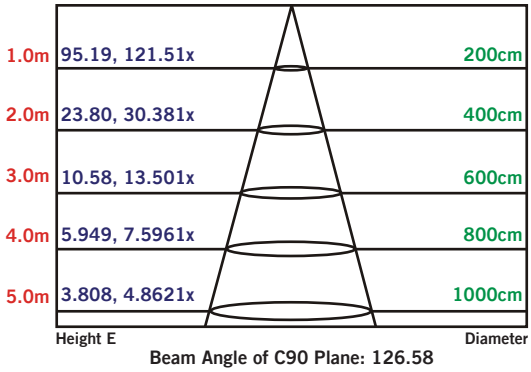
PHOTOMETRIC CHARACTERISTICS

Color Temperature (CCT)	5000K
Luminous Flux	2400 lm
Color Rendering Index (CRI)	>83
Efficacy	126 lm/W
Visible Light Area	360º

SPECTRAL DISTRIBUTION



LUX DISTANCE CURVE



Beam Angle of C90 Plane: 126.58

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KT-LED19HID-E26-850-D

HID REPLACEMENT LED LAMP

WIRING DIAGRAM

STEP 1
Disconnect power. Disconnect and remove existing ballast, capacitor, and/or ignitor (where applicable) from fixture.

STEP 2
Rewire for line voltage to the lamp socket.

STEP 3
Install new LED replacement lamp. Ensure lamp is operating properly when power is turned on.

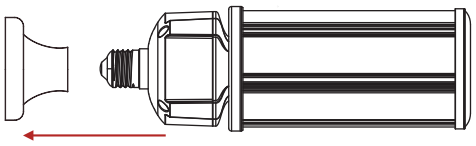


FIGURE 1

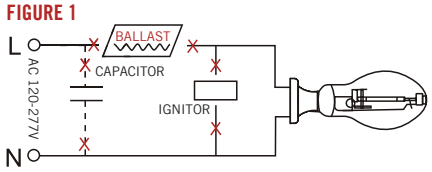


FIGURE 2

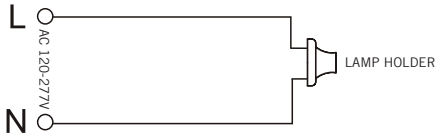
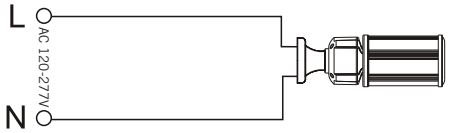
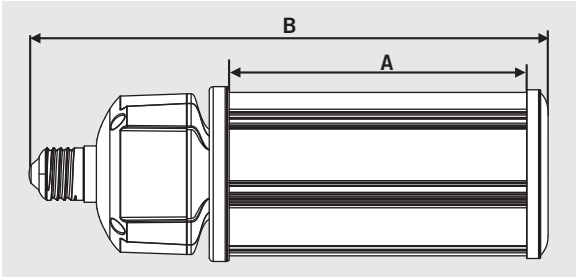
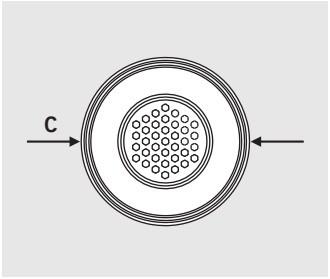


FIGURE 3



PHYSICAL CHARACTERISTICS





LAMP DIMENSIONS

A (Illuminated Length)	2.70”
B (Body Length)	6.12”
C (Diameter)	2.40”

BASE TYPE: E26 (Medium)

ORDERING INFORMATION

ORDER CODE	PACKAGING STYLE	PACK QTY.	ITEM STATUS
KT-LED19HID-E26-850-D-DP	Distributor Pack (Individual Cartons)	16	Quick Ship

CATALOG NUMBER BREAKDOWN

KT-LED19HID-E26-850-D-DP

KT	LED	19	HID	E26	850	D	DP
Keystone Technologies	LED Lamp	Wattage	Lamp Type	Base Type	800 Series	Color Temp.	Direct Drive Series	Packaging Style

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KT-LED27HID-E26-850-D

HID REPLACEMENT LED LAMP

DESCRIPTION

27W HID Replacement LED Lamp | 5000K | >83 CRI | IP64 Rated

LAMP TYPE: HID Replacement LED
BASE TYPE: E26 (Medium)
WATTAGE: 27W
COLOR TEMPERATURE: 5000K
METAL HALIDE EQUIVALENT: 100W
COLOR RENDERING INDEX (CRI): >83
WARRANTY: 5 Years

PRODUCT FEATURES

- Replacement for Conventional Metal Halide Lamp
- Non-Dimmable; Do Not Dim
- 50,000+ Hour Lifetime
- Environmentally Friendly: No Mercury Used
- Instant Startup
- UL Listed
- Operating Temperature: -29ºC/-20ºF to 60ºC/140ºF
- Integral Driver, Eliminates the Need for External Driver or Ballast; Includes 4kV Surge Protection
- IP64 Rated; Integrated Heat Sink Quickly Dissipates Heat and Guides Water Intrusion Out of the Lamp

OPERATING SPECIFICATIONS

ELECTRICAL CHARACTERISTICS

Input Voltage	Power Consumption	Power Factor	Input Current
120-277Vac	27W	>0.9	0.23A @ 120V 0.10A @ 277V

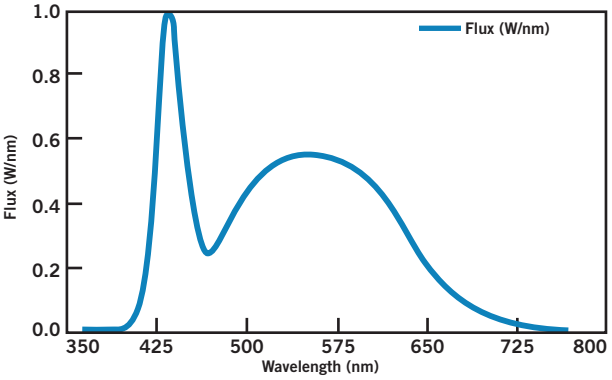
RATED LIFE

L70 (Hours)	50,000

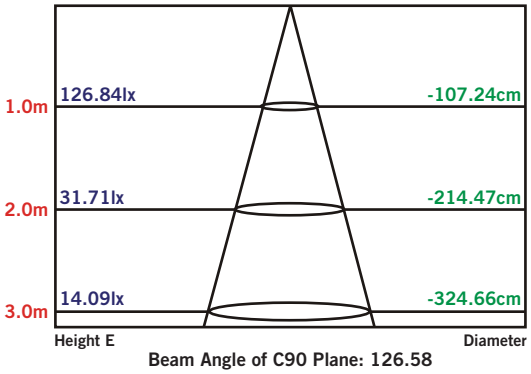
PHOTOMETRIC CHARACTERISTICS

Color Temperature (CCT)	5000K
Luminous Flux	3830 lm
Color Rendering Index (CRI)	>83
Efficacy	142 lm/W
Visible Light Area	360º

SPECTRAL DISTRIBUTION



LUX DISTANCE CURVE



Beam Angle of C90 Plane: 126.58

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KT-LED27HID-E26-850-D

HID REPLACEMENT LED LAMP

WIRING DIAGRAM

STEP 1
Disconnect power. Disconnect and remove existing ballast, capacitor, and/or ignitor (where applicable) from fixture.

STEP 2
Rewire for line voltage to the lamp socket.

STEP 3
Install new LED replacement lamp. Ensure lamp is operating properly when power is turned on.

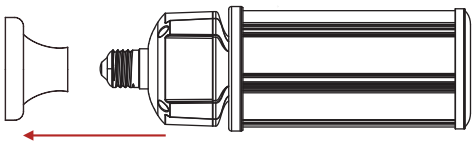


FIGURE 1

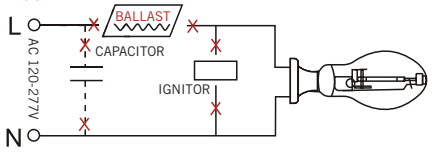


FIGURE 2

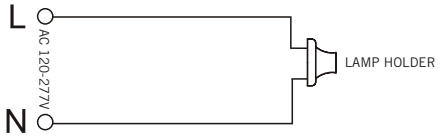
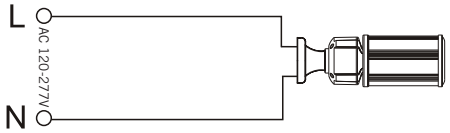
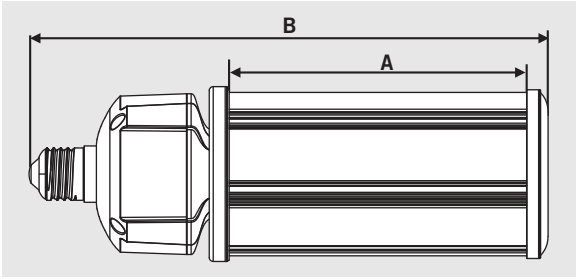
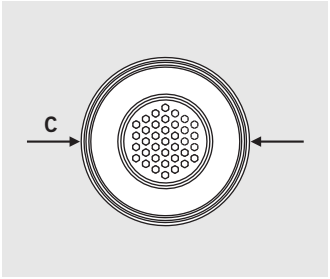


FIGURE 3



PHYSICAL CHARACTERISTICS





LAMP DIMENSIONS

A (Illuminated Length)	3.62"
B (Body Length)	7.95"
C (Diameter)	3.43"

BASE TYPE: E26 (Medium)

ORDERING INFORMATION

ORDER CODE	PACKAGING STYLE	PACK QTY.	ITEM STATUS
KT-LED27HID-E26-850-D-DP	Distributor Pack (Individual Cartons)	16	Quick Ship

CATALOG NUMBER BREAKDOWN

KT-LED27HID-E26-850-D-DP

KT	LED27	HID	E26	850	D	DP
Keystone Technologies	LED Lamp	Wattage	Lamp Type	Base Type	800 Series	Color Temp.	Direct Drive Series	Packaging Style

KT-LED54HID-EX39-850-D /G2

HID REPLACEMENT LED LAMP

DESCRIPTION

54W HID Replacement LED Lamp | 5000K | >80 CRI | IP64 Rated

LAMP TYPE: HID Replacement LED
BASE TYPE: EX39 (Mogul)
WATTAGE: 54W
COLOR TEMPERATURE: 5000K
METAL HALIDE EQUIVALENT: 200-250W
COLOR RENDERING INDEX (CRI): >80
WARRANTY: 5 Years

PRODUCT FEATURES

- Replacement for Conventional Metal Halide Lamp
- Non-Dimmable; Do Not Dim
- 50,000+ Hour Lifetime
- Environmentally Friendly: No Mercury Used
- Instant Startup
- UL Listed
- DLC Listed
- Operating Temperature: -29ºC/-20ºF to 60ºC/140ºF
- Integral Driver, Eliminates the Need for External Driver or Ballast; Includes 4kV Surge Protection
- IP64 Rated; Integrated Heat Sink Quickly Dissipates Heat and Guides Water Intrusion Out of the Lamp
- Suitable for Use in Fully Enclosed Fixture

OPERATING SPECIFICATIONS

ELECTRICAL CHARACTERISTICS

Input Voltage	Power Consumption	Power Factor	Input Current
120-277Vac	54W	>0.9	0.45A @ 120V 0.20A @ 277V

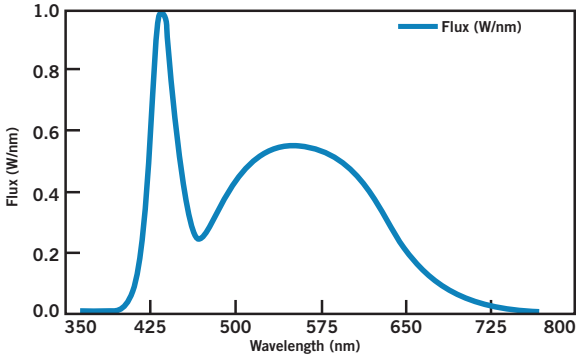
RATED LIFE

L70 (Hours)	50,000

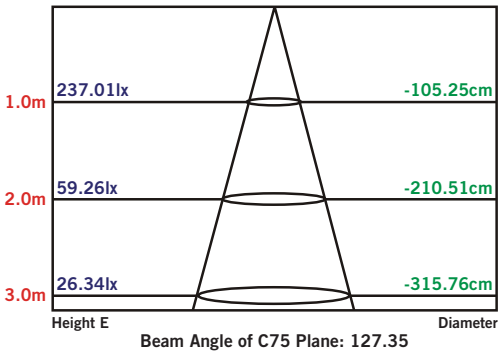
PHOTOMETRIC CHARACTERISTICS

Color Temperature (CCT)	5000K
Luminous Flux	8100 lm
Color Rendering Index (CRI)	>80
Efficacy	150 lm/W
Visible Light Area	360º

SPECTRAL DISTRIBUTION



LUX DISTANCE CURVE



Beam Angle of C75 Plane: 127.35

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KT-LED54HID-EX39-850-D /G2

HID REPLACEMENT LED LAMP

WIRING DIAGRAM

STEP 1
Disconnect power. Disconnect and remove existing ballast, capacitor, and/or ignitor (where applicable) from fixture.

STEP 2
Rewire for line voltage to the lamp socket.

STEP 3
Install new LED replacement lamp. Ensure lamp is operating properly when power is turned on.

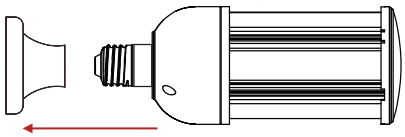


FIGURE 1

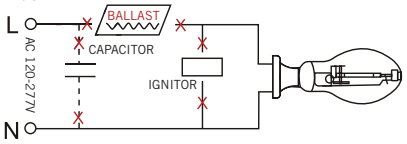
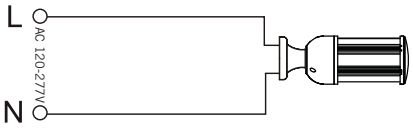
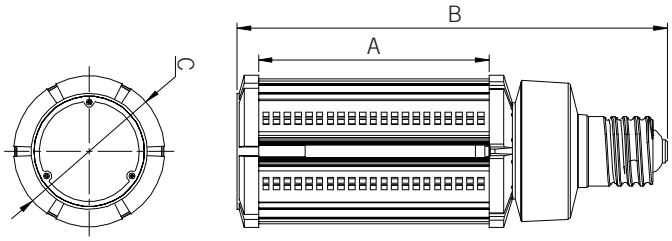


FIGURE 2

FIGURE 3



PHYSICAL CHARACTERISTICS



LAMP DIMENSIONS

A (Illuminated Length)	5.07”
B (Body Length)	9.80”
C (Diameter)	3.34”

BASE TYPE: EX39 (Mogul)

ORDERING INFORMATION

ORDER CODE	PACKAGING STYLE	PACK QTY.	ITEM STATUS
KT-LED54HID-EX39-850-D /G2-DP	Distributor Pack (Individual Cartons)	12	Quick Ship

CATALOG NUMBER BREAKDOWN

KT-LED54HID-EX39-850-D /G2-DP

- KT — Keystone Technologies
- LED54HID — LED Lamp
- EX39 — Wattage
- 850 — Lamp Type
- D — Base Type
- /G2 — 800 Series
- -DP — Color Temp., Direct Drive Series, 2nd Generation, Packaging Style

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KT-LED100HID-EX39-850-D

HID REPLACEMENT LED LAMP

rev.1

DESCRIPTION

100W HID Replacement LED Lamp | 5000K | >83 CRI | IP64 Rated

- **LAMP TYPE:** HID Replacement LED
- **BASE TYPE:** EX39 (Mogul)
- **WATTAGE:** 100W
- **COLOR TEMPERATURE:** 5000K
- **METAL HALIDE EQUIVALENT:** 400W
- **COLOR RENDERING INDEX (CRI):** >83
- **WARRANTY:** 5 Years

PRODUCT FEATURES

- Replacement for Conventional Metal Halide Lamp
- Non-Dimmable; Do Not Dim
- 50,000+ Hour Lifetime
- Environmentally Friendly: No Mercury Used
- Instant Startup
- UL Listed
- DLC Listed
- Operating Temperature: -29ºC/-20ºF to 60ºC/140ºF
- Integral Driver, Eliminates the Need for External Driver or Ballast; Includes 6kV Surge Protection
- IP64 Rated; Integrated Heat Sink Quickly Dissipates Heat and Guides Water Intrusion Out of the Lamp
- Active Cooling Technology: When Internal Thermal Sensor Reaches 84°C, Lamp Power Reduces To 80% Of Max; When Sensor Cools To 65°C Lamp Powers Back Up To 100% Rated Power
- Lamp Includes Safety Tether for Additional Security When Installing Lamp in Luminaire
- Suitable for Use in Fully Enclosed Fixture

OPERATING SPECIFICATIONS

ELECTRICAL CHARACTERISTICS

Input Voltage	Power Consumption	Power Factor	Input Current
120-277Vac	100W	>0.9	0.93A @ 120V 0.40A @ 277V

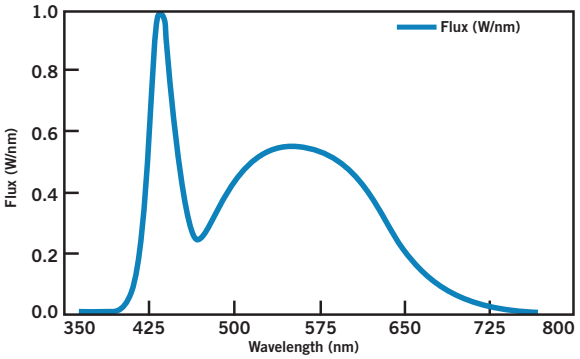
PHOTOMETRIC CHARACTERISTICS

Color Temperature (CCT)	5000K
Luminous Flux	14,100 lm
Color Rendering Index (CRI)	>83
Efficacy	141 lm/W
Visible Light Area	360º

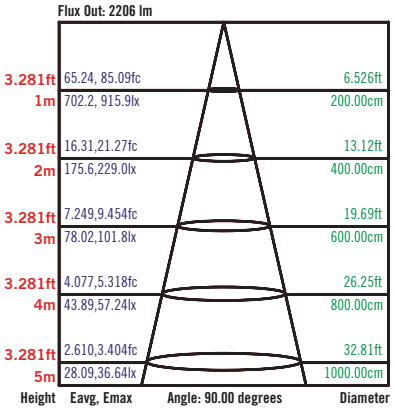
RATED LIFE

L70 (Hours)	50,000

SPECTRAL DISTRIBUTION



LUX DISTANCE CURVE



Note: The curves indicate the illuminated area and the average illumination when the luminaire is at a different distance.

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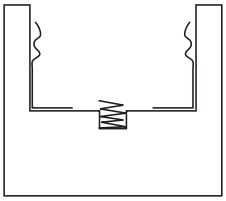
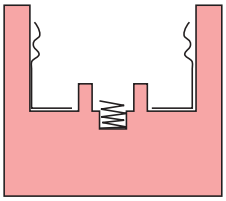
KT-LED100HID-EX39-850-D

HID REPLACEMENT LED LAMP

rev.1



E39 MOGUL SOCKET



EX39 MOGUL SOCKET

EX39-based lamps will work in both E39 and EX39 sockets.

WIRING DIAGRAM

STEP 1
Disconnect power. Disconnect and remove existing ballast, capacitor, and/or ignitor (where applicable) from fixture.

STEP 2
Rewire for line voltage to the lamp socket.

STEP 3
Install new LED replacement lamp. Ensure lamp is operating properly when power is turned on.

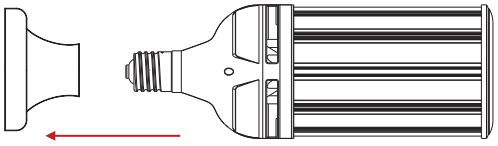


FIGURE 1

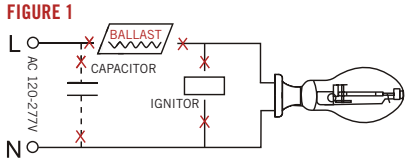


FIGURE 2

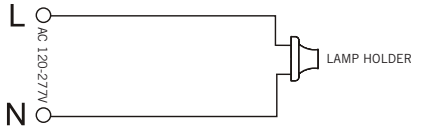
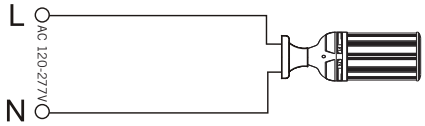
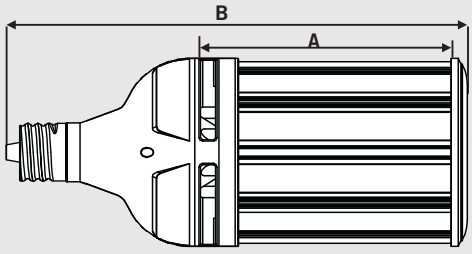
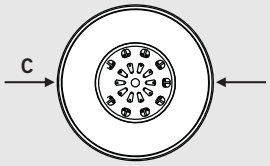


FIGURE 3



PHYSICAL CHARACTERISTICS





LAMP DIMENSIONS

A (Illuminated Length)	5.78”
B (Body Length)	12.57”
C (Diameter)	5.12”

BASE TYPE: EX39 (Mogul)

ORDERING INFORMATION

ORDER CODE	PACKAGING STYLE	PACK QTY.	ITEM STATUS
KT-LED100HID-EX39-850-D rev1	Distributor Pack (Individual Cartons)	6	Quick Ship

CATALOG NUMBER BREAKDOWN

KT-LED100HID-EX39-850-D rev1

- KT — Keystone Technologies
- LED100 — LED Lamp
- HID — Wattage
- EX39 — Lamp Type
- 850 — Base Type
- D — 800 Series
- rev1 — Color Temp. / Direct Drive Series / LED Chip Revision

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RAIL95NW/D10

RAB | Indoor

High efficiency. High output. High Bay RAIL.

Color: White

Weight: 10.3 lbs

Project:	Type:
Prepared By:	Date:

Driver Info

Type:	Constant Current
120V:	0.77A
208V:	0.48A
240V:	0.42A
277V:	0.35A
Input Watts:	91W
Efficiency:	N/A

LED Info

Watts:	95W
Color Temp:	4000K (Neutral)
Color Accuracy:	77 CRI
L70 Lifespan:	100,000
Lumens:	12,176
Efficacy:	134 LPW

Technical Specifications

Listings

UL Listing:

Suitable for damp locations

DLC Listed:

This product is listed by Design Lights Consortium (DLC) as an ultra-efficient premium product that qualifies for the highest tier of rebates from DLC Member Utilities.
DLC Product Code: PZGCRWP8

LED Characteristics

Lifespan:

100,000-hour LED lifespan based on IES LM-80 results and TM-21 calculations

Color Stability:

LED Color temperature is warrantied to shift no more than 200K in CCT over a 5 year period

Color Uniformity:

RAB's range of CCT (Correlated Color Temperature) follows the guidelines of the American National Standard for Specifications for the Chromaticity of Solid State Lighting (SSL) Products, ANSI C78.377-2017.

Electrical

Driver:

One Driver, Class 2, Constant Current, 100-277VAC, 50-60Hz, 4kV, 1.1A,

Dimming Driver:

Driver includes dimming control wiring for 0-10V dimming systems. Requires separate 0-10V DC dimming circuit. Dims as low as 10%.

THD:

5.6% at 120V, 9.7% at 277V

Power Factor:

99.8% at 120V, 93% at 277V

Construction

Maximum Ambient Temperature:

Suitable for use 12 hours a day, 6 days a week in 60°C (140°F). Suitable for 24/7 use in up to 50°C (122°F).

Housing:

Extruded aluminum

Lens:

High-transmittance polystyrene

Reflector:

Specular, high-reflectance aluminum with 95% reflectivity

Mounting:

V hooks (chain by others)

Finish:

Formulated for high-durability and long lasting color

Green Technology:

Mercury and UV-free. RoHS compliant components.

Recommended Mounting Height:

Up to 25 ft

Other

Replacement:

Replaces 100-250W MH

Warranty:

RAB warrants that our LED products will be free from defects in materials and workmanship for a period of five (5) years from the date of delivery to the end user, including coverage of light output, color stability, driver performance and fixture finish. RAB's warranty is subject to all terms and conditions found at

Buy American Act Compliance:

RAB values USA manufacturing! Upon request, RAB may be able to manufacture this product to be compliant with the Buy American Act (BAA). Please contact customer service to request a quote for the product to be made BAA compliant.

Sensor Specifications

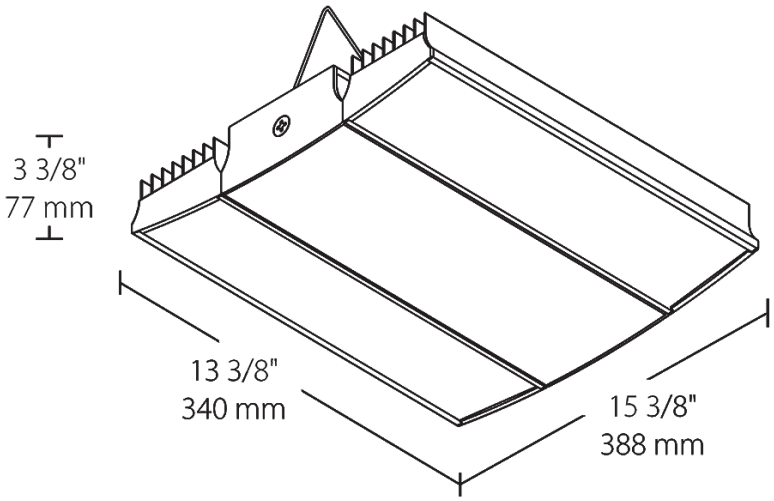
Handheld Wireless Configuration Tool:

Adjust settings using handheld wireless configuration tool. Only available with 0-10V dimming driver options.

RAIL95NW/D10

RAB | Indoor

Dimensions



Features

- Ideal for large spaces
- 100,000 hour lifespan - virtually maintenance free operation
- 0-10V driver for variable dimming down to 10%
- Low-glare design with semi-diffuse lens

Ordering Matrix

Family	Wattage	Color Temp	Finish	Driver Options	Control Options	Other Options
RAIL	95	N	W	/D10	^	^
	95 = 95W **150** = 150W **185** = 185W **225** = 225W **400** = 400W	**Blank** = 5000K (Cool) **N** = 4000K (Neutral) **YN** = 3500K (Warm Neutral)	**W** = White	**/D10** = 120-277V, 0-10V Dim **/480/D10** = 480V, 0-10V Dim	**Blank** = No Option **/BL** = Bi-Level Control **/WS2** = Multi-Level Motion Sensor 20 ft. **/WS4** = Multi-Level Motion Sensor 40 ft. **/LOS** = LOSBAY 800 Sensor **/LC** = Lightcloud® Controller **/LCS** = Lightcloud® Sensor **/E2** = Emergency Battery Pack	**Blank** = Standard **USA** = BAA Compliant

RWLED3T150/PCT

RAB | Outdoor

LED roadway lighting that's easy to buy. Free trial program and leasing options make it easy to get started with LED. Specification-grade optics deliver efficient, clean, uniform light distributions at a reasonable cost. Optics are factory installed and meet IES Distribution Type III. LROAD™ 150W replaces 400W metal halide roadway fixtures.

Color: Bronze

Weight: 32.5 lbs

Project:	Type:
Prepared By:	Date:

Driver Info		LED Info	
Type:	Constant Current	Watts:	150W
120V:	1.31A	Color Temp:	5000K (Cool)
208V:	0.80A	Color Accuracy:	71 CRI
240V:	0.69A	L70 Lifespan:	100,000
277V:	0.60A	Lumens:	16,839
Input Watts:	155W	Efficacy:	108 LPW
Efficiency:	97%		

Technical Specifications

Listings

UL Listing:

Suitable for wet locations as a downlight

DLC Listed:

This product is on the Design Lights Consortium (DLC) Qualified Products List and is eligible for rebates from DLC Member Utilities.
DLC Product Code: P00001774

IESNA LM-79 & IESNA LM-80 Testing:

RAB LED luminaires and LED components have been tested by an independent laboratory in accordance with IESNA LM-79 and LM-80.

Electrical

Driver:

One Driver, Constant Current, Class 2, 2100mA 100-277V, 50-60Hz, Power Factor 99%

Photocell:

120-277V twistlock photocell included. Photocell is compatible with 120-277V.

Surge Protection:

6kV surge suppression protection tested in accordance with IEEE/ANSI C62.41.2.

THD:

4.9% at 120V, 13.8% at 277V

Power Factor:

99.5% at 120V, 93.7% at 277V

LED Characteristics

Lifespan:

100,000-hour LED lifespan based on IES LM-80 results and TM-21 calculations

LEDs:

Multi-chip, high-output, long-life LEDs

Color Consistency:

7-step MacAdam Ellipse binning to achieve consistent fixture-to-fixture color

Color Stability:

LED color temperature is warrantied to shift no more than 200K in CCT over a 5 year period

Color Uniformity:

RAB's range of CCT (Correlated Color Temperature) follows the guidelines of the American National Standard for Specifications for the Chromaticity of Solid State Lighting (SSL) Products, ANSI C78.377-2017.

Construction

IES Classification:

The Type III distribution is ideal for roadway, general parking and other area lighting applications where a larger pool of lighting is required. It has greater streetside (transverse) throw, allowing the light to project outward and fill the area.

IP Rating:

Ingress Protection rating of IP66 for dust and water

Vibration Rating:

Industry-leading 5G vibration rating per ANSI C136.31

Ambient Temperature:

Suitable For use in 40°C (104°F)

Cold Weather Starting:

Minimum starting temperature is -40°C (-40°F)

Thermal Management:

Superior thermal management design with external Air-Flow fins provides maximum operational life, even in high ambient temperature environments

Effective Projected Area:

EPA = 0.75

Lens:

Tempered glass lens

Housing:

Die cast aluminum housing, lens frame and mounting arm

Mounting:

Fits most standard roadway upsweep arms. Adaptor brackets supplied fit 1", 1 1/4", 1 1/2" and 2" OD arms.

Wedge Mounting Option:

Allows field adjustment of +/- 5 degree tilt to achieve a level installation of LROAD150 universal adaptor roadway fixtures.

Recommended Mounting Height:

Up to 35 ft

Reflector:

Specular vacuum-metallized polycarbonate

RWLED3T150/PCT

RAB | Outdoor

Technical Specifications (continued)

Construction

Gaskets:

High temperature silicone gaskets

Finish:

Formulated for high-durability and long lasting color

Green Technology:

Mercury and UV-free. RoHS compliant components.

Other

Patents:

The LROAD™ design is protected by patents pending in the U.S., Canada, China, Taiwan and Mexico.

Warranty:

RAB warrants that our LED products will be free from defects in materials and workmanship for a period of ten (10) years from the date of delivery to the end user, including coverage of light output, color stability, driver performance and fixture finish. RAB's warranty is subject to all terms and conditions found at

Equivalency:

Replaces 400W Metal Halide

Buy American Act Compliance:

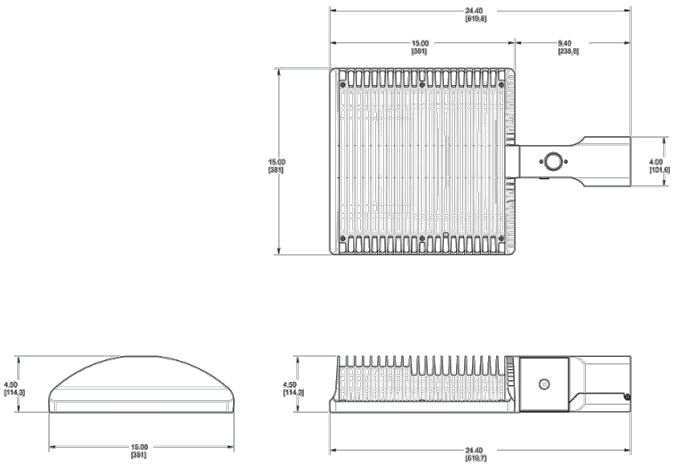
RAB values USA manufacturing! Upon request, RAB may be able to manufacture this product to be compliant with the Buy American Act (BAA). Please contact customer service to request a quote for the product to be made BAA compliant.

Optical

BUG Rating:

B1 U0 G2

Dimensions



Features

- Ideal for roadway, general parking and major roads
- 27 year lifespan dramatically reduces maintenance and re-lamping costs
- Precision optics deliver maximum downward street side lumens with uniformity and minimal glare
- Compatible with standard roadway arms
- Universal adaptors for 1", 1 1/4", 1 1/2" and 2" OD pipe included
- Industry-leading 5G vibration rating per ANSI C136.31
- Easy-access electrical compartment makes wiring fast and secure
- 10-Year, No-Compromise Warranty

Ordering Matrix

Family	Distribution	Wattage	Mounting	Color Temp	Finish	Options	Other Options
RWLED	3T	150	^	^	^	/PCT	^
	4T = Type IV **3T** = Type III **2T** = Type II	**50** = 50W **78** = 78W **105** = 105W **125** = 125W **150** = 150W	**Blank** = Roadway Arm **SF** = Slipfitter	**Blank** = 5000K (Cool) **N** = 4000K (Neutral) **Y** = 3000K (Warm)	**Blank** = Bronze **RG** = Gray **W** = White	**Blank** = No Option **/PCT** = 120-277V Twistlock Photocell **/PCS** = 120V Swivel Photocell **/PCS2** = 277V Swivel Photocell **/BL** = Bi-Level Control **/D10** = 0-10V Dimming **/480** = 480V Driver **/480/PCS4** = 480V w/ 480V Swivel Photocell **/480/PCT4** = 480V w/ 480V Twistlock Photocell	**Blank** = Standard **USA** = BAA Compliant

SLIM26

RAB Outdoor

12, 18 and 26 Watt SLIM wallpacks are ultra efficient and deliver impressive light distribution with a compact low-profile design that's super easy to install as a downlight or uplight.

Color: Bronze

Weight: 4.8 lbs

Project:	Type:
Prepared By:	Date:

Driver Info		LED Info	
Type:	Constant Current	Watts:	26W
120V:	0.27A	Color Temp:	5100K (Cool)
208V:	0.17A	Color Accuracy:	75 CRI
240V:	0.15A	L70 Lifespan:	100,000
277V:	0.13A	Lumens:	3,536
Input Watts:	30W	Efficacy:	120 LPW
Efficiency:	88%		

Technical Specifications

Listings

UL Listing:

Suitable for wet locations. Suitable for mounting within 1.2m (4ft) of the ground.

ADA Compliant:

SLIM™ is ADA Compliant

IESNA LM-79 & LM-80 Testing:

RAB LED luminaires and LED components have been tested by an independent laboratory in accordance with IESNA LM-79 and LM-80.

DLC Listed:

This product is on the Design Lights Consortium (DLC) Qualified Products List and is eligible for rebates from DLC Member Utilities.
DLC Product Code: P0000171S

Construction

IP Rating:

Ingress Protection rating of IP66 for dust and water

Maximum Ambient Temperature:

Suitable for use in 40°C (104°F)

Housing:

Precision die-cast aluminum housing

Mounting:

Heavy-duty mounting bracket with hinged housing for easy installation

Recommended Mounting Height:

Up to 22 ft

Lens:

Tempered glass lens

Reflector:

Specular thermoplastic

Gaskets:

High-temperature silicone

Finish:

Formulated for high-durability and long lasting color

Green Technology:

Mercury and UV-free. RoHS compliant components.

LED Characteristics

LED:

Multi-chip, long-life LED

Lifespan:

100,000-hour LED lifespan based on IES LM-80 results and TM-21 calculations

Color Consistency:

7-step MacAdam Ellipse binning to achieve consistent fixture-to-fixture color

Color Stability:

LED color temperature is warrantied to shift no more than 200K in CCT over a 5 year period

Color Uniformity:

RAB's range of CCT (Correlated Color Temperature) follows the guidelines for the American National Standard for Specifications for the Chromaticity of Solid State Lighting (SSL) Products, ANSI C78.377-2017.

Electrical

Driver:

Constant Current, Class 2, 100-277V, 50/60 Hz., 6KV surge protection, 120V: 0.28A, 208V: 0.16A, 240V: 0.14A, 277V: 0.12A

THD:

7.5% at 120V, 17.7% at 277V

Power Factor:

99.1% at 120V, 90.3% at 277V

Other

Patents:

The design of the SLIM™ is protected by patents in U.S. Pat D681,864, and pending patents in Canada, China, Taiwan and Mexico.

HID Replacement Range:

Replaces 175W Metal Halide

Buy American Act Compliance:

RAB values USA manufacturing! Upon request, RAB may be able to manufacture this product to be compliant with the Buy American Act (BAA). Please contact customer service to request a quote for the product to be made BAA compliant.

Optical

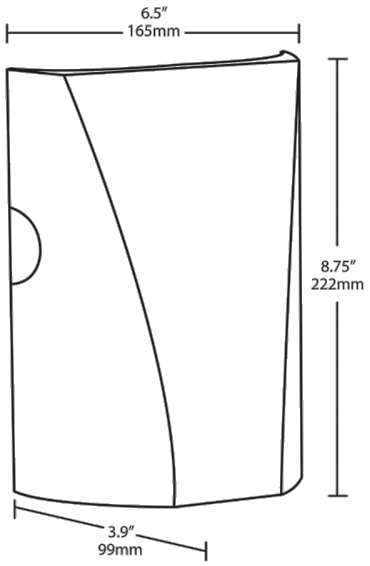
BUG Rating:

B1 U0 G0

SLIM26

RAB Outdoor

Dimensions



Features

- Full cutoff, fully shielded LED wallpack
- Can be used as a downlight or uplight
- Contractor friendly features for easy installation
- 100,000-hour LED Life
- 5-Year, No-Compromise Warranty

Ordering Matrix

Family	Wattage	Color Temp	Finish	Driver	Options
SLIM	26	^	^	^	^
	12 = 12W **18** = 18W **26** = 26W	**Blank** = 5000K (Cool) **N** = 4000K (Neutral) **Y** = 3000K (Warm)	**Blank** = Bronze **W** = White	**Blank** = Standard (120-277V) **/D10** = Dimmable	**Blank** = No Option **/PC** = 120V Button **/PC2** = 277V Button **/LC** = Lightcloud Controller

SLIM37/PC2

RAB Outdoor

37, 57 and 62 Watt SLIM Wallpacks are designed to cover the footprint of most traditional wallpacks. They are suitable for mounting heights from 20' to 30', and replace HID Wattages from 200W MH to 320W MH. These ultra-high efficiency fixtures are available in cutoff or full cutoff models.

Color: Bronze

Weight: 7.5 lbs

Project:	Type:
Prepared By:	Date:

Driver Info		LED Info	
Type:	Constant Current	Watts:	37W
120V:	N/A	Color Temp:	5000K (Cool)
208V:	0.19A	Color Accuracy:	73 CRI
240V:	0.16A	L70 Lifespan:	100,000
277V:	0.14A	Lumens:	3,905
Input Watts:	35W	Efficacy:	111 LPW
Efficiency:	N/A		

Technical Specifications

Electrical

Photocell:

277V Button Photocell Included. Photocell is compatible with 208V-277V.

Driver:

Constant Current, 100-277V. 50/60Hz, 100-277VAC 0.6A, 4kV Surge Protection, 700mA, Power Factor 99.6%.

THD:

11.5% at 120V, 21% at 277V

Listings

UL Listing:

Suitable for wet locations. Wall Mount only.

DLC Listed:

This product is on the Design Lights Consortium (DLC) Qualified Products List and is eligible for rebates from DLC Member Utilities.
DLC Product Code: P0000171T

IESNA LM-79 & LM-80 Testing:

RAB LED luminaires and LED components have been tested by an independent laboratory in accordance with IESNA LM-79 and LM-80.

Construction

Footprint:

Designed to replace RAB HID WP1 wallpacks, both in size and footprint template, so upgrading to LED is easy and seamless

IP Rating:

Ingress Protection rating of IP66 for dust and water

Cold Weather Starting:

Minimum starting temperature is -40°C (-40°F)

Maximum Ambient Temperature:

Suitable for use in 40°C (104°F)

Housing:

Precision die-cast aluminum housing and door frame

Mounting:

Die-cast back box with four (4) conduit entry points and knockout pattern for junction box or direct wall mounting. Hinged housing and bubble level for easy installation.

Cutoff:

Cutoff (7.5°)

Recommended Mounting Height:

Up to 20 ft

Lens:

Microprismatic diffusion glass lens reduces glare and has smooth and even light distribution

Reflector:

Specular thermoplastic

Gaskets:

The unique design of the tight-lock gasket ensures no water or environmental elements will ever get inside the SLIM

Finish:

Formulated for high-durability and long lasting color

Green Technology:

Mercury and UV-free. RoHS compliant components.

LED Characteristics

LED:

Long-life, high-efficiency, micro-power, surface mount LEDs; binned and mixed for uniform light output and color

Lifespan:

100,000-hour LED lifespan based on IES LM-80 results and TM-21 calculations

Color Stability:

LED color temperature is warrantied to shift no more than 200K in CCT over a 5 year period

Color Consistency:

7-step MacAdam Ellipse binning to achieve consistent fixture-to-fixture color

Other

Accessories:

Available accessories include polyshield and wire guard. Click to see all accessories.

Patents:

The design of the SLIM™ is protected by patents pending in US, Canada, China, Taiwan and Mexico

HID Replacement Range:

Replaces 200W Metal Halide

Technical Specifications (continued)

Other

Buy American Act Compliance:

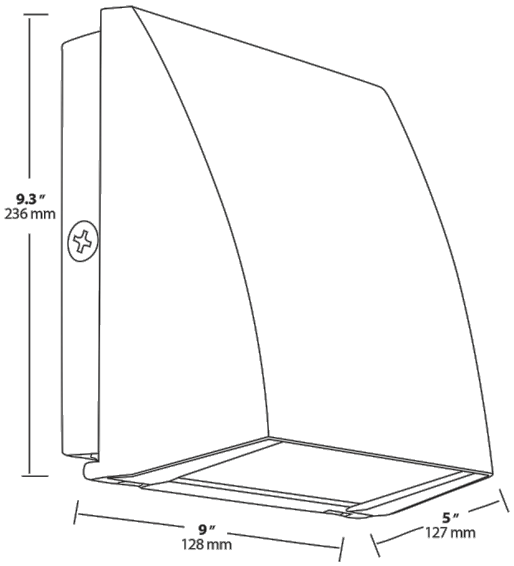
RAB values USA manufacturing! Upon request, RAB may be able to manufacture this product to be compliant with the Buy American Act (BAA). Please contact customer service to request a quote for the product to be made BAA compliant.

Optical

BUG Rating:

B1 U1 G1

Dimensions



Features

- Covers footprint of most traditional wallpacks
- Easy installation with hinged access, bubble level and multiple conduit entries
- Tight-lock gasket keeps elements out
- 100,000-hour LED lifespan
- 5-Year, No-Compromise Warranty

Ordering Matrix

Family	Cutoff	Wattage	Color Temp	Finish	Driver Options	Options	Other Options
SLIM	^	37	^	^	^	/PC2	^
	Blank = Cutoff (10 degrees) **FC** = Full Cutoff (0 degrees)	**37** = 37W **57** = 57W **62** = 62W	**Blank** = 5000K (Cool) **N** = 4000K (Neutral) **Y** = 3000K (Warm)	**Blank** = Bronze **W** = White	**Blank** = Standard (120-277V) **/BL** = Bi-Level **/D10** = Dimmable **/480** = 480V	**Blank** = No Option **/PC** = 120V Button Photocell **/PC2** = 277V Button Photocell **/PCS** = 120V Swivel Photocell **/PCS2** = 277V Swivel Photocell **/LC** = Lightcloud Controller	**Blank** = Standard **USA** = BAA Compliant

LED Exit Sign w/ Battery Backup

Item No. ES-LED-RW-B

Energy efficient, low profile LED exit sign provides a clean and compact look. The battery backup offers illumination during a power outage.

› Print preview

› Tell a friend

TOPAZ
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High-Power LED PAR

LP20/7/50K/D

6.5 Watt LED PAR20 Lamp

- *Dimmable down to 10%*
- *Advanced Optics & Thermal Management*
- *Contains no mercury*

Item #	LP20/7/50K/D-46
Product Code	70925
UPC Code	751338002968
Watts	6.5
Volts	120
Lamp Shape	PAR20
Base	E26 Medium
Beam Spread	25°
CRI	80
Color Temp	5000K
Initial Lumens	500
Average Rated Life	25,000
MOL	3.25"
Equivalent Wattage	50
Warranty	5 years

Specifications are subject to change without prior notice.

Suitable for Enclosed Fixtures

ENERGY STAR

c UL us LISTED
E338632

WET LOCATION

RoHS COMPLIANT

LED

DIMMABLE LED

5 YEAR WARRANTY

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CA Office: *225 Parkside Drive, San Fernando, CA 91340 • 888-551-2852 or 818-838-3123 • Fax: 888-690-2852 or 818-838-3102*
FL Office: *2020 West 26th Street, Jacksonville, FL 32209 • 800-338-2852 • Fax: 772-778-5386*

TOPAZ
Friendly Service ... Powerful Solutions™

High-Power LED PAR

LP30/10/50K/D

10.5 Watt LED PAR30 Lamp

- *Dimmable down to 10%*
- *Advanced Optics & Thermal Management*
- *Contains no mercury*

Item #	LP30/10/50K/D-46
Product Code	70929
UPC Code	751338003002
Watts	10.5
Volts	120
Lamp Shape	PAR30
Base	E26 Medium
Beam Spread	40°
CRI	80
Color Temp	5000K
Initial Lumens	810
Average Rated Life	25,000
MOL	3.625”
Equivalent Wattage	75
Warranty	5 years

Specifications are subject to change without prior notice.

Not suitable for use in enclosed fixtures

ENERGY STAR

c UL us LISTED
E338632

WET LOCATION

RoHS COMPLIANT

DIMMABLE LED

5 YEAR WARRANTY

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Job Name/Title:_____Catalog Number_____

Contractor:_____Notes:_____

LED Omnidirectional A19 and A21

SPEC SHEET

A19 A21

True Omnidirectional Light Distribution

Topaz LED Omnidirectional A19 and A21 lamps are ideal for both residential and commercial settings including down lights, wall sconces, ceiling fans, table and floor lamps. Dimmable down to 10% for additional energy savings and ambiance control.

FEATURES

- 300° beam spread
- 85% energy savings compared to incandescent lamps
- Suitable for use in totally enclosed luminaires
- Long life – up to 10X longer than traditional incandescents
- RoHS compliant and mercury free
- Plastic lens material provides shatter protection

APPLICATIONS

- Fan lights, decorative, recessed, task lighting
- Residential, hospitality, retail, restaurants, commercial

ENERGY STAR | c UL us LISTED E338632 | RoHS COMPLIANT | DAMP LOCATION | 5 YEAR WARRANTY

Job Name/Title:_____Catalog Number_____

Contractor:_____Notes:_____

LED Omnidirectional A19 and A21

SPEC SHEET

GENERAL SPECIFICATIONS

Input Voltage: 120V

Average Rated Life: 25,000 Hours

CRI: 80

THD: <15%

Beam Angle: 220°

Ambient temp: -4°F to 104°F

PK-QTY: 1/6/24

SPECIFICATIONS / ORDER INFO

Item #	Order Code	UPC Code	Shape	Watts	Equivalent Wattage	Base	CCT (Kelvin)	Avg. Lumens	MOL In.	MOD In	Energy Star	Dimmable
LA19/5/27K/D-46	77004	751338002708	A19	5	40W A19	E26	2700	450	4.35"	2.37"	Y	Y
LA19/5/30K/D-46	77005	751338002777	A19	5	40W A19	E26	3000	450	4.35"	2.37"	Y	Y
LA19/5/40K/D-46	77006	751338002784	A19	5	40W A19	E26	4000	450	4.35"	2.37"	Y	Y
LA19/5/50K/D-46	77007	751338002791	A19	5	40W A19	E26	5000	450	4.35"	2.37"	Y	Y
LA19/9/27K/D-46	77008	751338002807	A19	9.5	60W A19	E26	2700	800	4.35"	2.37"	-	Y
LA19/9/30K/D-46	77009	751338002814	A19	9.5	60W A19	E26	3000	800	4.35"	2.37"	Y	Y
LA19/9/40K/D-46	77010	751338002821	A19	9.5	60W A19	E26	4000	800	4.35"	2.37"	Y	Y
LA19/9/50K/D-46	77011	751338002838	A19	9.5	60W A19	E26	5000	800	4.35"	2.37"	Y	Y
LA19/12/27K/D-46	77012	751338002845	A19	11.5	75W A19	E26	2700	1,100	4.65"	2.37"	Y	Y
LA19/12/30K/D-46	77013	751338002852	A19	11.5	75W A19	E26	3000	1,100	4.65"	2.37"	Y	Y
LA19/12/40K/D-46	77014	751338002869	A19	11.5	75W A19	E26	4000	1,100	4.65"	2.37"	Y	Y
LA19/12/50K/D-46	77015	751338002876	A19	11.5	75W A19	E26	5000	1,100	4.65"	2.37"	Y	Y
LA21/16/27K/D-46	77018	751338002883	A21	15.5	100W A21	E26	2700	1,600	5.55"	2.65"	Y	Y
LA21/16/30K/D-46	77019	751338002890	A21	15.5	100W A21	E26	3000	1,600	5.55"	2.65"	Y	Y
LA21/16/40K/D-46	77020	751338002906	A21	15.5	100W A21	E26	4000	1,600	5.55"	2.65"	Y	Y
LA21/16/50K/D-46	77021	751338002913	A21	15.5	100W A21	E26	5000	1,600	5.55"	2.65"	Y	Y
LA19/9/27K/GU24D-46	71024	751338003378	A19	9.5	60W A19	GU24	2700	800	4.55"	2.37"	-	Y
LA19/9/30K/GU24D-46	71025	751338003385	A19	9.5	60W A19	GU24	3000	800	4.55"	2.37"	-	Y
LA19/9/40K/GU24D-46	71026	751338003392	A19	9.5	60W A19	GU24	4000	800	4.55"	2.37"	-	Y
LA19/12/30K/GU24D-46	74152	751338016286	A19	11.5	75W A19	GU24	3000	1,100	4.55"	2.37"	-	Y

NOMENCLATURE

Example: LA19/5/27K/D

LA19=LED A19 Shape / **5**=5 Watt / **27K**=2700K / **D**=Dimmable

ENERGY SAVINGS

	LED Watts	Incandescent Watts	Energy Saving, Watts	Yearly Saving, Fixture	5 Year Cost Savings
Based on 5 hours/day and .11¢/kwhr					
LA19/5/XXK/D	5	40	35	$7.03	$35.13
LA19/9/XXK/D	9.5	60	50.5	$10.14	$50.69
LA19/12/XXK/D	11.5	75	63.5	$12.75	$63.74
LA21/16/XXK/D	15.5	100	84.5	$16.96	$84.82

Suitable for enclosed fixtures. This device is not intended for use with emergency exits.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. Specifications subject to change without notice.

FIVE (5) YEAR LIMITED WARRANTY: TOPAZ LIGHTING CORP. warrants to the original purchaser that all TOPAZ LED lamps shall be free from defects of material and workmanship for a period of five (5) years from the date of purchase. Based on 12 hours of use per day. TOPAZ LIGHTING CORP. will, at its option, repair or replace without charge a defective LED lamp that has not been misused, carelessly handled or improperly installed. Repair or replacement, as stated above, shall constitute the purchaser's exclusive warranty, which does not extend to transportation, installation, labor or any other consequential charges. www.topaz-usa.com

Specifications subject to change without notice.

Job Name/Title:_____Catalog Number_____

Contractor:_____Notes:_____

LED Decorative Candelabra Series

SPEC SHEET

Give Your Home a Cozy Look and Feel

Topaz LED Decorative candelabra lamps are the energy savings alternative to traditional lighting. Available in blunt or flame tip configurations and offered in aesthetically pleasing warm 2700K and 3000K color temperatures. Dimmable for complete ambiance control and additional energy and maintenance savings. A long lasting direct replacement for incandescent lamps in ceiling fans, wall sconces and chandeliers.

FEATURES

- Blunt tip and flame tip models available
- Filament style best replicates the aesthetic appeal of incandescents lamps
- Up to 90% energy savings over incandescent
- Long life – up to 10X longer than traditional incandescents
- RoHS compliant and mercury free

APPLICATIONS

- Decorative lighting, wall sconces, chandeliers
- Residential, hospitality, commercial

ENERGY STAR | c UL us LISTED E338632 | RoHS COMPLIANT | DIMMABLE LED | 5 YEAR WARRANTY

Job Name/Title:_____Catalog Number_____

Contractor:_____Notes:_____

LED Decorative Candelabra Series

SPEC SHEET

GENERAL SPECIFICATIONS

Input Voltage: 120V
THD: <15%
Ambient Temperature: -4°F to 104°F

LETC/3 LCTC/3 LCTF/5 LCFF/5 LCFC/5 LCTC/5 LCTC/7

SPECIFICATIONS / ORDER INFO

Item #	Code	UPC Code	Watts	Volts	Shape	Base	CRI	CCT (KELVIN)	Initial Lumens	Avg. Rated Life	MOL	Equiv. Wattage	Dimming	Energy Star	PK QTY
Clear															
LCTC/3/830/D	79981	751338097766	3	120	Blunt Tip	E12	80	3000	165	25,000	3.8"	25	Y	-	1/20/100
LETC/3/830/D	79989	751338097827	3	120	Blunt Tip	E26	80	3000	165	25,000	3.8"	25	Y	-	1/20/100
LCFC/5/830/D	78914	751338002197	4.7	120	Flame Tip	E12**	82	3000	315	25,000	4.55"	40	Y	Y	1/20/100
LCTC/5/830/D	79896	751338001800	4.7	120	Blunt Tip	E12**	82	3000	315	25,000	4.15"	40	Y	-	1/20/100
LCTC/7/827/D	79346	751338000971	6.5	120	Blunt Tip	E12	80	2700	500	25,000	4.5"	60	Y	Y	1/20/100
LCTC/7/830/D	79348	751338000988	6.5	120	Blunt Tip	E12	80	3000	500	25,000	4.5"	60	Y	Y	1/20/100
Frosted															
LCFF/5/830/F/D	70728	751338016675	4.5	120	Flame Tip	E12**	80	3000	300	15,000	3.98"	40	Y	Y	1/12/48
LCTF/5/830/F/D	70729	751338016682	4.5	120	Blunt Tip	E12**	80	3000	300	15,000	3.85"	40	Y	Y	1/12/48

NOMENCLATURE

Example: LCTC/3/830/D

LCTC=LED Candleabra Torpedo E12 Base Clear / **3**=3 Watt / **830**=3000K / **D**=Dimmable

ENERGY SAVINGS

Item #	LED Watts	Incandescent Watts	Energy Savings, Watts	Yearly Cost Savings	5 Year Cost Savings
Based on 8 hours/day and .11¢/kwhr					
LCTC/3/830/D	3	25	22	$7.07	$35.33
LETC/3/830/D	3	25	22	$7.07	$35.33
LCTC/5/830/D	4.7	40	35.3	$11.34	$56.70
LCFC/5/830/D	4.7	40	35.3	$11.34	$56.70
LCFF/5/830/F/D	4.5	40	35.5	$11.40	$57.00
LCTF/5/830/F/D	4.5	40	35.5	$11.40	$57.00
LCTC/7/827/D	6.5	60	53.5	$17.80	$85.90
LCTC/7/830/D	6.5	60	53.5	$17.80	$85.90

*Dimming - This lamp is designed to be compatible with most leading edge or incandescent style rotary or slide type dimmers. (Dimming range 100% - 10%) Performance may vary depending on dimmer

** E26 Adapter included

This device is not intended for use with emergency exits.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. Specifications subject to change without notice.

FIVE (5) YEAR LIMITED WARRANTY: TOPAZ LIGHTING CORP. warrants to the original purchaser that all TOPAZ LED lamps shall be free from defects of material and workmanship for a period of five (5) years from the date of purchase. Based on 12 hours of use per day. TOPAZ LIGHTING CORP. will, at its option, repair or replace without charge a defective LED lamp that has not been misused, carelessly handled or improperly installed. Repair or replacement, as stated above, shall constitute the purchaser's exclusive warranty, which does not extend to transportation, installation, labor or any other consequential charges. www.topaz-usa.com

Specifications subject to change without notice.

Job Name/Title:_____Catalog Number_____

Contractor:_____Notes:_____

LED Dimmable Globe Lamp

SPEC SHEET

Excellent Light Distribution

Topaz Dimmable LED Globe lamps are a long lasting and energy savings alternative to traditional incandescent lighting. 2700K color temperature replicates the aesthetically pleasing and warm color of incandescent lighting. 40W replacement can save up to 80% of energy. Dimmable for ambiance control and additional energy savings. Ideal for direct replacement in bathroom vanity lighting and decorative lighting used in residential, retail, hospitality and commercial applications.

FEATURES

- Up to 85% energy savings vs. 40W incandescent
- Dimmable down to 5%*
- 2700K Color temperature best replicates the aesthetic appeal of incandescents
- 80 CRI for quality color rendering
- Long Life – up to 18X longer than traditional incandescents

APPLICATIONS

- Bathroom vanity lighting, decorative and task lighting
- Residential, hospitality, retail, commercial

ENERGY STAR | c UL us LISTED E338632 | RoHS COMPLIANT | DIMMABLE LED | 5 YEAR WARRANTY

Job Name/Title:_____Catalog Number_____

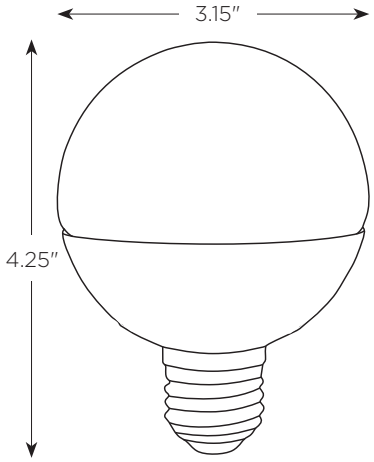
Contractor:_____Notes:_____

LED Dimmable Globe Lamp

SPEC SHEET

GENERAL SPECIFICATIONS

Input Voltage: 120V
CRI: 80
Finish: White
Beam Angle: 175°
Ambient temp: -4°F to 104°F



SPECIFICATIONS / ORDER INFO

Item #	Code	UPC Code	Watts	Shape	Base	CCT (KELVIN)	Initial Lumens	Avg. Rated Life	Equiv. Wattage	Energy Star	Dimmable	PK-Qty
LG25/6/827/D	79781	75133806435	6	G25	E26 Med.	2700	450	25,000	40	Y	Y	1/6/24

NOMENCLATURE

Example: **LG25/6/827/D**
LG25=LED G25 Shape Globe / **6**=6 Watt / **827**=2700K / **D**=Dimmable

ENERGY SAVINGS

Item #	LED Watts	Incandescent Watts	Energy Savings, Watts	Yearly Cost Savings	5 Year Cost Savings
Based on 5 hours/day and .11¢/kwhr LG25/6/827/D	6	40	34	$6.83	$34.13

*Dimming - This lamp is designed to be compatible with most leading edge or incandescent style rotary or slide type dimmers. (Dimming range 100% - 10%) Performance may vary depending on dimmer

Suitable for use in totally enclosed fixtures . This device is not intended for use with emergency exits.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. Specifications subject to change without notice.

FIVE (5) YEAR LIMITED WARRANTY: TOPAZ LIGHTING CORP. warrants to the original purchaser that all TOPAZ LED lamps shall be free from defects of material and workmanship for a period of five (5) years from the date of purchase. Based on 12 hours of use per day. TOPAZ LIGHTING CORP. will, at its option, repair or replace without charge a defective LED lamp that has not been misused, carelessly handled or improperly installed. Repair or replacement, as stated above, shall constitute the purchaser's exclusive warranty, which does not extend to transportation, installation, labor or any other consequential charges. www.topaz-usa.com

Specifications subject to change without notice.

TOPAZ
Friendly Service ... Powerful Solutions™

LED PAR38

LP38/17/850/FL/D

16.5W LED PAR38 Retrofit

- *No Mercury*
- *Equivalent to 90W PAR38 (Lumens) and 120W PAR38 (CBCP)*
- *Dimmable*
- *Wet location rated*

Item #	LP38/17/850/FL/D-46
Product Code	79674
UPC Code	751338042681
Watts	16.5
Volts	120
Lamp Shape	PAR38
Base	E26 Medium
Beam Spread	40°
CRI	80
Color Temp	5000K
Initial Lumens	1,300
Average Rated Life	35,000
Temperature Range	-20°C - 40°C
MOL	5.15″
Equivalent Wattage	100
Warranty	5 years

Specifications are subject to change without prior notice.

*Compatible with most leading edge or incandescent style dimmers.

Damp location rated. Not suitable for totally enclosed fixtures.

ENERGY STAR · c UL us LISTED · FC · RoHS COMPLIANT · WET LOCATION · DIMMABLE LED · 5 YEAR WARRANTY

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VANLED10

Low-profile vandal-resistant fixture covers the footprint of most traditional canopy lights. Available in flat or drop lens with frosted and unfrosted options.

Color: Bronze

Weight: 12.0 lbs

Project:	Type:
Prepared By:	Date:

Driver Info		LED Info	
Type:	Constant Current	Watts:	10W
120V:	0.30A	Color Temp:	5000K
208V:	0.20A	Color Accuracy:	78 CRI
240V:	0.17A	L70 Lifespan:	100000
277V:	0.15A	Lumens:	1681
Input Watts:	13W	Efficacy:	128 LPW
Efficiency:	76%		

Technical Specifications

Listings

UL Listing:

Suitable for Wet Locations. Covered Ceiling Mount Only.

DLC Listed:

This product is on the Design Lights Consortium (DLC) Qualified Products List and is eligible for rebates from DLC Member Utilities.
DLC Product Code: PMZZWGXN

IESNA LM-79 & LM-80 Testing:

RAB LED luminaires have been tested by an independent laboratory in accordance with IESNA LM-79 and LM-80, and have received the Department of Energy "Lighting Facts" label.

Electrical

Driver:

Class 2, Constant Current, 100-277V, 50-60Hz, 280mA

THD:

16% at 277V

Construction

Maximum Ambient Temperature:

Suitable for use in 40°C (104°F) ambient temperatures

Cold Weather Starting:

Minimum starting temperature is -40°C (-40°F)

Housing:

Die-cast aluminum housing and lens frame with (4) 1/2" NPS side conduit entries and weatherproof rear wire plug and access plate

Mounting:

Ceiling mount to recessed junction with knockout template or directy to ceiling surface, utilizing side conduit entry points.

IP Rating:

Ingress Protection rating of IP66 for dust and water

Lens:

Vandal-resistant polycarbonate textured opaque for low glare drop lens

Reflector:

Semi-specular, vacuum-metalized polycarbonate

Gaskets:

High-temperature silicone gaskets

Finish:

Our environmentally friendly polyester powder coatings are formulated for high-durability and long-lasting color.

Green Technology:

Mercury and UV free. RoHS compliant components. Polyester powder coat finish formulated without the use of VOC or toxic heavy metals.

LED Characteristics

LEDs:

Discreet LEDs on PCB board

Color Stability:

RAB LEDs exceed industry standards for chromatic stability.

Color Uniformity:

RAB's range of CCT (Correlated Color Temperature) follows the guidelines of the American National Standard for Specifications for the Chromaticity of Solid State Lighting (SSL) Products, ANSI C78.377-2017.

Other

Warranty:

RAB warrants that our LED products will be free from defects in materials and workmanship for a period of five (5) years from the date of delivery to the end user, including coverage of light output, color stability, driver performance and fixture finish. See our full warranty

Replacement:

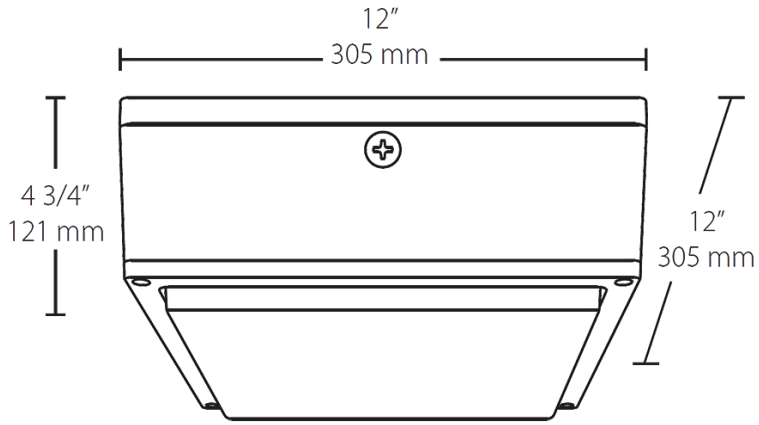
Replaces up to 50W Metal Halide.

Buy American Act Compliance:

RAB values USA manufacturing! Upon request, RAB may be able to manufacture this product to be compliant with the Buy American Act (BAA). Please contact customer service to request a quote for the product to be made BAA compliant.

VANLED10

Dimensions



Features

- Fits the footprint of older canopy lights
- Vandal resistant and UV resistant lens
- Ultra-high efficiency
- Clean, contemporary, low-profile design
- Available with drop lens or flat lens
- IP66 rated, keeps dust, bugs and water out
- Photo and motion sensor options available

Ordering Matrix

Family	Wattage	Color Temp	Lens	Motion Sensor & Finish	Driver Options	Photocell Options
VANLED						
	10 = 10W **20** = 20W **40** = 40W **52** = 52W **65** = 65W **75** = 75W	**Blank** = 5000K (Cool) **N** = 4000K (Neutral) **Y** = 3000K (Warm)	**Blank** = Drop lens **F** = Flat lens **FR** = Frosted Drop Lens **FFR** = Frosted Flat Lens	**Blank** = Bronze, no sensor **W** = White, no sensor **MS** = Bronze w/ SMS500 mini-sensor (not available w/ D10 models) **MSW** = White w/ SMS500 mini-sensor (not available w/ D10 models)	**Blank** = On/Off driver **/D10** = 0-10V Dimming (not available for 10w) **/480** = 480V (not available for 10W or 20W) **/480/D10** = 480V w/ 0-10V dimming (not available for 10W or 20W)	**/PCS** = 120V Swivel **/PCS2** = 277V Swivel **/PCS4** = 480V Swivel

VANLED10

Low-profile vandal-resistant fixture covers the footprint of most traditional canopy lights. Available in flat or drop lens with frosted and unfrosted options.

Color: Bronze

Weight: 12.0 lbs

Project:	Type:
Prepared By:	Date:

Driver Info

Type:	Constant Current
120V:	0.60A
208V:	0.19A
240V:	0.17A
277V:	0.14A
Input Watts:	38W
Efficiency:	N/A

LED Info

Watts:	40W
Color Temp:	5000K
Color Accuracy:	78 CRI
L70 Lifespan:	100000
Lumens:	5095
Efficacy:	134 LPW

Technical Specifications

Listings

UL Listing:

Suitable for Wet Locations. Covered Ceiling Mount Only.

DLC Listed:

This product is listed by Design Lights Consortium (DLC) as an ultra-efficient premium product that qualifies for the highest tier of rebates from DLC Member Utilities.
DLC Product Code: PHYYBQJS

IESNA LM-79 & LM-80 Testing:

RAB LED luminaires have been tested by an independent laboratory in accordance with IESNA LM-79 and LM-80, and have received the Department of Energy "Lighting Facts" label.

Electrical

Driver:

Class 2, Constant Current, 100-277V, 50-60Hz, 1050mA

THD:

5.5% at 277V

Construction

Maximum Ambient Temperature:

Suitable for use in 40°C (104°F) ambient temperatures

Cold Weather Starting:

Minimum starting temperature is -40°C (-40°F)

Housing:

Die-cast aluminum housing and lens frame with (4) 1/2" NPS side conduit entries and weatherproof rear wire plug and access plate

Mounting:

Ceiling mount to recessed junction with knockout template or directy to ceiling surface, utilizing side conduit entry points.

IP Rating:

Ingress Protection rating of IP66 for dust and water

Lens:

Vandal-resistant polycarbonate textured opaque for low glare drop lens

Reflector:

Semi-specular, vacuum-metalized polycarbonate

Gaskets:

High-temperature silicone gaskets

Finish:

Our environmentally friendly polyester powder coatings are formulated for high-durability and long-lasting color.

Green Technology:

Mercury and UV free. RoHS compliant components. Polyester powder coat finish formulated without the use of VOC or toxic heavy metals.

LED Characteristics

LEDs:

Discreet LEDs on PCB board

Color Stability:

RAB LEDs exceed industry standards for chromatic stability.

Color Uniformity:

RAB's range of CCT (Correlated Color Temperature) follows the guidelines of the American National Standard for Specifications for the Chromaticity of Solid State Lighting (SSL) Products, ANSI C78.377-2017.

Other

Warranty:

RAB warrants that our LED products will be free from defects in materials and workmanship for a period of five (5) years from the date of delivery to the end user, including coverage of light output, color stability, driver performance and fixture finish. See our full warranty

Replacement:

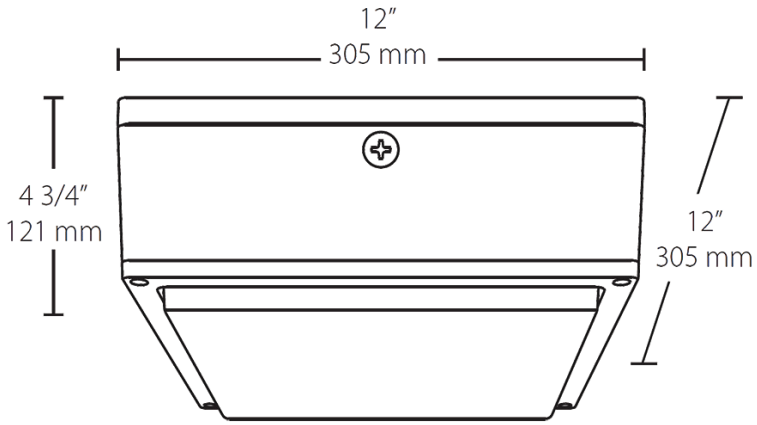
Replaces up to 100W Metal Halide.

Buy American Act Compliance:

RAB values USA manufacturing! Upon request, RAB may be able to manufacture this product to be compliant with the Buy American Act (BAA). Please contact customer service to request a quote for the product to be made BAA compliant.

VANLED10

Dimensions



Features

- Fits the footprint of older canopy lights
- Vandal resistant and UV resistant lens
- Ultra-high efficiency
- Clean, contemporary, low-profile design
- Available with drop lens or flat lens
- IP66 rated, keeps dust, bugs and water out
- Photo and motion sensor options available

Ordering Matrix

Family	Wattage	Color Temp	Lens	Motion Sensor & Finish	Driver Options	Photocell Options
VANLED						
	@ = 10W **40** = 20W **10** = 40W **54** = 52W **65** = 65W **75** = 75W	**Blank** = 5000K (Cool) **N** = 4000K (Neutral) **Y** = 3000K (Warm)	**Blank** = Drop lens **F** = Flat lens **FR** = Frosted Drop Lens **FFR** = Frosted Flat Lens	**Blank** = Bronze, no sensor **W** = White, no sensor **MS** = Bronze w/ SMS500 mini-sensor (not available w/ D10 models) **MSW** = White w/ SMS500 mini-sensor (not available w/ D10 models)	**Blank** = On/Off driver **/D@** = 0-10V Dimming (not available for 10w) **/180** = 480V (not available for 10W or 20W) **/180/D@** = 480V w/ 0-10V dimming (not available for 10W or 20W)	**/PCS** = 120V Swivel **/PCS4** = 277V Swivel **/PCS1** = 480V Swivel

WPLED13

RAB Outdoor

LED 10W & 13 Wallpacks. Patent Pending thermal management system. 100,000 hour L70 lifespan. 5-year, no-compromise warranty.

Color: Bronze

Weight: 4.4 lbs

Project:	Type:
Prepared By:	Date:

Driver Info

Type:	Constant Current
120V:	0.13A
208V:	0.08A
240V:	0.07A
277V:	0.06A
Input Watts:	15W
Efficiency:	86%

LED Info

Watts:	13W
Color Temp:	5000K (Cool)
Color Accuracy:	73 CRI
L70 Lifespan:	100,000
Lumens:	1,530
Efficacy:	101 LPW

Technical Specifications

Listings

UL Listing:

Suitable for Wet Locations as a Downlight. Suitable for Damp Locations as an Uplight. Wall Mount only. Suitable for Mounting within 4ft. of ground.

IESNA LM-79 & IESNA LM-80 Testing:

RAB LED luminaires and LED components have been tested by an independent laboratory in accordance with IESNA LM-79 and LM-80.

LED Characteristics

Lifespan:

100,000-hour LED lifespan based on IES LM-80 results and TM-21 calculations

Color Temperature (Nominal CCT):

5000K

Lumen Maintenance:

The LED will deliver 70% of its initial lumens at 100,000 hours of operation

Color Consistency:

7-step MacAdam Ellipse binning to achieve consistent fixture-to-fixture color

Color Stability:

LED color temperature is warrantied to shift no more than 200K in CCT over a 5 year period

Color Uniformity:

RAB's range of CCT (Correlated Color Temperature) follows the guidelines of the American National Standard for Specifications for the Chromaticity of Solid State Lighting (SSL) Products, ANSI C78.377-2017.

Construction

Cold Weather Starting:

Minimum starting temperature is -40°C (-40°F)

Maximum Ambient Temperature:

Suitable for use in 55°C (131°F)

Finish:

Formulated for high-durability and long lasting color

Green Technology:

Mercury and UV-free. RoHS compliant components.

Gaskets:

High Temperature Silicone

Electrical

Driver:

Multi-chip 13W high output long life LED Driver Constant Current, Class 2 100V - 277V, 50/60 Hz

Surge Protection:

4kV

THD:

10.4% at 120V, 16.7% at 277V

Power Factor:

98.8% at 120V, 92.6% at 277V

Other

Patents:

The design of the LPACK is protected by U.S. Pat. D604,004 and patents pending in Canada, China and Taiwan.

Warranty:

RAB warrants that our LED products will be free from defects in materials and workmanship for a period of five (5) years from the date of delivery to the end user, including coverage of light output, color stability, driver performance and fixture finish. RAB's warranty is subject to all terms and conditions found at

Equivalency:

Equivalent to 100W Metal Halide

Buy American Act Compliance:

RAB values USA manufacturing! Upon request, RAB may be able to manufacture this product to be compliant with the Buy American Act (BAA). Please contact customer service to request a quote for the product to be made BAA compliant.

Optical

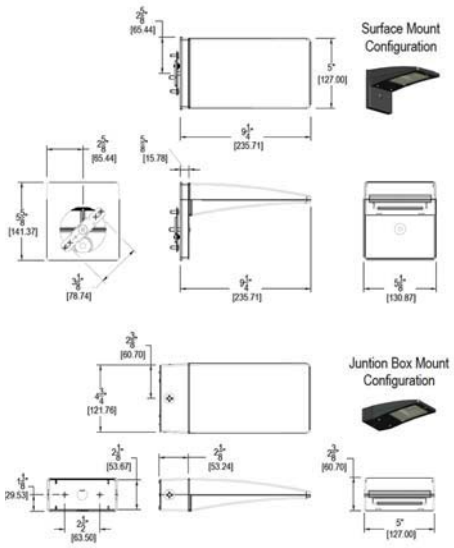
BUG Rating:

B1 U0 G0

WPLED13

RAB | Outdoor

Dimensions



Features

- High performance LED light engine
- Maintains 70% of initial lumens at 100,000 hours
- Weatherproof high temperature silicone gaskets
- Superior heat sinking with die cast aluminum housing and external fins
- 5-Year, No-Compromise Warranty

Ordering Matrix

Family	Wattage	Color Temp	Sensor	Surface Plate	Surface Place	Finish	Photocell	Other Options
WPLED								
	10 = 10W **13** = 13W	**Blank** = 5000K (Cool) **Y** = 3000K (Warm) **N** = 4000K (Neutral)	**Blank** = No Sensor **MS** = Mini Sensor	**Blank** = No Surface Plate	**S** = Surface Plate	**Blank** = Bronze **W** = White	**Blank** = No Photocell **/PC** = 120V Button **/PCS** = 120V Swivel **/PC2** = 277V Button	**USA** = BAA Compliant **Blank** = Standard

WPLED26

RAB Outdoor

Color: Bronze

Weight: 7.2 lbs

Project:	Type:
Prepared By:	Date:

Driver Info

Type:	Constant Current
120V:	0.26A
208V:	0.16A
240V:	0.14A
277V:	0.12A
Input Watts:	29W
Efficiency:	89%

LED Info

Watts:	26W
Color Temp:	5000K (Cool)
Color Accuracy:	72 CRI
L70 Lifespan:	100,000
Lumens:	3,483
Efficacy:	120 LPW

Technical Specifications

Listings

UL Listing:

Suitable for wet locations. Suitable for mounting within 1.2m (4ft) of the ground.

DLC Listed:

This product is listed by Design Lights Consortium (DLC) as an ultra-efficient premium product that qualifies for the highest tier of rebates from DLC Member Utilities.
DLC Product Code: P0000170I

LED Characteristics

Lifespan:

100,000-hour LED lifespan based on IES LM-80 results and TM-21 calculations

Color Consistency:

7-step MacAdam Ellipse binning to achieve consistent fixture-to-fixture color

Color Stability:

LED color temperature is warrantied to shift no more than 200K in CCT over a 5 year period

Color Uniformity:

RAB's range of CCT (Correlated Color Temperature) follows the guidelines of the American National Standard for Specifications for the Chromaticity of Solid State Lighting (SSL) Products, ANSI C78.377-2017.

Construction

IP Rating:

Ingress Protection rating of IP66 for dust and water

Finish:

Formulated for high-durability and long lasting color

Ambient Temperature:

Suitable For use in 40°C (104°F)

Cold Weather Starting:

Minimum starting temperature is -40°C (-40°F)

Green Technology:

Mercury and UV-free. RoHS compliant components.

Electrical

Driver:

Multi-chip 26W high output long life LED Driver Constant Current, 720mA, Class 2, 6kV Surge Protection, 100V-277V, 50-60 Hz, 100-240V.4 Amps.

THD:

11.91% at 120V, 9.58% at 277V

Power Factor:

99.1% at 120V, 93.1% at 277V

Other

Patents:

The WPLED design is protected by U.S. Pat. D634878, Canada Pat 134878, China Pat. CN301649064S.

Equivalency:

Equivalent to 175W Metal Halide

Buy American Act Compliance:

RAB values USA manufacturing! Upon request, RAB may be able to manufacture this product to be compliant with the Buy American Act (BAA). Please contact customer service to request a quote for the product to be made BAA compliant.

Optical

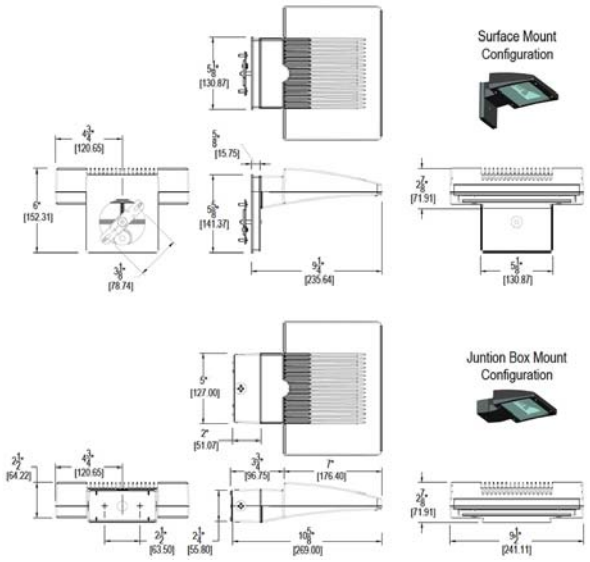
BUG Rating:

B1 U0 G0

WPLED26

RAB | Outdoor

Dimensions



Features

- Maintains 70% of initial lumens at 100,000 hours
- Weatherproof high temperature silicone gaskets
- Superior heat sinking with die cast aluminum housing and external fins
- 100 up to 277 Volts
- 5-year warranty

WPTLED12/D10/PC2

High performance LED tallpack. Covers footprint of most HID Tallpacks. Vandal resistant lens. Precision die-cast aluminum. 0-10V dimmable driver with 120-277V photocell.

Color: Bronze

Weight: 6.5 lbs

Project:	Type:
Prepared By:	Date:

Driver Info

Type:	Constant Current
120V:	0.108A
208V:	0.068A
240V:	0.059A
277V:	0.053A
Input Watts:	13W
Efficiency:	89%

LED Info

Watts:	12W
Color Temp:	5000K
Color Accuracy:	74 CRI
L70 Lifespan:	100000
Lumens:	1371
Efficacy:	102 LPW

Technical Specifications

Listings

UL Listing:

Suitable for wet locations. Wall mount only.

IESNA LM-79 & LM-80 Testing:

RAB LED luminaries have been tested by an independent laboratory in accordance with IESNA LM-79 and LM-80, and have been received the Department of Energy "Lighting Facts" label.

LED Characteristics

Lifespan:

100,000-hour LED lifespan based on IES LM-80 results and TM-21 calculations.

LEDs:

Long-life, high-efficiency surface mounting LEDs

Color Stability:

LED color temperature is warrantied to shift no more than 200K in CCT over a 5 year period.

Color Uniformity:

RAB's range of CCT (Correlated Color Temperature) follows the guidelines of the American National Standard for Specifications for the Chromaticity of Solid State Lighting (SSL) Products, ANSI C78.377-2017.

Electrical

Drivers:

Constant Current, Class 2, 300mA, 100-277V, 50-60Hz, 120V: 0.108A, 208V: 0.068A, 240V: 0.059A, 277V: 0.053A, Surge Protection: 6kV

Power Factor:

98.6% at 120V, 90.8% at 277V

THD:

13.6% at 120V, 14.4% at 277V

Dimming Driver:

0-10V dimming driver standard for ultimate flexibility. Use as on/off or utilize the 0-10V DC dimming circuit for controls.

Photocell:

Photocell is rated for 120V thru 277V. To disable, simply use the provide silicone rubber cap and cover.

Optical

BUG Rating:

B0 U3 G2

Construction

Ambient Temperature:

Suitable for -40°C (-40°F) to 40°C (104°F) ambient temperatures

Cold Weather Starting:

Minimum starting temperature is -40°C (-40°F)

Thermal Management:

Superior thermal management with die-cast aluminum heatsink

Housing:

Precision die-cast aluminum.

Refractor Lens:

High-impact, diffuse, UV-stabilized polycarbonate

Mounting:

Three (3) 1/2" NPS conduit entry points (2 sides for through-feed, and bottom), and drilling template for easy wall box mounting.

Reflector:

High-gloss white aluminum.

Gaskets:

High-temperature silicone gaskets

Finish:

Formulated for high-durability and long lasting color.

Green Technology:

Mercury and UV free. RoHS compliant components. Polyester powder coat finish formulated without the use of VOC or toxic heavy metals.

Other

Equivalency:

Equivalent to 50W Metal Halide/35W HPS.

Warranty:

RAB warrants that our LED products will be free from defects in materials and workmanship for a period of five (5) years from the date of delivery to the end user, including coverage of light output, color stability, driver performance and fixture finish.

Patents:

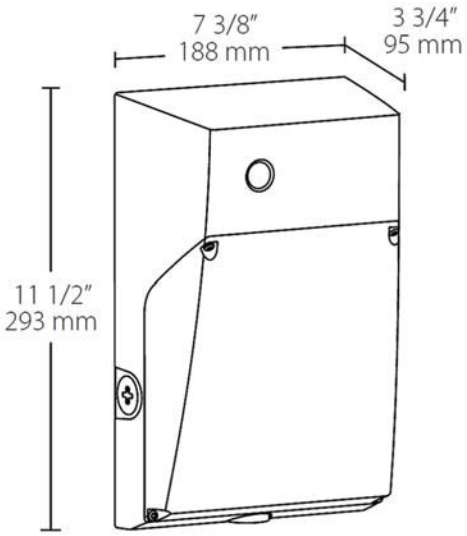
The design of WPTLED is protected by patents pending in US, Canada, China, Taiwan and Mexico.

Buy American Act Compliance:

RAB values USA manufacturing! Upon request, RAB may be able to manufacture this product to be compliant with the Buy American Act (BAA). Please contact customer service to request a quote for the product to be made BAA compliant.

WPTLED12/D10/PC2

Dimensions



Features

- Covers footprints of most HID tallpacks
- 0-10V dimmable driver & 120 - 277V photocell
- Vandal-resistant lens
- 100,000-Hour LED lifespan

Ordering Matrix

Family	Wattage	Color Temp	Finish	Dimming	Photocell
WPTLED	12			/D10	/PC2
	12 = 12W **25** = 25W **40** = 40W	**Blank** = 5000K (Cool) **Y** = 3000K (Warm) **N** = 4000K (Neutral)	**Blank** = Bronze **W** = White	**/D10** = Dimmable	**/PC2** = 120-277V Photocell

SLI M2 6Proi e

High output 26W LED yardblaster delivers enough light to hit the broad side of a barn. Replaces 175W mercury vapor and 150W HPS barn lights. Durable finish withstands harsh environments.

Color: Silver gray

Weight: 6.9 lbs

oct :Typa	ed Ta
ocT BcTD L da	2 BpTa

2 cvnTc fElt

Type:	Constant Current
120V:	0.25A
208V:	0.16A
240V:	0.14A
277V:	0.12A
Input Watts:	28W
Efficiency:	93%

I M2 fElt

Watts:	26W
Color Temp:	5000K
Color Accuracy:	67 CRI
L70 Lifespan:	100000
Lumens:	2689
Efficacy:	96 LPW

eTyI EvyBsg TyvhyBpt EU

MsTypcvyBs

oI t pt yTssa

120-277V twistlock photocell included. Photocell is compatible with 120-277V.

2 cvnTca

Constant Current, 120V, 50/60 Hz, 700mA, 120V: 0.6A

ot A Tc CBypt ca

99.3% at 120V, 92.5% at 277V

em2 a

7.0% at 120V, 10.0% at 277V

gNc- T oct pTypt Ea

2kV

I vUpE- U

7 I I vUpE- a

Suitable for wet locations

fMg 9 & I 8 0uR x I 8 0bH eTUpE- a

RAB LED luminaires have been tested by an independent laboratory in accordance with IESNA LM-79 and LM-80, and have received the Department of Energy "Lighting Facts" label.

I M2 j I BcBypTcvUpyU

I M2 Ua

Multi-chip, high-output, long-life LED

I vhTU BEa

100,000-hour LED lifespan based on IES LM-80 results and TM-21 calculations

j t st c gpBGvspda

LED color temperature is warrantied to shift no more than 200K in CCT over a 5 year period.

j t st c 7 Evt ck vpda

RAB's range of CCT (Correlated Color Temperature) follows the guidelines of the American National Standard for Specifications for the Chromaticity of Solid State Lighting (SSL) Products, ANSI C78.377-2017.

j t EUpcNypt E

j t sD F TBpI Tc gpBcpE- a

Minimum starting temperature is -40°C (-40°F)

mt NUE- a

Precision die-cast aluminum housing and arm

8 t NEpE- a

Mounts on wall or existing arm/pole YARM24 (1 5/8" diameter pipe).

MHhTypnT oct :TypTD &cTBa

EPA = 0.3

wTyt k k TEDTD 8 t NEpE- mTv- I pa

15 ft.

I TEUa

High-impact, frosted polycarbonate lens

wThsTypt ca

High-reflectance white paint

OBU(TpUa

High-temperature silicone

CvEvUI a

Our environmentally friendly polyester powder coatings are formulated for high-durability and long-lasting color.

OcTTE eTyI Et st - da

Mercury and UV free. RoHS compliant components. Polyester powder coat finish formulated without the use of VOC or toxic heavy metals.

) pI Tc

oBpTEpUa

The design of YBLED26 is protected by patents pending in US, Canada, China, Taiwan and Mexico.

F BccBEpda

RAB warrants that our LED products will be free from defects in materials and workmanship for a period of five (5) years from the date of delivery to the end user, including coverage of light output, color stability, driver performance and fixture finish.

wT sByTk TEpa

Replaces 175W mercury vapor and 150W HPS.

L Nd &k TcvyBE &ypj t k svBEyTa

RAB values USA manufacturing! Upon request, RAB may be able to manufacture this product to be compliant with the Buy American Act (BAA). Please contact customer service to request a quote for the product to be made BAA compliant.

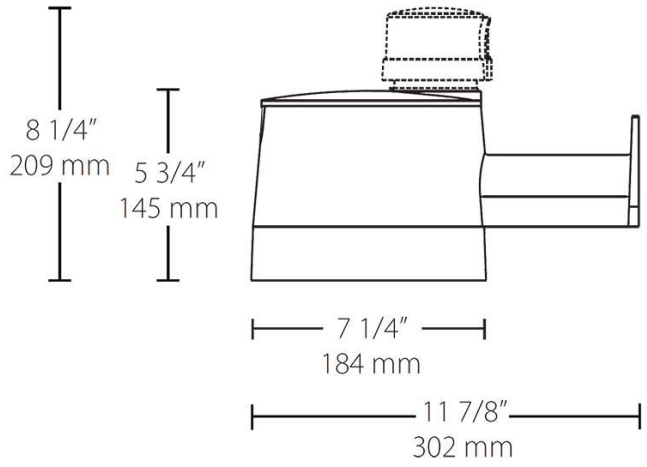
) pvyBs

L 7 O wBpE- a

B1 U2 G1

SLIM26Projecte

2vk TEUvt EU



CTBpNcTU

- Replaces 175W mercury vapor and 150W HPS barn lights
- Widespread light distribution illuminates large areas
- Vandal-resistant
- High-impact polycarbonate lens
- Rugged die-cast aluminum housing withstands harsh environments
- Integrated dusk to dawn photocell
- 100,000-hour LED lifespan

) cDTcvE- 8 Bpcv

CBk vsd	F BqpB- T	j t st ceTk	8 t NEpvE-	) pt EU
YBLED	26			/PCT
	6P = 26W	**LsBE(** = 5000K (Cool) **S** = 3000K (Warm) **9** = 4000K (Neutral)	**LsBE(** = Wall **r&w8** = Arm	**LsBE(** = No Option **roje** = 120-277V Twistlock

YBLED40/ARM/PCT

RAB | Outdoor

High output LED yardblaster delivers enough light to hit the broad side of a barn. Durable finish withstands harsh environments.

Color: Silver gray

Weight: 12.8 lbs

Project:	Type:
Prepared By:	**Date:**

Driver Info		LED Info	
Type:	Constant Current	Watts:	40W
120V:	0.4A	Color Temp:	5000K (Cool)
208V:	0.217A	Color Accuracy:	70 CRI
240V:	0.188A	L70 Lifespan:	100,000
277V:	0.17A	Lumens:	5,539
Input Watts:	42W	Efficacy:	132 LPW
Efficiency:	95%		

Technical Specifications

Listings

UL Listing:

Suitable for dry and wet locations

DLC Listed:

This product is listed by Design Lights Consortium (DLC) as an ultra-efficient premium product that qualifies for the highest tier of rebates from DLC Member Utilities.
DLC Product Code: PDCEWIL1

IESNA LM-79 & LM-80 Testing:

RAB LED luminaires and LED components have been tested by an independent laboratory in accordance with IESNA LM-79 and LM-80.

Electrical

Driver:

Constant Current, Class 2, 120V-277V, 50/60 Hz, 1100mA, 120V: 0.4A, 208V: 0.217A, 240V: 0.188A, 277V: 0.17A

Dimming Driver:

Driver includes dimming control wiring for 0-10V dimming systems. Requires separate 0-10V DC dimming circuit. Dims as low as 10%.

THD:

6% at 120V, 8.6% at 277V

Power Factor:

99.7% at 120V, 88.9% at 277V

Surge Protection:

4 kV Line-Line, 6 kV Line-Earth

Photocell:

120-277V twistlock photocell included. Photocell is compatible with 120-277V.

LED Characteristics

LEDs:

Long-life, high-efficiency, surface mount LEDs

Lifespan:

100,000-hour LED lifespan based on IES LM-80 results and TM-21 calculations

Color Stability:

LED color temperature is warrantied to shift no more than 200K in CCT over a 5 year period

Color Uniformity:

RAB's range of CCT (Correlated Color Temperature) follows the guidelines of the American National Standard for Specifications for the Chromaticity of Solid State Lighting (SSL) Products, ANSI C78.377-2017.

Construction

IP Rating:

Ingress Protection rating of IP66 for dust and water

IES Classification:

The Type V distribution produces light in a wide and uniform 360° pattern that is perfect for large outdoor areas such as parking lots, corporate parks and retail settings

Cold Weather Starting:

Minimum starting temperature is -40°C (-40°F)

Housing:

Precision die-cast aluminum housing and arm

Mounting:

Mounts on pole

Reflector:

High-reflectance white paint

Lens:

Flat polycarbonate lens

Gaskets:

High-temperature silicone

Finish:

Formulated for high-durability and long lasting color

Green Technology:

Mercury and UV-free. RoHS compliant components.

Optical

BUG Rating:

B2 U3 G2

Other

Patents:

The design of YBLED26 is protected by patents pending in US, Canada, China, Taiwan and Mexico

Warranty:

RAB warrants that our LED products will be free from defects in materials and workmanship for a period of five (5) years from the date of delivery to the end user, including coverage of light output, color stability, driver performance and fixture finish. RAB's warranty is subject to all terms and conditions found at

YBLED40/ARM/PCT

RAB | Outdoor

Technical Specifications (continued)

Other

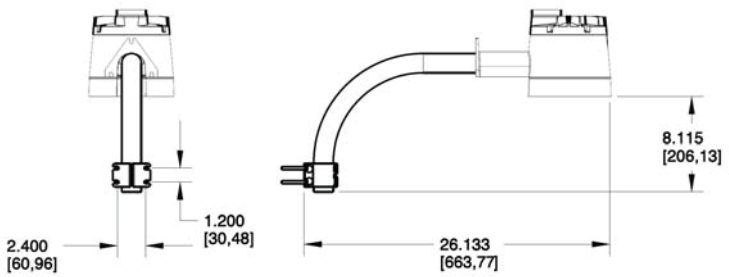
Equivalency:

Equivalent to 175 HPS

Buy American Act Compliance:

RAB values USA manufacturing! Upon request, RAB may be able to manufacture this product to be compliant with the Buy American Act (BAA). Please contact customer service to request a quote for the product to be made BAA compliant.

Dimensions



Features

- Widespread light distribution illuminates large areas
- Vandal-resistant
- High-impact polycarbonate lens
- Rugged die-cast aluminum housing withstands harsh environments
- Integrated dusk to dawn photocell
- 100,000-hour LED lifespan

Ordering Matrix

Family	Wattage	Color Temp	Mounting	Dimming	Options
YBLED	40	^	/ARM	^	/PCT
	26 = 26W **40** = 40W **60** = 60W	**Blank** = 5000K (Cool) **Y** = 3000K (Warm) **N** = 4000K (Neutral)	**Blank** = Wall **/ARM** = Arm	**Blank** = No Dimming **/D10** = 0-10V Dimming	**Blank** = Button Photocell **/PCU** = Standard Button Photocell **/PCT** = Twistlock Photocell **/5PR** = 5-Pin Receptacle **/LC** = Lightcloud® Controller

E-Saver 2016-R™

OPTIMIZED FOR RETROFIT APPLICATIONS

E-Saver 2016-R maximizes energy savings and provides the fastest payback when supplying a combination of light loading and electronic equipment, a load profile documented to be widespread in most building types. E-Saver 2016-R often reduces losses by over 70% compared to the transformer being replaced.

E-Saver 2016-R is k-rated per UL1561 and is cULus Listed and CSA Efficiency Verified for this nonlinear load profile to be compatible with the type of loads fed by most low voltage transformers today, and has been designed and tested to maintain higher efficiency and lower losses in this environment.

RETROFIT BEST PRACTICE

Replacing existing transformers cost effectively requires a multi-step best practice for the project cycle, including gathering detailed site data, field measurement of loading, losses and efficiency, a flexible design and manufacturing process that removes the many barriers associated with replacing an existing transformer, including footprint, impedance, internal terminal layout, inrush, fault and arc flash levels, as well as a measurement and verification report.

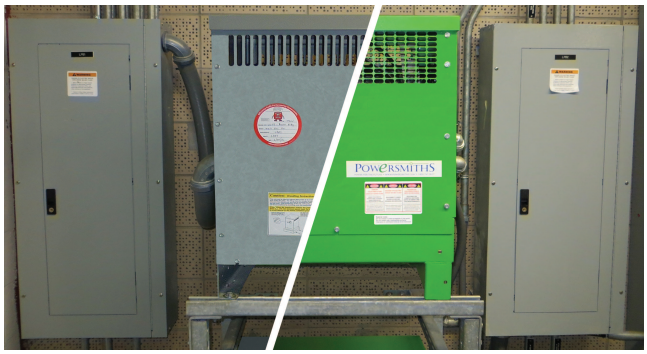
A broad selection of transformer kVA sizes enables Powersmiths retrofits to provide the best balance between installed cost, energy savings, and available capacity.

SUSTAINABILITY/GREEN BUILDING CONTRIBUTIONS

E-Saver 2016-R contributes to green building programs and carbon footprint reduction mainly through its substantial reduction in energy losses compared to legislation. Additional sustainability benefits include our ISO 14001 certified manufacturing, biodegradable packaging, optional integrated metering and ability to integrate with the Powersmiths WOW™ Sustainability Management Platform.

WARRANTY

E-Saver 2016-R has an industry leading 25-year pro-rated warranty.



45 kVA E-Saver 2016-R shown replacing an existing 45 kVA transformer. The E-Saver 2016-R was configured to fit within existing physical and electrical constraints to embed significant energy savings, reduce installation costs, and support a smooth and effective retrofit

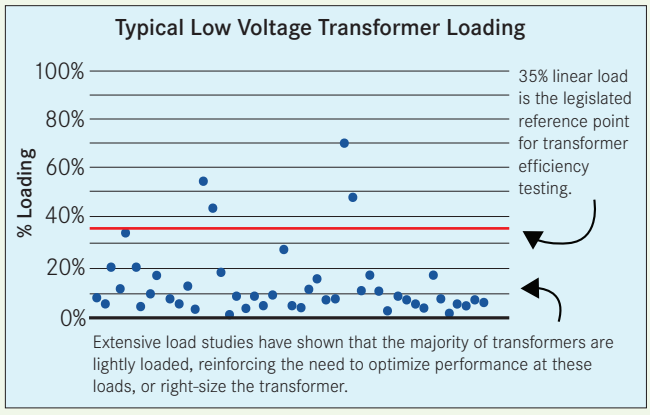
CERTIFICATIONS & TESTING

Powersmiths' certifications include UL and CSA, ISO 9001 (Quality), ISO 14001 (Environment), and our ISO 17025 Certified Efficiency Test Lab Measurement and Verification (M&V) Program enables apples-to-apples comparison of the new unit with the baseline measurements by repeating tests under an equivalent load profile and load current THD profile.

When tested according to the U.S. DOE 10 CFR Part 431, a linear load test at 35% of nameplate capacity, E-Saver 2016-R delivers on average 33% less losses than current legislation. Significantly higher savings are embedded once the E-Saver-2016-R is installed, since real world load conditions significantly lower the performance of industry standard transformers as these are not optimized for the light yet nonlinear load profile found in most applications.

INTEGRATED OPTIONS

Powersmiths offers many options, all with arc flash safety in mind, such as integrated metering and meter ports to provide information about capacity utilization, load profiles, power and energy use, lockable hinged doors, and a patented Rotatable IR Port™ to enable safe, quick, cost-effective and non-invasive thermal imaging of the live transformer.



KEY FEATURES

- Optimized for light, nonlinear load found in most applications
- Footprint, impedance, internal terminal layout, inrush, fault and arc flash levels adjusted to meet requirements
- Reduce associated transformer cooling costs
- Best practice ensures a smooth retrofit with verified savings
- Performance exceeds NEMA Premium®, CEE Tier 1, U.S. DOE 2016 legislation[1] and CSL-3
- K-rated as required by UL for today's electronic equipment
- Manufactured in a certified ISO 9001, ISO 14001 and ISO 17025 facility for quality, low environmental impact, and transformer efficiency testing

[1] U.S. Department of Energy, 10 CFR Part 431: Energy Conservation Program: Energy Conservation Standards for Distribution Transformers; Final Rule, April 2013.

TECHNICAL SPECIFICATIONS

E-Saver 2016-R is an aluminum-wound dry-type isolation transformer with a common-core, 10kV BIL, 200% rated neutral, built to NEMA ST-20, UL1561 and other applicable ANSI and IEEE standards, and is cULus Listed and CSA Efficiency Verified. All E-Saver™ models come standard in a NEMA 1 ventilated drip-proof indoor enclosure made of heavy gauge steel finished with epoxy powder coating for durability and low environmental impact with a wide variety of enclosures and options available. Both primary and secondary terminals and voltage taps (typically six 2.5%) are readily accessible by removing the front enclosure panel. E-Saver 2016-R is UL Listed for 2" clearance for ventilated openings - a significant improvement over the typical industry 6" limit, and especially important in retrofits. E-Saver 2016-R's 220°C class insulation system is NOMEX-based with an Epoxy Co-polymer impregnant with technical performance characteristics that embed lower environmental impact, long term reliability and long life expectancy. E-Saver 2016-R comes standard with 60Hz, K-4 rating, 130°C temperature rise, and carries OSHPD and IBC Seismic Certification (S_{DS}=1.5g)*. The seismic bracing option provides a higher 2.28g. E-Saver 2016-R is available in three-phase and single-phase configurations.

When tested according to the U.S. Dept. of Energy's 10 CFR Part 431, a linear load test at 35% of nameplate capacity, E-Saver 2016-R delivers on average 33% less losses, over the kVA size range, than current EPAct 2005 legislation/NEMA TP1/C802.2, and exceeds the performance requirements of U.S. DOE CSL-3, NEMA Premium®, and the new, more stringent U.S. DOE 2016 legislation[1]. E-Saver 2016-R also meets or exceeds the Consortium for Energy Efficiency CEE Tier 1 efficiency for the full kVA range.

Designs have been carefully optimized to address primary breaker inrush characteristics and manage secondary short circuit currents and arc flash levels.

Keeping noise at a minimum is key. Every Powersmiths E-Saver 2016-R is tested for noise prior to shipment ensuring each one meets NEMA ST-20. An even lower noise option is available for very sensitive environments.

ORDERING INFORMATION

kVA: Rating of unit (9-1000 kVA)
PV: Primary voltage (up to 600V)
SV: Secondary voltage (up to 347/600V)

PRODUCT & MODEL INFORMATION

E-SAVER 2016-R model no. format:
E-SAVER-E3L-KVA-PV-SV

TECHNICAL DATA

kVA	Efficiency (%)	Impedance (%Z)	Weight (lbs)	Standard Case Size (in)	Alternate Smaller Case Size (in)
15	97.90	3.0-6.0	220-270	A (18W x 17D x 27H)	17.4W x 14.5D x 25H
20	98.02	3.0-6.0	260-310	B (26W x 18D x 30H)	23W x 15.5D x 27.5H
25	98.13	3.0-6.0	300-350	B (26W x 18D x 30H)	23W x 15.5D x 27.5H
30	98.25	3.0-6.0	340-380	B (26W x 18D x 30H)	23W x 15.5D x 27.5H
45	98.40	3.0-6.0	400-440	B (26W x 18D x 30H)	25W x 16D x 29H
50	98.43	3.0-6.0	450-500	C (32W x 22D x 40H)	26.5W x 17D x 33H
63	98.52	3.0-6.0	500-550	C (32W x 22D x 40H)	26.5W x 17D x 33H
75	98.60	3.0-6.0	600-650	C (32W x 22D x 40H)	26.5W x 17D x 33H
100	98.70	3.0-6.0	675-725	C (32W x 22D x 40H)	30.5W x 20D x 33H
112.5	98.80	3.0-6.0	750-850	C (32W x 22D x 40H)	30.5W x 20D x 33H
125	98.83	3.0-6.0	875-975	D (38W x 27D x 48H)	33W x 22.5D x 38H
150	98.90	3.0-6.0	1000-1100	D (38W x 27D x 48H)	33W x 22.5D x 38H
175	98.92	3.0-6.0	1100-1200	D (38W x 27D x 48H)	34.5W x 24D x 42H
200	98.93	3.0-6.0	1175-1275	D (38W x 27D x 48H)	34.5W x 24D x 42H
225	98.95	3.0-6.0	1275-1375	D+ (38W x 32D x 52H)	34.5W x 24D x 42H
250	98.97	3.0-6.0	1400-1500	D+ (38W x 32D x 52H)	37W x 26D x 43H
300	99.02	3.0-6.0	1575-1675	D+ (38W x 32D x 52H)	37W x 26D x 43H
400	99.08	3.0-6.0	2025-2125	E+ (52W x 38D x 61H)	43W x 33D x 51H
450	99.11	3.0-6.0	2200-2300	E+ (52W x 38D x 61H)	43W x 33D x 51H
500	99.14	3.0-6.0	2475-2575	E+ (52W x 38D x 61H)	43W x 33D x 51H
600	99.18	3.0-6.0	2725-2825	F (64W x 47D x 67H)	51.4W x 37.5D x 60.6H
750	99.23	3.0-6.0	3200-3300	F (64W x 47D x 67H)	51.4W x 37.5D x 60.6H
850	99.26	3.0-6.0	3600-3800	F+ (64W x 53D x 67H)	Custom
1000	99.30	3.0-6.0	4200-4400	F+ (64W x 53D x 67H)	Custom

NOTE: The above data applies to the standard 3-phase configuration of each kVA. Selection of some options may change enclosure size and/or transformer weight. Consult factory for detailed product data sheet for these and other configurations. Efficiencies tested according to U.S. Dept. of Energy's 10 CFR Part 431, a linear load test at 35% of nameplate capacity.

AVAILABLE OPTIONS

Metering: Express Logger™, SMART™ or Cyberhawk TX™ (See product cut sheets for more info)
TLP: Twist lock port to access output voltage & CTs
N3R: NEMA 3R, ventilated enclosure
N2S: Indoor sprinkler proof enclosure
OSEC: Enclosure for outdoor public areas
OV: Enclosure for outdoor secure areas
SS: Painted stainless steel enclosure
NVI: Non-ventilated indoor enclosure
IRP: Rotatable IR Port™
HD: Hinged Door
F50: 50 Hz design
1S: Single electrostatic shield
2S: Dual electrostatic shields
3S: Triple electrostatic shields
SPD: (120/208 V OR 277/480V)
- **PRO80:** 80kA, 7 mode, Filter
- **PRO120:** 120kA, 7 mode, Filter
- **PRO200:** 200kA, 7 mode, Filter
- **PRO240:** 240kA, 7 mode Filter
- **PROXX:** Where XX is custom ID

LKS: Lug kit, screw-type
LKC: Lug kit, compression type
LI: Low inrush
COL: Custom color
TS: Thermal sensors at 170°C and 200°C
NLT: Nonlinear load test
SE: Sensitive environment, extra low noise
SB: Seismic bracing
**For Seismic certification details contact Powersmiths*
Wall-mount kit is available and sold separately

POWERSMITHS

POWERSMITHS INTERNATIONAL CORP. 10 Devon Road, Brampton, Ontario L6T 5B5 Canada
Phone: (905) 791-1493 Toll-free: (800) 747-9627 Fax: (905) 791-8870 Email: info@powersmiths.com
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Low voltage AC drives

ABB industry specific drives
ACQ810
0.37 to 500 kW
Catalog

Power and productivity
for a better world™

The intelligent choice for water and wastewater applications

Real time clock
Setup real time related functions for system control based on time-of-day variable demand.

Embedded modbus
Utilize the most common communication protocol in the water industry right out of the box.

Side-by-side mounting
A compact, narrow module design allows for cabinet mounting including DIN rail mounts on smaller frame sizes.

Remote monitoring
With a built-in web server, SREA-01 enables worldwide access to drives.

Removable memory unit
Download and upload parameters to a number of drives on startups, installations, and trouble-shooting.

Whether your system requires redundancy in multi-pump applications or built-in macros designed for the water and wastewater markets, the ACQ810 will surpass your requirements.

Startup and maintenance tools
DriveStudio and the DriveSPC programming tool for startup, configuration, daily use and process tuning of the drive to application requirements.

Flexible product configurations
Drives are built to order with a wide range of options such as EMC filters.

Communication with all major automation networks
Fieldbus adapters enable connectivity with all major automation networks.

Extended connectivity
In addition to the standard interfaces the drive has a built-in slot for additional input/output extension modules.

Commercial Gas Water Heater

CYCLONE® Xi

MODELS BTX AND BTXL 100
96% THERMAL EFFICIENT POWER DIRECT VENT MODELS.

The Cyclone® Xi is a light-duty, power direct vent, fully condensing commercial gas water heater with an internal helical heat exchanger. This helical heat exchanger helps Cyclone® Xi achieve 96% thermal efficiency and deliver outstanding hot water output.

ADVANCED ELECTRONIC CONTROL

- Large LCD display.
- Temperature control up to 181°F.
- Advanced diagnostics.
- iCOMM™ Compatible and can be monitored from remote locations. Call 1.888.WATER02 for more information.

ENERGY STAR® QUALIFIED

HELICAL INTERNAL HEAT EXCHANGER

- Spiral heat exchanger keeps hot combustion gases in the tank longer to lengthen the heat transfer cycle.
- Positioned in the center of the tank for more even heat distribution.
- Operates at 96% thermal efficiency, which saves money on operating costs compared to a standard 80% efficient gas water heater.

POWER DIRECT VENT DESIGN

- Combined vertical and horizontal runs terminating through the roof or an outside wall. Vents using PVC, CPVC or polypropylene piping. Canadian installations require ULC S636 approved pipe for venting.
- 2" pipe, vents up to 45 equivalent feet.
- 3" pipe, vents up to 125 equivalent feet.

CONDENSING DESIGN

- 96% efficient condensing design.
- Equipped with condensate drain tee.

SIDE-MOUNTED HOT AND COLD RECIRCULATING TAPS

- Allows Cyclone® Xi to be installed as part of combination space heating/water heating applications.

COREGARD™ ANODE ROD

- Our anode rods have a stainless steel core that extends the life of the anode rod allowing superior tank protection far longer than standard anode rods.

BLUE DIAMOND® GLASS COATING

- Provides superior corrosion resistance compared to industry-standard glasslining.

TOP FIRED ULTRA-LOW NOx GAS BURNER

- Enhanced Ultra-low NOx burner complies with SCAQMD Rule 1146.2 and other Air Quality Management Districts with similar requirements for NOx emissions of less than 14 ng/J or 20 ppm.

AVAILABLE IN NATURAL GAS OR PROPANE

MAXIMUM HYDROSTATIC WORKING PRESSURE: 150 PSI

STANDARDS AND CERTIFICATIONS

- Design-certified by CSA International according to ANSI Z21.10.3 - CSA 4.3 Standards.
- These models meet the thermal efficiency and standby loss requirements of the U.S. Department of Energy and current edition ASHRAE/IES 90.1.
- CSA certified and ASME rated T&P relief valve.
- Approved for Canada.

3-YEAR LIMITED TANK AND 1 YEAR LIMITED PARTS WARRANTY

- For complete warranty information, consult written warranty or go to hotwater.com.

BTX 100

BTXL 100

ENERGY STAR

CLASSIFIED UL WATER QUALITY

DESIGN CERTIFIED

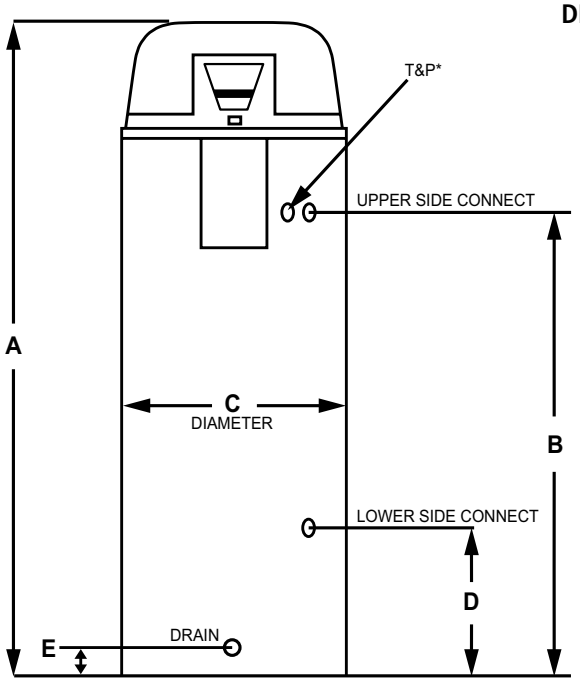
Low Lead Content

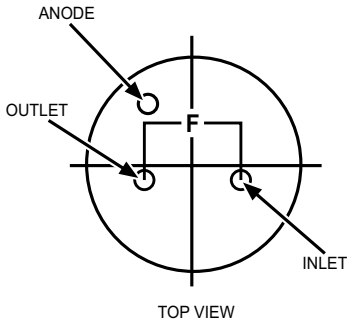
CERTIFIED

AHRI CERTIFIED®
www.ahridirectory.org

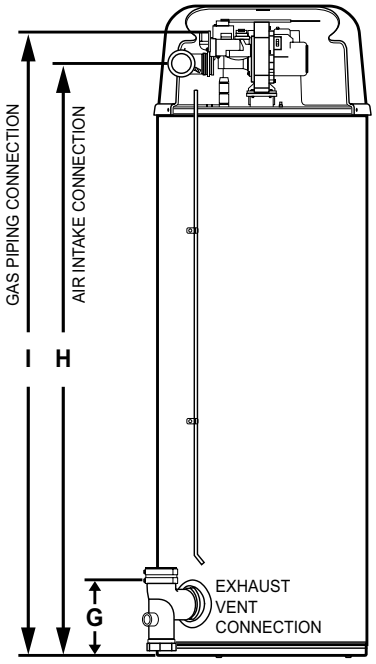
Commercial Gas Water Heater

DIMENSIONS FOR BTX-100





*INSTALL IN ACCORDANCE WITH LOCAL CODES.



ROUGH-IN DIMENSIONS

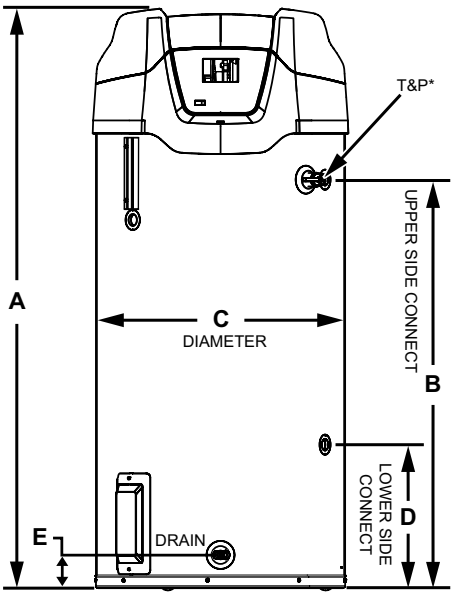
Model Number	Approximate Capacity		Units	A	B	C	D	E	F	G	H	I
	U.S. Gals.	Liters										
BTX-100	50	189	Inches	66.75	49.25	22	15.75	3	8	8	62	65
			cm	169.5	125.09	55.88	40	7.62	20.32	20.32	157.48	165.1

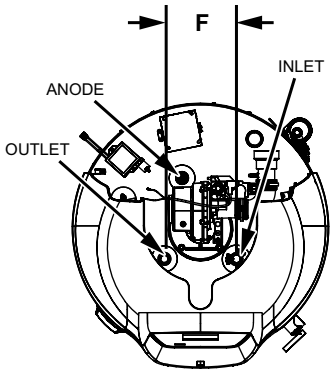
Specify when ordering propane (LP) gas.
Standard model certified from sea level to 10,100 ft. elevation.
Optional Concentric Vent Kit (9006328005) and Condensate Neutralization Kit (9007959005).
Top Inlet and Outlet: 3/4" NPT
Side Inlet and Outlet: 3/4" NPT
Gas Inlet: 1/2" NPT
Condensate drain outlet: 1/2" NPT
Electrical Characteristics: 120V 60Hz <5 amps
The manifold pressure is factory set and is not adjustable. A negative pressure will be seen with just the blower running without the Gas Control Valve open.
All models - Maximum Supply Pressure: 14 inches W.C. (3.48kPa)
Minimum Supply Pressure for Natural Gas: 3.50" (.87kPa)
Minimum Supply Pressure for Propane Gas: 8.00" (1.99kPa)
Minimum pressure must be maintained under both load and no load (dynamic and static) conditions.

www.hotwater.com | 800-527-1953 Toll-Free USA | A. O. Smith Corporation | 500 Tennessee Waltz Parkway | Ashland City, TN 37015

Commercial Gas Water Heater

DIMENSIONS FOR BTXL-100





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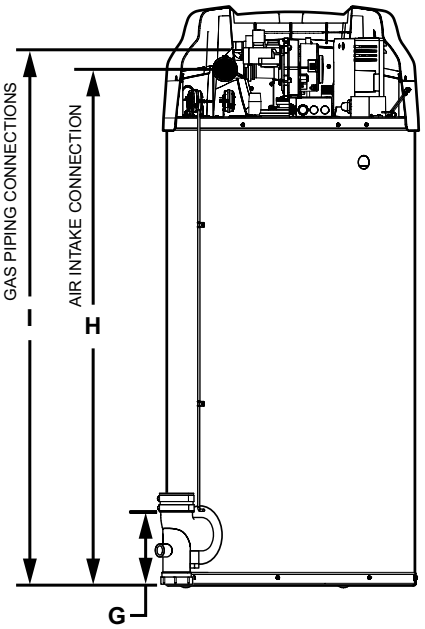

ROUGH-IN DIMENSIONS

Model Number	Approximate Capacity		Units	A	B	C	D	E	F	G	H	I
	U.S. Gals.	Liters										
BTXL-100	75	284	Inches	65.25	45.64	27.75	16	3.71	8	7.93	57.36	58.98
			cm	165.7	115.9	70.5	40.6	9.4	20.32	20.1	145.7	149.8

Specify when ordering propane (LP) gas.
Standard model certified from sea level to 10,100 ft. elevation.
Optional Concentric Vent Kit (9006328005) and Condensate Neutralization Kit (9007959005).
Top Inlet and Outlet: 1" NPT
Side Inlet and Outlet: 1" NPT
Gas Inlet: 1/2" NPT
Condensate drain outlet: 1/2" NPT
Electrical Characteristics: 120V 60Hz <5 amps
The manifold pressure is factory set and is not adjustable. A negative pressure will be seen with just the blower running without the Gas Control Valve open.
All models - Maximum Supply Pressure: 14 inches W.C. (3.48kPa)
Minimum Supply Pressure for Natural Gas: 3.50" (.87kPa)
Minimum Supply Pressure for Propane Gas: 8.00" (1.99kPa)
Minimum pressure must be maintained under both load and no load (dynamic and static) conditions.

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Commercial Gas Water Heater

RECOVERY CAPACITIES - BTX AND BTXL

Input		Recovery Capacities													
Rating (Btu/hr)	Rating (Kw)	Temp Rise	F	30	40	50	60	70	80	90	100	110	120	130	140
			C	17	22	28	33	39	44	50	56	61	67	72	78
		GPH		387	291	233	194	166	145	129	115	106	97	90	83
100,000	**29.3**	LPH		1465	1102	882	734	628	549	488	439	401	367	341	314

MAXIMUM VENTING DISTANCE - BTX AND BTXL

Number of 90° Elbows	2" Maximum Pipe-ft. (m)	3" Maximum Pipe-ft. (m)
1	40 (12.19)	120 (36.57)
2	35 (10.66)	115 (35.05)
3	30 (9.14)	110 (33.52)
4	25 (7.62)	105 (32)
5	20 (6.09)	100 (30.48)
6	15 (4.57)	95 (28.95)

Note: See the Instruction Manual for the most current and detailed venting information.

SUGGESTED SPECIFICATION

(Natural or Propane) gas water heater(s) shall be A. O. Smith Cyclone Xi model with 96% thermal efficiency with storage capacity _____; an input rating of 100,000 BTUs per hour, a recovery rating of 116 gallons per hour at 100ºF rise and a maximum hydrostatic working pressure of 150 psi. Water heater(s) shall be of power direct vent design, using 2" or 3" PVC, CPVC, or polypropylene pipe for horizontal and/or vertical vent runs. Water heater(s) shall have: 1: Steel tank construction with seamless glass lining and a spiral-shaped heat exchanger placed entirely inside the tank, which shall be glasslined on the flue gas side to protect against acidic condensate. 2: Advanced electronic control w/ LCD display and actual diagnostic. 3: A 3-year limited warranty against tank leaks. Water heater(s) shall meet the thermal efficiency and standby loss requirements of the U.S. Department of Energy and current edition of ASHRAE/IESNA 90.1 and be design-certified by UL (Underwriters Laboratories) according to ANSI Z21.10.3-CSA 4.3 standards governing storage tank water heaters. Water heater should incorporate the iCOMM™ system connection for remote monitoring, leak detection and fault alert.

For Technical Information, call 800-527-1953. A. O. Smith Corporation reserves the right to make product changes or improvements without prior notice.

www.hotwater.com | 800-527-1953 Toll-Free USA | A. O. Smith Corporation | 500 Tennessee Waltz Parkway | Ashland City, TN 37015

HIGH EFFICIENCY COMMERCIAL CONDENSING BOILERS

KNIGHT® COMMERCIAL BOILER XL

5 MODELS FROM 399,000 TO 800,000 BTU/HR

94% THERMAL EFFICIENCY

5:1 TURNDOWN RATIO

STAINLESS STEEL WATERTUBE HEAT EXCHANGER

Lochinvar SMART SYSTEM™
W/CASCADING SEQUENCER

CONXUS®
REMOTE CONNECT CAPABLE

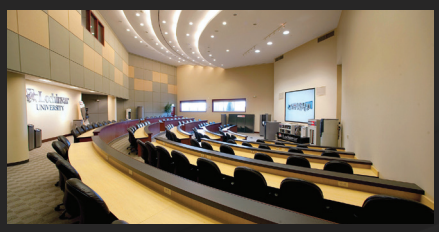
A SMART CHOICE FOR CONDENSING BOILER PERFORMANCE

DESIGNED ★ ENGINEERED ★ ASSEMBLED USA

Lochinvar®

THE LOCHINVAR DIFFERENCE

BROADEST LINE OF WATER HEATING SOLUTIONS IN THE INDUSTRY



INDUSTRY-LEADING TRAINING ON CAMPUS AND ONLINE AT LOCHINVARU.COM

A WORLD-CLASS RESEARCH & DEVELOPMENT DEPARTMENT THAT CONTINUOUSLY INTRODUCES NEW AND INNOVATIVE TECHNOLOGY

A COMMITMENT TO IN-DEPTH SERVICE BEFORE, DURING AND AFTER EVERY SALE

NO ONE BRINGS IT ALL TOGETHER LIKE LOCHINVAR

Lochinvar is the industry leader that other leading companies call upon for the most advanced and efficient water heating products in the world. For that reason, Lochinvar is trusted to go beyond the call of duty to find a solution for every project, no matter the size. You will not find a water heating company that works harder or cares more.

That's why no one brings it all together quite like Lochinvar.

A HISTORY OF INNOVATION

For nearly 80 years, Lochinvar, an American company, has been a leader of innovation and high-efficiency water heating. Through Lochinvar's pride in leadership and commitment to excellence, the company has continually improved year after year.

Today, Lochinvar touts the broadest line of high-efficiency water heating solutions, a world-class research & development department, comprehensive service with every sale and industry-leading training through Lochinvar University.

AN INDUSTRY LEADER IN THE MAKING, 1954.

DESIGNED ★ ENGINEERED ★ ASSEMBLED
USA

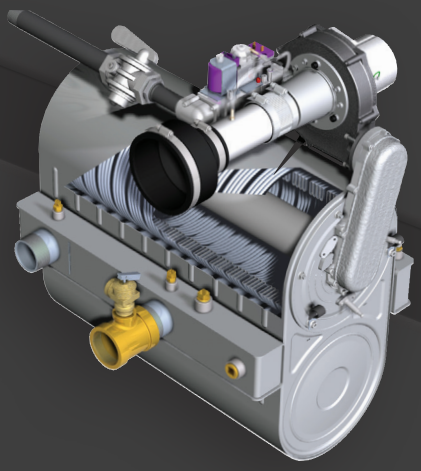
KNIGHT® COMMERCIAL BOILER XL

A SMART CHOICE FOR CONDENSING BOILER PERFORMANCE

The KNIGHT XL®, engineered with Lochinvar's exclusive SMART SYSTEM™ control and an array of other innovative features, places it far ahead of any commercial heating boiler in its class. It promises and delivers ultimate ease of installation and maintenance. With up to 94% thermal efficiency, low-NOx emissions and a fully modulating burner, it is the best "green choice" for today's environmentally focused market.

Five modulating/condensing stainless steel KNIGHT XL boilers are available with 399,000–800,000 Btu/hr inputs and remarkably small space-saving footprints. All are equipped for direct-vent installation with air intake and exhaust runs up to 100 feet using PVC, CPVC, Polypropylene or AL29-4C vent materials. This range of choices is ideal for light-duty applications such as small hotels, schools and office buildings. For higher-demand applications, up to eight KNIGHT XL units can be installed utilizing the built-in cascading sequencer to deliver up to 6.4 million Btu/hr heating capacity.

THE KNIGHT XL BOILER reflects Lochinvar's constant commitment to providing all the options you need to serve every application.



ADVANCED NEGATIVE REGULATION TECHNOLOGY

KNIGHT XL safely and reliably operates with supply gas pressure as low as 4 inches water column. Negative Regulation (Neg/Reg) technology automatically adjusts fan speed that ensures the correct volume and mix of fuel and air throughout the firing range.

TWO-IN-ONE STAINLESS STEEL HEAT EXCHANGER

A primary heat exchanger combined with a secondary heat exchanger captures flue gas heat and condenses to utilize available latent energy. The stainless steel, pH-tolerant design features a weld-sealed assembly with no O-rings or gaskets and does not require special glycol. ASME Section IV approved and stamped.

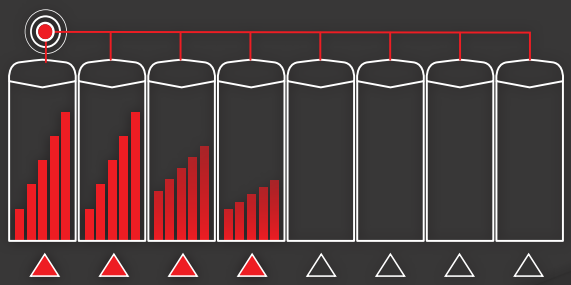
FULLY MODULATING BURNER

The SMART SYSTEM allows fully modulating combustion with 5:1 turndown. The burner can fire as low as 20% of maximum input and modulates the firing rate up to 100% as demand increases. The burner is a single stainless steel assembly covered with woven steel mesh and fires in a 360° pattern along the entire length of the primary heat exchanger. This allows the compact KNIGHT XL to exceed the capacity of units with larger multiple burners.

SELECTABLE CASCADE OPTIONS

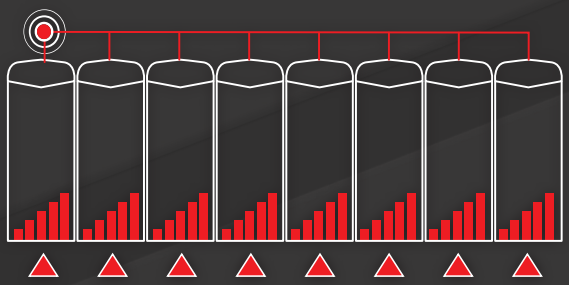
When multiple KNIGHT XL boilers are installed together, the SMART SYSTEM built-in sequencer can be set for “Lead-Lag” cascade or “Efficiency Optimized” cascade operation.

LEAD-LAG CASCADE



The “lead” boiler modulates with demand to capacity. As demand increases, additional boilers fire and modulate to capacity. This continues, with additional boilers firing and modulating to capacity until all units are operating. Every 24 hours, the SMART SYSTEM automatically shifts the lead boiler role to the next in the sequence, distributing lead-lag runtimes equally.

EFFICIENCY OPTIMIZED CASCADE



This feature optimizes the modulation capabilities of the boiler plant while evenly distributing run time across all cascaded boilers. Every 24 hours the SMART SYSTEM automatically shifts the 1st boiler on role to the next in the sequence, distributing run time equally.

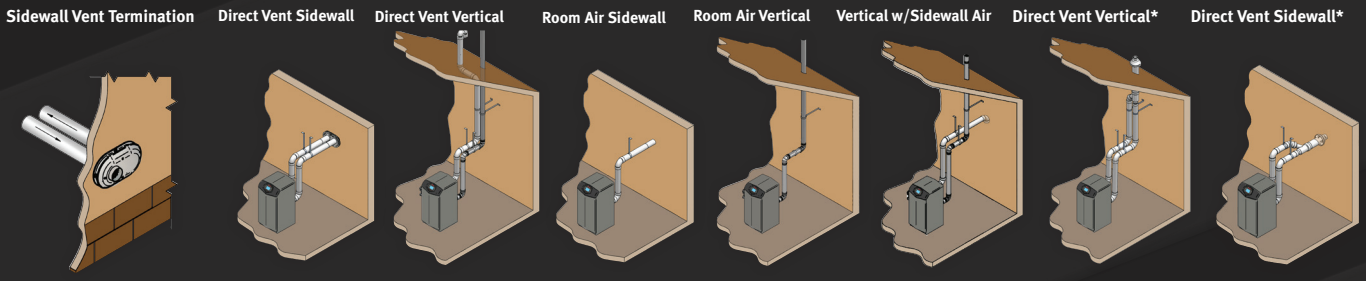
SMART SYSTEM Cascade option allows 2 - 8 boilers to be sequenced.

DIRECT VENTING UP TO 100 FEET

KNIGHT XL offers 7 venting options and tremendous flexibility for placement of units within the building, because it permits direct-vent air intake and exhaust runs up to 100 equivalent feet using either PVC, CPVC, Polypropylene or AL29-4C stainless steel vent pipe. A sidewall vent termination kit is shipped standard with every KNIGHT boiler.

Sidewall Vent Termination

7 Flexible Venting Options



**Optional Concentric Vent Kit Sold Separately (for 400-601 Models)*

Lochinvar SMART SYSTEM™

REFINED DESIGN PUTS MORE CONTROL AND INFORMATION AT YOUR FINGERTIPS

Advanced features include:

- Multi-Color Graphic LCD Display
- Navigation Dial
- USB Port
- Ability to control up to three different setpoint temperatures
- Compatibility with Copper-Fin II Non-Condensing Boiler to Create a Front-End Loading System
- Boilers with Different Inputs can be Cascaded Together to Maximize Boiler Plant Turndown
- Modbus Capability (Optional)
- DHW Modulation Limiting
- DHW Night Setback
- 0-10 VDC Boiler Rate Output
- 0-10 VDC Signal to control variable speed boiler pump
- 0-10 VDC System Pump Signal Input
- Heat Demand from 0-10V Input
- Installer Can Program Name and Number into the Boiler
- Installer Adjustable Freeze Protection Parameters
- Separately adjustable SH/DHW Switching times
- Installer access to BMS and ramp delay settings

AT-A-GLANCE COLOR CODING

BLUE SCREEN
Normal system operation.

YELLOW SCREEN
Maintenance due - shows the installer's name and number on the display.

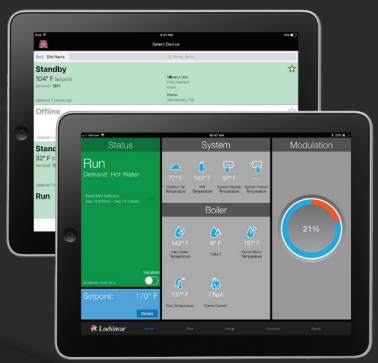
RED SCREEN
Lockout mode.

BOILER CONTROL FROM ANYWHERE

CON·X·US®

The industry's most advanced boiler control system now includes the CON·X·US® Remote Connect option. See next page for a complete list of SMART SYSTEM™ functions and features.

From wherever you are, the CON·X·US option lets you use any internet-capable device to link up with the SMART SYSTEM on an unlimited number of KNIGHT XL boilers. With CON·X·US, you're always in touch and in control. Optional CON·X·US control board is sold separately.



» DO REGULAR CON·X·US CHECKS FOR ALL YOUR KNIGHT XL CUSTOMERS, AND LET THEM KNOW YOU'RE MONITORING THEIR BOILER'S PERFORMANCE.

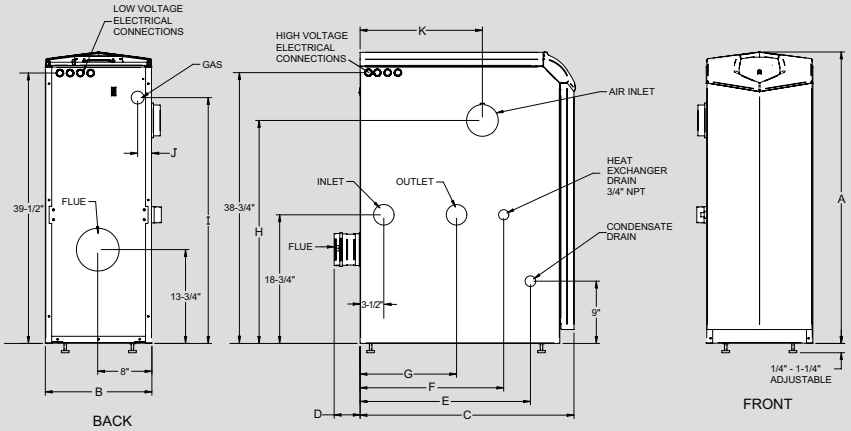
» ADJUST SETPOINTS, DOMESTIC HOT WATER, RESET CURVES, PUMP DELAYS AND MORE, USING THE CON·X·US INTERACTIVE DISPLAY.

» STATUS ALERTS VIA TEXT OR E-MAIL LET YOU KNOW WHEN A KNIGHT XL BOILER NEEDS ATTENTION.

Download on the App Store

ANDROID APP ON Google play

KNIGHT® XL BOILER DIMENSIONS AND SPECIFICATIONS



Model Number Guide

KB	N	701	M13
Knight XL	Natural Gas	Btu/hr Input	Firing Controls

KNIGHT XL HEATING BOILER

Model Number	Input Min MBH	Input Max MBH	Thermal Efficiency	Gross Output MBH	Net AHRI Rating MBH
KBN400	79	399	94.0%	375	326
KBN501	100	500	94.0%	470	409
KBN601	120	600	94.0%	564	490
KBN701	140	700	94.0%	658	572
KBN801	160	800	94.0%	752	654

DIMENSIONS AND SPECIFICATIONS

A	B	C	D	E	F	G	H	I	J	K	Gas Conn.	Water Conn.	Air Inlet	Vent Size	Shipping Wt. (lbs.)
42-1/2"	15-1/2"	27-3/4"	3-3/4"	20-3/4"	21"	14"	34"	34"	2"	18-3/4"	1"	1-1/2"	4"	4"	280
42-1/2"	15-1/2"	31-1/2"	3-3/4"	25-1/2"	21"	14"	32-1/2"	36"	2"	18"	1"	1-1/2"	4"	4"	310
42-1/2"	15-1/2"	36-1/4"	3-3/4"	25"	21"	14"	36"	32-3/4"	5-1/2"	19-1/2"	1"	2"	4"	4"	340
42-1/2"	15-1/2"	40-1/4"	3-3/4"	29"	23"	17"	36"	32-3/4"	3-1/4"	23-1/2"	1"	2"	4"	6"	370
42-1/2"	15-1/2"	45-1/4"	3-3/4"	33-1/4"	23"	17"	36"	32-3/4"	3-1/4"	27-3/4"	1"	2"	4"	6"	405

*Notes: Indoor installation only. All information subject to change. Change "N" to "L" for LP gas models. *The Net AHRI Water Ratings shown are based on a piping and pickup allowance of 1.15.*

STANDARD FEATURES

- **94% Thermal Efficiency**
- **Modulating Burner with 5:1 Turndown**
  - Direct-Spark Ignition
  - Low NOx Operation
  - Sealed Combustion
  - Low Gas Pressure Operation
- **ASME Stainless Steel Heat Exchanger**
  - ASME Certified, "H" Stamped Gasketless Heat Exchanger
  - 160 psi Working Pressure
  - Highly efficient, condensing design
- **Vertical & Horizontal Direct-Vent**
  - Category IV up to 100 feet PVC, CPVC, Polypropylene or AL29-4C Vent
  - Factory Supplied Sidewall Vent Termination
- **Smart System Control**
- **Other Features**
  - On/Off Switch
  - Adjustable High Limit w/ Manual Reset
  - Automatic Reset High Limit
  - Flow Switch
  - 50 psi ASME Relief Valve
  - Flue Temperature Sensor
  - Low Air Pressure Switch
  - Temperature & Pressure Gauge
  - Adjustable Leveling Legs
  - Condensate Trap
  - Zero Clearances to Combustible Material
  - 10 Year Limited Warranty (See Warranty)
  - 1 Year Warranty on Parts (See Warranty)

OPTIONAL EQUIPMENT

- Alarm Bell
- Condensate Neutralization Kit
- Concentric Vent Kit (KB400-KB601)
- BMS Gateway to LON or BACNet IP
- High & Low Gas Pressure Switches w/ Manual Reset (KB501-KB801)
- Variable Speed Boiler Circulation Pump
- MODBUS Communication
- Multi Temperature Loop Control
- Low Water Cutoff w/Manual Reset & Test
- Constant Speed Boiler Circulation Pump
- Stainless Steel Vent Kits (KB701-KB801)
- Stack Frame
- CON·X·US
- BACnet MSTP

SMART SYSTEM FEATURES

- **SMART SYSTEM Digital Operating Control Multi-Color Graphic LCD Display w/ Navigation Dial**
- **Three Reset Temperature Inputs with curves for three set point temperature inputs**
- **Built in Cascading Sequencer for up to 8 Boilers**
  - Multiple Size Boiler Cascade
  - Front end loading capability with Copper Fin II
  - Lead Lag
  - Efficiency Optimization
- **Outdoor Reset Control with Outdoor Air Sensor**
- **Programmable System Efficiency Optimizers**
  - Night Setback
  - DHW Night Setback
  - Anti-Cycling
  - Outdoor Air Reset Curve
  - Ramp Delay
  - Boost Temperature & Time
- **Three Pump Control**
  - System Pump With Parameter for Continuous Operation
  - Boiler Pump With Variable Speed Pump Control
  - Domestic Hot Water Pump
- **Domestic Hot Water Prioritization**
  - DHW tank piped with priority in the boiler loop
  - DHW tank piped as a zone in the system with the pumps controlled by the Smart System
  - DHW Modulation Limiting
  - Separately Adjustable SH/DHW Switching Times
- **Building Management System Integration**
  - 0-10 VDC Input to Control Modulation or Set Point
  - 0-10 VDC Input Signal from Variable Speed System Pump
  - 0-10 VDC Modulation Rate Output
  - 0-10 VDC Input to Enable/Disable call for heat
  - Access to BMS Settings through Display
- **High Voltage Terminal Strip**
  - 120 VAC / 60 Hertz / 1 Phase Power Supply
  - Three sets of Pump Contacts with Pump Relays
- **Low Voltage Terminal Strip**
  - Device Relay Contacts
  - Proving Switch Contacts
  - Flow Switch Contacts
  - Alarm on Any Failure Contacts
  - Runtime Contacts
  - DHW Thermostat Contacts
  - 3 Space Heat Thermostat Contacts
  - System Sensor Contacts
  - DHW Tank Sensor Contacts
  - Outdoor Air Sensor Contacts
  - Cascade Contacts
  - 0-10 VDC BMS External Control Contact
  - 0-10 VDC Boiler Rate Output Contacts
  - 0-10 VDC Variable Speed System Pump Signal Input
  - 0-10 VDC Signal to Control Variable Speed Boiler Pump
  - Modbus Contacts
- **Time Clock**
- **Data Logging**
  - Hours Running, Space Heating
  - Hours Running, Domestic Hot Water
  - Ignition Attempts
  - Last 10 Lockouts
- **Other Features**
  - Low Water Flow Safety Control & Indication
  - Password Security
  - Inlet & Outlet Temperature Readout
  - Customizable Freeze Protection Parameters
  - Custom Maintenance Reminder with Contractor Info

FIRING CODES

M9	Standard Construction
M7	California Code
M13	CSD1 / FM / GE Gap (KB501-KB801)

*Lochinvar should be consulted before selecting a boiler for installations having unusual piping and pickup requirements, such as intermittent system operation, extensive piping systems, etc. *The ratings have been determined under the provisions governing forced draft burners.

Lochinvar, LLC
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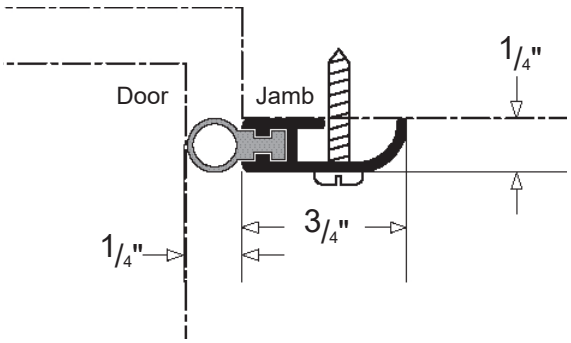
P: 615.889.8900 / F: 615.547.1000
Lochinvar.com

Registered Under U.S. Patents #7824178 and 7506617

ASB-2.5K-10/19-Printed in U.S.A.

DS080 - Light Duty (Rounded) Door Weatherstripping

Construction: PVC rigid vinyl. Mitered corners ensure a secure fit with slotted mounting holes for easy adjustment.
Insert: 1/4" flexible, bubble type neoprene or vinyl insert.
Finish: Brown or white finish.
Set: 1-3' piece and 2-7' pieces. Custom lengths also available.

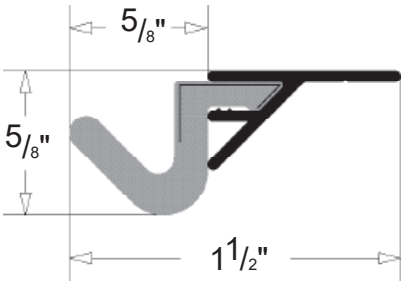


DS080-AL-V

MODEL	DESCRIPTION	FINISH		INSERT	
DS075	Door Weatherstripping	BR	Brown	V	Vinyl
		WH	White		

DS050 - Door Weatherstripping

Construction Q-Lon: Extruded aluminum. Mitered corners ensure a secure fit with slotted mounting holes for easy adjustment.
Insert: Soft cell foam insert. Foam has thermoplastic cover and will not deteriorate.
Finish: Aluminum, brown or white finish.
Set: 1-3' piece and 2-7' pieces. Custom lengths also available.



DS050-AL

MODEL	DESCRIPTION	FINISH	
DS100	Door Weatherstripping	AL	Aluminum
		BR	Brown
		WH	White

**Q-Lon is replaceable without removing holder from the door.*
**Approved for Sound Abatement Program.*

Kerf Q-LON® Door Seals

QEBD-500

Kerf Width: .125" (3.2mm)
Reach: .512" (13.0mm)

QDS-650

Kerf Width: .125" (3.2mm)
Reach: .650" (16.5mm)

QEBD-650

Kerf Width: .125" (3.2mm)
Reach: .650" (16.5mm)

QEB-653

Kerf Width: .125" (3.2mm)
Reach: .650" (16.5mm)

QEBD-730

Kerf Width: .125" (3.2mm)
Reach: .740" (18.8mm)

QEBD-825

Kerf Width: .125" (3.2mm)
Reach: .825" (20.9mm)

QEB-M570

Kerf Width: .125" (3.2mm)
Reach: .570" (14.5mm)

QDS-M670

Kerf Width: .125" (3.2mm)
Reach: .670" (17.0mm)

Kerf Q-LON® Weatherseals

QEZ-100

Kerf Width: .078" (2.0mm)
Reach: .100" (2.5mm)

QEZ-120

Kerf Width: .078" (2.0mm)
Reach: .315" (8.0mm)

QEZD-260

Kerf Width: .078" (2.0mm)
Reach: .260" (6.6mm)

QEZ-293

Kerf Width: .106" (2.7mm)
Reach: .334" (8.5mm)

QEZD-320

Kerf Width: .078" (2.0mm)
Reach: .336" (8.5mm)

QEZ-374*

Kerf Width: .078" (2.0mm)
Reach: .374" (9.5mm)

QWS-21

Kerf Width: .106" (2.7mm)
Reach: .346" (8.8mm)

QWS-77

Kerf Width: .106" (2.7mm)
Reach: .250" (6.4mm)

QWS-109

Kerf Width: .106" (2.7mm)
Reach: .270" (6.9mm)

QEZD-250

Kerf Width: .078" (2.0mm)
Reach: .250" (6.4mm)

QWS-DH1

Kerf Width: .106" (2.7mm)
Reach: .390" (9.9mm)

QWS-LS*

Kerf Width: .106" (2.7mm)
Reach: .410" (10.4mm)

Kerf APTUS® Plastic Weatherseals

AP-150

Bulb Diameter: .140" (3.6mm)
Kerf Width: .078" (2.0mm)

AP-412

Bulb Diameter: .300" (7.6mm)
Kerf Width: .078" (2.0mm)

AP-425

Bulb Diameter: .250" (6.4mm)
Kerf Width: .078" (2.0mm)

AP-427

Bulb Diameter: .275" (7.0mm)
Kerf Width: .078" (2.0mm)

AP-435

Bulb Diameter: .350" (8.9mm)
Kerf Width: .100" (2.5mm)

APF-310

Bulb Diameter: .310" (7.9mm)
Kerf Width: .078" (2.0mm)

AP-625

Bulb Diameter: .250" (6.4mm)
Kerf Width: .100" (2.5mm)

AP-415

Bulb Diameter: .250" (6.4mm)
Kerf Width: .078" (2.0mm)

Kerf POLYFLEX® Plastic

PF-101


PF-103


PF-104


PF-109


PF-115


PF-130


PF-138


PF-141


PF-144


PF-145


PF-154


PF-164


KERF PILE

KP-11

Kerf Width: .078" (2.0mm)

KP-51

Kerf Width: .078"-.100" (2.0-2.5mm)

KP-52

Kerf Width: .078"-.100" (2.0-2.5mm)

KP-56

Kerf Width: .125" (3.2mm)

KP-57

Kerf Width: .125" (3.2mm)

KP-44

Kerf Width: .078"-.100" (2.0-2.5mm)

KP-43

Kerf Width: .078" (2.0mm)

KP-84

Kerf Width: .078" (2.0mm)

*Special Order – contact VISCO Products for details.

Formaldehyde-free™ Fiber Glass Insulation

Kraft-Faced

JM Formaldehyde-free™ Thermal and Acoustical Fiber Glass Insulation

JM FORMALDEHYDE-FREE™ FIBER GLASS INSULATION

JM Formaldehyde-free™ fiber glass building insulation offers superior thermal and acoustical performance—and it improves indoor air quality because it's made without formaldehyde. Why is that important? Because the U.S. Environmental Protection Agency (EPA) recommends limiting exposure to formaldehyde as much as possible, and the California Air Resources Board, a division of the California EPA, recommends that homeowners, builders and architects use building materials and insulation made without formaldehyde when building a home or remodeling. JM is the only company in the industry with a complete line of fiber glass building insulation made without formaldehyde. Visit specJM.com for more information.

PRODUCT DESCRIPTION

Johns Manville Kraft-Faced insulation is a lightweight thermal and acoustical fiber glass insulation made of long, resilient glass fibers bonded with an acrylic thermosetting binder. The kraft facing can serve as an integral vapor retarder.

AVAILABLE FORMS

- Pre-cut batts – fit standard wall cavities and are faster to install than roll products.
- Rolls – can be cut to fit any size cavity and installed in any part of a building.

APPLICATIONS

- Wood frame construction – residential homes and light commercial buildings
- Metal frame construction – commercial buildings
- Pre-manufactured homes – modular or manufactured housing
- Engineered wood construction – assemblies framed with 12" to 19.2" (305 mm to 488 mm) on-center cavities, wide-spaced wood trusses or I-joists
- Interior wall sound control – interior walls and floor and ceiling assemblies (for sound class ratings for wall assemblies, see the appropriate STC values data sheet for either steel or wood framing)

INSTALLATION

Kraft-faced insulation cuts easily with an ordinary utility knife. Stapling tabs are provided for attachment to wood framing. The insulation can also be installed with fasteners or simply pressed in place between studs or joists. The kraft facing on this product will burn and must not be left exposed. It must be covered with gypsum board or another approved interior finish. Where an exposed application is required, use FSK-25 flame-resistant faced insulation.

Note: In colder climate areas, vapor retarders (whether attached to the insulation or applied separately) are often placed toward the heated or conditioned side of the wall. This is done to reduce water vapor penetration into the wall from the building interior. Conversely, in predominantly hot, humid climates local practices often call for placing the vapor retarder toward the outside of the wall cavity. Check your local building codes for vapor retarder requirements.

PACKAGING

This insulation is compression-packaged for savings in storage and freight costs.

RECOMMENDED STORAGE AND TRANSPORT

Store insulation indoors. Keep insulation clean and dry at all times. When transporting, cover completely with a waterproof tarpaulin as necessary.

SPECIFICATION COMPLIANCE

ASTM C 665, Type II, Class C, Category 1
ASTM E 96 Permeability (Kraft) 1.0 Perm

PERFORMANCE ADVANTAGES

- Improves indoor air quality – because it's made without formaldehyde.
- Thermally efficient – provides effective resistance to heat transfer with R-values up to R-38 (RSI-6.7).
- Controls moisture – kraft facing resists water vapor transmission.
- Controls sound – reduces transmission of conversations and equipment noises through interior and exterior walls and floor and ceiling assemblies.
- Noncorrosive – does not accelerate corrosion of pipes, wiring or metal studs.
- Durable – unaffected by moisture, oil, grease and most acids. It will not rot, mildew or otherwise deteriorate.
- Resilient – bonded glass fibers will not pull apart during normal applications and resist settling, breakdown and sagging from vibration.
- Flexible – forms readily around corners and curved surfaces.

Kraft-Faced

JM Formaldehyde-free™ Thermal and Acoustical Fiber Glass Insulation

Visit our website at specJM.com

BUILDING CODE COMPLIANCE AND FIRE HAZARD CLASSIFICATION

	ICBO	SBCCI	BOCA	IBC/IRC	Flame Spread*	Smoke Developed*
Kraft-Faced	Types III, IV, V	Types III, V, VI	Types III, IV, V	Types III, IV, V/All Types	Not Rated	Not Rated

*Per ASTM E 84.

AVAILABLE FORMS*

Specification Compliance	R-Value (hr•ft²•°F/Btu)	RSI-Value (m²•°C/Watts)	Thickness** (in)	Thickness** (mm)	Width*** Metal Framing (in)	Width*** Wood Framing (in)	Width*** Metal Framing (mm)	Width*** Wood Framing (mm)
ASTM C 665	38c	6.7	10 ¼	260	—	15 ½, 23 ⅝	—	394, 600
Kraft-Faced	38	6.7	13	330	16, 24	16, 24	406, 610	406, 610
Type II, Class C	30c	5.3	8 ¼	210	—	15 ¼, 23 ⅝	—	394, 600
Category 1	30	5.3	10 ¼	260	12, 16, 24	12, 16, 19, 24	304, 406, 610	305, 406, 483, 610
	25	4.4	8 ½	216	—	15, 23	—	381, 584
	22	3.9	7 ½	191	—	15, 19, 23	—	381, 483, 584
	21	3.7	5 ½	140	—	15, 23	—	381, 584
	19	3.3	6 ½	165	16, 24	11, 15, 19, 23	406, 610	279, 381, 483, 584
	15	2.6	3 ½, 3 ⅝	89, 92	—	15, 23	—	381, 584
	13	2.3	3 ½, 3 ⅝	89, 92	16, 24	11, 15, 23	406, 610	279, 381, 584
	11	1.9	3 ½, 3 ⅝	89, 92	16, 24	11, 15, 23	406, 610	279, 381, 584

* Consult your local JM sales representative or product availability chart for other available sizes and R-values (RSI-values).
** Thickness may vary by producing location.
*** Special widths and lengths may be available. Check with your local JM sales representative. Standard product lengths include 48", 93" and 96" (1.22 m, 2.36 m and 2.44 m) batts.
c Cathedral ceiling application

SHORT FORM SPECIFICATION

All insulation shown on drawings or specified herein shall be "Johns Manville Kraft-Faced Formaldehyde-free Thermal and Acoustical Fiber Glass Insulation." Thermal resistance "R" values (RSI) of the insulation shall be R (RSI) _____ in ceilings, R (RSI) _____ in walls, and R (RSI) _____ in floors over unheated spaces.

LIMITATIONS OF USE

Check applicable building codes. Kraft-faced insulation should not be left exposed.

SCS CERTIFIED
Minimum 25% Recycled Content
5% Pre-consumer
20% Post-consumer
SCIENTIFIC CERTIFICATION SYSTEMS
SCS-MC-01073

Technical specifications as shown in this literature are intended to be used as general guidelines only. The physical and chemical properties of kraft-faced thermal and acoustical fiber glass insulation listed herein represent typical, average values obtained in accordance with accepted test methods and are subject to normal manufacturing variations. They are supplied as a technical service and are subject to change without notice. Any references to numerical flame spread or smoke developed ratings are not intended to reflect hazards presented by these or any other materials under actual fire conditions. Check with the sales office nearest you for current information. All Johns Manville products are sold subject to Johns Manville's Limited Warranty and Limitation of Remedy. For a copy of the Johns Manville Limited Warranty and Limitation of Remedy or for information on other Johns Manville thermal and acoustical insulation and systems, call or write to the 800 number or address listed below.

Properly insulating a structure using Johns Manville building insulation helps preserve our environment by reducing energy consumption for heating and cooling, reducing the pollution resulting from fuel burning, reducing the emission of hazardous air pollutants during manufacturing and reducing waste through the utilization of recycled materials. Look for the cross and globe emblem on Johns Manville building insulation which indicates independent certification by Scientific Certification Systems, Inc. of 25% or more recycled glass content.

Distributed by:

Johns Manville

Insulation Systems
717 17th St.
Denver, CO 80202
(800) 654-3103
specJM.com

BID-0016 10-09 (Replaces 10-08)

Walls
Interior and Exterior

With rigid foam insulation from Dow on the walls, your building can perform more efficiently. Both the The Ultra Air Barrier Wall System and Thermax Wall System meet ASTM E2357 wall assembly test and ASHRAE 90.1 for continuous insulation and air barriers. It passed ASTM E331 water leakage test and is an approved air barrier assembly by the Air Barrier Association of America (ABAA). These products offer:

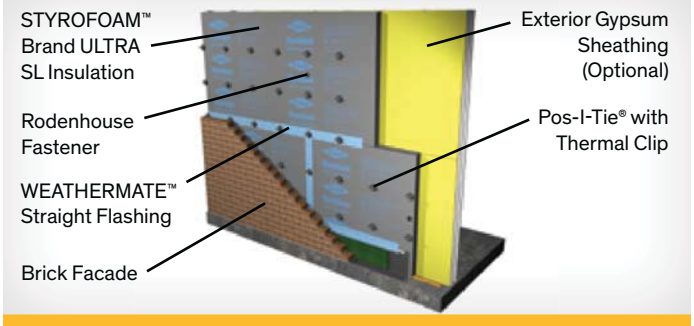
- Excellent long-term thermal performance
- Ease of use
- Moisture resistance
- Reusability in some situations

Note: Applicable codes may require a 15-minute thermal barrier between insulation and occupied space.

Exterior Cavity Wall – Steel Stud

Products:
- The Ultra Air Barrier Wall System
- STYROFOAM™ Brand CAVITYMATE™ SC Insulation
- STYROFOAM™ Brand Ultra SL Insulation
- THERMAX™ Sheathing
- THERMAX™ (ci) Exterior Insulation
- WEATHERMATE™ Straight Flashing

Application:
The Ultra Air Barrier Wall System featuring STYROFOAM™ Brand Ultra SL Insulation with shiplap edges and WEATHERMATE™ Straight Flashing Tape, provides designers a simple solution for exceptional long-term thermal insulating performance and excellent air/vapor and moisture barrier capability in steel stud backup in one solution.
- Meets NFPA 285 requirements*

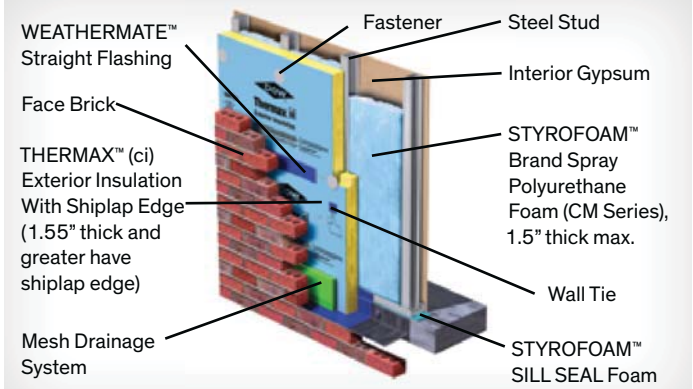


Ultra Wall Air Barrier System combines insulating power of STYROFOAM™ Brand Ultra SL Insulation and WEATHERMATE™ Straight Flashing Tape in one easy-to-install system that deliver continuous insulation performance and an air/vapor and moisture barrier

Exterior Cavity Wall – THERMAX™ Wall System

Products:
- THERMAX™ (ci) Exterior Insulation
- STYROFOAM™ Brand Spray Polyurethane Foam† (SPF) (CM Series)
- WEATHERMATE™ Straight Flashing

Application:
Install THERMAX™ (ci) Exterior Insulation over steel studs with sheathing joints and other thru-wall penetrations protected by WEATHERMATE™ Straight Flashing. After closing in the building, create an effective air barrier by spraying STYROFOAM™ Brand SPF (CM Series) on the interior of the THERMAX™ (ci) Exterior Insulation in the stud cavity.
- Three-in-one construction for maximum design efficiency
- Integral, durable acrylic-coated aluminum facer provides drainage plane and water-resistive barrier
- Lightweight sheathing weighs just 12 lbs per board, speeding up the construction process
- Meets ASHRAE 90.1 prescriptive requirements for continuous insulation
- Patent pending continuous insulation system
- Has approved NFPA 285 behind various cladding including metal panel & composts, cementicious siding, brick, stucco, and terracotta.*

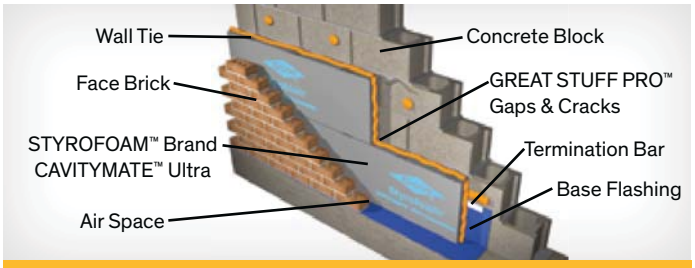


For more detailed installation information, contact your Dow representative or refer to the product literature.
*Meets NFPA 285 per Section 2603.5.5 of the building code. For specific assemblies see code report ESR 2142.
†STYROFOAM™ Brand Spray Polyurethane Foam should be installed by a trained SPF applicator wearing protective clothing, gloves, goggles and proper respiratory protection. Consult the instructions and Material Safety Data Sheets carefully before use.

Exterior Cavity Wall – Block Backed

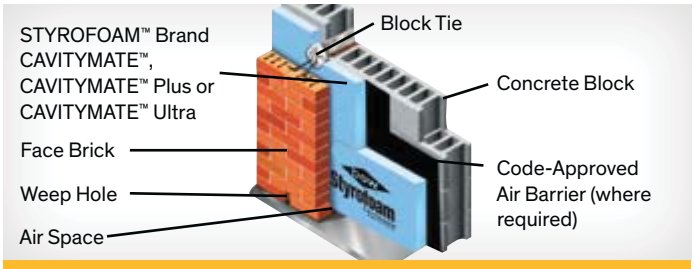
Products:
- STYROFOAM™ Brand CAVITYMATE™ Ultra Insulation 15 3/4" or 16" width
- STYROFOAM™ Brand Ultra SL Insulation 4' x 8'
- STYROFOAM™ Brand CAVITYMATE™ Insulation
- STYROFOAM™ Brand CAVITYMATE™ Plus Insulation
- GREAT STUFF PRO™ Gaps & Cracks Insulating Foam Sealant*
- WEATHERMATE™ Straight Flashing Tape

Application:
The Ultra Air Barrier Wall System is a tested wall assembly for brick and block wall providing long-term continuous insulation and excellent air/vapor and moisture barrier properties in one system. The Ultra Air Barrier Wall System meets ASTM E2357 wall assembly test and ASHRAE 90.1 for continuous insulation and air barriers. It passed ASTM E331 water leakage test and is an approved air barrier assembly by the Air Barrier Association of America (ABAA).
- Meets NFPA 285 requirements**



Ultra Wall Air Barrier System combines insulating power of STYROFOAM™ Brand CAVITYMATE™ Ultra Insulation and the exceptional air sealing capabilities of GREAT STUFF PRO™ Gaps & Cracks Insulating Foam Sealant in one easy-to-install system that deliver continuous insulation performance and an air/vapor and moisture barrier

Application:
Install insulation on the exterior of block-backed cavity walls.

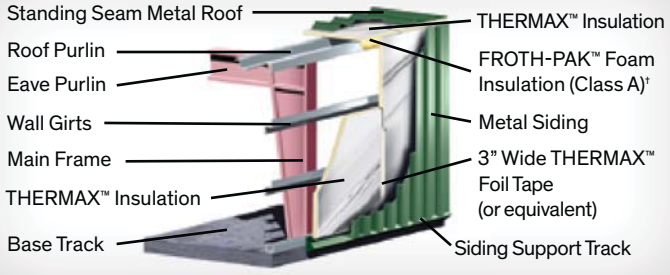


STYROFOAM™ Brand CAVITYMATE™ Insulation is designed specifically for moist cavity wall environments. Manufactured with distinct carbon block technology to absorb infrared radiation, STYROFOAM™ Brand CAVITYMATE™ Ultra Insulation has an R-value of 5.6 per inch - the highest of any polystyrene foam insulation and is available in 15 3/4" and 16" widths making it easy to fit between brick ties in cavity wall applications.

Metal Building

Products:
- THERMAX™ Metal Building Board
- THERMAX™ Heavy Duty
- THERMAX™ Light Duty
- THERMAX™ Sheathing

Application:
Install insulation between wall girts and metal siding.



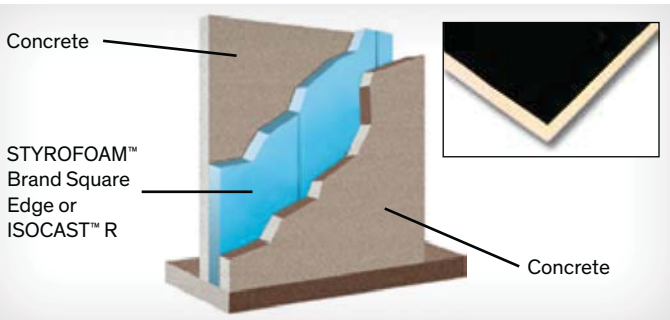
THERMAX™ Insulation products help safeguard pre-engineered metal buildings against thermal loss and moisture buildup. A variety of thicknesses and lengths up to 30' are available to meet specific design requirements.

†For air sealing the roof/wall juncture

Exterior Precast

Products:
- STYROFOAM™ Brand Square Edge Insulation
- ISOCAST™ R Insulation

Application:
Used in insulated precast, prestressed or tilt-up construction, rigid foam insulation products from Dow combine insulating capabilities with the added strength of concrete. The foam is sandwiched between two wythes of concrete and held together structurally by metal or nonconductive connectors.



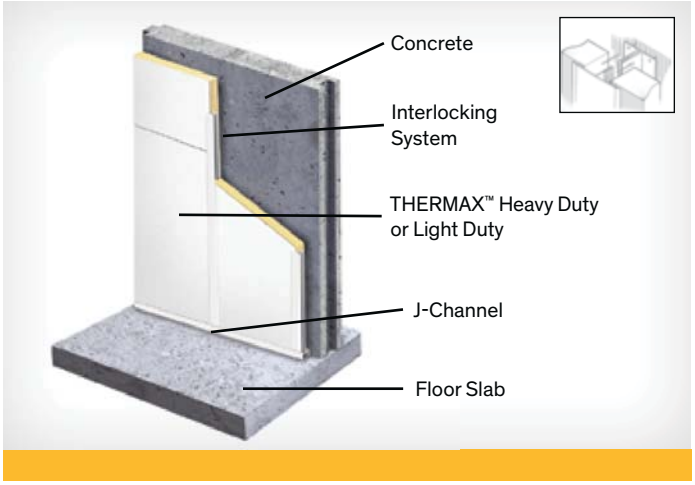
ISOCAST™ R Polyisocyanurate Insulation features a trilaminate aluminum/poly/kraft facer for strength and high R-value per inch in precast concrete walls.

For more detailed installation information, contact your Dow representative or refer to the product literature.
* Read label and MSDS carefully before use.
** Meets NFPA 285 per Section 2603.5.5 of the building code. For specific assemblies see code report ESR 2142.

Interior – Exposed Wall

Products:
- THERMAX™ White Finish
- THERMAX™ Light Duty
- THERMAX™ Heavy Duty

Application:
For best results, install against interior of structural wall with the Interlocking System joint closure. Ask your seller about other installation methods. Distinct, easy-to-clean facers of aluminum and/or acrylic-coated aluminum make THERMAX™ Polyisocyanurate Insulation ideal for exposed interior walls, adding durability and moisture control. With THERMAX™ Insulation, there is no need for drywall or gypsum board.

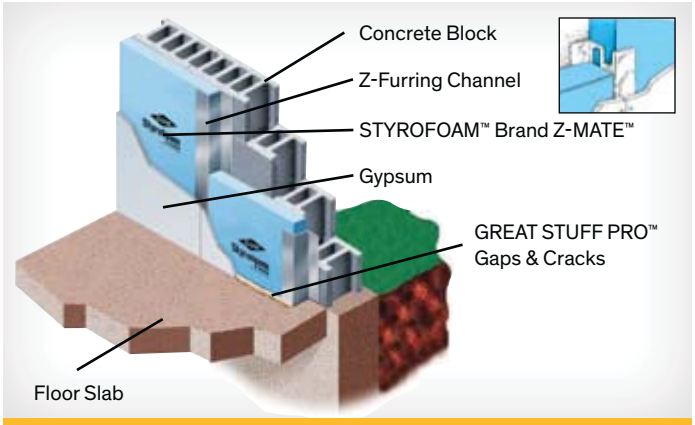


Interior – Concealed Wall

Products:
- STYROFOAM™ Brand Z-MATE™ Insulation
- STYROFOAM™ Brand Square Edge Insulation
- THERMAX™ Sheathing
- TUFF-R™ Commercial Insulation
- Super TUFF-R™ Commercial Insulation
- GREAT STUFF PRO™ Gaps & Cracks Insulating Foam Sealant†

Application:
Install rigid foam insulation between furring strips. Cover with an approved thermal barrier.

A bead of GREAT STUFF PRO™ Gaps & Cracks Insulating Foam Sealant helps to seal the wall/slab joint.

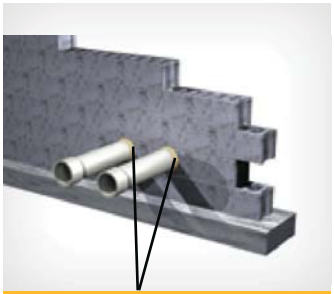


STYROFOAM™ Brand Z-MATE™ Insulation, nominally 24" wide, is pre-cut to 23-7/8", so it can be installed between Z-furring channels placed on 24" centers.

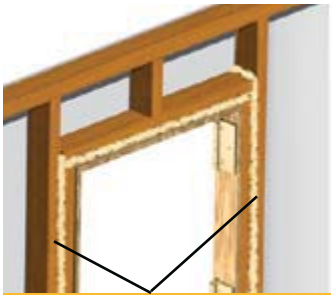
One- and Two-Component Polyurethane Foam Sealants†† for Air Sealing The Building Envelope

Products:
- FROTH-PAK™ Foam Insulation
- GREAT STUFF PRO™ Gaps & Cracks Insulating Foam Sealant
- GREAT STUFF PRO™ Window & Door Insulating Foam Sealant

FROTH-PAK™ Foam Insulation is ideal for sealing roof/wall junctures up to 6" high or less (max. 2" thick) for unlimited length and can be left exposed per NFPA 286 in roof/wall junctures.



Seal smaller areas, such as gaps around pipe penetrations, with GREAT STUFF PRO™ Gaps & Cracks Insulating Foam Sealant.



GREAT STUFF PRO™ Window & Door Insulating Foam Sealant fills gaps around window and door frames without causing bowing, when properly applied.

Our Insulating Foam Sealant options create an airtight and moisture-resistant seal and meet ASHRAE energy code requirements.

For more detailed installation information, contact your Dow representative or refer to the product literature.
† Consult the instructions and Material Safety Data Sheet carefully before use

Foundations and Slabs
Above Grade and Below Grade

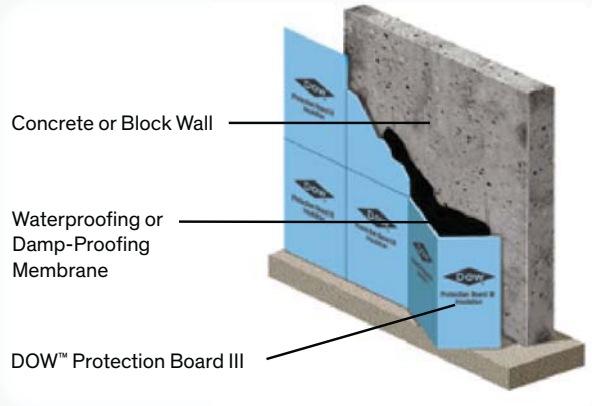
Rigid foam insulation products from Dow offer excellent insulation and moisture protection in foundation and slab applications. Extruded polystyrene foam insulation from Dow offers a combination of benefits for almost any application.

- Long-term thermal performance
- High compressive strength
- Ease of use
- Excellent moisture resistance
- Waterproofing protection

Foundations

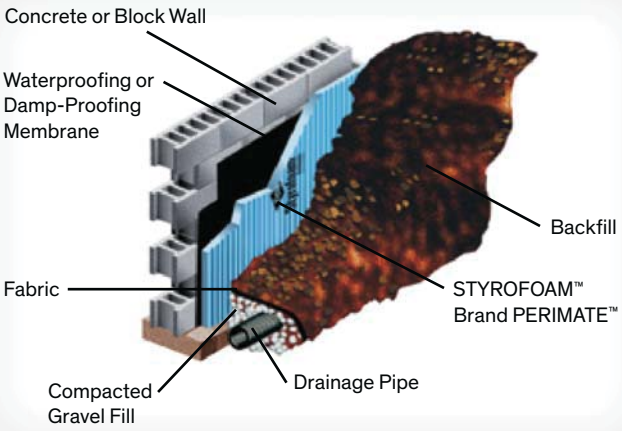
Products:
- STYROFOAM™ Brand PERIMATE™ Insulation
- STYROFOAM™ Brand Square Edge Insulation
- STYROFOAM™ Brand Scoreboard Insulation
- DOW™ Protection Board III Insulation

Application:
Install extruded polystyrene foam insulation from Dow against the exterior foundation wall. When properly installed, the insulation resists moisture, so it offers more stable longterm R-value* in moist foundation applications.

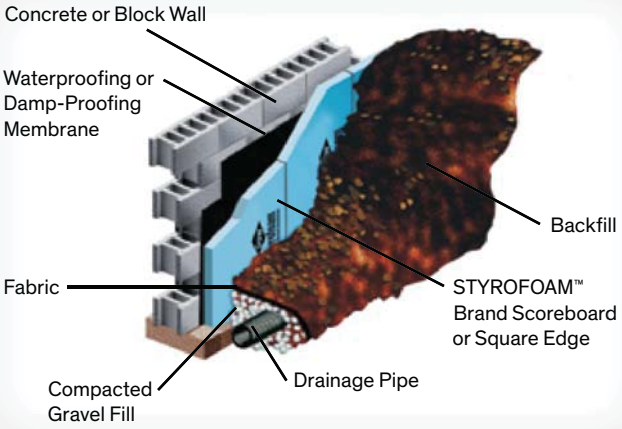


Fanfolded on 24" centers with plastic film on one side, DOW™ Protection Board III Insulation is durable yet easy to install and work with on the job site.

For additional information regarding DOW™ Protection Board III visit http://www.adamsplasticsinc.com/



STYROFOAM™ Brand PERIMATE™ Insulation features drainage grooves to direct water away from the foundation, offering thermal insulation and drainage of subsurface soil in a single step.



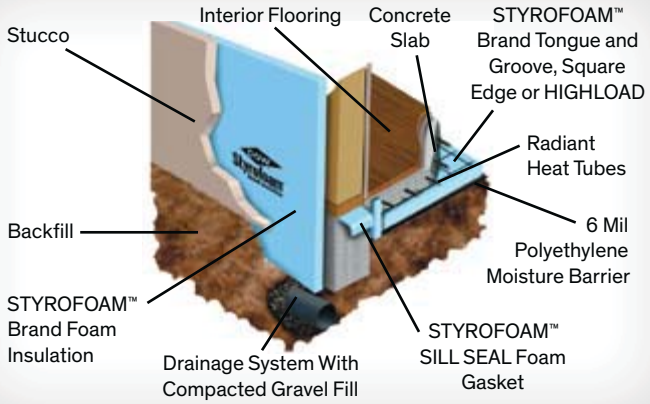
STYROFOAM™ Brand Square Edge Insulation and STYROFOAM™ Brand Scoreboard Insulation provide long-term thermal performance.

For more detailed installation information, contact your Dow representative or refer to the product literature.
* R means resistance to heat flow. The higher the R-value, the greater the insulating power.

Radiant Floor – Under Slab

Products:
- STYROFOAM™ Brand Tongue and Groove Insulation
- STYROFOAM™ Brand Square Edge Insulation
- STYROFOAM™ Brand HIGHLOAD 40, 60 or 100 Insulation

Application:
Install STYROFOAM™ Brand Extruded Polystyrene Foam Insulation under the slab to help provide moisture protection and to prevent radiant floor heat from dissipating into the ground.



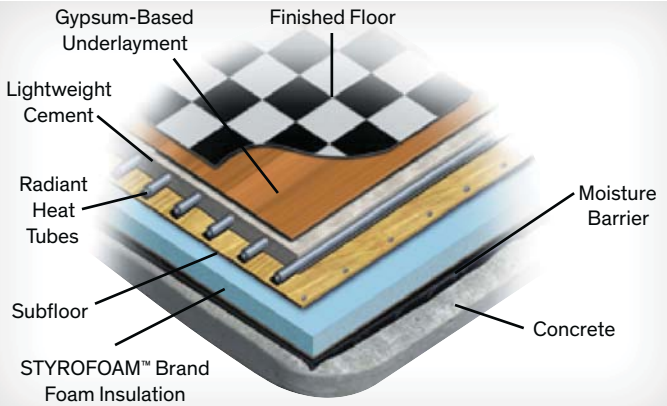
STYROFOAM™ Brand Extruded Polystyrene Foam Insulation offers excellent moisture resistance and insulating power in slab-on-grade radiant floor applications.

Radiant Floor – Over Deck/Subfloor

Products:
- STYROFOAM™ Brand Scoreboard Insulation
- STYROFOAM™ Brand Square Edge Insulation
- STYROFOAM™ Brand WALLMATE™ Insulation

Application:
Use in upper level floors in new construction or over the slab in a retrofit situation. Extruded polystyrene foam insulation from Dow helps direct radiant floor heat upward, into the room.

Consult local building code official for construction specifics.



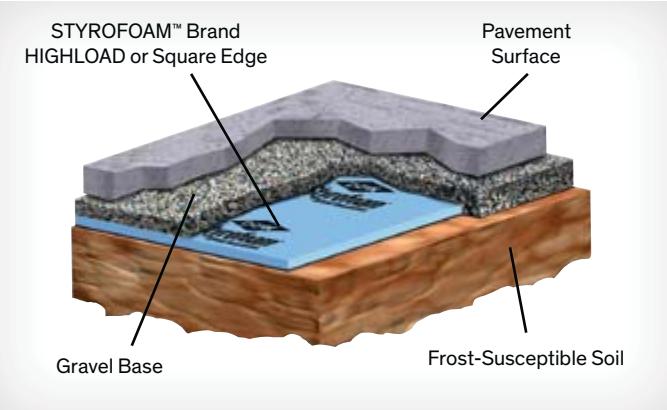
Assembly for new construction for an upper level floor or as a retrofit over existing slab. If no vapor retarder was installed under the existing slab, it is recommended to add one between the slab and the rigid foam insulation. A vapor retarder is not needed if the deck is a second-floor application.

Geotechnical

Products:
- STYROFOAM™ Brand HIGHLOAD 40, 60 or 100 Insulation
- STYROFOAM™ Brand Square Edge Insulation

Application:
Use wherever excellent load-bearing, insulating and moistureresistance capabilities are needed, including under building floor slabs; airport runways, taxiways and aprons; railroads; culverts; retaining walls; storage tank slabs; and swimming pools.

Lay STYROFOAM™ Brand Extruded Polystyrene Foam Insulation on top of leveled soil. Top with a gravel base and pavement or other surface. For low-temperature floors such as ice rinks, position insulation under the wearing slab.



STYROFOAM™ Brand Extruded Polystyrene Foam Insulation offers excellent moisture resistance and insulating power in slab-on-grade radiant floor applications.

For more detailed installation information, contact your Dow representative or refer to the product literature.

Roofs
Plaza and Protected Membrane

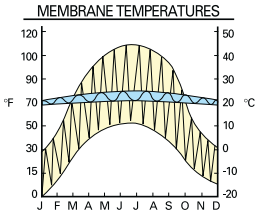
STYROFOAM™ Brand Extruded Polystyrene Foam Insulation offers exceptional performance in plaza and protected membrane roofing (PMR) applications.

- Excellent moisture resistance and stable long-term R-value
- Extends life of plaza or roof, providing protection from ultraviolet deterioration
- Protects membrane against weathering, physical abuse and damage
- Maintains membrane at a relatively constant temperature, minimizing effects of freeze-thaw cycling and excessive heat
- Reduces repair expenditures
- Easy removal and re-installation of ballast and insulation

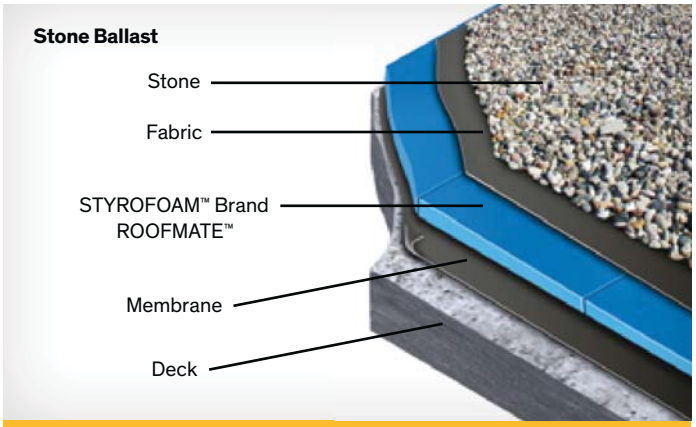
Products:
- STYROFOAM™ Brand HIGHLOAD 40, 60 or 100 Insulation
- STYROFOAM™ Brand PLAZAMATE™ Insulation
- STYROFOAM™ Brand ROOFMATE™ Insulation
- STYROFOAM™ Brand Ribbed ROOFMATE™ Insulation

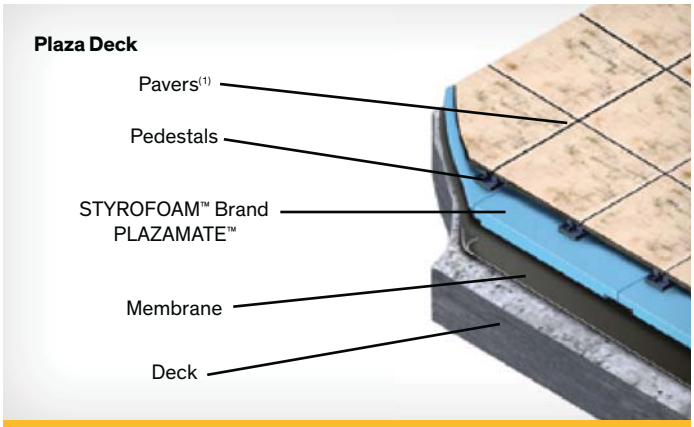
Application:
Install on top of the waterproofing membrane. Follow with approved fabric. For PMR construction, finish with a layer of crushed stone, gravel, pavers or green roof. For plaza decks where pedestrian or vehicular traffic is anticipated, cover fabric with gravel or pedestals for drainage, then top with pavers, poured concrete or other exterior topping.
- Year-round construction – roof is waterproofed first, then insulated
- Over forty years' proven performance
- Thermal warranties available from Dow; full system warranties available from membrane manufacturers

Membrane Field Temperature Test



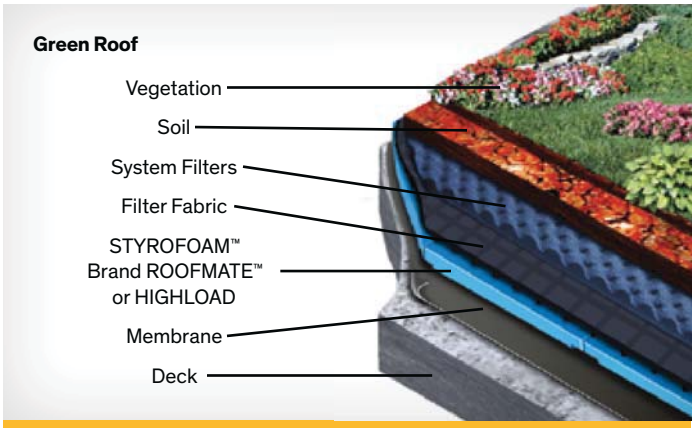
Membrane protection (PMR vs. conventional): Field studies have shown that a constant temperature can extend the life of the membrane. STYROFOAM™ Brand ROOFMATE™ Insulation products offer excellent temperature control.
- PMR (blue line) – the membrane temperature remains relatively constant
- Conventional roof (yellow line) – membrane temperature fluctuates widely





STYROFOAM™ Brand PLAZAMATE™ Insulation is designed to hold up under the heavy demands of plaza roof construction.

(1) Pavers require pedestals unless STYROFOAM™ Brand Ribbed ROOFMATE™ Insulation is used.



For more detailed installation information, contact your Dow representative or refer to the product literature.

Conventional – Mechanically Attached, Ballasted And Fully Adhered

In conventional roofing applications, STYROFOAM™ Brand Extruded Polystyrene Foam Insulation products from Dow offer:

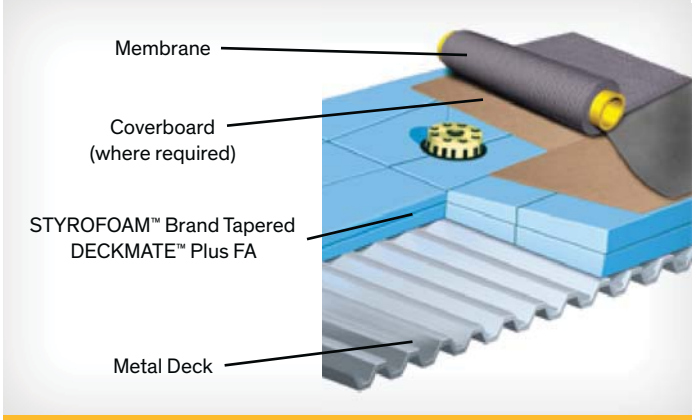
- Long-term R-value
- Moisture resistance
- High compressive strength for excellent durability and damage resistance
- Ease of use
- Planed surface for excellent bonding of adhesives (STYROFOAM™ Brand DECKMATE™ Plus FA Insulation)

STYROFOAM™ Brand Extruded Polystyrene Foam Insulation may be installed directly on metal decks according to Underwriters Laboratories Construction Nos. 260 and 440. Consult Dow and/or local building code for installation requirements.

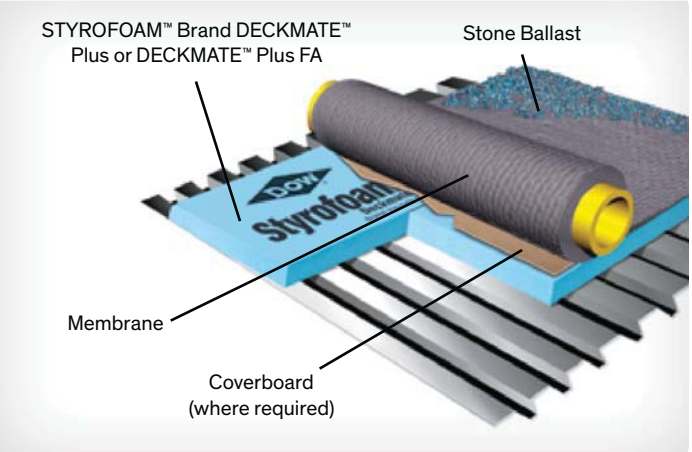
Products:
- STYROFOAM™ Brand DECKMATE™ Plus Insulation
- STYROFOAM™ Brand DECKMATE™ Plus FA Insulation
- STYROFOAM™ Brand Tapered DECKMATE™ Plus FA Insulation
- INSTA STIK™ Quik Set Commercial Roofing Adhesive

Application:
Install insulation directly on structural deck, including metal decking. Any application-appropriate roofing membrane may be used with rigid board insulation from Dow. Use INSTA STIK™ Quik Set Roofing Adhesive to adhere the insulation to the roofing deck and cover board without the need of fasteners that penetrate the roofing assembly.

In some cases a coverboard or slip sheet may be required between the insulation and the membrane for heat or chemical protection.



STYROFOAM™ Brand Tapered DECKMATE™ Plus FA Insulation provides a positive slope to improve roof drainage. Experienced custom fabricators provide exceptional job service. Consult Dow and/or local building code for installation requirements.



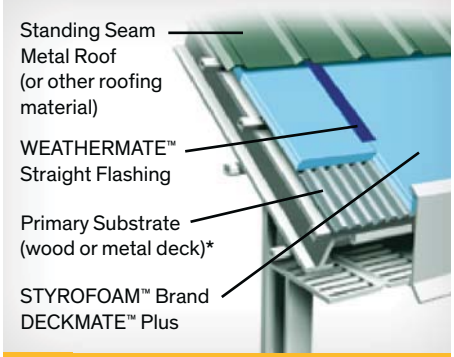
In the United States, a 50-year thermal warranty is available on STYROFOAM™ products 1.5 inches and greater. For thickness less than 1.5 inches, other warranties may apply. Warranties are available as described at www.dbswarranties.com.

For more detailed installation information, contact your Dow representative or refer to the product literature.

Steep Slope

In steep slope roof construction, insulation and adhesive products from Dow offer high R-value, high compressive strength, durability and ease of use.

- For use on metal or wood decks
- Accept a variety of roofing materials, including shingles, slate, tile and metal membranes
- STYROFOAM™ Brand DECKMATE™ Plus Extruded Polystyrene Foam Insulation offers excellent moisture resistance
- In standing seam metal roofs, THERMAX™ Polyisocyanurate Insulation allows the use of lighter gauge decking (26 gauge instead of the typical 22 gauge) and open frame designs
- WEATHERMATE™ Straight Flashing at seams between insulation boards resists water intrusion under standing seam metal roofs



STYROFOAM™ Brand DECKMATE™ Plus Insulation provides excellent moisture resistance and high R-value in a lightweight board.

Use Class A rated THERMAX™ products in open frame designs, where the insulation boards may be left exposed to the interior. Tape top side of seams with WEATHERMATE™ Straight Flashing.

Products:
- STYROFOAM™ Brand DECKMATE™ Plus Insulation
- THERMAX™ Heavy Duty
- THERMAX™ Light Duty
- THERMAX™ Metal Building Board
- THERMAX™ Sheathing
- THERMAX™ White Finish
- WEATHERMATE™ Straight Flashing

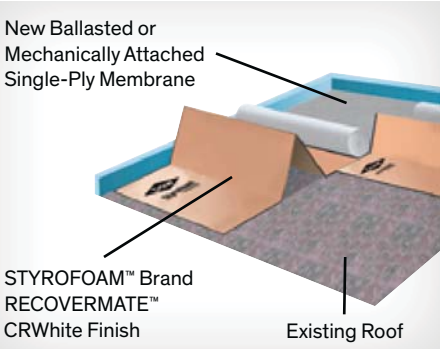
Application:
Install insulation on clean, dry, structural roof deck. Cover with an underlayment where required. Finish with shingles, tile, slate, metal or other roofing material.

Available in 4", 6" and 9" widths, WEATHERMATE™ Straight Flashing combines a high-density polyethylene film facer with a butyl rubber adhesive for a strong mechanical and chemical bond to insulation and other building materials.

Roof Re-Cover Applications

STYROFOAM™ Brand RECOVERMATE™ CR Insulation is designed specially for roof re-cover applications:

- Resistant to the effects of moisture
- Excellent compressive retention
- Lightweight: easy to cut, handle, install and store
- Withstands temperatures to 165°F
- Chemical-resistant; useful for installation with plasticized membranes
- Fanfolded
- For light-colored membranes only



Use Class A rated THERMAX™ products in open frame designs, where the insulation boards may be left exposed to the interior. Tape top side of seams with WEATHERMATE™ Straight Flashing.

Products:
- STYROFOAM™ Brand RECOVERMATE™ CR Insulation

Application:
Install STYROFOAM™ Brand RECOVERMATE™ CR Insulation over entire surface of old roof, on top of existing membrane. Top with ballasted or mechanically attached sheet membrane.

For additional information on STYROFOAM™ Brand RECOVERMATE™ CR Insulation visit http://www.adamsplasticsinc.com/

For more detailed installation information, contact your Dow representative or refer to the product literature.
* Only applies to code accepted wood or metal deck
† For air sealing the roof/wall juncture

One- And Two-Component Polyurethane Foam Products For Roofs

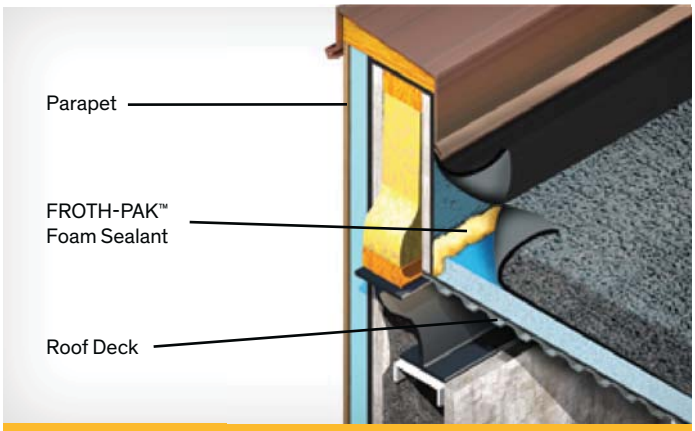
Polyurethane foam insulation, sealant and adhesive products from Dow deliver the high quality and reliability professionals require in a wide range of commercial roofing applications, including:

- Flat and low slope roofs
- Steep slope roofs
- Barrel and dome roofs
- Roof re-cover projects
- New and re-roof projects

Sealant

Products:
- FROTH-PAK™ Foam Sealant**

Application:
Use FROTH-PAK™ Foam Sealant to fill gaps or joints 4" or less. When properly applied, the spray forms an effective air sealant or insulation on most roofing materials. FROTH-PAK™ Foam Sealant is also useful in sealing the perimeter of the building between the roof deck and parapet.



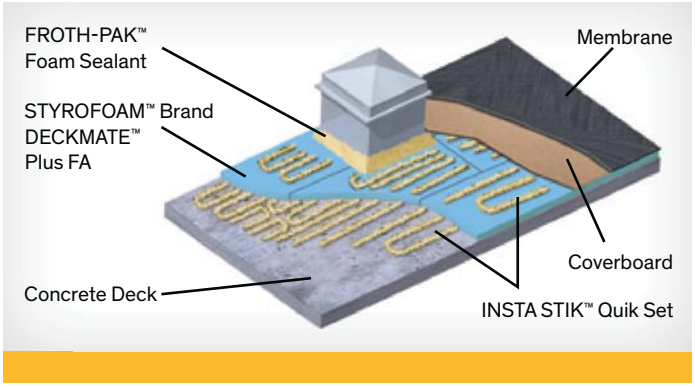
Adhesives

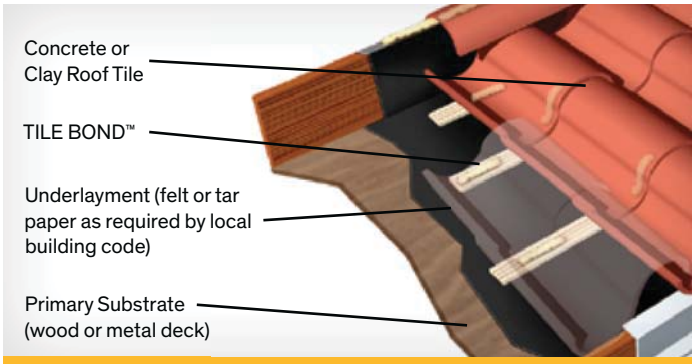
Products:
- INSTA STIK™ Quik Set Commercial Roofing Adhesive**
- TILE BOND™ Roof Tile Adhesive**

Application:
Polyurethane adhesive products from Dow provide a fast, efficient method for securing foam insulation boards or roof tiles to appropriate roof deck or substrate.

INSTA STIK™ Quik Set has a limited 10-year adhesion warranty when applied to compatible materials or substrates by an approved applicator. Limited 15- and 20- year adhesion warranties are available at additional cost. Certain conditions apply; see the appropriate warranty for details.

TILE BOND™, with its easy-to-use, self-contained dispensing equipment, is designed for use with low/flat, medium, high and two-piece barrel profiles. TILE BOND™ must be applied by an approved applicator to meet certain building code requirements. Consult local code authorities.





TILE BOND™ Roof Tile Adhesive adheres concrete or clay tiles to the roof deck/substrate. Refer to tile manufacturer's instructions for details.

For more detailed installation information, contact your Dow representative or refer to the product literature.
**Consult the instructions and Material Safety Data Sheet carefully prior to use

Dow Polyisocyanurate Insulation

Physical Properties**	Thermal Resistance[1,2]	Compressive Strength (lb/in²), min., core foam	Flexural Strength (lb/in²), typ. for 1" core foam	Water Absorption (% increase by volume, 2-hr. results), max., core foam	Water Vapor Permeance[3] (perm)	Dimensional Stability[6] (% linear change), max.	Complies with ASTM	Maximum Use Temperature (°F)	Flame Spread[4], max., core foam	Smoke Developed, max., core foam	Width (inches)	Length (inches)	Typical Thickness Range (inches), core foam
ASTM Method	C518	D1621	C203	C209	E96	D2126	C1289		E84	E84			
ISOCAST™ R	6.5	25	40	0.1	<0.03	4.0	Type I Class 1 or 2[5]	190	55	200	48	96	1.0, 1.5, 2.0
Super TUFF-R™ Commercial	6.5	25	40	0.1	<0.03	4.0	Type I Class 1 or 2[5]	190	55	200	16 48 48	96 96 108	0.5, 0.75, 1.0, 1.5, 1.75, 2.0
THERMAX™ (ci) Exterior Insulation	6.5	25	55	0.1	<0.03	4.0	Type I Class 2	250	25	190	48 48	96 144	0.625, 1.0, 1.55, 2.0, 2.5, 3.0
THERMAX™ Heavy Duty	6.5	25	55	0.1	<0.03	4.0	Type I Class 2	250	25	190	48 48	96 120	1.0, 1.25, 1.55, 1.75, 2.0, 2.5, 3.0
THERMAX™ Heavy Duty Plus	6.5	25	55	0.1	<0.03	4.0	Type I Class 2	250	25	190	48 48	96 120	1.0, 1.25, 1.55, 1.75, 2.0, 2.5
THERMAX™ Light Duty	6.5	25	55	0.1	<0.03	4.0	Type I Class 2	250	25	190	48 48	96 120	0.5, 0.75, 1.0, 1.25, 1.55, 1.75, 2.0, 2.5, 3.0
THERMAX™ Metal Building Board	6.5	25	55	0.1	<0.03	4.0	Type I Class 2	250	25	190	48 48	96 120	0.5, 0.75, 1.0, 1.75, 2.0, 2.5, 3.0, 3.5, 4.0
THERMAX™ Sheathing	6.5	25	40	0.1	<0.03	4.0	Type I Class 2	250	25	190	48	96, 108, 120, 144	0.5, 0.75, 1.0, 1.5, 1.55, 2.0, 2.5, 3.0, 3.5, 4.0
THERMAX™ White Finish	6.5	25	55	0.1	<0.03	4.0	Type I Class 2	250	25	190	48	108	0.5, 0.75, 1.0, 1.25, 1.5, 1.55, 1.75, 2.0
TUFF-R™ Commercial	6.5	25	40	0.1	<0.03	4.0	Type I Class 1 or 2[5]	190	55	200	48	96 108	1.0, 1.25, 1.50, 1.875, 2.0

(1) Aged R-value per 1" @ 75°F mean temperature. R-values are expressed in ft2•h•°F/Btu.
(2) R means resistance to heat flow. The higher the R-value, the greater the insulating power. R-values determined by ASTM C518 using the aging process in ASTM C1289 (90 days @ 140°F).
(3) Water vapor permeance varies with product type and thickness. Values are based on the desiccant method, and they apply to insulation 1" in thickness. Thicker products have lower permeance.
(4) These numerical flame spread ratings are not intended to reflect hazards presented by this or any other material under actual fire conditions.
(5) Varies with thickness.
(6) Dimensional Stability is for the thickness

Note: Not all products are available in all parts of the country. Other product sizes are available on a made-to-order basis. Custom lengths of THERMAX™ Insulation products are available for orders of 7,500 board feet or more. Contact your Dow representative with questions.

Dow Polyurethane Foam Insulation

Physical Properties**	Property (units)	Flexural Strength (lb/in²), parallel	Thermal Resistance, R-value per inch, ft²•h•°F/Btu	Compressive Strength (lb/in²), parallel	Shear Strength (lb/in²), parallel	Apparent Core Density (lb/ft³)	Water Absorption (5% by volume)	Water Vapor Permeance (perm) @ 1" Thick	Cure Time	Application Temperature (°F)	Sizes
ASTM Method		C203	C518	D1621	C273	D1622	D2842	E96			
FROTH-PAK™ Foam Insulation (CLASS A)		22.7	5.6[1]	21.1	16.7	2.0	2.17	3.9	Tack-free[2] <1 min.	60-90	Selection of kit sizes and refill systems available
STYROFOAM™ SPF (CM Series)[3]	2030	NA	6.0[4]	25	NA	2.5	Pass	2.2	NA	30–70 Ambient (30–60 Substrate)	55 gal drums (one ISO, one polyol)
	2045	NA	6.5[5]	21.7	NA	2.3	Pass	2.7	NA	45–95 Ambient (45–100 Substrate)	

(1) Aged R-value: 90 days at 140°F. Initial R-value: 6.6.
(2) Actual cure time will depend on temperature, foam thickness, specific nozzle used, etc.
(3) Approved for use exclusively with the THERMAX™ Wall System.
(4) Aged R-value: 90 days at 140°F.
(5) Aged R-value: 180 days at room temperature.

** These are typical physical properties. Not to be construed as sales specifications.

For more detailed installation information, contact your Dow representative or refer to the product literature.

Dow Polyurethane Foam Sealants and Adhesives

Product	Cure Time	Size	Yield[1]
FROTH-PAK™ Foam Sealant[2, 3]	Tack-free <1 min.	Selection of kit sizes and refill systems available	12-620 bd ft Refill Systems 2,000-43,900 bd ft
GREAT STUFF PRO™ Gaps & Cracks[4]	Tack-free within 6 mins, trim in 30; full cure 1 hour	24 oz can, reusable straw 24 oz can, gun 30 oz can, reusable straw 30 oz can, gun	775 ft[5] 970 ft[5] 995 ft[5] 1,450 ft[5]
GREAT STUFF PRO™ Window & Door[4]	Tack-free within 9 mins, trim 1 hour; full cure 12 hours	20 oz can, reusable straw 20 oz can, gun 24.5 oz can, reusable straw 24.5 oz can, gun	6-9 windows[6] 8-11 windows[6] 8-11 windows[6] 11-14 windows[6]
INSTA STIK™ Quik Set	Tack-free 3-7 mins, depending on humidity	30 lb canister only (23 lb net chemical weight)	(refer to E-Z Estimating Guide, Form No. 179-05069)
TILE BOND™	Tack-free 5-15 mins	23 lb complete (canister with gun/hose assembly) 23 lb canister only 28 oz can with reusable straw	Up to 375 field tiles for 23 lb tank

(1) For estimated yields at other product sizes, bead sizes and conditions, contact your Dow representative or call 1-866-583-BLUE (2583).
(2) FROTH-PAK™ products are available in a selection of densities, formulations and sizes to meet a wide range of project specifications.
(3) Actual cure time will depend on temperature, foam thickness, the specific nozzle used, etc.
(4) Actual cure time will depend on temperature, relative humidity and size of foam bead.
(5) Estimated yield under ideal conditions based on gun foam, 3/8" bead.
(6) Estimated yield (gun foam) under ideal conditions for 36" x 60" window, 3/8" wide gap, 1" deep, 3/8" bead.

WEATHERMATE™ Straight Flashing

Property	Value
Water Vapor Transmission, ASTM E96, perm	<1
Application Temperature, °F, min.	20
UV Resistance, days 180	180
Size	4" x 100', 6" x 100', 9" x 100'

STYROFOAM™ SILL SEAL Foam Gasket

Nominal Thickness x Width	Roll Length
.25" x 3.5"	50'
.25" x 5.5"	50'

For more detailed installation information, contact your Dow representative or refer to the product literature.

Dow Building & Construction

1 PRODUCT NAME
THERMAX Light Duty Insulation

2 Manufacturer

The Dow Chemical Company
Building & Construction
200 Larkin
Midland, MI 48674
1-866-583-BLUE (2583)
Fax 1-989-832-1465
www.dowstyrofoam.com/architect

3 Product Description

THERMAX* Light Duty insulation consists of a glass-fiber-reinforced polyisocyanurate foam core faced with nominal 1.25 mil embossed white acrylic-coated aluminum on one side and 1.25 mil embossed aluminum on the other. It can be installed exposed to the interior without a thermal barrier.

THERMAX Light Duty offers high, long-term R-value**. The facers help prevent water and water vapor intrusion into the insulation foam, and allow the foam to stabilize at a higher R-value. Used in conjunction with the appropriate joint closure system for the application, THERMAX Light Duty with its low perm rating helps to prevent moisture condensation within and behind the insulation.

BASIC USE

THERMAX Light Duty is designed as an insulation and interior finish system for walls and ceilings in metal, wood post frame, and concrete or masonry buildings, as governed by building codes. The tough 1.25 mil white embossed aluminum surface of THERMAX Light Duty makes a durable insulation/finish choice for use in light-impact areas. It can be pressure-washed up to 1,000 psi with a 15-degree or greater spray tip (at minimum 3' distance).

SIZES

Width and length:
4' x 8', 4' x 10'
Edge treatments:
Square edge, shiplap

Product thicknesses and R-values are shown in Table 1. Not all products are available in all parts of the country. Additional product sizes are available by custom order. Consult a Dow representative about other sizes and lead-time requirements.

TABLE 1

THERMAX Light Duty Insulation R-Values	
Nominal Foam Thickness, in.	Stabilized R-Value[1,2]
0.5	3.3
0.75	5.0
1.0	6.5
1.25	8.0
1.55	10.0
1.75	11.4
2.0	13.0
2.5	15.8
3.0	19.0

(1) Stabilized R-values @ 75°F mean temperature determined in accordance with ASTM C518.
(2) R-values expressed in ft²•hr°F/Btu.

4 Technical Data

APPLICABLE STANDARDS

THERMAX Light Duty meets ASTM C1289-02 – Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board, Type I, Class 2 (previously known as Federal Specification HH-I-1972), which includes:

- ASTM C203 – Standard Test Methods for Breaking Load and Flexural Properties of Block-Type Thermal Insulation
- ASTM C209 – Standard Test Methods for Cellulosic Fiber Insulating Board
- ASTM C518 – Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
- ASTM D1621 – Standard Test Method for Compressive Properties of Rigid Cellular Plastics
- ASTM D2126 – Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging
- ASTM E96 – Standard Test Method for Water Vapor Transmission of Materials
- ASTM D1623 – Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics

*Trademark of The Dow Chemical Company

**R means resistance to heat flow. The higher the R-value, the greater the insulating power. R-value determined by ASTM C518.

THERMAX Light Duty Insulation

5 Installation

Boards of THERMAX™ Light Duty are lightweight and can be sawed or cut with a knife. They install quickly to walls and ceilings – inside and outside of purlins, trusses or bar joints. Butt joints must be installed over structural members. The surface of the insulation at all joints must be continuously sealed with tape or with one of Dow's joint closure systems.

Contact a local Dow representative or access the literature library at www.dowstyrofoam.com/architect for more specific instructions.

6 Availability

THERMAX™ Light Duty insulation is manufactured in several locations and is distributed through an extensive network. For more information, call 1-800-232-2436.

7 Warranty

Fifteen-year limited thermal warranty.

8 Maintenance

Not applicable.

9 Technical Services

Dow can provide technical information to help address questions when using THERMAX™ Light Duty. Technical personnel are available to assist with any insulation project. Call 1-866-583-BLUE (2583).

10 Filing Systems

- www.dowstyrofoam.com/architect
- www.sweets.com

TABLE 2

Physical Properties of THERMAX Light Duty Insulation	
Property and Test Method	**Value**
Compressive Strength[1], ASTM D1621, psi, min.	25.0
Flexural Strength, ASTM C203, psi, min.	40.0
Water Absorption, ASTM C209, % by volume, max.	0.03
Water Vapor Permeance, ASTM E96, perms, max.	<0.03
Maximum Use Temperature, °F	250
Light Reflectance, Visual Light Spectrophotometer, %	65

(1) Vertical compressive strength is measured at 10 percent deformation or at yield, whichever occurs first.

TABLE 3

Chemical Resistance of THERMAX Light Duty Insulation	
Acid, inorganic	Not recommended
Acid, organic	Excellent
Alcohol	Excellent
Asphalt, water-based	Good
Bases (caustics)	Poor
Brines and other salts	Excellent
Cements and mortar	Poor
Gases, carbon dioxide (CO_2)	Excellent
Gasoline	Excellent
Hydrocarbons	Excellent
Insecticides	Excellent
Kerosene	Excellent
Mineral oil USP	Excellent
Naphtha	Excellent
Paints, alcohol-based	Excellent
Paints, water-based	Excellent
Polyglycols, including propylene glycol	Excellent
Water[1]	Excellent

(1) Water may cause discoloration of aluminum facers. This does not impact the R-value of dry, core insulation.
NOTE: This table should be used as a guide only. For design purposes, specific test data on the intended application may be needed.

PHYSICAL/CHEMICAL PROPERTIES

THERMAX Light Duty exhibits the properties and characteristics indicated in Table 2 when tested as represented.

For chemical resistance properties of THERMAX Light Duty, see Table 3.

ENVIRONMENTAL DATA

THERMAX Light Duty is manufactured with hydrocarbon blowing agents, which have no ozone depletion potential.

FIRE PROTECTION

THERMAX products should be used only in strict accordance with product application instructions. THERMAX products, when used in a building containing combustible materials, may contribute to the spread of fire. For more information, consult MSDS and/or call Dow at 1-866-583-BLUE (2583). In an emergency call 1-989-636-4400.

CODE COMPLIANCES

THERMAX Light Duty complies with the following codes:

- International Residential Code 2003 (IRC) Section 314
- International Building Code (IBC) Section 2603
- National Evaluation Services (NES) NER-681
  BOCA – Section 2603.0 and Research Report #98-25 (replaced)
  ICBO – Section 2602 and Evaluation Report #3223 (replaced)
  SBCCI – Section 2603 and Evaluation Report 9574C (replaced)
- FM 4880 – Wall-Ceiling Construction Metal-Faced – Class 1 Fire Rated to Max. 30' High, 4.25" Thick, 4' Wide, When Installed as Described in the Current Edition of FMRC Approval Guide
- THERMAX products are covered under Underwriters Laboratories Inc. (UL) files R5622, R8181 and R2637
- UL 1256 – Fire Test of Roof Deck Constructions, Roof Deck Construction No. 120 and No. 123
- UL 723 (ASTM E84) Surface Burning Characteristics of Building Materials
- The following designs are 1, 2, 3 or 4 hour wall rated assemblies as listed in the UL Fire Resistance Directory: U026, U324, U325, U326, U330, U354, U355, U460, U902, U904, U905, U906, U907
- Fire Performance Evaluation of an Exterior Masonry Wall System Incorporating THERMAX Insulation Tested in Accordance With NFPA 285, 1998 Edition (UBC 26.9, intermediate scale – multistory testing)
- FMVSS No. 302 – Flammability of Interior Materials – Passenger Cars, Multipurpose Passenger Vehicles, Trucks and Buses (Docket No. 3-3; Notice 4)
- Miami-Dade NOA 02-0703.02 Interior Insulation on CMU Block
- Miami-Dade NOA 02-0703.03 Insulated Wall
- Miami-Dade NOA 02-0703.05 Insulated Roof Assembly

Contact your Dow sales representative or local authorities for state and local building code requirements and related acceptances.

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT & COMPANY IDENTIFICATION Page: 1

24-Hour Emergency Phone Number: 989-636-4400

Product: THERMAX(TM) 1.00 Inch Light Duty Insulation Board

Product Code: 98855

Effective Date: 07/13/05 Date Printed: 06/16/04 MSD: 007472

The Dow Chemical Company, Midland, MI 48674

Customer Information Center: 800-258-2436

2. COMPOSITION/INFORMATION ON INGREDIENTS

Modified polyisocyanurate rigid cellular polymer >45% Aluminum CAS# 007429-90-5 2-85% Tris(2-chloroisopropyl)phosphate CAS# 013674-84-5 <6% Continuous filament glass fiber 1-bromopropane CAS# 000106-94-5 <3% May contain either:

Proprietary hydrocarbon blowing agents <8% 1,1-dichloro-1-fluoroethane CAS# 001717-00-6 <15%

Note: The aluminum amount varies for each product from 2 to 82% with most products containing around 50% aluminum.

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

****

* * Tan to brown foam. Odorless. No significant immediate hazards * * for emergency response are known. *

****

*

POTENTIAL HEALTH EFFECTS (See Section 11 for toxicological data.)

EYE: Solid or dust may cause irritation or corneal injury due to mechanical action. Elevated temperatures may generate vapor levels sufficient to cause eye irritation. Effects may include discomfort and redness.

SKIN: May cause itching. May cause skin irritation due to mechanical abrasion. No adverse effects anticipated by skin absorption.

(Continued on page 2 , over)

INGESTION: Swallowing is unlikely because of the physical state. May cause choking if swallowed.

INHALATION: Dusts or fibers generated in processing may cause irritation of the upper respiratory tract (nose and throat). Dust or fume generated by welding, burning, melting, cutting, brazing, grinding and possibly machining, etc., may cause respiratory irritation and other effects. Symptoms of excessive exposure may be anesthetic or narcotic effects; dizziness and drowsiness may be observed. For 1,1-dichloro-1-fluoroethane (HCFC 141b): may cause central nervous system effects. Excessive exposure may increase sensitivity to epinephrine and increase myocardial irritability (irregular heartbeats). Concentrations of the blowing agent(s) anticipated incidental to proper industrial handling are not expected to cause acute inhalation effects.

SYSTEMIC (OTHER TARGET ORGAN) EFFECTS: Repeated exposures to dusts of this material are not anticipated to result in systemic toxicity or permanent lung injury; however, excessive exposures may cause less severe respiratory effects. Repeated exposure to particles generated by grinding fiberglass-reinforced materials may result in implantation of particles in the skin. In laboratory animals, repeated inhalation exposure to 8000 ppm dichlorofluoroethane produced no adverse effects; higher concentrations produced only minor biochemical changes such as an increase in cholesterol. Contains component(s) which have been reported to cause effects on the following organs in animals: kidney, liver, nervous system, male reproductive organs, female reproductive organs. Other additives are encapsulated in the product and are not expected to be released under normal processing conditions.

CANCER INFORMATION: Direct administration (injection) of polyurethane dust into lungs of rats resulted in benign tumors; this route of administration delivers large particles to the lungs and is not relevant to industrial exposure. The fiberglass in this product is continuous filament fiberglass. Based on available data, IARC concluded that there is inadequate evidence of carcinogenicity in laboratory animals and in humans for continuous filament fiberglass. Benign testicular tumors were observed in rats exposed to high concentrations (5000 ppm or higher) of dichlorofluoroethane for 2 years; no tumors were observed at 1500 ppm. The significance of these findings is considered equivocal.

(Continued on page 3)

TERATOLOGY (BIRTH DEFECTS): Contains component(s) which did not cause birth defects in animals; other fetal effects occurred only at doses toxic to the mother. The component(s) is/are 1,1-dichloro-1-fluoroethane and 1-bromopropane.

REPRODUCTIVE EFFECTS: In a 2-generation reproduction study, no reproductive effects were observed in rats exposed to 8000 ppm dichlorofluoroethane. Slight effects were observed in rats exposed to 20,000 ppm. Effects included minimal decreases in the number of litters and in litter size, and delayed sexual maturation of male offspring believed to be secondary to the slower growth rate of the animals. Contains 1-bromopropane which has been shown to interfere with reproduction and fertility in animal studies. Testing has indicated that normal handling and cutting are unlikely to result in exposure levels of 1-bromopropane sufficient to cause the listed effects.

4. FIRST AID

EYE: Flush eyes thoroughly with water for several minutes. Remove contact lenses after initial 1-2 minutes and continue flushing for several additional minutes. If effects occur, consult a physician, preferably an ophthalmologist.

SKIN: Wash skin with plenty of water.

INGESTION: If swallowed, seek medical attention. May cause gastrointestinal blockage. Do not give laxatives. Do not induce vomiting unless directed to do so by medical personnel.

INHALATION: Move person to fresh air. If not breathing, give artificial respiration. If breathing is difficult, oxygen should be administered by qualified personnel. Call a physician or transport to a medical facility.

NOTE TO PHYSICIAN: Exposure may increase "myocardial irritability". Do not administer sympathomimetic drugs such as epinephrine unless absolutely necessary. No specific antidote. Treatment of exposure should be directed at the control of symptoms and the clinical condition of the patient.

5. FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES FLASH POINT: Not applicable

(Continued on page 4 , over)

METHOD USED: Not applicable
AUTOIGNITION TEMPERATURE: Not applicable

FLAMMABILITY LIMITS
LFL: Not applicable
UFL: Not applicable

HAZARDOUS COMBUSTION PRODUCTS: During a fire, smoke may contain the original material in addition to combustion products of varying composition which may be toxic and/or irritating. In smoldering or flaming conditions, carbon monoxide, carbon dioxide and carbon are generated. Combustion products may include and are not limited to: nitrogen oxides, carbon monoxide, carbon dioxide. Combustion products may include trace amounts of: hydrogen fluoride, hydrogen cyanide, hydrogen chloride, hydrogen bromide, aromatic hydrocarbons.

OTHER FLAMMABILITY INFORMATION: Mechanical cutting, grinding or sawing can cause formation of dusts. To reduce the potential for dust explosion, do not permit dust to accumulate. This product contains a flame retardant to inhibit accidental ignition from small fire sources. Dense smoke is emitted when burned without sufficient oxygen.

EXTINGUISHING MEDIA: Water, dry chemical fire extinguishers and carbon dioxide fire extinguishers.

FIRE FIGHTING INSTRUCTIONS: Keep people away. Isolate fire area and deny unnecessary entry. Soak thoroughly with water to cool and prevent re-ignition. Cool surroundings with water to localize fire zone. Hand held dry chemical or carbon dioxide extinguishers may be used for small fires.

PROTECTIVE EQUIPMENT FOR FIRE FIGHTERS: Wear positive-pressure, self-contained breathing apparatus (SCBA) and protective fire fighting clothing (includes fire fighting helmet, coat, pants, boots, and gloves). If protective equipment is not available or not used, fight fire from a protected location or safe distance.

6. ACCIDENTAL RELEASE MEASURES (See Section 15 for Regulatory Information)

PROTECT PEOPLE: Use appropriate safety equipment. For additional information, refer to Section 8, Exposure Controls/Personal Protection.

(Continued on page 5)

PROTECT THE ENVIRONMENT: Prevent from entering into soil, ditches, sewers, waterways and/or groundwater. See Section 12, Ecological Information.

CLEANUP: Sweep up. Use explosion proof vacuum to clean up dust generated during fabrication. Collect in suitable and properly labeled containers. See Section 7, Handling and Storage for additional information. See Section 13, Disposal Considerations for additional information.

7. HANDLING AND STORAGE

HANDLING: This product is combustible and may constitute a fire hazard if improperly used or installed. When installed, this product should be adequately protected as directed by national building regulations or instructions in the specific application brochure. No smoking, open flames or sources of ignition in handling or storage area.

Mechanical handling equipment can cause formation of dusts. Maintain good housekeeping. Layers of flammable dusts should not be permitted to accumulate. Keep dust away from ignition sources. Provide adequate local ventilation and appropriate dust handling systems.

Fabrication methods which involve cutting into the product may release blowing agent remaining in the cells. Provide adequate ventilation to assure localised concentrations in release areas are maintained below the lower flammability limit. See Section 8, Exposure Controls/Personal Protection.

STORAGE: Store in cool, well ventilated area away from sources of ignition. Maintain good housekeeping to minimize dust accumulation.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

ENGINEERING CONTROLS: Provide general and/or local exhaust ventilation to control airborne levels below the exposure guidelines.

PERSONAL PROTECTIVE EQUIPMENT

EYE/FACE PROTECTION: Use safety glasses. If there is a potential for exposure to particles which could cause eye

(Continued on page 6 , over)

discomfort, wear chemical goggles. If exposure causes eye discomfort, use a full-face respirator.

SKIN PROTECTION: Wear clean, long-sleeved, body-covering clothing. Use gloves chemically resistant to this material.

RESPIRATORY PROTECTION: Atmospheric levels should be maintained below the exposure guideline. If respiratory irritation is experienced, use an approved air-purifying respirator.

EXPOSURE GUIDELINES: 1,1-Dichloro-1-fluoroethane: AIHA WEEL is 500 ppm.

Fiber glass: ACGIH has two guidelines for continuous filament glass fibers: 1 fiber/cc for fibers longer than 5 um with an aspect ratio greater than 3:1, and 5 mg/m3 for the inhalable fraction. Dow IHG is 1 fiber/cc.

Aluminum: ACGIH TLV is 10 mg/m3; OSHA PEL is 15 mg/m3 total, 5 mg/m3 respirable, as A1, for the metal. ACGIH TLV is 5 mg/m3 for fumes, 2 mg/m3 for alkyls and soluble salts.

1-Bromopropane: Dow IHG is 5 ppm (25.2 mg/m3) TWA, ACGIH is 10 ppm TWA.

Contains proprietary ingredient for which the exposure guideline has been omitted.

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE: Tan to brown foam ODOR: Odorless VAPOR PRESSURE: Not applicable VAPOR DENSITY: Not applicable BOILING POINT: Not applicable SOLUBILITY IN WATER: Not applicable SPECIFIC GRAVITY: 1.9

10. STABILITY AND REACTIVITY

CHEMICAL STABILITY: Thermally stable at typical use temperatures.

CONDITIONS TO AVOID: Avoid temperatures above 260C (500F). Exposure to elevated temperatures can cause product to decompose.

INCOMPATIBILITY WITH OTHER MATERIALS: Avoid contact with

(Continued on page 7)

oxidizing materials.

HAZARDOUS DECOMPOSITION PRODUCTS: Decomposition products depend upon temperature, air supply and the presence of other materials.

HAZARDOUS POLYMERIZATION: Will not occur.

11. TOXICOLOGICAL INFORMATION (See Section 3 for Potential Health Effects. For detailed toxicological data, write or call the address or non-emergency number shown in Section 1)

MUTAGENICITY: For fiberglass: in vitro mutagenicity studies were inconclusive. For 1-bromopropane: in vitro mutagenicity studies were positive. Animal mutagenicity studies were negative. The weight of evidence from a battery of mutagenicity studies suggests that dichlorofluoroethane has a very low potential to affect genetic material.

12. ECOLOGICAL INFORMATION (For detailed Ecological data, write or call the address or non-emergency number shown in Section 1)

ENVIRONMENTAL FATE

MOVEMENT & PARTITIONING: No bioconcentration is expected because of the relatively high molecular weight (MW >1000). In the terrestrial environment, material is expected to remain in the soil. In the aquatic environment, material is expected to float.

DEGRADATION & PERSISTENCE: Surface photodegradation is expected with exposure to sunlight. No appreciable biodegradation is expected. Based largely or completely on information for blowing agent: dichlorofluoroethane (HCFC 141b) has a stratospheric ozone depletion potential of 0.11, relative to CFC 12 (ODP=1).

ECOTOXICITY: Not expected to be acutely toxic to aquatic organisms.

13. DISPOSAL CONSIDERATIONS (See Section 15 for Regulatory Information)

DISPOSAL: DO NOT DUMP INTO ANY SEWERS, ON THE GROUND, OR INTO ANY BODY OF WATER. All disposal methods must be in compliance with all Federal, State/Provincial and local laws and regulations. Regulations may vary in different locations. Waste character

(Continued on page 8 , over)

izations and compliance with applicable laws are the responsibility solely of the waste generator. THE DOW CHEMICAL COMPANY HAS NO CONTROL OVER THE MANAGEMENT PRACTICES OR MANUFACTURING PROCESSES OF PARTIES HANDLING OR USING THIS MATERIAL. THE INFORMATION PRESENTED HERE PERTAINS ONLY TO THE PRODUCT AS SHIPPED IN ITS INTENDED CONDITION AS DESCRIBED IN MSDS SECTION 2 (Composition/Information On Ingredients).

FOR UNUSED & UNCONTAMINATED PRODUCT, the preferred options include sending to a licensed, permitted incinerator or other thermal destruction device, or landfill.

As a service to its customers, Dow can provide names of information resources to help identify waste management companies and other facilities which recycle, reprocess or manage chemicals or plastics, and that manage used drums. Telephone Dow's Customers Information Center at 800-258-2436 or 989-832-1556 for further details.

14. TRANSPORT INFORMATION

DEPARTMENT OF TRANSPORTATION (D.O.T.): This product is not regulated by D.O.T. when shipped domestically by land.

CANADIAN TDG INFORMATION: This product is not regulated by TDG when shipped domestically by land.

15. REGULATORY INFORMATION (Not meant to be all-inclusive--selected regulations represented)

NOTICE: The information herein is presented in good faith and believed to be accurate as of the effective date shown above. However, no warranty, express or implied is given. Regulatory requirements are subject to change and may differ from one location to another; it is the buyer's responsibility to ensure that its activities comply with federal, state or provincial, and local laws. The following specific information is made for the purpose of complying with numerous federal, state or provincial, and local laws and regulations. See other sections for health and safety information.

U.S. REGULATIONS

SARA 313 INFORMATION: This product contains the following substances subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR

(Continued on page 9)

REGULATORY INFORMATION (CONTINUED) Part 372: CHEMICAL NAME CAS NUMBER CONCENTRATION

1,1-DICHLORO-1-FLUOROETHANE	001717-00-6	<15	%
ALUMINUM (FUME OR DUST)	007429-90-5 2	-85	%

SARA HAZARD CATEGORY: This product has been reviewed according to the EPA "Hazard Categories" promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 (SARA Title III) and is considered, under applicable definitions, to meet the following categories:

Not to have met any hazard category

TOXIC SUBSTANCES CONTROL ACT (TSCA):

All ingredients are on the TSCA inventory or are not required to be listed on the TSCA inventory.

STATE RIGHT-TO-KNOW: The following product components are cited on certain state lists as mentioned. Non-listed components may be shown in the composition section of the MSDS.

CHEMICAL NAME CAS NUMBER LIST

PROPANE, 1-BROMO-000106-94-5 PA1 PROPRIETARY INGREDIENT PROPRIETARY NJ1 NJ2 NJ3
PA1 1,1-DICHLORO-1-FLUOROETHANE 001717-00-6 NJ2 ALUMINUM (FUME OR DUST) 007429-90-5 NJ2 NJ3 PA3
PA1

NJ1=New Jersey Special Health Hazard Substance (present at greater than or equal to 0.1%). NJ2=New Jersey Environmental Hazardous Substance (present at greater
than or equal to 1.0%).

(Continued on page 10) , over)

REGULATORY INFORMATION (CONTINUED)

NJ3=New Jersey Workplace Hazardous Substance (present at greater than or equal to 1.0%). PA1=Pennsylvania Hazardous Substance (present at greater than or equal to 1.0%). PA3=Pennsylvania Environmental Hazardous Substance (present at greater than or equal to 1.0%).

OSHA HAZARD COMMUNICATION STANDARD:

This product is not a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200. CANADIAN REGULATIONS
==========

WHMIS INFORMATION: The Canadian Workplace Hazardous Materials Information System (WHMIS) Classification for this product is: This product is exempt under WHMIS.

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA):

All substances in this product are listed on the Canadian Domestic Substances List (DSL) or are not required to be listed.

16. OTHER INFORMATION MSDS STATUS: Revised Section 8 (Exposure Guideline). OTHER: For further information, contact the Plastics Customer Information Group at 1-866-583-BLUE(2583).

Insulation Fact Sheet

Applegate Loose-fill Cellulose Insulation has been installed with the manufacturer's recommendations to provide a value of R-_____ using _____ bags of insulation to cover _____ square feet of area at a thickness of _____ inches.

This is Applegate Loose-fill Cellulose Insulation

applegate LOOSE-FILL CELLULOSE INSULATION

Building Address

City, State, Zip

Signature of Installer

Company Name

Company City, State, ZIP

Date Installed

R&D Services

R & D Services, Inc. Classified Applegate Loose-Fill Cellulose Reference File: RDS-LF9587

R-Value @ 75 °F	Initial Installed Thickness (Inches)	Minimum Settled Thickness (Inches)	Maximum Net Coverage Area (Square Feet per Bag)	Number of Bags per 1,000 Square Feet	Minimum Weight per Square Foot (Pounds)
11	3.92	3.52	128.8	7.8	0.21
13	4.50	4.05	99.3	10.1	0.27
19	6.36	5.72	57.4	17.4	0.46
22	7.32	6.58	47.2	21.2	0.56
24	7.96	7.16	42.2	23.7	0.63
26	8.60	7.74	38.1	26.3	0.70
30	9.90	8.91	31.9	31.4	0.83
32	10.55	9.49	27.4	36.5	0.97
38	12.50	11.25	24.0	41.6	1.10
40	13.15	11.83	22.6	44.2	1.17
45	14.78	13.30	19.7	50.6	1.34
48	15.76	14.18	18.3	54.5	1.44
49	16.08	14.48	17.9	55.8	1.48
50	16.41	14.77	17.5	57.1	1.51
55	18.05	16.24	15.7	63.5	1.68
60	19.68	17.71	14.3	70.0	1.85

Minimum installed thickness determined according to ASTM C1374 using a Krendl 500 with gate at 5 and air at 6.5. Settings are not adjustable

APPLEGATE MANUFACTURING FACILITIES

1000 HIGHVIEW DR. WEBBERVILLE, MI 48892 800-627-7536	1925 STATE ROUTE 1241 N HICKORY, KY 42051 888-502-7753	600 INDUSTRIAL DR. BLOOMER, WI 54724 800-633-3179	230 SHOOP DR. PENROSE, CO 81240 866-568-9639	2500 JACKSON ST. MONROE, LA 71202 800-854-1907	1241 MEADOWBROOK DR. EASTANOLLEE, GA 30538 888-427-7534	1050 SUPERIOR AV. CHAMBERSBURG, PA 17201 800-231-1939

Read This Before You Buy

What You Should Know About R-Values

The chart shows the R-Value of this insulation. "R" means resistance to heat flow. The higher the R-Value, the greater the insulating power. Compare insulation R-values before you buy.

There are other factors to consider. The amount of insulation you need depends mainly on the climate you live in. Also, your fuel savings from insulation will depend upon the climate, the type and size of your house, the amount of insulation already in your house, and your fuel use patterns and family size. If you buy too much insulation, it will cost you more than what you'll save on fuel.

To get the marked R-Value, it is essential that this insulation be installed properly.

Chart based on settled thickness, a nominal bag weight of 26.5 lbs and coverage based on the Krendl 500 blowing machine. Machine settings are not adjustable. Stated R-value is provided by installing the required number of bags per 1,000 sq ft at a minimum installed thickness. Installation of the required number of bags may yield more than the specified minimum thickness and minimum weight per sq ft. Actual coverage will be influenced by job conditions and application techniques and may vary as much as 10% without significantly affecting the stated R-value. Failure of the installer to provide at least the required number of bags per 1,000 sq ft and at least the minimum thickness may result in a lower installed R-value. Compaction may occur during installations above R-30, requiring more than the stated number of bags to obtain the minimum installed thickness. This product is intended for dry loose-fill attic application. This coverage chart does not apply to spray-applied application. Do not add water to this product in attic applications.

Except the LORD build the house, they labour in vain that build it... (Psalm 127:1)

1. PRODUCT NAME
Constant Pressure Dispensing System (CPDS™ Series 2).
Item # 4505500150

2. MANUFACTURER
Convenience Products
866 Horan Dr., Fenton, MO 63026 USA
(636) 349-5855
(800) 325-6180
FAX: (636) 349-5335
E-mail: support@touch-n-seal.com
Website: www.touch-n-seal.com

3. PRODUCT DESCRIPTION
The Touch 'n Seal® CPDS Series 2 is an inexpensive, low maintenance dispensing mechanism that, when used according to manufacturer's directions, applies Class I fire retardant, thermal insulating and sound attenuating 2-component polyurethane spray foam. Touch 'n Seal spray foam is permanent and dries within minutes of application.

The Touch 'n Seal CPDS Series 2 uses disposable chemical cylinders and dispenses polyurethane spray foam using a unique air compressor, system controls and standard 120V electrical supply. In the absence of electricity, the system may be operated using dry pressurized nitrogen or compressed air.

Using a constant delivery rate, the CPDS Series 2 applies polyurethane spray foam to horizontal/vertical surfaces up to 150' away (46 meters). Chemical calibration is not required.

At approximately 24.5"W x 33"D x 48" H (62 x 84cm) the Touch 'n Seal CPDS Series 2 is small enough to be transported in a standard pick-up truck, and fits easily through most doors and entrances. The empty unit weighs less than 155 pounds (70 kg).

Basic Use
The CPDS Series 2 provides many of the features of a "bulk" spray foam system when used with Touch 'n Seal CP660 FR, CP750 FR and CP1200 FR 2-component foam kits. Touch 'n Seal foams offer superior insulation performance, protect against energy-robbing air infiltration, and retard vapor migration while reducing home and commercial building energy consumption.

Sizes
(*CP660 FR Foam Kits, # 4505500660)*
660 board feet (61.3 m^2 @ 25 mm) @ 2.0 pcf density (32 ± 3.2 kg m^3)
(CP750 FR Foam Kits, #4505500750)
750 board feet (69.68 m^2 @ 25 mm) @ 1.75 pcf density (28.03 kg /m^3)
(CP1200 FR Foam Kits, # 4505501200)
1200 board feet (111.5m^2 @ 25mm) @ 1.0 - 1.25 pcf density (16.0 – 20.0 kg/m^3)

Features/Benefits (CP750 FR and CP1200 FR Foam Kits)
- Class 1, fire retardant foam
- Easy to transport
- No expensive maintenance
- Low investment cost
- No deposit/No return
- Reduces energy loss by as much as 40%
- Reduces use of fossil fuels and improves air quality
- Permanent insulation; does not shrink or settle like cellulose; maintains air seal
- Compatible with all fiber insulation systems including cellulose, fiberglass and rockwool
- No Ozone Depleting Chemicals
- Helps to reduce Green House Gas Emissions
- Expands to fill smallest to largest gaps, cracks and holes, reducing air exchanges
- High R-value
- Open and closed cell formulas
- Allows for down-sized HVAC systems; uses less energy, fewer cycle times, more consistent "comfort level", reduces equipment maintenance
- Significantly increases structural strength; important in high wind situations (per the Spray Polyurethane Foam Alliance)

Limitations (CP750 FR and CP1200 FR Foam Kits)
- Not for use as an exterior roofing system.
- Do not expose to temperatures above 250°F (121°C), open flames or sparks.
- Do not expose to ultraviolet light.
- Chemical contents must be 70°F - 90°F (21° - 32°C) prior to spraying.
- Do not store in temperatures above 120°F (49°C).
- Always refer to local building code regulations.
- Certain structures such as cold storage and freezers have very specific design criteria. Ensure the structure has been designed by an appropriate design professional.
- For best adhesion, apply first layer ½" (12mm) thick. Apply additional foam in 1" (25mm) thick layers. Allow foam to cool between the application of additional layers.
- Product is not a fire stop.
- Do not leave product exposed. Cover with approved facings

4. TECHNICAL DATA (CP750 FR and CP1200 FR Foam Kits)
Applicable Standards
- ASTM G21 Fungi Resistance
- ASTM E84 Surface Burning Characteristics
- ASTM E96 Water Vapor Transmission
- ASTM E 283 Air Permeance
- ASTM C518 R-Value
- ASTM D1621 Compressive Strength
- ASTM D1622 Density
- ASTM D1623 Tensile Strength
- ASTM D2126 Thermal and Humid Aging – Dimensional Stability
- ASTM D6226 Closed Cell Content

Approvals/Certifications
- International Residential Code
- California Bureau of Home Furnishings and Insulation (CP750 FR)

Physical/Chemical Properties
See Table 1. Test data available upon request.

Fire Performance
- See Table 1

Shelf Life
1 year in unopened container when stored between 60° - 90°F (16° - 32°C), in a cool, dry, well-ventilated area.

Storage & Disposal
Keep containers tightly closed in a cool, dry, well-ventilated area. Ideal storage temperature is 60° - 90°F (16°- 32°C). Storage above 90°F (32°C) will reduce shelf life. Do not store at temperatures above 120°F (49°C). Do not expose containers to conditions that may damage, puncture, or burst the containers. Dispose of leftover material/containers in accordance with federal, state and local regulations. See Material Safety Data Sheet for more information.

5. INSTALLATION / APPLICATION
Please refer to CPDS Series 2 Installation, Set Up and Operation Instructions" found inside the "A" canister carton or request a faxed set of these instructions by calling Customer Service at 800-325-6180.

Always refer to local building codes prior to application of Touch 'n Seal spray foam. Touch 'n Seal spray foam can be applied to and will adhere to almost any traditional building material surfaces including; wood, concrete, polystyrene, gypsum board, fiberboard, masonry and metal.

Surfaces to be sprayed must be dry, clean and free of dust, dirt, grease and other substances that may inhibit proper adhesion.

For best results apply Touch 'n Seal spray foam when surface and ambient temperatures are between 60° - 90°F (16° - 32°C). Chemical contents must be between 70° - 90°F (21° - 32°C) before dispensing. Use all chemical contents within 30 days of initial dispensing.

Keep out of reach of children. Always wear proper personal protective equipment, including head covering, gloves, clothing, eyewear and respirator. Use in well-ventilated area.

6. AVAILABILITY & COST

Availability

Touch 'n Seal CPDS Series 2 units and spray polyurethane foams are available throughout the U.S., Canada, Mexico and the world. Contact Convenience Products Customer Service at 800-325-6180 or FAX 636-349-1708 for distributor information.

Cost

Contact Convenience Products for local distributors who can provide cost and delivery information.

7. WARRANTY

Convenience Products warrants its CPDS Series 2 to be free of defects in workmanship and function.

Further, Convenience Products provides a limited, six (6) month warranty on the CPDS Series 2 air compressor, wheels, and canisters if the CPDS Series 2 is used in the manner intended. Such limited warranty is for replacement of the listed items.

Convenience Products is not liable for any incidental, consequential or any other damages or remedies. There are no warranties that extend beyond the description herein, however, certain states have specific laws regarding limitation on incidental or consequential damages, in which case, you may have other legal rights.

8. MAINTENANCE

Minor. See owners' manual.

9. TECHNICAL SERVICE

Technical assistance, including detailed information, product literature, test results, assistance with preparing project specifications and application training is available by contacting Convenience Products.

10. FILING SYSTEMS

Additional information is available from the manufacturer upon request.

The information contained herein was accurate at the time of publishing. Please refer to the Touch 'N Seal website for the latest information.

PROPERTIES OF TOUCH 'N SEAL SPRAY POLYURETHANE FOAM

	CP1200 FR (Open Cell)	CP750 FR (Closed Cell)		CP660 FR (Closed Cell)
Shelf Life	1 year; unopened container	1 year; unopened container		1 year; unopened container
Output	1200 board feet (111.5 m^2 @ 25 mm)	750 board feet (69.68 m^2 @ 25 mm)		660 board feet (61.3 m^2 @ 25 mm)
Dry time/Tack Free Time	30 - 60 seconds	30 – 60 seconds		30 – 60 seconds
Typical Output – 30' (9 m) Hose	4 - 5 lbs/min. (1.8 - 2.3 kg/min.)	4 - 5 lbs/min. (1.8 - 2.3 kg/min.)		------
Fully Cured	Approximately 1 hour	Approximately 1 hour		Approximately 1 hour
Cuttable	2 - 5 minutes	2 - 5 minutes		2 - 5 minutes
ASTM G21 Fungi Resistance	Does not support growth	Does not support growth		Does not support growth
ASTM E84 Surface Burning Characteristics @ 2" (51 mm)		Class 1 @ 2" (51mm) thick	Class 1 @ 3" (75mm) wide bead	
Flame Spread	10	25	10	20
Smoke Development	250	350	50	350
ASTM E96 Water Vapor Transmission	5.4 perms@ 1 in. (25 mm)	2.80 perms@ 1 in. (25 mm)		3.45 perms@ 1 in. (25 mm)
ASTM E 283 Air Permeance	0.003 cfm/ft^2 @1"	0.001 cfm/ft^2 @1/2"		0.0004 cfm/ft^2 @ 1.57 psf 0.002 L/s/m^2 @ 75 Pa
ASTM C518 R-Value - Initial	4.96 / in. (25 mm)	7.12 / in. (25 mm)		6.3 / in. (25 mm)
– Aged (28 days)	4.1/ in. (25 mm)	5.48 / in. (25 mm)		5.1 / in. (25 mm)
ASTM D1621 Compressive Strength	5 psi (0.92 kgf /cm2)	13.1 psi (0.92 kgf /cm^2)		31.0/214 kPa
ASTM D1622 Density	1.0 – 1.25 pcf/16.0 - 20.0 kg m^3	1.75 ± .10 pcf (28.03 ± 1.60 kg/m^3)		2.0 pcf ± .2 pcf (32 ± 3.2 kg m^3)
ASTM D1623 Tensile Strength	N/A	38.23 psi (2.69 kgf/cm^2)		30.8 psi/212 kPa
ASTM D2126 Thermal and Humid Aging –	N/A	Linear	Mass	Mass	
Dimensional Stability					
-40°F (-40ºC) 2 weeks	N/A	+0.05%	+0.10%	+0.10%	0.9%
158°F (70ºC) 2 weeks		+1.90%	-2.95%	-2.95%	5.7%
Combined -40°F (-40ºC) 2 weeks & 158°F (70ºC) 2 weeks		+1.85%	-2.85%	-2.85%	1.6%
ASTM D-2842 Water absorption	3 - 4% by volume	N/A			2.7%
ASTM D6226 Closed Cell Content	< 10%	> 90%			> 92%
AC 377 Appendix X - Use in Attic & Crawl Spaces					Passed. Refer to independent laboratory test reports.
International Residential Code	Compliant	Compliant			Compliant
Coast Guard Title 33 CFR, Paragraph 83.114	N/A	N/A			Meets Criteria
California Bureau of Home Furnishings and Insulation	N/A	Filed			N/A

TECH DATA SHEET

1. PRODUCT NAME
Touch 'n Seal® Foam Kit 1.75 pcf FR ICC

2. MANUFACTURER
Convenience Products
866 Horan Dr.
Fenton, MO 63026 USA
Phone: (636) 349-5855
Toll Free: (800) 325-6180
FAX: (636) 349-5335
E-mail: support@touch-n-seal.com
Website: www.touch-n-seal.com

3. PRODUCT DESCRIPTION
Touch 'n Seal Foam Kit 1.75 pcf FR ICC is a two-component foam system, available in a variety of low-pressure dispensing units. When used according to manufacturer's directions, Foam Kit 1.75 pcf FR ICC produces a closed cell rigid polyurethane foam with ASTM E-84 Class A(I) fire resistance. The system complies with 2006, 2009 and 2012 IBC, IRC, and IECC as supported by ICC Evaluation Services listing ESR-3052

Basic Use

Touch 'n Seal Foam Kit 1.75 pcf FR ICC i**s suitable for Type V(B) construction where code jurisdictions require an ICC-ES listing to demonstrate code compliance.**

Sizes:

Product	Yield, Bd. ft.*	Item #
FOAM KIT 200 1.75 PCF FR ICC	200	4004001200
FOAM KIT 600 1.75 PCF FR ICC	600	4004521600
FOAM KIT 600 1.75 PCF FR ICC Replacement	600	4004521601
CP-750 1.75 PCF FR ICC	750	4505500750
RF-17 1.75 PCF FR ICC	2000	4505200000
RF-60 1.75 PCF FR ICC	6800	4505170000
RF-120 1.75 PCF FR ICC	15,400	4505113000

Features/Benefits

- Medium density spray polyurethane foam insulates and seals
- Saves energy
- Increases comfort by reducing drafts
- Foam Kits contain everything needed – ready to use
- No shaking or pre-mixing required
- Applied with patented no-crossover applicator
- Closed cell structure
- Cured foam does not shrink or settle
- Reduces vibration and sound transmission
- Low-odor formulation
- Easy to transport
- Low maintenance
- Increases structural strength
- 15 month shelf life

Limitations

- Chemical contents must be 70° - 90°F (21° – 32°C) prior to spraying.
- Surface and ambient temperatures should be between 60° - 90°F (16° – 32°C).
- Foam is combustible. Do not expose to temperatures above 250°F (121°C), open flames or sparks.
- Do not expose uncoated foam to sunlight or UV.
- Do not use for filling closed gypsum board stud wall cavities
- Product is not a fire stop.
- Refer to local building code authorities for guidance in construction applications. Ignition or thermal barrier coating may be required over exposed foam.

4. TECHNICAL DATA
Applicable Methods & Standards

- ASTM G21 Fungi Resistance
- ASTM E84 Surface Burning Characteristics
- ASTM E96 Vapor Permeance
- ASTM E283 Air Permeance
- ASTM C518 R-Value
- ASTM D1621 Compressive Strength
- ASTM D1622 Density
- ASTM D1623 Tensile Strength
- ASTM D2126 Dimensional Stability
- ASTM D6226 Closed Cell Content

5. SAFE USE AND HANDLING

- Keep out of reach of children.
- Always wear proper personal protective equipment, including head covering, gloves, clothing, eyewear and respirator
- Use in well-ventilated area
- Refer to product Safety Data Sheet (SDS) and the "Safe Use, Storage and Handling for Low Pressure Spray Foam Products" brochure, both available from Customer Service at 800-325-6180 or at www.touch-n-seal.com prior to handling or using Touch 'n Seal products.

Storage & Disposal

- Store containers tightly closed in a well-ventilated area between 60° - 90°F (16° – 32°C). Storage above 90°F (32°C) will reduce shelf life.
- Storage below 60°F (16°C) may cause crystals to form in A-component.
- Do not store at temperatures above 120°F (49°C).
- Do not expose containers to conditions that may damage, puncture, or burst the containers.
- Dispose of leftover material / containers in accordance with federal, state and local regulations.
- See Safety Data Sheet for more information.
- Refer to "Foam Kit Operation Instructions" for storage of partially used disposable Foam Kits.

Shelf Life

15 months in unopened container when stored between 60° - 90°F (16° – 32°C), in a dry, well-ventilated area.

TECH DATA SHEET

6. INSTALLATION / APPLICATION

Refer to local building code authorities for guidance in construction applications. Touch 'n Seal spray foam can be applied to and will adhere to almost any traditional building material surfaces including; wood, concrete, polystyrene, gypsum board, fiberboard, masonry and metal.

Surfaces to be sprayed must be dry, clean and free of dust, dirt, grease and other substances that may inhibit proper adhesion. For best results apply Touch 'n Seal Slow Rise foam when surface and ambient temperatures are between 60° - 90°F (16° – 32°C). Chemical contents must be between 70° - 90°F (21° – 32°C) before dispensing.

Use all chemical contents within 30 days of initial dispensing.

7. AVAILABILITY

Touch 'n Seal Two Component Spray Foam Kits are available throughout the U.S., Canada, Mexico and the world. Contact Convenience Products Customer Service at 800-325-6180 or FAX 636-349-1708 for distributor information

8. WARRANTY

Convenience Products warrants this product to be free from defects. The Company shall not be liable for any consequential or other damage or remedy; its sole obligation and your exclusive remedy are limited to product replacement. Warranty is null and void if unit is operated without attaching a new spray foam applicator gun/hose set. Some states do not allow limitations on the exclusive or limitation of incidental or consequential damages, so the above limitations or exclusions may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state. There are no warranties which extend beyond the description on the face hereof.

9. MAINTENANCE

Refer to "Foam Kit Operation Instructions."

10. TECHNICAL SERVICE

Technical assistance, including detailed information, product literature, test results, assistance with preparing project specifications and application training is available by contacting Convenience Products.

TYPICAL PROPERTIES OF Touch 'n Seal® Foam Kit 1.75 pcf FR ICC

Property	Test Method	Typical Values	
Shelf Life		15 months; unopened container	
Dry time / Tack Free Time		45 seconds	
Cuttable Time		5 minutes	
Fully Cured Time		1 hour	
R-Value, aged 1 in. 2 in.	ASTM C518	 5.4 h·ft^2·°F/Btu (0.95 K·m^2/W) 11 h·ft^2·°F/Btu (1.9 K·m^2/W)	
Compressive Strength	ASTM D1621	**31 psi (21 kPa)**	
Tensile Strength	ASTM D1623	31 psi (21 kPa)	
Density, Free Rise	ASTM D1622	1.75 pcf (28 kg/m^3)	
Surface Burning Characteristics 2" thickness Flame Spread Index Smoke Developed	ASTM E84	 15 350	
Vapor Permeance	ASTM E96	1.77 perm @ 1 in. (25 mm) 0.98 perm @ 2 in. (50 mm) 0.69 perm @ 3 in. (75 mm)	
Air Permeance	ASTM E283	< 0.004 CFM / ft^2 (< 0.02 L/s/m^2)	
Dimensional Stability, % volume change	ASTM D2126	- 4 °F (- 20°C)	0.9%
		158°F (70°C) / 97% r.h.	5.7%
		176 °F (80°C)	1.6%
Sound Transmission Class (STC Rating)	ASTM C90	32 @ 1 ½ in. (38 mm)	
Closed Cell Content	ASTM D6226	>90%	
Fungi Resistance	ASTM C1338	Does not support growth	

**Theoretical yield is used as an industry standard to represent the size of two-component foam kits. The calculation is based upon ideal conditions, does not include blowing agent loss, and may vary according to application method or environmental factors.*

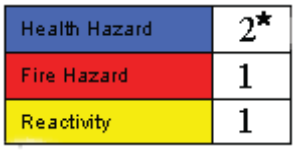
The higher the R-value the greater the insulating power. Ask your seller for the fact sheet on R-values.

The information contained herein was accurate at the time of publishing. Please refer to the Touch 'N Seal website for the latest information.

Convenience Products
866 Horan Dr., Fenton, MO 63026 USA
(800) 325-6180, (636) 349-5855 tel.

MADE IN U.S.A.

Material Safety Data Sheet

NFPA	HMIS	PPE	Transport Symbol
			

Issuing Date 27-Feb-2007 **Revision Date 12-Nov-2012** **Revision Number 5**

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name
Component A for:
Touch 'n Seal® Foam kit Class I FR Foam
Touch 'n Seal Refillable Class I FR Foam
Touch 'n Seal CPDS Class I FR Foam
Touch 'n Seal Mine Foam
Touch 'n Seal Rib & Roof Foam Sealant
Touch 'n Seal Foam Kit Low Density

Product ID No: MSDS / A MF-FR

Recommended Use Sealant, Insulation

Supplier Address
Convenience Products, Division of Clayton Corp.
866 Horan Drive
Fenton, MO 63026-2416 USA
TEL: (636) 349-5333

Emergency Telephone Number
Chemtel 1-800-255-3924
(813) 248-0585 outside US

2. HAZARDS IDENTIFICATION

WARNING!

Emergency Overview

Contents under pressure.
May be harmful if swallowed or inhaled.
May cause allergic skin reaction.
May cause allergic respiratory reaction.
Persons allergic to isocyanates, and particularly those suffering from asthma or other respiratory conditions, should not work with isocyanates.
Vapors may be irritating to eyes, nose, throat, and lungs.
May cause drowsiness and dizziness.
Keep upwind of spill. Stay out of low areas

Appearance Pale Amber **Physical State** Liquid Aerosol **Odor** Faint hydrocarbon

Potential Health Effects

Principle Routes of Exposure Inhalation, Skin contact, Eye contact.

Acute Toxicity

Eyes Irritating to eyes. May cause slight temporary corneal injury due to adhesive character.

Skin

Prolonged or repeated exposure may cause slight skin irritation. Material will stick to skin causing irritation upon removal. Animal studies have shown that skin contact with isocyanates may play a role in causing respiratory sensitization. Repeated or prolonged skin contact may cause allergic reactions with susceptible persons.

Skin Absorption

A single prolonged exposure is unlikely to result in the material being absorbed in harmful amounts.

Inhalation

Maintain local exhaust ventilation system during use. If large concentrations of vapors build up they could cause upper respiratory tract and lung irritation. May cause allergic respiratory reaction. Inhalation of vapors in high concentration may cause shortness of breath (lung edema).

Ingestion

May be harmful if swallowed. May cause additional affects as listed under "Inhalation". Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhea. Product may cure in the gastrointestinal tract and form an obstruction. May cause adverse cardiac effects, blood disturbances, and metabolic acidosis.

Chronic Effects

Tissue injury in the upper respiratory tract and lungs has been observed in laboratory animals after repeated excessive exposures to MDI / Polymeric MDI aerosols. Intentional misuse by deliberately concentrating and inhaling contents may be harmful or fatal. Repeated or prolonged contact causes sensitization, asthma and eczemas.

Birth / Developmental Effects:

In laboratory animals, MDI/Polymeric MDI did not cause birth defects; other fetal effects occurred only at high doses that were toxic to the mother.

Aggravated Medical Conditions

Allergies. Skin disorders. Respiratory disorders. Central nervous system. Preexisting eye disorders. Kidney disorders. Liver disorders.

Interactions with Other Chemicals

Irritants. Sensitizers. Epoxies. Use of alcoholic beverages may enhance toxic effects.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	CAS-No	Weight %
1,1,1,2 – Tetrafluoroethane (HFC-134a, Fluorocarbon)	811-97-2	7-14
Polymethylene polyphenylene isocyanate	9016-87-9	30-60
Methylene bisphenyl isocyanate (MDI)	101-68-8	30-60
Methylenediphenyl diisocyanate	26447-40-5	5-10

4. FIRST AID MEASURES

General Advice

If emergency warrants call 911 or emergency medical service. Show this safety data sheet to the doctor in attendance. Remove and wash soiled clothing before reuse.

Eye Contact

Immediately flush with plenty of water. After initial flushing, remove any contact lenses and continue flushing for at least 15 minutes. Keep eye wide open while rinsing. Obtain medical attention, preferably from an ophthalmologist.

Skin Contact

Remove contaminated clothing; wash before reuse. Foam will stick to skin; studies demonstrate that cleaning very soon after exposure with corn oil or nail polish remover is most effective. If foam dries on skin, apply generous amounts of petroleum jelly or lanolin, put on plastic gloves and wait 1 hour. With a clean cloth, firmly wipe off petroleum jelly and repeat process if necessary. Do not attempt to remove dried foam with solvents.

Inhalation	Move victim to fresh air. Apply artificial respiration if victim is not breathing. If breathing is difficult, oxygen should be administered by qualified personnel. Call a physician or transport to a medical facility.
Ingestion	Call a physician or Poison Control Center immediately. May produce an allergic reaction. Do not induce vomiting unless directed to do so by medical personnel. Drink plenty of water. Never give anything by mouth to an unconscious person.
Notes to Physician	Maintain adequate ventilation and oxygenation of the patient. May cause asthma-like (reactive airways) symptoms. May cause respiratory sensitization or asthma-like symptoms. Respiratory symptoms, including pulmonary edema, may be delayed. Exposure may increase "myocardial irritability". If you are sensitized to diisocyanates, consult your physician regarding working with other respiratory irritants or sensitizers. No specific antidote. Treatment of exposure should be directed at the control of symptoms and the clinical condition of the patient.
Protection of First-aiders	Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

5. FIRE-FIGHTING MEASURES

Flammable Properties	Foam cylinders exposed to fire can rupture.
Flash Point	None
Suitable Extinguishing Media	Isolate fire and deny unnecessary entry. Use an extinguishing agent suitable for type of surrounding fire. Dry chemical, CO_2, water spray, fog or regular foam. Stay upwind. Keep out of low areas where gases fumes can accumulate. Move containers from fire area if you can do it without risk. Damaged cylinders should be handled only by specialists.

Explosion Data

Sensitivity to mechanical impact	None
Sensitivity to static discharge	None
Specific Hazards Arising from the Chemical	Ruptured cylinders may rocket.
Protective Equipment and Precautions for Firefighters	As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA	**Health Hazard** 2	**Flammability** 1	**Stability** 1	**Physical and Chemical Hazards** -
HMIS	**Health Hazard** 2*	**Flammability** 1	**Stability** 1	**Personal Precautions** -B

6. ACCIDENTAL RELEASE MEASURES

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions

Do not touch or walk through spilled material. Use appropriate safety equipment. Evacuate area. Keep personnel out of low areas, confined or poorly ventilated areas. Keep upwind of spill. Ensure adequate ventilation. No smoking in area. Only trained and properly protected personnel must be involved in clean-up operations.

Methods for Containment

If possible, turn leaking containers so that gas escapes rather than liquid. Allow substance to evaporate. Contain spilled materials if possible without risk. Absorb with materials such as Sawdust, dirt, and vermiculite. Collect in suitable and properly labeled open containers. Do not place in sealed containers. Wash what is left of the spill site with large quantities water.

Methods for Cleaning Up

Soak up with inert absorbent material. Sweep up and shovel into suitable containers for disposal. Do not direct water at spill or source of leak.

Other Information

Ventilate the area. Curing foam gives off HFC-134a. Do not put curing foam in a sealed drum.

7. HANDLING AND STORAGE

Handling

Avoid contact with skin, eyes and clothing. Wear personal protective equipment. Remove and wash contaminated clothing before re-use. Do not breathe vapors or spray mist. Do not eat, drink or smoke when using this product. Use only in area provided with appropriate exhaust ventilation. Avoid breathing vapors or mists. Contents under pressure. Do not puncture or incinerate cylinders. Container, even those that have been emptied, can contain vapors. Do not stick pin or any other sharp object into opening on top of cylinder.

Storage

Keep containers tightly closed in a cool, well-ventilated place. Keep in properly labeled containers. Keep in an area equipped with sprinklers. Keep out of the reach of children. Ideal storage temperature is 16-32 °C / 60 – 90 °F. Storage above 32 °C / 90 °F will reduce its shelf-life. Never keep at temperatures above 48.8 °C / 120 °F.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure Guidelines

Chemical Name	ACGIH TLV	OSHA PEL	NIOSH IDLH
Methylene bisphenyl isocyanate (MDI)	TWA: 0.005 ppm	Ceiling: 0.02 ppm Ceiling: 0.2 mg/m^3	75 mg/m^3

NIOSH IDLH: Immediately Dangerous to Life or Health

Engineering Measures

Emergency Showers
Eyewash stations
Ventilation systems

Personal Protective Equipment

Eye/Face Protection

Tightly fitting safety glasses with side-shields.

Skin and Body protection

Lightweight protective clothing. Impervious gloves.

Respiratory Protection

Atmospheric levels of PMDI should be maintained below the exposure guidelines. If exposure limits are exceeded or irritation is experienced, use a NIOSH/MSHA approved air-purifying respirator equipped with an organic vapor absorbent and a particle filter. For situations where the atmospheric levels exceed the level for which an air-purifying respirator is effective, use a positive-pressure air-supplied respirator. Respiratory protection must be provided in accordance with current local regulations.

Hygiene Measures When using, do not eat, drink or smoke. Maintain regular cleaning of equipment, work area and clothing.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	Pale Amber	**Odor**	Faint hydrocarbon
Odor Threshold	No information available	**Physical State**	Liquid Aerosol
pH	No information available		
Flash Point	None	**Autoignition Temperature**	Not applicable
Decomposition temperature	No data available	**Boiling Point/Range**	-26°C / -15°F for HFC-134a
Melting Point/Range	No data available		
Flammability Limits in Air	No data available	**Explosion Limits**	No data available
Specific Gravity	1.2	**Water Solubility**	Not Compatible
Solubility	Compatible.	**Evaporation Rate**	No data available
Vapor Pressure	No data available	**Vapor Density**	No data available
		EPA VOC (g/l)	0
Partition Coefficient (n-octanol/water)	No data available		

10. STABILITY AND REACTIVITY

Stability Stable under recommended storage conditions

Conditions to Avoid Keep away from open flames, hot surfaces and sources of ignition. Temperatures above 48.8 °C / 120 °F.

Incompatible Products Water. Alcohols. Strong bases. Strong oxidizing agents. Finely powdered metals.

Hazardous Decomposition Products Carbon monoxide (CO), Carbon dioxide (CO_2), Nitrogen oxides (NOx), Hydrogen cyanide.

Hazardous Polymerization Hazardous polymerization does not occur.

11. TOXICOLOGICAL INFORMATION

Acute Toxicity

Sensitization - Skin Skin contact may cause an allergic skin reaction. Animal studies have shown that skin contact with isocyanates may play a role in respiratory sensitization.

11. TOXICOLOGICAL INFORMATION

Sensitization – Respiratory May cause allergic respiratory response. MDI concentrations below the exposure guidelines may cause allergic respiratory reactions in individuals already sensitized. Asthma-like symptoms may include coughing, difficult breathing and a feeling of tightness in the chest. Occasionally, breathing difficulties may be life threatening.

Product Information .

Chemical Name	LD50 Oral	LD50 Dermal	LC50 Inhalation
Polymethylene polyphenylene isocyanate	49 g/kg (Rat)	9400 mg/kg (Rabbit)	490 mg/m^3 (Rat) 4 h
Methylene bisphenyl isocyanate (MDI)	9200 mg/kg (Rat)		
Methylenediphenyl diisocyanate		6200 mg/kg (Rabbit)	0.369 mg/L (Rat) 4 h

Chronic Toxicity

Chronic Toxicity Repeated or prolonged exposure may cause central nervous system damage. Tissue injury in the upper respiratory tract and lungs has been observed in laboratory animals after repeated excessive exposures to MDI/polymeric MDI aerosols. Repeated or prolonged contact causes sensitization, asthma and eczemas. Repeated or prolonged contact may causes sensitization, asthma and eczemas.

Carcinogenicity There are no known carcinogenic chemicals in this product.

Mutagenicity Contains no known mutagenetic chemicals

Reproductive Toxicity This product does not contain any known or suspected reproductive hazards

Target Organ Effects Contains component(s) that have been reported to cause effects on the following organs in animals: Kidney, Liver, Bone marrow.

Endocrine Disruptor Information This product does not contain any known or suspected endocrine disruptors

12. ECOLOGICAL INFORMATION

Ecotoxicity
Ecotoxicity effects.

Chemical Name	Toxicity to Algae	Toxicity to Fish	Microtox	Daphnia Magna (Water Flea)
Methylenediphenyl diisocyanate	EC50 = 3230 mg/L 96 h			EC50 > 1000 mg/L 24 h

Chemical Name	Log Pow
1,1,1,2,-Tetrafluoroethane HFC-134a	1.06

13. DISPOSAL CONSIDERATIONS

Waste Disposal Method This material, as supplied, is not a hazardous waste according to Federal regulations (40 CFR 261). Should not be released into the environment. Dispose of in accordance with local regulations. Allow foam to cure before disposal.

Contaminated Packaging Dispose of in accordance with local regulations.

14. TRANSPORT INFORMATION

DOT

UN-No	UN1956
Proper Shipping Name	Compressed gas, n.o.s. (Fluorinated Hydrocarbon, Nitrogen)
Hazard Class	2.2
Description	Nonflammable gas (Fluorinated Hydrocarbon, Nitrogen)

TDG

UN-No	UN1956
Proper Shipping Name	Compressed gas, n.o.s. (Fluorinated Hydrocarbon, Nitrogen)
Hazard Class	2.2
Description	Nonflammable gas (Fluorinated Hydrocarbon, Nitrogen)

MEX

UN-No	UN1956
Proper Shipping Name	Compressed gas, n.o.s. (Fluorinated Hydrocarbon, Nitrogen)
Hazard Class	2.2
Description	Nonflammable gas (Fluorinated Hydrocarbon, Nitrogen)

ICAO

UN-No	UN1956
Proper Shipping Name	Compressed gas, n.o.s. (Fluorinated Hydrocarbon, Nitrogen)
Hazard Class	2.2
Description	Nonflammable gas (Fluorinated Hydrocarbon, Nitrogen)

IATA

UN-No	UN1956
Proper Shipping Name	Compressed gas, n.o.s. (Fluorinated Hydrocarbon, Nitrogen)
Hazard Class	2.2
ERG Code	2L
Description	Nonflammable gas (Fluorinated Hydrocarbon, Nitrogen)

IMDG/IMO

UN-No	UN1956
Proper Shipping Name	Compressed gas, n.o.s. (Fluorinated Hydrocarbon, Nitrogen)
Hazard Class	2.2
Description	Nonflammable gas (Fluorinated Hydrocarbon, Nitrogen)

RID

UN-No	UN1956
Proper Shipping Name	Compressed gas, n.o.s. (Fluorinated Hydrocarbon, Nitrogen)
Hazard Class	2
Classification Code	5A
Description	Nonflammable gas (Fluorinated Hydrocarbon, Nitrogen)
ADR/RID-Labels	2

ADR

UN-No	UN1956
Proper Shipping Name	Compressed gas, n.o.s. (Fluorinated Hydrocarbon, Nitrogen)
Hazard Class	2
Classification Code	5A
ADR/RID-Labels	2

ADN

UN-No	UN1956
Proper Shipping Name	Compressed gas, n.o.s. (Fluorinated Hydrocarbon, Nitrogen)
Hazard Class	2
Classification Code	5A
Special Provisions	63, 190, 191, 277, 913
Description	Nonflammable gas (Fluorinated Hydrocarbon, Nitrogen)
Hazard Labels	2

15. REGULATORY INFORMATION

International Inventories

TSCA	Complies
DSL	Complies
EINECS/ELINCS	Complies
ENCS	Complies
CHINA	Complies
KECL	Complies
PICCS	Complies
AICS	Complies

U.S. Federal Regulations

SARA 313
Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372.

Chemical Name	CAS-No	Weight %	SARA 313 - Threshold Values
Polymethylene polyphenylene isocyanate	9016-87-9	10-30	1.0
Methylene bisphenyl isocyanate (MDI)	101-68-8	10-30	1.0
Methylenediphenyl diisocyanate	26447-40-5	1-5	1.0

SARA 311/312 Hazard Categories

Acute Health Hazard	Yes
Chronic Health Hazard	Yes
Fire Hazard	No
Sudden Release of Pressure Hazard	Yes
Reactive Hazard	No

Clean Water Act
This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42).

CERCLA
This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302).

Chemical Name	Hazardous Substances RQs	Extremely Hazardous Substances RQs
Methylene bisphenyl isocyanate (MDI)	5000 lb	

U.S. State Regulations

California Proposition 65
This product does not contain any Proposition 65 chemicals.

U.S. State Right-to-Know Regulations

Chemical Name	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Methylene bisphenyl isocyanate (MDI)	X	X	X	X	X
1,1,1,2 – Tetrafluoroethane (HFC-134a, Fluorocarbon)		X	X		X

International Regulations

Mexico - Grade

The exposure limits values for 101-68-8 are listed under two synonyms:
Diphenylmethane diisocyanate - 0.02 ppm TWA; 0.2 mg/m^3 TWA
Methylene bisphenyl isocyanate - 0.005 ppm TWA; 0.051 mg/m^3 TWA

Chemical Name	Carcinogen Status	Exposure Limits
Methylene bisphenyl isocyanate (MDI)		Mexico: TWA= 0.2 mg/m^3 Mexico: TWA= 0.02 ppm
Diphenylmethane diisocyanate		Mexico: TWA= 0.005 ppm Mexico: TWA= 0.051 mg/m^3

Canada

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

WHMIS Hazard Class
A Compressed gases
D2B Toxic materials

Chemical Name	NPRI
Methylene bisphenyl isocyanate (MDI)	X
Polymethylene polyphenylene isocyanate	X
1,1,1,2- Tetrafluoroethane, HFC-134a	X

Legend
NPRI - National Pollutant Release Inventory
WHMIS – Workplace Hazardous Materials Information System
TSCA – Toxic Substance Control Act
DSL – Domestic Substance List
EINECS – European Inventory of Existing Commercial Chemical Substances
ENCS – Japan, Existing and New Chemical Substances
KECL- Korean Existing Chemical List
PICS – Philippine Inventory of Chemicals and Chemical Substances
AICS – Australian Inventory of Chemical Substances
TDG – Transportation of Dangerous Goods Act
ICAO – International Civil Aviation Organization
IATA – International Maritime Dangerous Goods Code
IMDG – International Maritime Dangerous Goods Code

16. OTHER INFORMATION

Issuing Date 27-Feb-2007

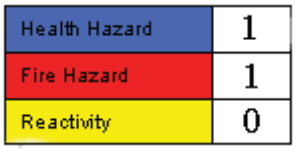
Revision Date 12-Nov-2012

Revision Note Revised format. Revised by Clayton Corporation EHS Department

Disclaimer
The information provided on this MSDS is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

End of MSDS

Material Safety Data Sheet

NFPA	HMIS	PPE	Transport Symbol
			

Issuing Date 27-Feb-2007 **Revision Date 12-Nov-2012** **Revision Number 5**

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name

Component B for:
Touch 'n Seal® Foam kit Class I FR Foam
Touch 'n Seal Refillable Class I FR Foam
Touch 'n Seal CPDS Class I FR Foam
Touch 'n Seal Mine Foam
Touch 'n Seal Rib & Roof Foam Sealant
Touch 'n Seal Foam Kit Low Density

Product ID No: MSDS / B MF-FR

Recommended Use Sealant, Insulation

Supplier Address

Convenience Products, Division of Clayton Corp.
866 Horan Drive
Fenton, MO 63026-2416 USA
TEL: (636) 349-5333

Emergency Telephone Number

Chemtel 1-800-255-3924
(813) 248-0585 outside US

2. HAZARDS IDENTIFICATION

WARNING!

Emergency Overview

Contents under pressure.
May cause drowsiness and dizziness.

Appearance Pale Amber **Physical State** Liquid Aerosol **Odor** Faint hydrocarbon

Potential Health Effects

Principle Routes of Exposure Inhalation, Skin contact, Eye contact.

Acute Toxicity

Eyes May cause slight irritation to eyes. Avoid contact with eyes.

Skin May cause slight skin irritation and/or dermatitis.

Skin Absorption A single prolonged exposure is unlikely to result in the material being absorbed in harmful amounts.

Inhalation Maintain local exhaust ventilation system during use. If large concentrations of vapors build up they could cause upper respiratory tract and lung irritation. Inhalation of vapors in high concentration may cause shortness of breath (lung edema). Avoid breathing vapors or mists.

Ingestion Not an expected route of exposure. No known effect based on information supplied.

Chronic Effects No known effect based on information supplied

Birth / Developmental Effects: No known effect based on information supplied

Aggravated Medical Conditions Central nervous system. Use of alcoholic beverages may enhance toxic effects.

Interactions with Other Chemicals Oxidizing agents. Strong acids. Strong Bases.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	CAS-No	Weight %
1,1,1,2 – Tetrafluoroethane (HFC-134a, Fluorocarbon)	811-97-2	10-30
Proprietary Polyol Blend	Proprietary mixture	60-90

4. FIRST AID MEASURES

General Advice If emergency warrants call 911 or emergency medical service. Show this safety data sheet to the doctor in attendance. Remove and wash soiled clothing before reuse.

Eye Contact Immediately flush with plenty of water. After initial flushing, remove any contact lenses and continue flushing for at least 15 minutes. Keep eye wide open while rinsing. Obtain medical attention, preferably from an ophthalmologist.

Skin Contact Wash off immediately with plenty of water for at least 15 minutes. Remove soiled clothing; wash before reuse.

Inhalation Move victim to fresh air. Apply artificial respiration if victim is not breathing. If breathing is difficult, oxygen should be administered by qualified personnel. Call a physician or transport to a medical facility.

Ingestion Clean mouth with water. Do not induce vomiting unless directed to do so by medical personnel. Drink plenty of water. Never give anything by mouth to an unconscious person.

Notes to Physician Maintain adequate ventilation and oxygenation of the patient. No specific antidote. Treatment of exposure should be directed at the control of symptoms and the clinical condition of the patient.

Protection of First-aiders Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

5. FIRE-FIGHTING MEASURES

Flammable Properties Pressurized cylinders exposed to fire can rupture.

Flash Point None

Suitable Extinguishing Media

Isolate fire and deny unnecessary entry. Use an extinguishing agent suitable for type of surrounding fire. Dry chemical, CO_2, water spray, fog or regular foam. Stay upwind. Keep out of low areas where gases fumes can accumulate. Move containers from fire area if you can do it without risk. Damaged cylinders should be handled only by specialists. Do not scatter spilled material with high pressure water streams.

Explosion Data

Sensitivity to mechanical impact None
Sensitivity to static discharge None

Specific Hazards Arising from the Chemical

Ruptured cylinders may rocket.

Protective Equipment and Precautions for Firefighters

As in any fire, wear self-contained breathing apparatus pressure demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA	**Health Hazard** 1	**Flammability** 1	**Stability** 0	**Physical and Chemical Hazards** -
HMIS	**Health Hazard** 1	**Flammability** 1	**Stability** 0	**Personal Precautions** -B

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions

Do not touch or walk through spilled material. Use appropriate safety equipment. Evacuate area. Keep personnel out of low areas, confined or poorly ventilated areas. Keep upwind of spill. Ensure adequate ventilation. No smoking in area. Only trained and properly protected personnel must be involved in clean-up operations.

Methods for Containment

If possible, turn leaking containers so that gas escapes rather than liquid. Allow substance to evaporate. Contain spilled materials if possible without risk. Absorb with materials such as Sawdust, dirt, and vermiculite. Collect in suitable and properly labeled open containers. Do not place in sealed containers. Wash what is left of the spill site with large quantities water.

Methods for Cleaning Up

Soak up with inert absorbent material (sand, silica sawdust). Sweep up and shovel into suitable containers for disposal. Do not direct water at spill or source of leak.

Other Information

Ventilate the area. Curing foam gives off HFC-134a. Do not put curing foam in a sealed drum.

7. HANDLING AND STORAGE

Handling

Avoid contact with skin, eyes and clothing. Wear personal protective equipment. Remove and wash soiled clothing before re-use. Do not breathe vapors or spray mist. Do not eat, drink or smoke when using this product. Use only in area provided with appropriate exhaust ventilation. Contents under pressure. Do not puncture or incinerate cylinders. Container, even those that have been emptied, can contain vapors. Do not stick pin or any other sharp object into opening on top of cylinder.

Storage

Keep containers tightly closed in a cool, well-ventilated place. Keep in properly labeled containers. Keep in an area equipped with sprinklers. Keep out of the reach of children. Ideal storage temperature is 16-32 °C / 60 – 90 °F. Storage above 32 °C / 90 °F will reduce its shelf-life. Never keep at temperatures above 48.8 °C / 120 °F. Protect the container from physical abuse.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure Guidelines

Chemical Name	ACGIH TLV	OSHA PEL	NIOSH IDLH
1,1,1,2 – Tetrafluoroethane (HFC-134a, Fluorocarbon)	None-established	None-established	None-established

NIOSH IDLH: Immediately Dangerous to Life or Health

Engineering Measures

Showers
Eyewash stations
Ventilation systems

Personal Protective Equipment

Eye/Face Protection

Tightly fitting safety glasses with side-shields.

Skin and Body protection

Lightweight protective clothing. Impervious gloves.

Respiratory Protection

Handle in accordance with good industrial hygiene and safety practice.

Hygiene Measures

When using, do not eat, drink or smoke. Maintain regular cleaning of equipment, work area and clothing.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	Pale Amber	**Odor**	Faint hydrocarbon
Odor Threshold	No information available	**Physical State**	Liquid Aerosol
pH	No information available		
Flash Point	None	**Autoignition Temperature**	Not applicable
Decomposition temperature	No data available	**Boiling Point/Range**	-26°C / -15°F for HFC-134a
Melting Point/Range	No data available		
Flammability Limits in Air	No data available	**Explosion Limits**	No data available
Specific Gravity	1.2	**Water Solubility**	Not Compatible
Solubility	Compatible.	**Evaporation Rate**	No data available
Vapor Pressure	No data available	**Vapor Density**	No data available
		EPA VOC (g/l)	0
Partition Coefficient (n-octanol/water)	No data available		

10. STABILITY AND REACTIVITY

Stability	Stable under recommended storage conditions
Conditions to Avoid	Keep away from open flames, hot surfaces and sources of ignition. Temperatures above 48.8 °C / 120 °F.
Incompatible Products	Water. Alcohols. Strong bases. Strong oxidizing agents. Finely powdered metals.
Hazardous Decomposition Products	Thermal Decomposition can lead to release of irritating gases and vapors. Carbon monoxide (CO), Carbon dioxide (CO_2), Nitrogen oxides (NOx), Hydrogen cyanide.
Hazardous Polymerization	Hazardous polymerization does not occur.

11. TOXICOLOGICAL INFORMATION

Acute Toxicity

Sensitization - Skin No acute toxicity information is available for this product

Sensitization – Respiratory No acute toxicity information is available for this product

Product Information

Chemical Name	LD50 Oral	LD50 Dermal	LC50 Inhalation

Chemical Name	LD50 Oral	LD50 Dermal	LC50 Inhalation
1,1,1,2 – Tetrafluoroethane (HFC-134a, Fluorocarbon)	Non-established	Non-established	Non-established

Chronic Toxicity

Chronic Toxicity No Chronic toxicity information is available for this product

Carcinogenicity There are no known carcinogenic chemicals in this product.

Mutagenicity Contains one or more known mutagenetic chemicals

Target Organ Effects Contains component(s) that have been reported to cause effects on the following organs in animals: (CNS) Kidney, Liver.

Endocrine Disruptor Information This product does not contain any known or suspected endocrine disruptors

12. ECOLOGICAL INFORMATION

Ecotoxicity
Ecotoxicity effects.

Chemical Name	Toxicity to Algae	Toxicity to Fish	Microtox	Daphnia Magna (Water Flea)
1,1,1,2 – Tetrafluoroethane (HFC-134a, Fluorocarbon)	None-established			None-established

Chemical Name	Log Pow
1,1,1,2,-Tetrafluoroethane HFC-134a	1.06

13. DISPOSAL CONSIDERATIONS

Waste Disposal Method This material, as supplied, is not a hazardous waste according to Federal regulations (40 CFR 261). Should not be released into the environment. Dispose of in accordance with local regulations.

Contaminated Packaging Dispose of in accordance with local regulations.

14. TRANSPORT INFORMATION

DOT

UN-No UN1956
Proper Shipping Name Compressed gas, n.o.s. (Fluorinated Hydrocarbon, Nitrogen)
Hazard Class 2.2
Description Nonflammable gas (Fluorinated Hydrocarbon, Nitrogen)

TDG

UN-No UN1956
Proper Shipping Name Compressed gas, n.o.s. (Fluorinated Hydrocarbon, Nitrogen)
Hazard Class 2.2
Description Nonflammable gas (Fluorinated Hydrocarbon, Nitrogen)

MEX

UN-No UN1956
Proper Shipping Name Compressed gas, n.o.s. (Fluorinated Hydrocarbon, Nitrogen)
Hazard Class 2.2
Description Nonflammable gas (Fluorinated Hydrocarbon, Nitrogen)

14. TRANSPORT INFORMATION

ICAO

UN-No	UN1956
Proper Shipping Name	Compressed gas, n.o.s. (Fluorinated Hydrocarbon, Nitrogen)
Hazard Class	2.2
Description	Nonflammable gas (Fluorinated Hydrocarbon, Nitrogen)

IATA

UN-No	UN1956
Proper Shipping Name	Compressed gas, n.o.s. (Fluorinated Hydrocarbon, Nitrogen)
Hazard Class	2.2
ERG Code	2L
Description	Nonflammable gas (Fluorinated Hydrocarbon, Nitrogen)

IMDG/IMO

UN-No	UN1956
Proper Shipping Name	Compressed gas, n.o.s. (Fluorinated Hydrocarbon, Nitrogen)
Hazard Class	2.2
Description	Nonflammable gas (Fluorinated Hydrocarbon, Nitrogen)

RID

UN-No	UN1956
Proper Shipping Name	Compressed gas, n.o.s. (Fluorinated Hydrocarbon, Nitrogen)
Hazard Class	2
Classification Code	5A
Description	Nonflammable gas (Fluorinated Hydrocarbon, Nitrogen)
ADR/RID-Labels	2

ADR

UN-No	UN1956
Proper Shipping Name	Compressed gas, n.o.s. (Fluorinated Hydrocarbon, Nitrogen)
Hazard Class	2
Classification Code	5A
ADR/RID-Labels	2

ADN

UN-No	UN1956
Proper Shipping Name	Compressed gas, n.o.s. (Fluorinated Hydrocarbon, Nitrogen)
Hazard Class	2
Classification Code	5A
Special Provisions	63, 190, 191, 277, 913
Description	Nonflammable gas (Fluorinated Hydrocarbon, Nitrogen)
Hazard Labels	2

15. REGULATORY INFORMATION

International Inventories

TSCA	Complies
DSL	Complies
EINECS/ELINCS	Complies
ENCS	One or more components not listed on inventory.
CHINA	Complies
KECL	Complies
PICCS (PH)	One or more components not listed on inventory.
AICS	One or more components not listed on inventory.
IECS	One or more components not listed on inventory.
NZ CLSC	One or more components not listed on inventory.

U.S. Federal Regulations

SARA 313
Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372.

Chemical Name	CAS-No	Weight %	SARA 313 - Threshold Values
1,1,1,2 – Tetrafluoroethane (HFC-134a, Fluorocarbon)	811-97-2	10-30	1.0

SARA 311/312 Hazard Categories

Acute Health Hazard	Yes
Chronic Health Hazard	No
Fire Hazard	No
Sudden Release of Pressure Hazard	Yes
Reactive Hazard	No

Clean Water Act
This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42).

CERCLA
This material, as supplied, does not contain a substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302).

Chemical Name	Hazardous Substances RQs	Extremely Hazardous Substances RQs

U.S. State Regulations

California Proposition 65
This product does not contain any proposition 65 chemicals.

U.S. State Right-to-Know Regulations

Chemical Name	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
1,1,1,2 – Tetrafluoroethane (HFC-134a, Fluorocarbon)		X	X		X

International Regulations

Canada

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

WHMIS Hazard Class
A Compressed gases

Chemical Name	NPRI
1,1,1,2- Tetrafluoroethane, HFC-134a	X

Legend
NPRI - National Pollutant Release Inventory
WHMIS – Workplace Hazardous Materials Information System
TSCA – Toxic Substance Control Act
DSL – Domestic Substance List
EINECS – European Inventory of Existing Commercial Chemical Substances
ENCS – Japan, Existing and New Chemical Substances
KECL- Korean Existing Chemical List
PICS – Philippine Inventory of Chemicals and Chemical Substances
AICS – Australian Inventory of Chemical Substances
TDG – Transportation of Dangerous Goods Act
ICAO – International Civil Aviation Organization
IATA – International Maritime Dangerous Goods Code
IMDG – International Maritime Dangerous Goods Code
IECS - Inventory of Existing Chemical Substances (China)
NZ CLSC – New Zealand Interim Inventory of Chemicals.

16. OTHER INFORMATION

Issuing Date 27-Feb-2007

Revision Date 12-Nov-2012

Revision Note Revised format. Revised by Clayton Corporation EHS Department

Disclaimer

The information provided on this MSDS is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

End of MSDS

TREMCO

Dymonic FC

Fast Skinning, Low Modulus Polyurethane Sealant

Product Description:
Dymonic FC is a high performance, low modulus, one-component, moisture curing, polyurethane sealant.

Basic Uses:
Dymonic FC is a durable, flexible polyurethane sealant that offers excellent performance in moving joints. Dymonic FC does not require a primer on most construction materials, and exhibits tenacious adhesion once fully cured. Typical applications for Dymonic FC include: expansion and control joints, precast concrete panel joints, perimeter caulking (windows, door, panels), EIFS, aluminum, masonry & vinyl siding.

Limitations:
Do not apply over damp or contaminated surfaces.

Packaging:
1/12 gallon (300mL) cartridges, 20oz. (600mL) sausages, 3 (11.4 L) and 5-gallon (19 L) pails.

Standard Colors:
Aluminum Stone, Anodized Aluminum, Gray, Limestone, White, Off White, Buff, Precast White, Ivory, Beige, Almond, Hartford Green, Redwood Tan, Stone, Natural Clay, Dark Bronze, Bronze, Light Bronze, Black.

Applicable Standards:
Meets U.S. Federal Specification TT-S-00230C, Class A, Type II; Canadian Standard CAN/CGSB-19.13-M87; and ASTM C920, Type S, Grade NS, Class 100/50, Use NT, M, A and O. AAMA 802.3 Type I and II, and AAMA 808.3.

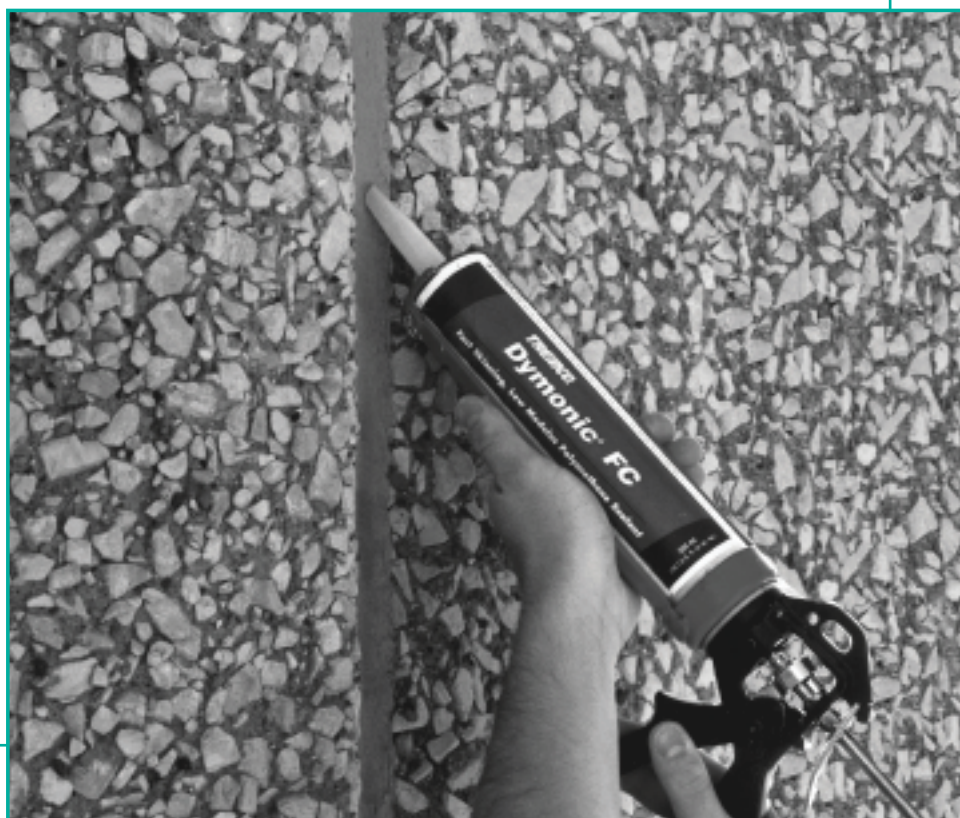
INSTALLATION
Joint Design:
May be used in any vertical or horizontal joint design in accordance with accepted architectural/engineering practice. Joint width should be 4 times anticipated movement, but not less than 1/4 inch (6.4mm) wide.

Joint Dimensions:
For joints 1/4 inch (6.4mm) to 1/2 inch (12.7mm) wide, the width to depth ratio should be equal. Joints 1/2 inch (12.7mm) wide or greater should have a sealant depth of 1/2 inch (12.7mm). Minimum joint size is 1/4 inch by 1/4 inch (6.4mm by 6.4mm).

Surface Preparation:
For good adhesion, the joint interface must be sound, clean and dry. Depending on the substrate, or presence of form release agents, masonry waterproofing, dust, loose mortar or laitance, architectural paints or finishes, the joint surface may require a thorough wire brushing, grinding, sandblasting, solvent washing and/or primer.

Tooling & Cleaning:
Tooling is recommended immediately after application to insure firm, intimate contact with the joint interface. Dry tooling is preferred, although tooling agents can be utilized. Excess sealant and smears adjacent to the joint can be removed with Xylol or Toluol before sealant cures.

Joint Backing Bond Breaking Tape:
Closed cell polyethylene backer rods are preferred as joint backing to control depth of sealant bead. Where depth of joint will prevent use of joint backing, an adhesive backed polyethylene tape should be installed to prevent three-sided adhesion.



Application:

Cartridges of Dymonic FC are easy to apply with conventional caulking equipment. Fill joint completely with a proper width-to-depth ratio and tool.

Maintenance:

Damaged sealant can be repaired. Consult your Tremco Distributor or Representative for repair procedures.

Availability:

Available from your local Tremco Field Representative, Tremco Distributor or Tremco Warehouse.

Warranty:

Tremco warrants its Sealants to be free of defects in materials, but makes no warranty as to appearance or color. Since methods of application and on-site conditions are beyond our control and can affect performance, Tremco makes no other warranty, expressed or implied, including warranties of MERCHANTABILITY and FITNESS FOR A PARTICULAR PURPOSE, with respect to Tremco Sealants. Tremco's sole obligation shall be, at its option, to replace, or refund the purchase of the quantity of Tremco Sealant proven to be defective and Tremco shall not be liable for any loss or damage.

TYPICAL PHYSICAL PROPERTIES

ASTM C920 TT-S-00230C	Requirement	Dymonic FC Results
Rheological Properties at 40 and 122˚F. (4.4 and 50˚C.)	3/16" (4.8mm) Maximum Flow No Deformation	0 None
Extrusion Rate	45 Seconds Maximum	15
Hardness Properties	25-50	25
Weight Loss	Less than 10%	Passes (<2%)
Skin Time	N/A	30-90 minutes
Tack Free Time	Tack Free 72 Hrs. Max.	3-4 Hours
Stain & Color Change	No Visible Change No Stain	None None
Adhesion-in-Peel	Not less than 5 pli (22N) Less than 25% Bond Loss	Concrete-18-22 pli Aluminum 20-25 pli No Adhesion Loss
Effects of Accelerated Weathering	No cracks greater than #2 on U.V. and Cold Temperature Bond Test	Passes
Movement Capability	N/A	+100%/-50%

For MSDS and Spec Data Sheets visit our website:
www.tremcosealants.com

TREMCO
Sealant/Weatherproofing Division
3735 Green Road • Beachwood, Ohio • 44122 • Phone: (216) 292-5000 • (800) 321-7906
220 Wicksteed Avenue • Toronto, ON M4H 1G7 • Phone: (416) 421-3300 • (800)363-3213

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SAFETY DATA SHEET

1. Identification

Material name: DYMONIC FC ALUMINUM STONE
Material: 960851 323

Recommended use and restriction on use

Recommended use: Sealant
Restrictions on use: Not known.

Manufacturer/Importer/Supplier/Distributor Information

Tremco U.S Sealants
3735 Green Road
Cleveland OH 44122
US

Contact person:	EH&S Department
Telephone:	216-292-5000
Emergency telephone number:	1-800-424-9300 (US); 1-613-996-6666 (Canada)

2. Hazard(s) identification

Hazard Classification

Health Hazards

Carcinogenicity	Category 1A
Toxic to reproduction	Category 1B

Unknown toxicity - Health

Acute toxicity, oral	10.19 %
Acute toxicity, dermal	12.47 %
Acute toxicity, inhalation, vapor	99.62 %
Acute toxicity, inhalation, dust or mist	99.94 %

Environmental Hazards

Acute hazards to the aquatic environment	Category 1

Unknown toxicity - Environment

Acute hazards to the aquatic environment	43.22 %
Chronic hazards to the aquatic environment	100 %

Label Elements

Hazard Symbol:

Signal Word: Danger

Hazard Statement: May cause cancer.
May damage fertility or the unborn child.
Very toxic to aquatic life.

Precautionary Statement:

Prevention: Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Use personal protective equipment as required. Avoid release to the environment.

Response: If exposed or concerned: Get medical advice/attention. Collect spillage.

Storage: Store locked up.

Disposal: Dispose of contents/container to an appropriate treatment and disposal facility in accordance with applicable laws and regulations, and product characteristics at time of disposal.

Other hazards which do not result in GHS classification: None.

3. Composition/information on ingredients

Mixtures

Chemical Identity	CAS number	Content in percent (%)*
Calcium carbonate	471-34-1	30 - 60%
Butyl benzyl phthalate	85-68-7	15 - 40%
Calcium Carbonate (Limestone)	1317-65-3	7 - 13%
Calcium oxide	1305-78-8	1 - 5%
Titanium dioxide	13463-67-7	0.5 - 1.5%
Stearic acid	57-11-4	0.5 - 1.5%
Hydrotreated heavy naphthenic distillate	64742-52-5	0.1 - 1%

* All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

4. First-aid measures

Ingestion: Call a POISON CENTER/doctor/.../if you feel unwell. Rinse mouth.

Inhalation: Move to fresh air.

Skin Contact: Wash skin thoroughly with soap and water. If skin irritation occurs: Get medical advice/attention.

Eye contact: Any material that contacts the eye should be washed out immediately with water. If easy to do, remove contact lenses. If eye irritation persists: Get medical advice/attention.

Most important symptoms/effects, acute and delayed

Symptoms: May cause skin and eye irritation.

Indication of immediate medical attention and special treatment needed

Treatment: Symptoms may be delayed.

5. Fire-fighting measures

General Fire Hazards: No unusual fire or explosion hazards noted.

Suitable (and unsuitable) extinguishing media

Suitable extinguishing media: Use fire-extinguishing media appropriate for surrounding materials.

Unsuitable extinguishing media: Do not use water jet as an extinguisher, as this will spread the fire.

Specific hazards arising from the chemical: During fire, gases hazardous to health may be formed.

Special protective equipment and precautions for firefighters

Special fire fighting procedures: No data available.

Special protective equipment for fire-fighters: Self-contained breathing apparatus and full protective clothing must be worn in case of fire.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures: No data available.

Methods and material for containment and cleaning up: Collect spillage in containers, seal securely and deliver for disposal according to local regulations.

Notification Procedures: In the event of a spill or accidental release, notify relevant authorities in accordance with all applicable regulations.

Environmental Precautions: Do not contaminate water sources or sewer. Prevent further leakage or spillage if safe to do so. Avoid release to the environment.

7. Handling and storage

Precautions for safe handling: Ventilate well, avoid breathing vapors. Use approved respirator if air contamination is above accepted level. Use mechanical ventilation in case of handling which causes formation of dust. Do not handle until all safety precautions have been read and understood. Obtain special instructions before use. Use personal protective equipment as required.

Conditions for safe storage, including any incompatibilities: Store locked up.

8. Exposure controls/personal protection

Control Parameters

Occupational Exposure Limits

Chemical Identity	type	Exposure Limit Values	Source
Calcium carbonate - Total dust.	PEL	15 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
Calcium carbonate - Respirable fraction.	PEL	5 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
Calcium Carbonate (Limestone) - Total dust.	PEL	15 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
Calcium Carbonate (Limestone) - Respirable fraction.	PEL	5 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
Calcium oxide	TWA	2 mg/m3	US. ACGIH Threshold Limit Values (2011)
	PEL	5 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
Titanium dioxide	TWA	10 mg/m3	US. ACGIH Threshold Limit Values (2011)
Titanium dioxide - Total dust.	PEL	15 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
Stearic acid	TWA	10 mg/m3	US. ACGIH Threshold Limit Values (2011)
Hydrotreated heavy naphthenic distillate - Inhalable fraction.	TWA	5 mg/m3	US. ACGIH Threshold Limit Values (03 2014)
Hydrotreated heavy naphthenic distillate	PEL	500 ppm 2,000 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
Hydrotreated heavy naphthenic distillate - Mist.	PEL	5 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)

Chemical name	type	Exposure Limit Values	Source
Calcium carbonate - Total dust.	STEL	20 mg/m3	Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)
Calcium carbonate - Respirable fraction.	TWA	3 mg/m3	Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)
Calcium carbonate - Total dust.	TWA	10 mg/m3	Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)
Calcium carbonate - Total dust.	TWA	10 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (12 2008)
Calcium Carbonate (Limestone) - Total dust.	STEL	20 mg/m3	Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)
	TWA	10 mg/m3	Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)

Calcium Carbonate (Limestone) - Respirable fraction.	TWA	3 mg/m3	Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)
Calcium Carbonate (Limestone) - Total dust.	TWA	10 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (12 2008)
Diisodecyl phthalate	TWAEV	5 mg/m3	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (11 2010)
Calcium oxide	TWA	2 mg/m3	Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)
Calcium oxide	TWAEV	2 mg/m3	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (11 2010)
Calcium oxide	TWA	2 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (12 2008)
Vinyltrimethoxysilane	STEL	10 ppm 60 mg/m3	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (11 2010)
Titanium dioxide - Total dust.	TWA	10 mg/m3	Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)
Titanium dioxide - Respirable fraction.	TWA	3 mg/m3	Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)
Titanium dioxide	TWAEV	10 mg/m3	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (11 2010)
Titanium dioxide - Total dust.	TWA	10 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (12 2008)
Hydrotreated heavy naphthenic distillate - Mist.	TWA	0.2 mg/m3	Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (05 2013)
	TWA	1 mg/m3	Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (05 2013)

Hydrotreated heavy naphthenic distillate - Mist.	TWAEV	5 mg/m3	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (11 2010)
	STEL	10 mg/m3	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (11 2010)
Hydrotreated heavy naphthenic distillate - Mist.	TWA	5 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (12 2008)
	STEL	10 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (12 2008)

Appropriate Engineering Controls Mechanical ventilation or local exhaust ventilation may be required. Observe good industrial hygiene practices. Observe occupational exposure limits and minimize the risk of inhalation of dust.

Individual protection measures, such as personal protective equipment

General information: Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. Supplementary local exhaust ventilation, closed systems, or respiratory and eye protection may be needed in special circumstances, such as poorly ventilated spaces, heating, evaporation of liquids from large surfaces, spraying of mists, mechanical generation of dusts, drying of solids, etc.

Eye/face protection: Wear safety glasses with side shields (or goggles).

Skin Protection

Hand Protection: Use suitable protective gloves if risk of skin contact.

Other: Wear suitable protective clothing.

Respiratory Protection: In case of inadequate ventilation use suitable respirator. Seek advice from local supervisor.

Hygiene measures: Observe good industrial hygiene practices. Wash hands before breaks and immediately after handling the product. Do not handle until all safety precautions have been read and understood. Obtain special instructions before use.

9. Physical and chemical properties

Appearance

Physical state: solid
Form: Paste
Color: Various
Odor: Mild
Odor threshold: No data available.
pH: No data available.
Melting point/freezing point: No data available.
Initial boiling point and boiling range: No data available.

Flash Point:	No data available.
Evaporation rate:	Slower than n-Butyl Acetate
Flammability (solid, gas):	No
Upper/lower limit on flammability or explosive limits	
Flammability limit - upper (%):	No data available.
Flammability limit - lower (%):	No data available.
Explosive limit - upper (%):	No data available.
Explosive limit - lower (%):	No data available.
Vapor pressure:	No data available.
Vapor density:	Vapors are heavier than air and may travel along the floor and in the bottom of containers.
Relative density:	1.5212
Solubility(ies)	
Solubility in water:	Insoluble in water
Solubility (other):	No data available.
Partition coefficient (n-octanol/water):	No data available.
Auto-ignition temperature:	No data available.
Decomposition temperature:	No data available.
Viscosity:	No data available.

10. Stability and reactivity

Reactivity:	No data available.
Chemical Stability:	Material is stable under normal conditions.
Possibility of hazardous reactions:	No data available.
Conditions to avoid:	Avoid heat or contamination.
Incompatible Materials:	Alcohols. Amines. Strong acids. Strong bases. Water, moisture.
Hazardous Decomposition Products:	Thermal decomposition or combustion may liberate carbon oxides and other toxic gases or vapors.

11. Toxicological information

Information on likely routes of exposure

Ingestion:	May be ingested by accident. Ingestion may cause irritation and malaise.
Inhalation:	In high concentrations, vapors, fumes or mists may irritate nose, throat and mucus membranes.
Skin Contact:	May be harmful in contact with skin. Causes mild skin irritation.
Eye contact:	Eye contact is possible and should be avoided.

Information on toxicological effects

Acute toxicity (list all possible routes of exposure)

Oral
Product: ATEmix: 82,880.4 mg/kg

Dermal
Product: ATEmix: 4,432.29 mg/kg

Inhalation
Product: No data available.

Repeated dose toxicity
Product: No data available.

Skin Corrosion/Irritation
Product: No data available.

Serious Eye Damage/Eye Irritation
Product: No data available.

Specified substance(s):

Calcium carbonate	in vivo (Rabbit, 24 - 72 hrs): Not irritating
Butyl benzyl phthalate	in vivo (Rabbit, 24 - 72 hrs): Not irritating
Calcium oxide	in vivo (Rabbit, 1 hrs): Irritating
Titanium dioxide	in vivo (Rabbit, 24 - 72 hrs): Not irritating
Stearic acid	in vivo (Rabbit, 27 - 72 hrs): Not irritating
Hydrotreated heavy naphthenic distillate	in vivo (Rabbit, 24 hrs): Not irritating

Respiratory or Skin Sensitization
Product: No data available.

Carcinogenicity
Product: No data available.

IARC Monographs on the Evaluation of Carcinogenic Risks to Humans:

Titanium dioxide	Overall evaluation: Possibly carcinogenic to humans.
Hydrotreated heavy naphthenic distillate	Overall evaluation: Not classifiable as to carcinogenicity to humans. Overall evaluation: Carcinogenic to humans.

US. National Toxicology Program (NTP) Report on Carcinogens:

Hydrotreated heavy naphthenic distillate	Known To Be Human Carcinogen.

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050):
No carcinogenic components identified

Germ Cell Mutagenicity

In vitro
Product: No data available.

In vivo
Product: No data available.

Reproductive toxicity
Product: May damage fertility or the unborn child.

Specific Target Organ Toxicity - Single Exposure
Product: No data available.

Specific Target Organ Toxicity - Repeated Exposure
Product: No data available.

Aspiration Hazard
Product: No data available.

Other effects: No data available.

12. Ecological information

Ecotoxicity:

Acute hazards to the aquatic environment:

Fish
Product: No data available.

Specified substance(s):

Calcium carbonate	LC 50 (Western mosquitofish (Gambusia affinis), 96 h): > 56,000 mg/l Mortality
Butyl benzyl phthalate	LC 50 (Fathead minnow (Pimephales promelas), 96 h): 1.39 - 3.88 mg/l

	Mortality
Titanium dioxide	LC 50 (Mummichog (Fundulus heteroclitus), 96 h): > 1,000 mg/l Mortality

Aquatic Invertebrates

Product:	No data available.

Specified substance(s):

Butyl benzyl phthalate	EC 50 (Water flea (Daphnia magna), 48 h): > 10 mg/l Intoxication EC 50 (Opossum shrimp (Americamysis bahia), 48 h): > 0.9 mg/l Mortality EC 50 (Water flea (Daphnia magna), 24 h): > 10 mg/l Intoxication EC 50 (Water flea (Daphnia magna), 21 d): > 0.76 mg/l Intoxication EC 50 (Water flea (Daphnia magna), 14 d): > 0.76 mg/l Intoxication
Titanium dioxide	EC 50 (Water flea (Daphnia magna), 48 h): > 1,000 mg/l Intoxication

Chronic hazards to the aquatic environment:

Fish

Product:	No data available.

Specified substance(s):

Butyl benzyl phthalate	NOAEL (Pimephales promelas, 126 d): 64.6 - 67.5 µg/l experimental result
Calcium oxide	NOAEL (Oncorhynchus mykiss, 60 d): 307 mg/l interpreted
Titanium dioxide	LC 0 (Coregonus autumnalis migratorius G., 30 d): 3 mg/l experimental result
Hydrotreated heavy naphthenic distillate	NOAEL (Oncorhynchus mykiss, 14 d): >= 1,000 mg/l QSAR

Aquatic Invertebrates

Product:	No data available.

Toxicity to Aquatic Plants

Product:	No data available.

Persistence and Degradability

Biodegradation

Product:	No data available.

BOD/COD Ratio

Product:	No data available.

Bioaccumulative Potential

Bioconcentration Factor (BCF)

Product:	No data available.

Specified substance(s):

Butyl benzyl phthalate	Bluegill (Lepomis macrochirus), Bioconcentration Factor (BCF): 772 (Flow through)

Partition Coefficient n-octanol / water (log Kow)

Product:	No data available.
Specified substance(s):	
Butyl benzyl phthalate	Log Kow: 4.91
Stearic acid	Log Kow: 8.23

Mobility in Soil: No data available.

Other Adverse Effects: Very toxic to aquatic organisms.

13. Disposal considerations

Disposal instructions: Dispose of waste at an appropriate treatment and disposal facility in accordance with applicable laws and regulations, and product characteristics at time of disposal.

Contaminated Packaging: No data available.

14. Transport information

TDG:

Not Regulated

CFR / DOT:

Not Regulated

IMDG:

UN3077, ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Butyl Benzyl Phthalate), 9, PG III, MARINE POLLUTANT

Further Information:

The above shipping description may not be accurate for all container sizes and all modes of transportation. Please refer to Bill of Lading.

15. Regulatory information

US Federal Regulations

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

None present or none present in regulated quantities.

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

None present or none present in regulated quantities.

CERCLA Hazardous Substance List (40 CFR 302.4):

Chemical Identity	Reportable quantity
Butyl benzyl phthalate	100 lbs.
Dibutyl phthalate	10 lbs.
Methanol	5000 lbs.
Acetic acid	5000 lbs.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories
Delayed (Chronic) Health Hazard

SARA 302 Extremely Hazardous Substance
None present or none present in regulated quantities.

SARA 304 Emergency Release Notification

Chemical Identity	Reportable quantity
Butyl benzyl phthalate	100 lbs.
Diisodecyl phthalate	
Dibutyl phthalate	10 lbs.
Diisodecyl phthalate (mixed Is)	
Methanol	5000 lbs.
Acetic acid	5000 lbs.

SARA 311/312 Hazardous Chemical

Chemical Identity	Threshold Planning Quantity
Calcium carbonate	500 lbs
Butyl benzyl phthalate	500 lbs
Calcium Carbonate (Limestone)	500 lbs
Calcium oxide	500 lbs
Titanium dioxide	500 lbs
Stearic acid	500 lbs
Hydrotreated heavy naphthenic distillate	500 lbs

SARA 313 (TRI Reporting)
None present or none present in regulated quantities.

Clean Water Act Section 311 Hazardous Substances (40 CFR 117.3)
None present or none present in regulated quantities.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130):
None present or none present in regulated quantities.

US State Regulations

US. California Proposition 65
This product contains chemical(s) known to the State of California to cause cancer and/or to cause birth defects or other reproductive harm.

US. New Jersey Worker and Community Right-to-Know Act

Chemical Identity
Calcium carbonate
Butyl benzyl phthalate
Calcium Carbonate (Limestone)
Calcium oxide
Hydrotreated heavy naphthenic distillate

US. Massachusetts RTK - Substance List

Chemical Identity
Calcium carbonate
Butyl benzyl phthalate
Calcium Carbonate (Limestone)
Calcium oxide
Crystalline Silica (Quartz)/ Silica Sand

US. Pennsylvania RTK - Hazardous Substances

Chemical Identity
Calcium carbonate
Butyl benzyl phthalate
Calcium Carbonate (Limestone)
Diisodecyl phthalate
Calcium oxide

US. Rhode Island RTK

Chemical Identity
Butyl benzyl phthalate
Diisodecyl phthalate

Other Regulations:

Regulatory VOC (less water and exempt solvent):	6 g/l
VOC Method 310:	0.39 %

Inventory Status:

Australia AICS:	One or more components in this product are not listed on or exempt from the Inventory.
Canada DSL Inventory List:	All components in this product are listed on or exempt from the Inventory.
EINECS, ELINCS or NLP:	One or more components in this product are not listed on or exempt from the Inventory.
Japan (ENCS) List:	One or more components in this product are not listed on or exempt from the Inventory.
China Inv. Existing Chemical Substances:	One or more components in this product are not listed on or exempt from the Inventory.
Korea Existing Chemicals Inv. (KECI):	One or more components in this product are not listed on or exempt from the Inventory.

Canada NDSL Inventory:	One or more components in this product are not listed on or exempt from the Inventory.
Philippines PICCS:	One or more components in this product are not listed on or exempt from the Inventory.
US TSCA Inventory:	All components in this product are listed on or exempt from the Inventory.
New Zealand Inventory of Chemicals:	One or more components in this product are not listed on or exempt from the Inventory.
Japan ISHL Listing:	One or more components in this product are not listed on or exempt from the Inventory.
Japan Pharmacopoeia Listing:	One or more components in this product are not listed on or exempt from the Inventory.

16.Other information, including date of preparation or last revision

Revision Date:	11/23/2015
Version #:	1.0
Further Information:	No data available.
Disclaimer:	For Industrial Use Only. Keep out of Reach of Children. The hazard information herein is offered solely for the consideration of the user, subject to their own investigation of compliance with applicable regulations, including the safe use of the product under every foreseeable condition.

TREMCO®

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High Performance Silicone Sealant

Product Description:

Spectrem 2 is a medium-modulus, one-part, high-performance, neutral-cure silicone sealant, ideal for a variety of perimeter caulking and glazing applications.

Basic Uses:

Spectrem 2 is suitable for both caulking and glazing applications, including cap beads, toe beads, heel beads and other typical air seals. It is particularly appropriate as a weather seal and tensile bead in two-sided structural glazing systems and ideal for sealing joints within the curtainwall or window systems.

Spectrem 2 may be used as a weather seal for materials such as aluminum, glass, steel, painted metal, plastic, stone, concrete and brick. Spectrem 2 exhibits primerless adhesion to many common building materials.

All Structur l l in A lic - tions must e re ie e n ro e y Tremco Tec nic l Ser ice rior to t e lic tion o S ectrem 2

Limitations:

Do not apply to damp or contaminated surfaces.
Use with adequate ventilation.
Clear silicones are not recommended for structural glazing applications.

Packaging:

1/12 gallon (300mL) cartridges, 20 oz. (600mL) sausages, 2 gallon (7.57 L) and 4.5 (17.1 L) gallon pails and 55 gallon (208 L) drums.

Standard Colors:

White, Off-White, Clear, Graystone, Gray, Bronze, Light Bronze, Limestone and Black.

Applicable Standards:

Conforms to ASTM C920 Type S, Grade NS, Class 50, Use NT, M, G, A and O, CAN/CGSB-19.13-M87, U.S. Federal Specification TT-S-001543A (COM-NBS) Class A, and U.S. Federal Specification TT-S-00230C (COM-NBS) Class A, Type II. Black Spectrem 2 meets all of AAMA 802.3-92 (Type I and II), 805.2-94 (Group C), and 808.3-92.

INSTALLATION

Joint Design:

May be used in any joint designed in accordance with accepted architectural/engineering practices. Joint width should be 4 times anticipated movement, but not less than 1/4 inch (6.4mm) wide.

Joint Dimensions:

For joints 1/4 inch (6.4mm) to 1/2 inch (12.7mm) wide, the width to depth ratio should be equal. Joints 1/2 inch (12.7mm) wide or greater should have a depth of 1/2 inch (12.7mm). Minimum joint size is 1/4 inch by 1/4 inch (6.4mm by 6.4mm).

Surface Preparation:

For good adhesion, the joint interface must be sound, clean and dry. Depending on the substrates, the joint surface may require a thorough wire brushing, grinding, sandblasting, solvent washing and/or primer.

Tooling & Cleaning:

Tooling is recommended immediately after application to insure firm, intimate contact with the joint interface. Dry tooling is preferred. Cleaning can be accomplished with solvents such as Xylene, Toluene or ME while sealant is in an uncured state.

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Joint Backing Bond Breaking Tape:
Closed cell polyethylene backer rods are preferred as joint backing to control depth of sealant bead. Where depth of joint will prevent use of joint backing, an adhesive-backed polyethylene tape should be installed to prevent three-sided adhesion. Joint backing must be dry at time of sealant application.

Application:
Spectrem 2 is easy to apply with conventional caulking equipment. Fill joint completely and tool. At 75˚F (23.9˚C), 50% R.H. a durable skin will form typically within less than 10 minutes.

Maintenance:
Damaged sealant can be repaired. Consult your Tremco Distributor or Representative for repair procedures.

Availability:
Immediately available from your local Tremco Field Representative, Tremco Distributor or Tremco Warehouse.

Warranty:
Tremco warranties its Sealants to be free of defects in material, but makes no warranty as to appearance or color. Since methods of application and on-site conditions are beyond our control and can affect performance, Tremco makes no other warranty, expressed or implied, including warranties of MERCHANTABILITY and FITNESS FOR A PARTICULAR PURPOSE, with respect to Sealants. Tremco's sole obligation shall be, at its option, to replace, or to refund the purchase price of the quantity of Sealant proved to be defective and Tremco shall not be liable for any loss or damage.

TYPICAL PHYSICAL PROPERTIES

Property	Test Method	Typical Value
As Supplied:		
Tack-free time	ASTM C-679	20-40 minutes
Sag	ASTM D-2202	0-0.1mm (0-0.03)
Tooling Time	Skin formation	10-20 minutes
As Cured: After 7 Days @ 77˚F (25˚C) and 50% R.H.		
Hardness (Shore A)	ASTM C-661	37-40
Tensile strength at maximum elongation	ASTM D-412	1.52-1.59 MPa (220-230 psi)
Elongation	ASTM D-412	235-260%
Tensile Strength at 100% elongation	ASTM C-1135	0.62-0.69 MPa (90-100 psi)
Tear Strength	ASTM D-624	6.14-7.02 kN/m (35-40 pli)
Peel Strength Aluminum, Glass	ASTM C-794	2.81-3.86 kN/m (16-22 pli)
Cyclic movement	ASTM C-719	50%

NOTE: The foregoing information is published as general information only. The listed properties and performance characteristics are approximate values and are not part of the product specification.

For MSDS and Spec Data Sheets, all our 24 Hour Fax-Back line:
1-800-551-2806
or visit our website:
www.tremcosealants.com

TREMCO
Sealant/Weatherproofing Division
3735 Green Road • Beachwood, Ohio • 44122 • Phone: (216) 292-5000 • (800) 321-7906
220 Wicksteed Avenue • Toronto, ON M4H 1G7 • Phone: (416) 421-3300 • (800) 363-3213
1451 Jacobson Avenue • Ashland, Ohio • 44805 • Phone: (800) 321-6357 • Fax (419) 289-6645

SPECTREM 2 ALUMINUM STONE

Version *2.0* Print Date 12/06/2013
REVISION DATE: 07/08/2012

SECTION 1 - PRODUCT IDENTIFICATION

Trade name	:	SPECTREM 2 ALUMINUM STONE
Product code	:	947851 502
COMPANY	:	Tremco Incorporated 3735 Green Road Cleveland, OH 44122
Telephone	:	(216) 292-5000 8:30 - 5:00 EST
Emergency Phone:	:	(216) 765-6727 8:30 - 5:00 EST After Hours: Chemtrec 1-800-424-9300
Product use	:	Sealant

SECTION 2 - HAZARDS IDENTIFICATION

Emergency Overview

Gray. Non-sag gunnable paste. May cause slight irritation to the respiratory system. Leave area to breathe fresh air. Avoid further overexposure. If symptoms persist, get medical attention.

Acute Potential Health Effects/ Routes of Entry

Inhalation	:	May cause slight irritation to the respiratory system.
Eyes	:	Direct contact may cause moderate irritation.
Ingestion	:	May cause irritation to the mouth, throat and stomach.
Skin	:	May cause mild irritation.

Aggravated Medical Conditions

Pre-existing eye, skin, liver, kidney, and respiratory disorders may be aggravated by exposure.

Chronic Health Effects

Possible skin sensitization. As a by-product of curing up to 4% Methyl Ethyl Ketoxime (MEKO) may be released within product. Repeated and prolonged exposure to MEKO can cause allergic skin reaction. It may adversely affect the blood, (methemoglobinemia and anemia). Inhalation of crystalline silica (quartz) can cause cancer based on animal data, and IARC concludes sufficient evidence in humans (Group 1). Prolonged and repeated overexposure to free crystalline silica dust above the TLV level may cause scarring of the lungs with cough and shortness of breath. A delayed lung injury, silicosis may result from breathing free silica. Organosilane may cause liver injury with fibrosis after repeated and prolonged overexposure. Fillers are encapsulated and not expected to be released from product under normal conditions of use.

Target Organs: Skin, Blood, Lung, Liver, Kidney

SECTION 3 - PRODUCT COMPOSITION

Chemical Name	CAS-No.	Weight %
Calcium Carbonate (Limestone)	1317-65-3	40.0 - 70.0
Silicone polymer	NJ TSRN# 51721300-5110P	30.0 - 60.0
Polydimethylsiloxane, trimethyl endcap	63148-62-9	7.0 - 13.0
Amorphous silica	7631-86-9	3.0 - 7.0
Organosilane	NJ TSRN# 51721300-5368P	1.0 - 5.0
Crystalline Silica (Quartz)/ Silica Sand	14808-60-7	- <1.0

SECTION 4 - FIRST AID MEASURES

Get immediate medical attention for any significant overexposure.

Inhalation	:	Leave area to breathe fresh air. Avoid further overexposure. If symptoms persist, get medical attention.
Eye contact	:	Flush with water for at least 15 minutes while holding eye lids apart. Get medical attention immediately.
Skin contact	:	Clean area of contact thoroughly using soap and water. If irritation, rash or other disorders develop, get medical attention immediately.
Ingestion	:	Do not induce vomiting unless advised by a physician. Call nearest Poison Control Center or Physician immediately.

SECTION 5 - FIRE FIGHTING MEASURES

Flash point	:	Not available.
Method	:	Not available.
Burning rate	:	Non-flammable solid
Lower explosion limit	:	Not available.
Upper explosion limit	:	Not available.
Autoignition temperature	:	Not available.
Extinguishing media	:	If water fog is ineffective, use carbon dioxide, dry chemical or foam.
Hazardous combustion products	:	Smoke, fumes.Carbon monoxide and carbon dioxide can form.Silicon oxides and trace amounts of MEKO.
Protective equipment for firefighters	:	Use accepted fire fighting techniques. Wear full firefighting protective clothing, including self-contained breathing apparatus (SCBA).
Fire and explosion conditions	:	This product not expected to ignite under normal conditions of use.

SECTION 6 - ACCIDENTAL RELEASE MEASURES

Use appropriate protective equipment. Avoid contact with material. Keep out of water courses. Scrape up and transfer to appropriate container for disposal.

SECTION 7 - HANDLING AND STORAGE

Personal protective equipment must be worn during maintenance or repair of contaminated mixer, reactor, or other equipment. Do not use in confined or poorly ventilated areas. Prevent inhalation of vapor, ingestion, and contact with skin eyes and clothing. Keep container closed when not in use. Precautions also apply to emptied containers. Change soiled work clothes frequently. Clean hands thoroughly after handling. Store in sealed containers in a cool, dry, ventilated warehouse location.

SECTION 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

Personal protection equipment

Respiratory protection	:	Wear appropriate, properly fitted NIOSH/MSHA approved respirator, as directed by the manufacturer, when the airborne contaminant level(s) exceed the exposure limits indicated on the MSDS.
Hand protection	:	Use suitable impervious rubber or vinyl gloves and protective apparel to reduce exposure.
Eye protection	:	Wear appropriate eye protection.Use safety glasses if eye contact is likely.
Skin and body protection	:	Prevent contact with shoes and clothing.
Protective measures	:	Use professional judgment in the selection, care, and use.
Engineering measures	:	General ventilation is sufficient.

Exposure Limits

Chemical Name	CAS Number	Regulation	Limit	Form
Calcium Carbonate (Limestone)	1317-65-3	OSHA PEL: OSHA PEL: ACGIH TWA: ACGIH TWA: OSHA TWA: OSHA TWA:	5 mg/m3 15 mg/m3 3 mg/m3 10 mg/m3 15 mg/m3 5 mg/m3	Respirable fraction. Total dust. Respirable particles. Inhalable particles. Total dust. Respirable fraction.
Amorphous silica	7631-86-9	ACGIH TWA: ACGIH TWA: OSHA PEL: OSHA PEL: OSHA TWA:	3 mg/m3 10 mg/m3 15 mg/m3 5 mg/m3 0.8 mg/m3	Respirable particles. Inhalable particles. Total dust. Respirable fraction.
Crystalline Silica (Quartz)/ Silica Sand	14808-60-7	OSHA TWA: OSHA TWA: OSHA PEL: OSHA PEL: ACGIH TWA:	0.1 mg/m3 0.3 mg/m3 15 mg/m3 5 mg/m3 0.025 mg/m3	Respirable. Total dust. Total dust. Respirable fraction. Respirable fraction.

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

Form	:	Non-sag gunnable paste
Color	:	Gray
Odor	:	Oxime
pH	:	Not available.
Vapour pressure	:	Not available.
Vapor density	:	Heavier than air
Melting point/range	:	Not available.
Freezing point	:	Not available.
Boiling point/range	:	Not available.
Water solubility	:	Negligible
Specific Gravity	:	1.34

% Volatile Weight : 2 %

SECTION 10 - REACTIVITY / STABILITY

Substances to avoid : Strong acids.Strong bases.Alcohols.Water or moisture and oxidizing agents.

Stability : Material is stable under normal storage, handling, and use.

Hazardous polymerization : Will not occur.

SECTION 11 - TOXICOLOGICAL INFORMATION

Amorphous silica, CAS-No.: 7631-86-9
Acute oral toxicity (LD-50 oral) 22,500 mg/kg (Rat) 15,000 mg/kg (Mouse)

SECTION 12 - ECOLOGICAL INFORMATION

No Data Available

SECTION 13 - DISPOSAL CONSIDERATIONS

Disposal Method : Waste not regulated under RCRA. Incinerate at EPA approved facility or dispose of waste in compliance with state and local regulations.

SECTION 14 - TRANSPORTATION / SHIPPING DATA

CFR / DOT:

Not Regulated

TDG:

Not Regulated

IMDG:

Not Regulated

SECTION 15 - REGULATORY INFORMATION

North American Inventories:

All components are listed or exempt from the TSCA inventory.
This product or its components are listed on, or exempt from the Canadian Domestic Substances List.

U.S. Federal Regulations:

SARA 313 Components : None present or none present in regulated quantities.

SARA 311/312 Hazards : Acute Health Hazard
Chronic Health Hazard

OSHA Hazardous Components :

Calcium Carbonate (Limestone)	1317-65-3
Amorphous silica	7631-86-9
Crystalline Silica (Quartz)/ Silica Sand	14808-60-7

OSHA Status: Considered hazardous based on the following criteria: : Irritant
Carcinogen

OSHA Flammability : Not Regulated

Regulatory VOC (less water and exempt solvent) : 34 g/l

VOC Method 310 : 2 %

Chemical is listed as an IARC, NTP, OSHA, or ACGIH Carcinogen:
Crystalline Silica (Quartz)/ Silica Sand 14808-60-7

U.S. State Regulations:

MASS RTK Components :	Calcium Carbonate (Limestone)	1317-65-3
	Amorphous silica	7631-86-9
Penn RTK Components :	Calcium Carbonate (Limestone)	1317-65-3
	Silicone polymer	NJ TSRN# 51721300-5110P
	Polydimethylsiloxane, trimethyl endcap	63148-62-9
	Amorphous silica	7631-86-9
NJ RTK Components :	Calcium Carbonate (Limestone)	1317-65-3
	Silicone polymer	NJ TSRN# 51721300-5110P
	Polydimethylsiloxane, trimethyl endcap	63148-62-9
	Amorphous silica	7631-86-9
	Organosilane	NJ TSRN# 51721300-5368P
	Crystalline Silica (Quartz)/ Silica Sand	14808-60-7

Components under California Proposition 65:
WARNING! Contains chemicals known to the State of California to cause cancer, birth defects and/or other reproductive harm

SECTION 16 - OTHER INFORMATION

HMIS Rating :

Health	2
Flammability	1
Reactivity	0
PPE	

0 = Minimum
1 = Slight
2 = Moderate
3 = Serious
4 = Severe

SPECTREM 2 ALUMINUM STONE

Version *2.0* Print Date 12/06/2013
REVISION DATE: 07/08/2012

Further information:

For Industrial Use Only. Keep out of Reach of Children. The hazard information herein is offered solely for the consideration of the user, subject to their own investigation of compliance with applicable regulations, including the safe use of the product under every foreseeable condition.

Prepared by: Rich Mikol

Legend

ACGIH - American Conference of Governmental Hygienists
CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act
DOT - Department of Transportation
DSL - Domestic Substance List
EPA - Environmental Protection Agency
HMIS - Hazardous Materials Information System
IARC - International Agency for Research on Cancer
MSHA - Mine Safety Health Administration
NDSL - Non-Domestic Substance List
NIOSH - National Institute for Occupational Safety and Health
NTP - National Toxicology Program
OSHA - Occupational Safety and Health Administration
PEL - Permissible Exposure Limit
RCRA - Resource Conservation and Recovery Act
RTK - Right To Know
SARA - Superfund Amendments and Reauthorization Act
STEL - Short Term Exposure Limit
TLV - Threshold Limit Value
TSCA - Toxic Substances Control Act
TWA - Time Weighted Average
V - Volume
VOC - Volatile Organic Compound
WHMIS - Workplace Hazardous Materials Information System

Safety Data Sheet

24 Hour Emergency Phone Numbers
Medical/Poison Control:
In U.S.: Call 1-800-222-1222

Outside U.S.: Call your local poison control center

Transportation/National Response Center:

1-800-535-5053
1-352-323-3500

NOTE: The National ResponseCenter emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

IMPORTANT: Provide this information to employees, customers, and users of this product. Read this SDS before handling or disposing of this product. This product is covered by the OSHA Hazard Communication Standard and this document has been prepared in accordance with requirements of this standard. All abbreviated terms used in this MSDS are further described in Section 16.

1. Identification

This Material Safety Data Sheet is available in American Spanish upon request.
Los Datos de Serguridad del Producto pueden obtenerse en Espanol si lo riquiere.

Product Name:	Alex Plus Clear	**Revision Date:**	6/19/2015
Product UPC Number:	18071	**Supercedes Date:**	7/10/2014
Product Use/Class:	Caulking Compound	**SDS No:**	00010019001
Manufacturer:	DAP Products Inc. 2400 Boston Street Suite 200 Baltimore, MD 21224-4723 888-327-8477 (non - emergency matters)		
Preparer:	Regulatory Department		

2. Hazards Identification

EMERGENCY OVERVIEW: Under normal use conditions, this product is not expected to cause adverse health effects. This product contains ethylene glycol.

GHS Classification
Not a hazardous substance or mixture.

Symbol(s) of Product

None

Signal Word
Not a hazardous substance or mixture.

3. Composition/Information on Ingredients

Chemical Name	CAS-No.	Wt. %	GHS Symbols	GHS Statements
White mineral oil	8042-47-5	10-25	GHS03-GHS07-GHS08	H270-304-312

Ethylene glycol	107-21-1	1.0-2.5	GHS03-GHS06	H270-331
Amorphous silica	112945-52-5	1.0-2.5	GHS03-GHS07	H270-315-319-332-335
Poly(oxy-1,2-ethanediyl), α-sulfo-ω-(nonylphenoxy)-, branched, sodium salt	68891-39-4	0.1-1.0	GHS03	H270

The text for GHS Hazard Statements shown above (if any) is given in the "Other information" Section.

4. First-aid Measures

FIRST AID - INHALATION: Material is not likely to present an inhalation hazard at ambient conditions. If you experience difficulty in breathing, leave the area to obtain fresh air. If continued difficulty is experienced, get medical attention immediately.

FIRST AID - SKIN CONTACT: No health hazards are known to exist. In case of contact, wash skin immediately with soap and water.

FIRST AID - EYE CONTACT: In case of contact, immediately flush eyes with large quantities of water for at least 15 minutes until irritation subsides. Get medical attention immediately.

FIRST AID - INGESTION: If swallowed, DO NOT INDUCE VOMITING. Get medical attention immediately.

5. Fire-fighting Measures

UNUSUAL FIRE AND EXPLOSION HAZARDS: None known.

SPECIAL FIREFIGHTING PROCEDURES: Wear self-contained breathing apparatus pressure-demand (NIOSH approved or equivalent) and full protective gear. Use water spray to cool exposed surfaces.

EXTINGUISHING MEDIA: Carbon Dioxide, Dry Chemical, Foam, Water Fog

6. Accidental Release Measures

ENVIRONMENTAL MEASURES: No Information

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED: Contain spilled material and remove with inert absorbent. Dispose of contaminated absorbent, container and unused contents in accordance with local, state and federal regulations. Scrape up dried material and place into containers. Use personal protective equipment as necessary. In case of spillage, absorb with inert material and dispose of in accordance with applicable regulations.

7. Handling and Storage

HANDLING: KEEP OUT OF REACH OF CHILDREN!DO NOT TAKE INTERNALLY. Use only with adequate ventilation. Ensure fresh air entry during application and drying. Wash thoroughly after handling.

STORAGE: Avoid excessive heat and freezing. Do not store at temperatures above 120 degrees F. Store away from caustics and oxidizers.

8. Exposure Controls/Personal Protection

Ingredients with Occupational Exposure Limits

Chemical Name	ACGIH TLV-TWA	ACGIH-TLV STEL	OSHA PEL-TWA	OSHA PEL-CEILING
White mineral oil	N.E.	N.E.	N.E.	N.E.
Ethylene glycol	N.E.	N.E.	N.E.	N.E.
Amorphous silica	N.E.	N.E.	N.E.	N.E.
Poly(oxy-1,2-ethanediyl), α-sulfo-ω-(nonylphenoxy)-, branched, sodium salt	N.E.	N.E.	N.E.	N.E.

Further Advice: MEL = Maximum Exposure Limit OES = Occupational Exposure Standard SUP = Supplier's Recommendation Sk = Skin Sensitizer N.E. = Not Established

Personal Protection

RESPIRATORY PROTECTION: No personal respiratory protective equipment normally required.

SKIN PROTECTION: Rubber gloves.

EYE PROTECTION: Goggles or safety glasses with side shields.

OTHER PROTECTIVE EQUIPMENT: Not required under normal use.

HYGIENIC PRACTICES: Wash hands before breaks and at the end of workday. Remove and wash contaminated clothing before re-use.

9. Physical and Chemical Properties

Appearance:	White (changes to clear as it cures)	**Physical State:**	Paste
Odor:	Very Slight Ammonia	**Odor Threshold:**	Not Established
Density, g/cm3:	1.03 - 1.04	**pH:**	Between 7.0 and 12.0
Freeze Point, °C:	Not Established	**Viscosity (mPa.s):**	Not Established
Solubility in Water:	Not Established	**Partition Coeff., n-octanol/water:**	Not Established
Decomposition Temperature, °C:	Not Established	**Explosive Limits, %:**	N.I. - N.I.
Boiling Range, °C:	N.I. - N.I.	**Auto-Ignition Temperature, °C**	Not Established
Minimum Flash Point, °C:	93.3	**Vapor Pressure, mmHg:**	No Information
Evaporation Rate:	Slower Than n-Butyl Acetate	**Flash Method:**	Seta Closed Cup
Vapor Density:	Heavier Than Air		
Combustibility:	Does not support combustion		

(See "Other information" Section for abbreviation legend)
(If product is an aerosol, the flash point stated above is that of the propellant.)

10. Stability and Reactivity

STABILITY: Stable under recommended storage conditions.

CONDITIONS TO AVOID: Excessive heat and freezing.

INCOMPATIBILITY: Incompatible with strong bases and oxidizing agents.

HAZARDOUS DECOMPOSITION PRODUCTS: Normal decomposition products, i.e., COx, NOx.

11. Toxicological Information

EFFECT OF OVEREXPOSURE - INHALATION: Under normal use conditions, this product is not expected to cause adverse health effects. Inhalation of vapors in high concentration may cause mild irritation of respiratory system (nose, mouth, mucous membranes).

EFFECT OF OVEREXPOSURE - SKIN CONTACT: Under normal use conditions, this product is not expected to cause adverse health effects. Prolonged or repeated contact with skin may cause mild irritation.

EFFECT OF OVEREXPOSURE - EYE CONTACT: Under normal use conditions, this product is not expected to cause adverse health effects. Direct eye contact may cause irritation.

EFFECT OF OVEREXPOSURE - INGESTION: Under normal use conditions, this product is not expected to cause adverse health effects. Single dose oral toxicity is very low. Amounts ingested incidental to industrial handling are not likely to cause injury; however,

ingestion of large amounts may cause injury. Ingestion of ethylene glycol can cause gastrointestinal irritation, nausea, vomiting, diarrhea and if ingested in sufficient quantities, death.

CARCINOGENICITY: No Information

PRIMARY ROUTE(S) OF ENTRY: Inhalation, Skin Contact

Acute Toxicity Values
The acute effects of this product have not been tested. Data on individual components are tabulated below

CAS-No.	Chemical Name	Oral LD50	Dermal LD50	Vapor LC50
8042-47-5	White mineral oil	>5000 mg/kg Rat	2000 mg/kg Rabbit	>20 mg/L
107-21-1	Ethylene glycol	4000 mg/kg Rat	9530 mg/kg Rabbit	> 2.5 mg/L Rat
112945-52-5	Amorphous silica	>3300 mg/kg Rat	>2000 mg/kg Rabbit	>20 mg/L
68891-39-4	Poly(oxy-1,2-ethanediyl), α-sulfo-ω-(nonylphenoxy)-, branched, sodium salt	N.I.	N.I.	N.I.

N.I. = No Information

12. Ecological Information

ECOLOGICAL INFORMATION: Ecological injuries are not known or expected under normal use.

13. Disposal Information

DISPOSAL INFORMATION: This product does not meet the definition of a hazardous waste according to U.S. EPA Hazardous Waste Management Regulation, 40 CFR Section 261. Dispose as hazardous waste according to all local, state, federal and provincial regulations. State and Local regulations/restrictions are complex and may differ from Federal regulations. Responsibility for proper waste disposal is with the owner of the waste.

14. Transport Information

SPECIAL TRANSPORT PRECAUTIONS: No Information

DOT UN/NA Number:	N.A.
DOT Proper Shipping Name:	Not Regulated.
DOT Technical Name:	N.A.
DOT Hazard Class:	N.A.
Hazard SubClass:	N.A.
Packing Group:	N.A.

15. Regulatory Information

U.S. Federal Regulations:

CERCLA - SARA Hazard Category

This product has been reviewed according to the EPA 'Hazard Categories' promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 (SARA Title III) and is considered, under applicable definitions, to meet the following categories:

Acute Health Hazard, Chronic Health Hazard

SARA SECTION 313:

This product contains the following substances subject to the reporting requirements of Section 313 of Title III of the Superfund Amendment and Reauthorization Act of 1986 and 40 CFR part 372:

Chemical Name	CAS-No.
Ethylene glycol	107-21-1

TOXIC SUBSTANCES CONTROL ACT:

All ingredients in this product are either on TSCA inventory list, or otherwise exempt.
This product contains the following chemical substances subject to the reporting requirements of TSCA 12(B) if exported from the United States:

No TSCA 12(b) components exist in this product.

CALIFORNIA PROPOSITION 65 CARCINOGENS

WARNING: This product contains chemicals known to the State of California to cause cancer.

CALIFORNIA PROPOSITION 65 REPRODUCTIVE TOXINS

This product does not contain any chemicals known to the State of California to cause birth defects or other reproductive harm.

International Regulations: As follows -

CANADIAN WHMIS:

This MSDS has been prepared in compliance with Controlled Product Regulations except for the use of the 16 headings.

WHMIS Class Consumer Commodity

16. Other Information

Revision Date: 6/19/2015 **Supersedes Date:** 7/10/2014

Reason for revision: HazCom2012/GHS Conversion

Datasheet produced by: Regulatory Department

HMIS Ratings:

Health:	1	**Flammability:**	0	**Reactivity:**	0	**Personal Protection:**	X

VOC Less Water Less Exempt Solvent, g/L 44.0

VOC Material, g/L: 26

VOC as Defined by California Consumer Product Regulation, Wt/Wt%: 0.1

Text for GHS Hazard Statements shown in Section 3 describing each ingredient:

H270	May cause or intensify fire; oxidiser.
H304	May be fatal if swallowed and enters airways.
H312	Harmful in contact with skin.
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H331	Toxic if inhaled.
H332	Harmful if inhaled.
H335	May cause respiratory irritation.

Icons for GHS Pictograms shown in Section 3 describing each ingredient:

GHS03

GHS06

GHS07

GHS08

Legend: N.A. - Not Applicable, N.E. - Not Established, N.D. - Not Determined

DAP believes the data and statements contained herein are accurate as of the date hereof. They are offered in good faith as typical values and not as a product specification. NO WARRANTY OF MERCHANTABILITY, WARRANTY OF FITNESS FOR ANY PARTICULAR PURPOSE OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED, IS MADE WITH REGARD TO THE INFORMATION HEREIN PROVIDED OR THE PRODUCT TO WHICH THE INFORMATION REFERS. Since thisdocument is intended only as a guide to the appropriate use and precautionary handling of the referenced product by a properly trained person, it is therefore the responsibility of the user to (i) review the recommendations with due consideration for the specific context of the intended use and (ii) determine if they are appropriate.

Safety Data Sheet

1 - Identification

Trade Name: WD-40 Specialist® Dirt & Dust Resistant Dry Lube **Chemical Name: Organic Mixture** **Product Use: Cleaner, Lubricant** **Restrictions on Use: None identified** **SDS Date Of Preparation: 07/13/14**	**Manufacturer: WD-40 Company** **Address: 1061 Cudahy Place (92110)** **P.O. Box 80607** **San Diego, California, USA** **92138 –0607** **Telephone:** **Emergency only: 1-888-324-7596 (PROSAR)** **Information: 1-888-324-7596** **Chemical Spills: 1-800-424-9300 (Chemtrec)** **1-703-527-3887 (International Calls)**

2 – Hazards Identification

Hazcom 2012/GHS Classification:
Flammable Aerosol Category 1
Gas Under Pressure: Compressed Gas
Aspiration Toxicity Category 1
Skin Irritant Category 2
Specific Target Organ Toxicity Single Exposure Category 3 (nervous system effects)

Note: This product is a consumer product and is labeled in accordance with the US Consumer Product Safety Commission regulations which take precedence over OSHA Hazard Communication labeling. The actual container label will not include the label elements below. The labeling below applies to industrial/professional products.

Label Elements:

DANGER!
Extremely Flammable Aerosol.
Contains gas under pressure; may explode if heated.
May be fatal if swallowed and enters airways.
Causes skin irritation.
May cause drowsiness or dizziness.

Prevention
Keep away from heat, sparks, open flames, hot surfaces – No smoking.
Do not spray on an open flame or other ignition source.
Pressurized container: Do not pierce or burn, even after use.
Avoid breathing vapors or mists.
Wash thoroughly with soap and water after handling.
Use only outdoors or in a well-ventilated area.
Wear protective gloves.
Response
IF SWALLOWED: Immediately call a POISON CENTER or physician. Do NOT induce vomiting.
IF ON SKIN: Wash with plenty of soap and water. If skin irritation occurs: Get medical attention. Take off contaminated clothing and wash before reuse.

IF INHALED: Remove to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or physician if you feel unwell.

Storage

Store locked up.

Protect from sunlight. Do not expose to temperatures exceeding 50°C/122°F. Store in a well-ventilated place.

Disposal

Dispose of contents and container in accordance with local and national regulations.

3 - Composition/Information on Ingredients

Ingredient	CAS #	Weight Percent	US Hazcom 2012/ GHS Classification
Heptane	64742-49-0 142-82-5	70-80%	Aspiration Toxicity Category 1 Flammable Liquid Category 2 Skin Irritant Category 2 Specific Target Organ Toxicity Single Exposure Category 3 (nervous system effects)
Propane Propellant	74-98-6	10-20%	Flammable Gas Category 1 Gas Under Pressure, Compressed Gas
Petroleum Solvent	64741-66-8 64742-47-8	5-10%	Flammable Liquid, Category 2 Aspiration Toxicity Category 1
Mineral Oil	Proprietary	1-5%	Not Hazardous

Note: The exact percentages are a trade secret.

4 – First Aid Measures

Ingestion (Swallowed): Aspiration Hazard. DO NOT induce vomiting. Call physician, poison control center or the WD-40 Safety Hotline at 1-888-324-7596 immediately.

Eye Contact: Flush thoroughly with water. Remove contact lenses if present after the first 5 minutes and continue flushing for several more minutes. Get medical attention if irritation persists.

Skin Contact: Wash with soap and water. If irritation develops and persists, get medical attention.

Inhalation (Breathing): If irritation is experienced, move to fresh air. Get medical attention if irritation or other symptoms develop and persist.

Signs and Symptoms of Exposure: Harmful or fatal if swallowed. If swallowed, may be aspirated and cause lung damage. May cause eye and respiratory irritation. Inhalation may cause coughing, headache and dizziness. Skin contact may cause drying of the skin.

Indication of Immediate Medical Attention/Special Treatment Needed: Immediate medical attention is needed for ingestion.

5 – Fire Fighting Measures

Suitable (and unsuitable) Extinguishing Media: Use water fog, dry chemical, carbon dioxide or foam. Do not use water jet or flooding amounts of water. Burning product will float on the surface and spread fire.

Specific Hazards Arising from the Chemical: Contents under pressure. Extremely flammable aerosol. Extremely flammable liquid and vapor. Keep away from ignition sources and open flames. Exposure of containers to extreme heat and flames can cause them to rupture often with violent force. Vapors can cause a flash fire. Vapors are heavier than air and may travel along surfaces to remote ignition sources and flash back. Combustion will produce oxides of carbon, smoke fumes, unburned hydrocarbons and small amounts of hydrogen fluoride and carbonyl fluoride. A vapor and air mixture can create an explosion hazard in confined spaces.

Special Protective Equipment and Precautions for Fire-Fighters: Firefighters should always wear positive pressure self-contained breathing apparatus and full protective clothing. Cool fire-exposed containers with water. Use shielding to protect against bursting containers.

6 – Accidental Release Measures

Personal Precautions, Protective Equipment and Emergency Procedures: Wear appropriate protective clothing (see Section 8). Eliminate all sources of ignition and ventilate area.
Methods and Materials for Containment/Cleanup: Leaking cans should be placed in a plastic bag or open pail until the pressure has dissipated. Contain and collect liquid with an inert absorbent and place in a container for disposal. Clean spill area thoroughly. Report spills to authorities as required.

7 – Handling and Storage

Precautions for Safe Handling: Avoid contact with eyes. Avoid prolonged contact with skin. Avoid breathing vapors or aerosols. Use only with adequate ventilation. Keep away from heat, sparks, pilot lights, hot surfaces and open flames. Unplug electrical tools, motors and appliances before spraying or bringing the can near any source of electricity. Electricity can burn a hole in the can and cause contents to burst into flames. To avoid serious burn injury, do not let the can touch battery terminals, electrical connections on motors or appliances or any other source of electricity. Wash thoroughly with soap and water after handling. Keep containers closed when not in use. Keep out of the reach of children. Do not puncture, crush or incinerate containers, even when empty.
Conditions for Safe Storage: Store in a cool, well-ventilated area, away from incompatible materials Do not store above 120°F or in direct sunlight. U.F.C (NFPA 30B) Level 3 Aerosol. Store away from oxidizers.

8 – Exposure Controls/Personal Protection

Chemical	Occupational Exposure Limits
Heptane	500 ppm TWA OSHA PEL 400 ppm TWA, 500 ppm STEL ACGIH TLV
Propane Propellant	1000 ppm TWA OSHA PEL
Petroleum Solvent	1400 mg/m3 TWA Supplier Recommended (total hydrocarbon)
Mineral Oil	5 mg/m3 (inhalable) TWA 5 mg/m3 TWA OSHA PEL

The Following Controls are Recommended for Normal Consumer Use of this Product
Appropriate Engineering Controls: Use in a well-ventilated area.
Personal Protection:
Eye Protection: Avoid eye contact. Always spray away from your face.
Skin Protection: Avoid prolonged skin contact. Chemical resistant gloves recommended for operations where skin contact is likely.
Respiratory Protection: None needed for normal use with adequate ventilation.

For Bulk Processing or Workplace Use the Following Controls are Recommended
Appropriate Engineering Controls: Use adequate general and local exhaust ventilation to maintain exposure levels below that occupational exposure limits.
Personal Protection:
Eye Protection: Safety goggles recommended where eye contact is possible.
Skin Protection: Wear chemical resistant gloves.
Respiratory Protection: None required if ventilation is adequate. If the occupational exposure limits are exceeded, wear a NIOSH approved respirator. Respirator selection and use should be based on contaminant type, form and concentration. Follow OSHA 1910.134, ANSI Z88.2 and good Industrial Hygiene practice.
Work/Hygiene Practices: Wash with soap and water after handling.

9 – Physical and Chemical Properties

Appearance:	Clear liquid	Flammable Limits:	LEL: 0.9% UEL: 9.5%
Odor:	Pleasant odor	Vapor Pressure:	40-50 psi @ 70°F

Odor Threshold:	Not established	Vapor Density:	Greater than 1 (air=1)
pH:	Not Applicable	Relative Density:	0.72
Melting/Freezing Point	Not established	Solubilities:	Insoluble in water
Boiling Point/Range:	90-140°C (194-284°F)	Partition Coefficient; n-octanol/water:	Not established
Flash Point:	<-29.2°F Tag Closed Cup	Autoignition Temperature:	Not established
Evaporation Rate:	Not established	Decomposition Temperature:	Not established
Flammability (solid, gas)	Flammable Aerosol	Viscosity:	Not established
VOC:	93.2%	Pour Point:	Not established

10 – Stability and Reactivity

Reactivity: Not reactive under normal conditions
Chemical Stability: Stable
Possibility of Hazardous Reactions: May react with strong oxidizers generating heat.
Conditions to Avoid: Avoid heat, sparks, flames and other sources of ignition. Do not puncture or incinerate containers.
Incompatible Materials: Strong oxidizing agents.
Hazardous Decomposition Products: Carbon monoxide and carbon dioxide, smoke fumes, unburned hydrocarbons and small amounts of hydrogen fluoride and carbonyl fluoride.

11 – Toxicological Information

Symptoms of Overexposure:
Inhalation: Mist or vapor can irritate the throat and lungs. High concentrations may cause nasal and respiratory irritation and central nervous system effects such as headache, dizziness and nausea. Intentional abuse may be harmful or fatal.
Skin Contact: May cause skin irritation with short-term exposure with redness, itching and burning of the skin. Prolonged and/or repeated contact may produce defatting and possible dermatitis.
Eye Contact: Contact may be irritating to eyes. May cause redness, stinging, swelling and tearing.
Ingestion: This product has low oral toxicity. If swallowed, this material may cause irritation of the mouth, throat and esophagus. Swallowing may cause gastrointestinal irritation, nausea, vomiting, diarrhea, dizziness, drowsiness and other central nervous system effects. This product is an aspiration hazard. If swallowed, can enter the lungs and may cause chemical pneumonitis, severe lung damage and death.
Chronic Effects: Prolonged or repeated skin contact may defeat the skin resulting in irritation and dermatitis.
Carcinogen Status: None of the components are listed as a carcinogen or suspect carcinogen by IARC, NTP, ACGIH or OSHA.
Reproductive Toxicity: None of the components is considered a reproductive hazard.

Numerical Measures of Toxicity:
The oral toxicity of this product is estimated to be greater than 2,000 mg/kg and the dermal toxicity greater than 2,000 mg/kg based on an assessment of the ingredients. This product is not classified as toxic by established criteria. It is an aspiration hazard.

12 – Ecological Information

Ecotoxicity: Heptane: 24 hr LC50 Goldfish – 4 mg/L; 24 hr EC50 Daphnia magna – >10 mg/L
Petroleum Solvent: No ecotoxicity data available. Ingredient is expected to be toxic to the aquatic environment with long-term adverse effects.
Persistence and Degradability: Component are not readily biodegradable.
Bioaccumulative Potential: Bioaccumulation is not expected based on an assessment of the ingredients.
Mobility in Soil: No data available
Other Adverse Effects: None known

13 - Disposal Considerations

If this product becomes a waste, it would be expected to meet the criteria of a RCRA ignitable hazardous waste (D001). However, it is the responsibility of the generator to determine at the time of disposal the proper classification and method of disposal. Do not puncture or incinerate containers, even empty. Dispose in accordance with federal, state, and local regulations.

14 – Transportation Information_

DOT Surface Shipping Description:
UN1950, Aerosols, 2.1 Ltd. Qty (Note: Shipping Papers are not required for Limited Quantities unless transported by air or vessel – each package must be marked with the Limited Quantity Mark)
IMDG Shipping Description: Un1950, Aerosols, 2.1, LTD QTY Marine Pollutant (Heptane)
ICAO Shipping Description: UN1950, Aerosols, flammable, 2.1 NOTE: WD-40 does not test aerosol cans to assure that they meet the pressure and other requirements for transport by air. We do not recommend that our aerosol products be transported by air.

15 – Regulatory Information

CERCLA 103 Reportable Quantity: This product is not subject to CERCLA reporting requirements, however, oil spills are reportable to the National Response Center under the Clean Water Act and many states have more stringent release reporting requirements. Report spills required under federal, state and local regulations.
SARA TITLE III:
Hazard Category For Section 311/312: Acute Health, Fire Hazard, Sudden Release of Pressure
Section 313 Toxic Chemicals: This product contains the following chemicals subject to SARA Title III Section 313 Reporting requirements: None
Section 302 Extremely Hazardous Substances (TPQ): None
EPA Toxic Substances Control Act (TSCA) Status: All of the components of this product are listed on the TSCA inventory
VOC Regulations: This product complies with the consumer product VOC limits of CARB, the US EPA and states adopting the OTC VOC rules.
California Safe Drinking Water and Toxic Enforcement Act (Proposition 65): This product does not contain chemicals regulated under California Proposition 65.
Canadian Environmental Protection Act: All of the ingredients are listed on the Canadian Domestic Substances List or exempt from notification
Canadian WHMIS Classification: Class A (Compressed Gas), Class B-5 (Flammable Aerosol), Class D-2-B (Toxic material causing other toxic effects)
This MSDS has been prepared according to the criteria of the Controlled Products Regulation (CPR) and the MSDS contains all of the information required by the CPR.

16 – Other Information:

HMIS Hazard Rating:
Health – 1 (slight hazard), Fire Hazard – 4 (severe hazard), Physical Hazard – 0 (minimal hazard)

Revision Date: July 13, 2014 Supersedes: September 2012

Revision Summary: Convert to Hazcom 2012. Changes in all sections.

Prepared by: Industrial Health & Safety Consultants, Inc. Shelton, CT, USA

APPROVED BY: I.Kowalski Regulatory Affairs Dept.

2095100/No.0049703

Honeywell
THE POWER OF CONNECTED

Home

Solve Complex Comfort Challenges.

RedLINK™ Technology

RedLINK™ Technology

RedLINK™ Technology

Complete. Connected. Control.

A home's indoor environment is made up of different areas that can have very different comfort challenges. While some rooms may be too dry, others may be too damp. Some may always be chilly, and others always warm. Whole-home comfort can be tough, both to sell and install.

Honeywell's suite of solutions with RedLINK™ Technology can help contractors solve home comfort challenges wirelessly, without running new wires or breaking through walls.

Your customers get complete control of their heating and cooling systems while you enjoy simple installations, increased add-on sales and a boost to your bottom line.

With RedLINK Technology, Honeywell gives you customizable solutions that fit the lifestyle of your customers and can grow with their changing needs.

Helping Homes Be Well.

Honeywell Whole-Home Comfort Solutions is an integrated portfolio of industry-leading products that help solve comfort and air quality issues throughout the home.

By recommending the right combination of products to solve humidity, ventilation, air cleaning and zoning issues, you can help customers be happier and more comfortable in their homes.

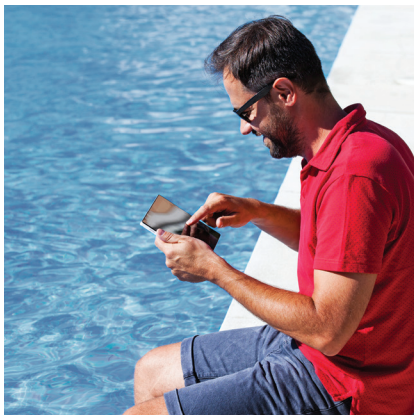
And when you build Whole-Home Comfort solutions around RedLINK Technology, you're helping your customers make the most of their homes by taking control and staying connected.

Don't Just Connect. Total Connect.

Once registered, your customers can customize their system and alert settings, download free mobile apps and more at **mytotalconnectcomfort.com**.

The Total Connect Comfort app enables users to:

- View and change their HVAC system settings (Heat, Cool, Off, Fan, Auto, EM Heat, Dehumidifier, Humidifier).
- View and set the temperature.
- View indoor humidity.
- View outdoor temperature and humidity[1].
- Access multiple thermostats if the system is zoned.
- Access multiple locations if more than one system is connected.
- Receive temperature and humidity alerts via e-mail.
- Access over 90 system alerts via the web.
- Get automatic upgrades as new features are available.



The Total Connect Comfort app is ideal for anyone with a smartphone, vacation home, investment property, or business.

Group Scheduling allows property managers to modify set points and schedules across all their connected thermostats at once.

[1]Outdoor air sensor required.

Comfort and Connection - At a Whole New Level.

Prestige® IAQ

Clean Design Meets Clear Sales Potential

The satisfaction your customers get from the comfort of experiencing the sleek design and straightforward functionalities of the Prestige thermostat will bring them back to your business for all their HVAC needs.

Delta T* Diagnostics and Alerts

Based on limits set at installation, your customers can be alerted with instructions to contact you for assistance when their system does not operate as expected. Alerts give customers a sense of security while the data logs for those alerts, as well as user interaction and system performance enable you to service or replace the equipment prior to a loss of heating or cooling.

*All Prestige IAQ systems come standard with a return and a discharge air temperature sensor to measure Delta T.

One Control is Always the Right Control

Now with selectable residential or commercial functionality, advanced staging control options, and assignable input and output relays, Prestige offers you the flexibility to use one thermostat in virtually every application.

Alerts and Interaction Logs

A searchable history of alerts and setting changes let you know if there is a system malfunction or if the issue was caused by user error.

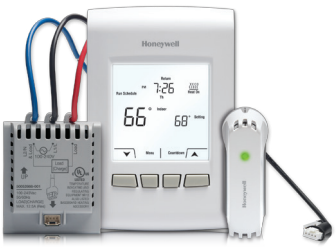
Customizable Service Reminders

Remind your customers when it's time to call you for service, when their warranty is expiring, or customize your own alerts.

RedLINK Wireless Comfort Systems

Wireless FocusPRO™
Thermostats

Wireless FocusPRO thermostats go anywhere and solve any problem. Now you can easily relocate a thermostat to a more suitable location, install multi-stage equipment, cool retrofits when wires are not available, or add zoning.



EConnect™
Wireless Thermostats for Electric Heat

Thanks to RedLINK communication and the simple wiring of an Equipment Interface Module your customers can experience the comfort they want controlled from a wireless thermostat located exactly where they want it.

TrueZONE™
Wireless Zoning Systems

When used with our RedLINK-enabled TrueZONE panels, the Honeywell Wireless Adapter lets you add zoning to any home or more zones to an existing system.

Connect to More Sales with Accessories

RedLINK accessories give your customers the option of customizing their system to achieve their control, comfort and convenience needs. With installation that requires no more than a few minutes and the touch of a button, RedLINK offers you the opportunity to increase profitability through add-on sales.

Equipment Remote Module
Lets control devices communicate wirelessly with outdoor two-stage compressors, heat pumps or an indoor boiler.

Wireless Outdoor Air Sensor
Installed on the exterior of a home or building, the sensor will display the outdoor temperature and humidity on all RedLINK thermostats and the Portable Comfort Control.

Wireless Entry / Exit Remote
Easily manage your comfort and energy consumption by controlling your thermostat from anywhere in the home or building.

RedLINK Internet Gateway
Connect to any wireless-enabled thermostat to access Total Connect Comfort Services.

Wireless Indoor Air Sensor
When paired with a Prestige IAQ thermostat the Wireless Indoor Sensor enables customers to change the sensing location of the thermostat, average temperature in large rooms or monitor humidity.

Portable Comfort Control™
Gives customers freedom to make adjustments everywhere in the system from anywhere in the conditioned space.

Wireless Vent and Filter Boost Remote
One-touch 20-40-60 minute timed ventilation and filtration boosts for the home. Compatible with all equipment and air cleaners controlled by a RedLINK thermostat.

Prestige Comfort Systems Selection Guide

		Model Number	Kit Includes	Stages (Dedicated Terminals)	Common Features	Wiring Terminals	Adding Wiring Terminals When Used with an EIM
Prestige IAQ Kits		YTHX9421R5085	Prestige IAQ System Kit Including: Prestige IAQ HD Thermostat, Equipment Interface Module (EIM), and Two Duct Sensors for Alerts and Diagnostics.	Up to 4H/2C Heat Pump & 3H/2C Conventional (Up to 4 Cool Conventional using the universal outputs [commercial only.] Up to 2 stages of Geothermal Radiant Heat using the universal outputs.)	**Equipment** • Heat Pump (Geothermal and Air-to-Air) • Forced Warm Air • Hot Water • Steam / Gravity **Commercial** VisionPRO Only: • Only Allows Temporary Setpoint Adjustments to Conserve Energy • Keypad Lockout • Initiate Occupancy • Connect to the Internet (THM6000R1002) Required • Remote Setback Using an Occupancy Sensor (THM5421R1021) Equipment Interface Module Required • Pre-occupancy Purge • Programmable Fan • Vacation Hold All Models: • Economizer / Time of Day • Commercial Dehumidification Options • 365 day Holiday Calendar (Preloaded and up to 25 Customer Events) **Power Supply** 24 VAC **RedLINK Accessories** • Displays Outdoor Temperature and Humidity - Wireless Outdoor Air Sensor (C7089R1013) Required • Temperature Control on Demand - Portable Comfort Control (REM5000R1001) Required • Connecting a Condensing Unit or Boiler to Control Devices — Without Wires - Equipment Remote Module (ERM5220R1018) Required • Remote Indoor Temperature and Humidity Sensing - Wireless Indoor Air Sensor (C7189R1004) Required • Connect to the Internet - RedLINK Internet Gateway (THM6000R1002) Required • One-touch Setback and Recovery - Entry / Exit Remote (REM1000R1003) Required **Programming** • 7-Day Programmable or Non-Programmable • Residential or Commercial • Programmable Fan • Vacations **Display** • HD Color • Touchscreen User Interface • 8 sq. in. Display Size (Viewable) • On-Screen Help • Backlighting — Continuous or On-Demand • Simultaneous Display of Room and Set Temperatures • Real-Time Clock • Language Options • Interview-Based Programming and Installer Setup • USB Port for Uploading Logo and Preset Installer Setup **Alerts and Diagnostics** • Universal Predictive Delta T Alerts and Diagnostics — Requires EIM • Alerts Using Dry Contact Input(s) — Requires EIM • Customizable Reminders (Calendar and Temperature-Based • Filter, Humidifier Pad and UV Lamp Replacement Reminder • User Interaction Log • Alerts Log • Dealer Logo On-Screen • Performance Log (Prestige IAQ Only) **Control** • Fan Circulation • Configurable Staging • IAQ Control and Configurable Outputs • Wired Sensor Inputs • Permanent Memory Retention • Auto or Manual Changeover • Adaptive Intelligent Recovery™ • Temperature Setpoint Limits • Keypad Lockout • Advanced Dual-Fuel Heat Pump Operation **Limited Warranty** 5 Year	Prestige IAQ – R, C Equipment Interface Module – R, C, W-O/B, W2/AUX1, W3/AUX2, Y, Y2, G, A-L/A, U1, U1, U2, U2, U3, U3, RH, RC, R, C, S1, S1, S2, S2, S3, S3, S4, S4	
		YTHX9421R5101	Prestige IAQ System Kit Including: Prestige IAQ HD Thermostat, Equipment Interface Module (EIM), Wireless Outdoor Temperature Sensor, and Two Duct Sensors for Alerts and Diagnostics.				
VisionPRO		TH8110R1008	RedLINK VisionPRO	1 Heat / 1 Cool*		R, Rc, W-O/B, Y, G, C, S1, S1, K	Equipment Interface Module — R, C, W-O/B, W2/AUX1, W3/AUX2, Y, Y2, G, A-L/A, U1, U1, U2, U2, U3, U3, RH, RC, R, C, S1, S1, S2, S2, S3, S3, S4, S4
		TH8110R1003	RedLINK VisionPRO	Up to 3 Heat / 2 Cool - Heat Pump Up to 2 Heat / 2 Cool - Conventional*		R, Rc, W-O/B, W2-AUX/E, Y, Y2, A-L/A, G, C, S1, S1, K	
		TH8321R1001	RedLINK VisionPRO	Up to 3 Heat / 2 Cool - Heat Pump Up to 2 Heat / 2 Cool - Conventional*		R, Rc, W-O/B, W2-AUX/E, Y, Y2, A-L/A, G, C, S1, S1, K, U1, U1	

Wireless FocusPRO Systems (Non-Zoned)

	Model Number	Kit Includes	Schedule Options			Common Features	Wiring Terminals
			Program Options	Temporary Override	Permanent Hold		
	YTH6320R1001	Programmable FocusPRO, Equipment Interface Module, and Return Air Sensor	5-1-1 / 5-2 Day	Yes	Yes	**Application** • Stages - Up to 3H / 2C Heat Pump or 2H / 2C Conventional • Gas, Oil or Electric • Heat Pump • Forced Warm Air • Hot Water • Steam / Gravity **Power Method** • Equipment Interface Module — Hardwired FocusPRO — Battery **Solutions** • Relocate Thermostat Without Running New Wires • Upgrade to Multi-stage or Add Cooling Without Running New Thermostat Wires • Displays Outdoor Temperature and Humidity - Wireless Outdoor Air Sensor (C7089R1013) Required • Temperature Control on Demand - Portable Comfort Control (REM5000R1001) Required • Adjust All RedLINK Thermostats from a Single Control **Features and Functions** • Permanent Memory Retention • Selectable Auto or Manual Changeover • Remote Locator • Advanced Dual-Fuel Heat Pump Operation • Backup Control • Private Labeling Available • Adaptive Intelligent Recovery, Temperature Setpoint Limits (Programmable Model Only) **Display Information** • 5.09 sq. in. Display Size (Viewable) • On demand Backlighting • Simultaneous Display of Room and Set Temperatures **User Interface** • Soft Keys **Limited Warranty** • FocusPRO and Equipment Interface Module — 5 Year	Equipment Interface Module — C, R, Rc, Rh, W-O/B, W2-Aux/E, Y, Y2, G, L, RAS, RAS
	YTH5320R1000	Non-Programmable FocusPRO, Equipment Interface Module, and Return Air Sensor	N/A				

EConnect Wireless Thermostats for Electric Heat

	Model Number	Common Features	Wiring Terminals
	YTL9160AR1000	**Equipment** • Baseboard • Convector • Fan-Forced Heater **Power Supply** • Thermostat: 2 AA Batteries, EIM: Hardwire **Specifications** • Color — Thermostat: White EIM: Comes with White and Light Almond Covers • Switching — SPST • Switching Method — Relay • Maximum Load — 1500 W @ 120 V, 3000 W @ 240 V • Minimum Load — 50 W @ 120 V, 100 W @ 240 V **Programming Options** • 7-Day / 5-2 Day • Energy Aware • Temporary Override • Permanent Hold **Limited Warranty** • 3 Year **RedLINK Accessories** • Displays Outdoor Temperature only - Wireless Outdoor Air Sensor (C7089R1013) Required • Temperature Control on Demand - Portable Comfort Control (REM5000R1001) Required • Connect to the Internet - RedLINK Internet Gateway (THM6000R1002) Required • One-touch Setback and Recovery - Entry / Exit Remote (REM1000R1003) Required **Display** • User Interface: Soft Keys English Display Only • 4.53 sq. in. Display Size (Viewable) • On Demand Backlighting **Control** • Permanent Memory Retention • Early Start • Temperature Limits • Unoccupied Input (Required CT240 or CT241) • 15' Floor Temperature Sensor	Equipment Interface Module — 3 Wire
	YTA7210-AR-SPK		

Learn More

Ask your Honeywell representative or visit ForwardThinking.Honeywell.com for more details about RedLINK™ Technology.

Home and Building Technologies
715 Peachtree Street NE
Atlanta, GA 30308
honeywell.com

03-00397 | SCH | 10/17

Honeywell

www.jinkosolar.com

Building Your Trust in Solar

Swan Bifacial 72H 380-400 Watt

MONOCRYSTALLINE MODULE

Positive power tolerance of 0~+3%

ISO9001:2008、ISO14001:2004、OHSAS18001 certified factory.

IEC61215、IEC61730 certified products.

PERC

KEY FEATURES

5 Busbar Solar Cell

5 busbar solar cell adopts new technology to improve the efficiency of modules , offers a better aesthetic appearance, making it perfect for rooftop installation.

PID Resistance

Excellent Anti-PID performance guarantee limited power degradation for mass production.

Higher Lifetime Power Yield

0.5% annual power degradation
30 year linear power warranty

Saving BOS Cost

Designed for high voltage systems of up to 1500 VDC, saving BOS cost

Higher power output

Module power increases 5-25% generally (per different reflective condition) lower LCOE and higher IRR

Better low-light performance

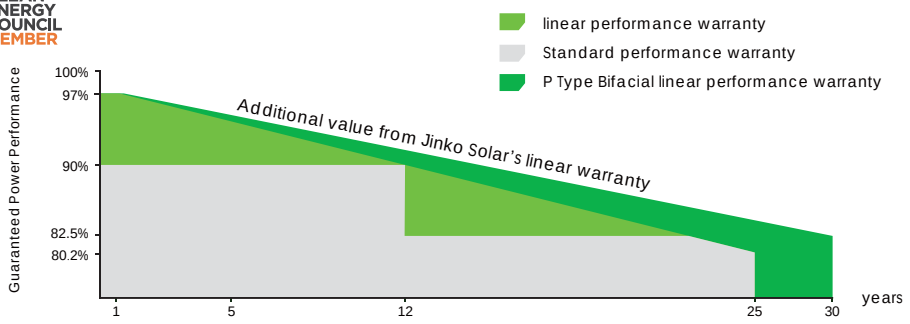
Excellent performance in low-light environments
(e.g. early morning, dusk, and cloud, etc.)

Strengthened Mechanical Support

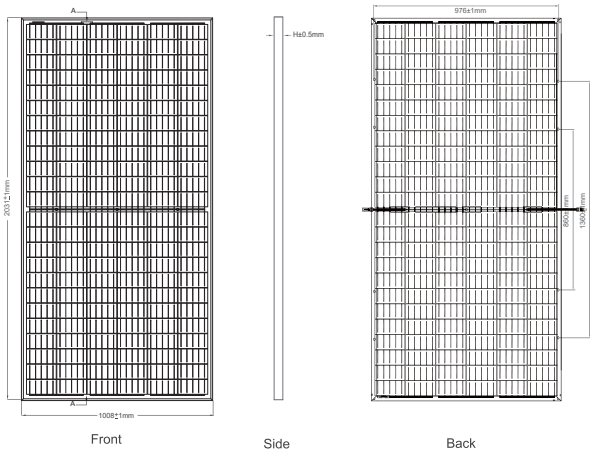
5400 Pa snow load, 2400 Pa wind load

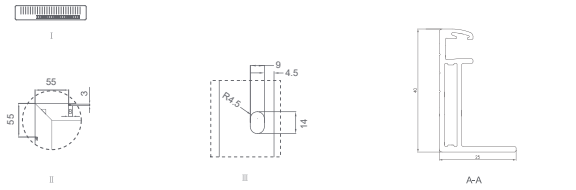
LINEAR PERFORMANCE WARRANTY

10 Year Product Warranty • 30 Year Linear Power Warranty
0.5% Annual Degradation Over 30 years



Engineering Drawings



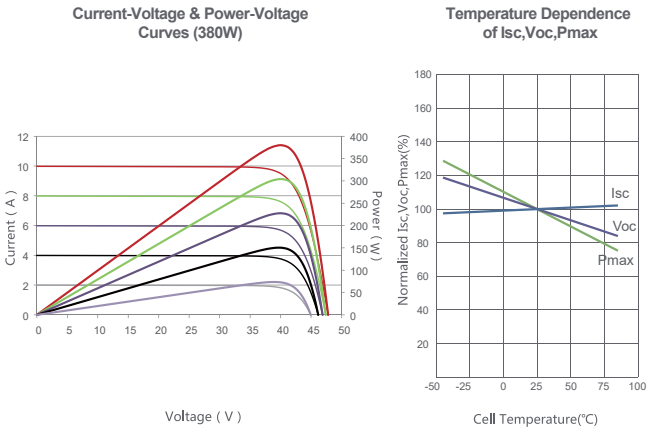


Packaging Configuration

(Two pallets = One stack)

26pcs/pallets, 52pcs/stack, 572pcs/ 40'HQ Container

Electrical Performance & Temperature Dependence



Mechanical Characteristics

Cell Type	Mono PERC 158.75×158.75mm
No.of cells	144 (6×24)
Dimensions	2031×1008×40mm (79.96×39.69×1.57 inch)
Weight	31.8kg (70.11 lbs)
Front Glass	2.5mm, Anti-Reflection Coating
Back Glass	2.5mm heat strengthened glass
Frame	Anodized Aluminium Alloy
Junction Box	IP67 Rated
Output Cables	TUV 1×4.0mm² (+): 250mm, (-): 150mm or cust omized length

SPECIFICATIONS

Module Type	JKM380M-72H-BDVP		JKM385M-72H-BDVP		JKM390M-72H-BDVP		JKM395M-72H-BDVP		JKM400M-72H-BDVP	
	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT
Maximum Power (Pmax)	380Wp	282Wp	385Wp	285Wp	390Wp	289Wp	395Wp	293Wp	400Wp	296Wp
Maximum Power Voltage (Vmp)	40.0V	36.4V	40.3V	36.6V	40.6V	36.8V	40.8V	37.0V	41.0V	37.2V
Maximum Power Current (Imp)	9.50A	7.75A	9.56A	7.80A	9.62A	7.86A	9.69A	7.92A	9.76A	7.97A
Open-circuit Voltage (Voc)	47.8V	44.0V	48.1V	44.2V	48.3V	44.4V	48.5V	44.6V	48.8V	44.8V
Short-circuit Current (Isc)	9.98A	8.08A	10.04A	8.13A	10.11A	8.18A	10.17A	8.24A	10.24A	8.29A
Module Efficiency STC (%)	18.56%		18.81%		19.05%		19.29%		19.54%	
Operating Temperature(℃)	-40℃~+85℃									
Maximum system voltage	1500VDC (IEC)									
Maximum series fuse rating	20A									
Power tolerance	0~+3%									
Temperature coefficients of Pmax	-0.36%/℃									
Temperature coefficients of Voc	-0.29%/℃									
Temperature coefficients of Isc	0.048%/℃									
Nominal operating cell temperature (NOCT)	45±2℃									
Refer. Bifacial Factor	70±5%									

BIFACIAL OUTPUT-REARSIDE POWER GAIN

5%	Maximum Power (Pmax)	399Wp	404Wp	410Wp	415Wp	420Wp
	Module Efficiency STC (%)	19.49%	19.75%	20.00%	20.26%	20.52%
15%	Maximum Power (Pmax)	437Wp	443Wp	449Wp	454Wp	460Wp
	Module Efficiency STC (%)	21.35%	21.63%	21.91%	22.19%	22.47%
25%	Maximum Power (Pmax)	475Wp	481Wp	488Wp	494Wp	500Wp
	Module Efficiency STC (%)	23.20%	23.51%	23.81%	24.12%	24.42%

*STC: Irradiance 1000W/m² Cell Temperature 25°C AM=1.5

NOCT: Irradiance 800W/m² Ambient Temperature 20°C AM=1.5 Wind Speed 1m/s

* Power measurement tolerance: ± 3%

The company reserves the final right for explanation on any of the information presented hereby.
SWAN DG JKM380-400M-72H-BDVP-F40-A1-EN

TRANE

LET'S GO BEYOND™

Trane High Efficiency Unit Heater

Industry-leading efficiency

What's hot in unit heaters? At Trane, we're focused on giving you more consistent temperature control while reducing the energy intensity of the world. Our High Efficiency Unit Heater is the most efficient and accurate model on the market. Its advanced, engineered design delivers up to 99% efficiency, while modulating the heat discharge to compensate for indoor and outdoor temperature variations.

Save money and be more sustainable. The Trane High Efficiency Unit Heater generates the exact, consistent heat you need.

IR Ingersoll Rand

Efficiency based on accuracy

You need a unit heater that can deliver consistent heat in places where variable temperatures can be detrimental to comfort and productivity, or where product quality and safety are at stake. But you also need to stay within budget—and keep your organization's sustainability goals in mind. The Trane High Efficiency Unit Heater delivers it all, with an industry leading efficiency rating and advance features that minimize temperature variations, while maximizing sustainability.

Outdoor Air Reset Modulation

Ideal in regions where temperatures vary greatly between morning and afternoon

High Efficiency Unit Heaters automatically vary discharge temperatures based on the outside air temperature. As the outdoor temperature increases, discharge temperature drops. When the outdoor temperature drops, the discharge temperature increases.

- Units operate efficiently at part load, so there's less cycling, lower fuel costs and improved occupancy comfort.
- Master outdoor air reset requires only one outdoor sensor per building. Units can be networked for seamless, coordinated operation.
- Modulating with indoor air reset: Units vary the discharge air temperature to more closely match the needs of the space.

Indoor Air Reset Modulation

Units will learn your building's heating needs and run at the bare minimum to maintain the desired space temperature for a greater period of time. This improves occupancy comfort, increases efficiency, and reduces cycling. Unlike outdoor air reset, this gas control is ideal for regions that do not have large temperature swings.

High efficiency—Tri-metal heat exchanger uses a unique combination of stainless steel and high-conductivity brass and aluminum, with turbulators that improve heat transfer from the hot flue gases to the bi-metal fins. **Delivers up to 99% maximum efficiency at full turndown; +95% efficiency at high fire.**

Sustainable—Consumes less fuel and uses a state-of-the-art combustion control system that reduces direct emissions.

Application flexibility—Designed for natural or LP gas. Available in multiple operating voltages, with flexible venting options and some of the longest throws available. Operate a single unit or create a multi-unit network that integrates with your building management system for easy communication and control.

Brushed stainless steel cabinet—Provides a high-end finish that looks great and performs well in high-humidity or corrosive environments.

Attitude auto-adust—Negative pressure valve keeps the gas pressure leaving the valve at approximately 0″ w.c. Units automatically compensate for altitude without changing components or manual adjustments.

Double-wall construction—Reflects more heat into the supply air stream. More supply air is blown down into the space instead of hovering at the ceiling. Enhances safety by keeping the jacket temperature cooler, too.

Single condensate connection—Uses an all-plastic power venter that allows for a single condensate connection without worries about corrosion or premature power venter failure.

Single orifice gas conversion kit—Simplifies conversion from natural gas to LP, or vice versa, and is included in the box with every unit.

LET'S GO BEYOND™

Want to learn more? Contact your Trane representative.

Ingersoll Rand

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Ingersoll Rand (NYSE:IR) advances the quality of life by creating comfortable, sustainable and efficient environments. Our people and our family of brands—including Club Car®, Ingersoll Rand®, Thermo King® and Trane®—work together to enhance the quality and comfort of air in homes and buildings; transport and protect food and perishables; and increase industrial productivity and efficiency. We are a $14 billion global business committed to a world of sustainable progress and enduring results.

HEGH-SLB001-EN

April 17, 2019

REZNOR®
MODEL F

ANSI Z83.8

CAN/CGA 2.6

Gas-Fires, Gravity-Vented, Fan-Type Unit Heater for Commercial/Industrial Use

WARNING: Gas-fired appliances are not designed for use in hazardous atmospheres containing flammable vapors or combustible dust, or atmospheres containing chlorinated or halogenated hydrocarbons.

Installations in public garages or airplane hangars are permitted when in accordance with ANSI Z223.1 and NFPA 54 Codes or CAN1-B149 Codes and enforcing authorities.

DESCRIPTION

Reznor® Series 100, Model F gas-fired, gravity-vented unit heaters are designed for 80% thermal efficiency and are designed for use with natural or propane gas, as specified, in sizes from 25,000 to 400,000 BTUH gas input.

Model F unit heaters are designed for ceiling suspension with a propeller fan for air delivery.

A terminal strip connector facilitates field connection to a remote 24-volt thermostat for automatic operation. Each unit is provided with a fan control and all required limit safety controls, including an energy cutoff (ECO) device and a blocked vent switch.

These units are approved for installation in The United States and Canada by the Canadian Standards Association (CSA).

NOTE: When installing gravity vented appliances check local and state codes for requirements. Some states require the addition of spark pilot Option AH2 or AH3.

STANDARD FEATURES

- Orifices for natural gas
- Aluminized steel heat exchanger
- Aluminized steel burner rack with stainless steel insert
- Spark ignited, intermittent safety pilot with electronic flame supervision
- Single-stage combination gas valve (field adjustable for high altitude operation)
- 115/1/60 supply voltage
- 115 volt fan motor with internal overload protection
- Fan and limit safety controls
- Energy cutoff (ECO) device
- Blocked vent shutoff system
- 24-volt control voltage transformer
- Individually adjustable horizontal louvers
- Full safety fan guard
- Terminal strip connector for 24-volt field wiring
- Convenient bottom burner access
- 2-point 3/8"-16 threaded hanger connections
- Horizontal/vertical vent outlet

The Energy Policy Act of 2005 mandated that beginning August of 2008, no Gravity Vented Unit Heaters may be sold without an Intermittent Ignition Device (No Standing Pilot- Spark Ignition Only) AND, (either an automatic shutoff vent damper or a power vent exhaust). Your state may have already enacted this restriction in their local codes. Please take note of this when placing orders for gravity vented units.

OPTIONAL FEATURES - FACTORY INSTALLED

- Equipped for propane gas
- E-3 (409) stainless steel heat exchanger and burner
- Two-stage gas control (50% low fire) - Sizes 75-400
- Spark ignited, intermittent safety pilot with electronic flame supervision with timed lockout (timed lockout is required for propane gas)
- Manual summer/winter switch
- Burner air shutters
- 208/230 single phase supply voltage
- 220/240 volt/50 Hertz electrical operation
- Totally enclosed 115V motor
- Low ambient fan control relay

OPTIONAL FEATURES - FIELD INSTALLED

- Power venter
- Vertical louvers
- Downturn air nozzle, 25-65° or 50-90° variable air deflector range (includes 4-point suspension kit)
- Thermostat and relay kits
- Air recirculation kits
- Manual summer/winter switch
- Multiple heater control
- 4-point suspension kit
- Unit-mounted thermostat bracket
- Step down transformer 230/115 or 460/115
- Burner air shutters
- Low ambient fan control relay kit
- Hanger kit to suspend from 1" pipe (2 or 4 point suspension)
- Single-stage and two-stage thermostats
- Thermostat guard with locking cover
- Manual shutoff valve and union
- Gas conversion kit

NOTE: Not certified for residential use.

NOTE: ***Regulated combination redundant gas valve consists of combination pilot solenoid valve, electric gas valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff, all in one body. Gas supply pressure must not exceed 0.5 psi (8 oz. or 14" w.c.). Minimum inlet pressure for natural gas is 5" w.c.; minimum inlet pressure for propane gas is 11" w.c.***

TECHNICAL DATA

Model F

Size		25		50		75		100		125	
Heating Input - BTUH (kW)		25,000	(7.3)	50,000	(14.7)	75,000	(22.0)	100,000	(29.3)	125,000	(36.6)
Thermal Output - BTUH (kw) (80%) [A]		20,000	(5.9)	40,000	(11.7)	60,000	(17.6)	80,000	(23.4)	100,000	(29.3)
Vent Outlet Diameter		4" Rd		4" Rd		5" Oval		6"Oval		7" Oval	
Gas Connection - Natural Gas [B]		1/2"		1/2"		1/2"		1/2"		1/2"	
Control Amps (24-volt)		0.33		0.33		0.33		0.33		0.33	
Full-Load Amps (115 volt)		0.8		1.3		1.9		2.8		2.9	
Normal Consumption (watts)		60		95		135		195		205	
Throw at 8' (2.4M) Mntg Ht - ft (M) [C]		35	(11)	39	(12)	48	(15)	60	(18)	73	(22)
Motor HP [D]	Standard	1/50		1/35		1/15		1/30		1/30	
	Optional Enclosed	--		1/15		1/15		1/8		1/8	
Motor RPM		1550		1550		1550		1050		1050	
Fan Diameter - in. (mm)		10	(254)	10	(254)	12	(305)	14	(356)	16	(406)
Air Volume - CFM (M^3/hr)		380	(646)	650	(1,104)	980	(1,665)	1,250	(2,124)	1,600	(2,718)
Outlet Velocity - FPM (M/s)		423	(2.1)	853	(4.3)	1,166	(5.9)	1,358	(6.9)	1,330	(6.8)
Approximate Net Wt - lbs (kg)		72	(33)	79	(36)	88	(40)	97	(44)	127	(58)
Approximate Shipping Wt - lbs (kg)		89	(40)	96	(44)	107	(49)	118	(54)	150	(68)

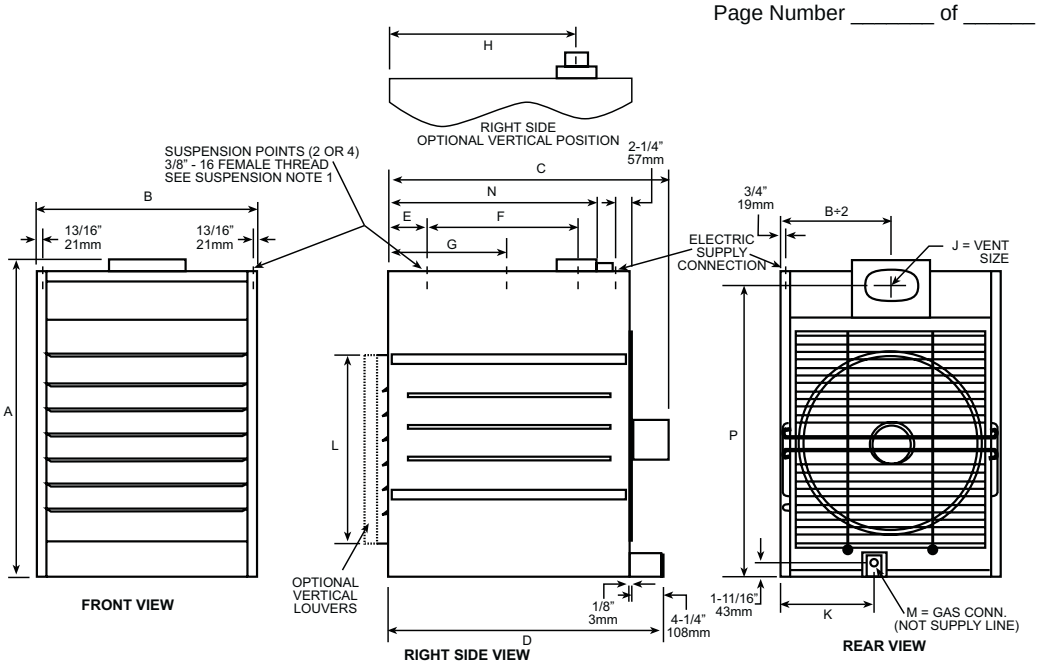
Size		165		200		250		300		400	
Heating Input - BTUH (kW)		165,000	(48.4)	200,000	(58.6)	250,000	(73.3)	300,000	(87.9)	400,000	(117.2)
Thermal Output - BTUH (kw) (80%) [A]		132,000	(38.7)	160,000	(46.9)	200,000	(58.6)	240,000	(70.3)	320,000	(93.8)
Vent Outlet Diameter		8" Oval		8" Oval		10" Oval		10" Oval		12" Oval	
Gas Connection - Natural Gas [B]		1/2"		1/2"		1/2"		3/4"		3/4"	
Control Amps (24-volt)		0.23		0.23		0.23		0.2		0.2	
Full-Load Amps (115 volt)		4		4		2.5		4		7	
Normal Consumption (watts)		275		300		280		375		565	
Throw at 8' (2.4M) Mntg Ht - ft (M) [C]		78	(24)	85	(26)	96	(29)	108	(33)	120	(37)
Motor HP [D]	Standard	1/20		1/20		1/6		1/4		1/2	
	Optional Enclosed	1/8		1/6		1/6		1/2		1/2	
Motor RPM		1050		1050		850		850		850	
Fan Diameter - in. (mm)		16	(406)	20	(508)	22	(559)	22	(559)	24	(610)
Air Volume - CFM (M^3/hr)		2,200	(3,738)	2,800	(4,757)	3,360	(5,708)	3,800	(6,456)	4,940	(8,393)
Outlet Velocity - FPM (M/s)		1,100	(5.6)	1,217	(6.2)	1,182	(6.0)	1,426	(7.2)	1,420	(7.2)
Approximate Net Wt - lbs (kg)		149	(68)	170	(77)	204	(93)	221	(100)	276	(125)

[A] For U.S. installations, ratings for altitudes to 2000 ft.. Above 2000 ft., derate by 4% for each 1000 ft. above sea level.
[A] For Canadian installations, ratings for altitudes to 2000 ft. High altitude units (2001-4500 ft.) are derated by 10% of maximum input.
[B] Gas connection for propane is 1/2" for all sizes. Sizes shown are for gas connection to a single-stage gas valve; NOT gas supply line size.
[C] Additional mounting heights shown later in this catalog.
[D] All other information in this table is based on a heater equipped with a standard 115v motor. (The standard motor for a Model 25 is an enclosed motor; all other standard motors are open motors. Optional enclosed motors are available in 115v only.)

DIMENSIONS

Model F

±1/16" (2mm)



Size		A	B	C	D	E	F	G	H	J	K	L	M - in. Nat	M - in. Pro	N	P
25,50	in	30 1/8	13 1/2	27	31 1/2	5 7/8	14 1/2	14	19	4 Rnd	10 1/4	16	1/2	1/2	21 1/2	27 5/8
	(mm)	(765)	(343)	(686)	(800)	(149)	(368)	(356)	(483)	--	(260)	(406)	--	--	(546)	(702)
75	in	30 1/8	15 1/2	27	31 1/2	5 7/8	14 1/2	14	19	5 Oval	10 1/2	16	1/2	1/2	21 1/2	27 5/8
	(mm)	(765)	(394)	(686)	(800)	(149)	(368)	(356)	(483)	--	(267)	(406)	--	--	(546)	(702)
100	in	30 1/8	17 1/2	30 1/2	31 1/2	5 7/8	14 1/2	14	19	6 Oval	12 7/8	16	1/2	1/2	21 1/2	27 5/8
	(mm)	(765)	(445)	(775)	(800)	(149)	(368)	(356)	(483)	--	(327)	(406)	--	--	(546)	(702)
125	in	32	23 1/4	30 1/2	31 1/2	5 7/8	14 1/2	14	19	7 Oval	14 1/2	16	1/2	1/2	21 1/2	28 1/2
	(mm)	(813)	(591)	(775)	(800)	(149)	(368)	(356)	(483)	--	(368)	(406)	--	--	(546)	(724)
165	in	40 1/8	20 1/4	35 1/2	36	4 7/8	19 1/2	15 3/4	23 3/8	8 Oval	14 1/4	24	1/2	1/2	27	36 3/4
	(mm)	(1,019)	(514)	(902)	(914)	(124)	(495)	(400)	(594)	--	(362)	(610)	--	--	(686)	(933)
200	in	40 1/8	23 1/4	36 1/4	36	4 7/8	19 1/2	15 3/4	23 3/8	8 Oval	14 3/8	24	1/2	1/2	27	36 3/4
	(mm)	(1,019)	(591)	(921)	(914)	(124)	(495)	(400)	(594)	--	(365)	(610)	--	--	(686)	(933)
250	in	43 1/2	28 3/4	36 1/4	36	4 7/8	19 1/2	15 3/4	21 3/4	10 Oval	12 3/8	24	1/2	1/2	27	38 3/8
	(mm)	(1,105)	(730)	(921)	(914)	(124)	(495)	(400)	(552)	--	(314)	(610)	--	--	(686)	(975)
300	in	43 1/2	28 3/4	36 3/4	36	4 7/8	19 1/2	15 3/4	21 3/4	10 Oval	12 3/8	24	3/4	1/2	27	38 3/8
	(mm)	(1,105)	(730)	(933)	(914)	(124)	(495)	(400)	(552)	--	(314)	(610)	--	--	(686)	(975)
400	in	43 1/2	37	37 1/4	36	4 7/8	19 1/2	15 3/4	21 3/4	12 Oval	13	24	3/4	1/2	27	38 3/8
	(mm)	(1,105)	(940)	(946)	(914)	(124)	(495)	(400)	(552)	--	(330)	(610)	--	--	(686)	(975)

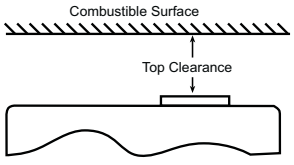
Units, bottom clearance exceeding 12" minimum is not required but may be desirable.

CLEARANCES FROM COMBUSTIBLES

Required Clearances (inches)

Sizes	Top [E]	Flue Connector	Sides	Bottom [F]	Rear [G]
25-125	2	6	18	12	24
165-400	6	6	18	12	24

[E] Measure top clearance as illustrated below.
[F] When supplied with optional downturn nozzle, bottom clearance is 42". For service purposes on standard units, bottom clearance exceeding 12" minimum is not required but may be desirable.
[G] For service purposes only, rear must have 24" clearance.



SUSPENSION NOTES:
1) Use dimension "G" for 2-point suspension and "E" and "F" for 4-point suspension.
2) Factory equipped with 2-point suspension; 4-point is optional.

Product Bulletin

JB(X) Series Burners

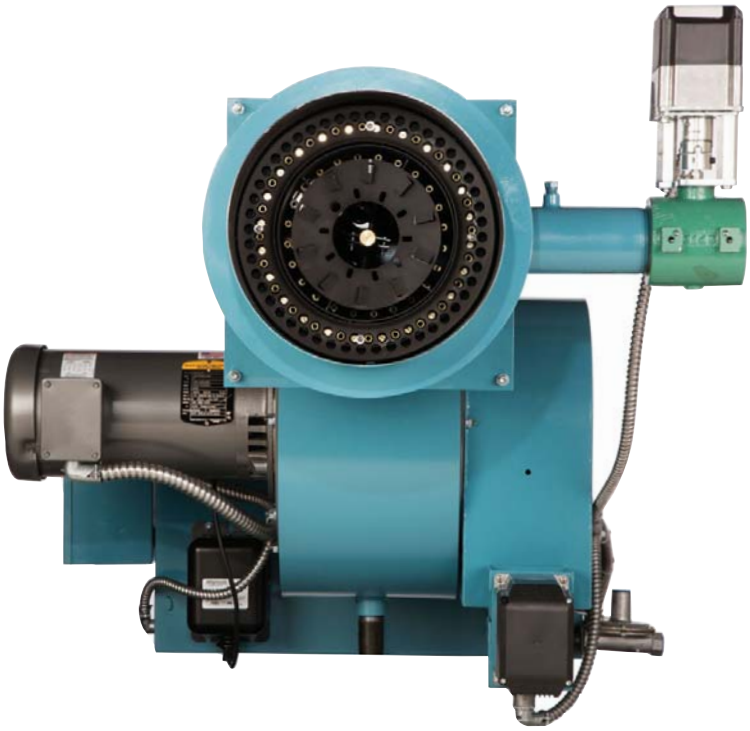
Efficient, Reliable, Safe Solutions For Cast Iron, Firetube, Firebox, Watertube And Process Applications

10 BHP to 300 BHP Range

www.webster-engineering.com

WEBSTER COMBUSTION
A Selas Heat Technology Company

Benefits Of The JB And JBX Series Burners



Webster JB(X) series burners offer years of dependable and efficient operation. Designed with ease of serviceability in mind, Webster burners are equipped with a wide variety of the latest control and technology options available. When combined with the patented Webster Temp A Trim control system, the JB(X) burner is by far the most efficient option in the industry.

Versatility and flexibility are prime considerations in the Webster JB(X) series design. JB(X) series units can be adapted to fire in most any furnace configuration or combustion environment, and Webster has years of proven experience firing a multitude of fuels including: Natural, LP, and Digester gas, No.2 through No. 6 oil, and other more exotic fuels.

Webster JB(X) burners are completely factory wired, assembled, and tested so they come to you ready for installation and connection to fuel and electrical supplies. Typical JB(X) series burners are installed and ready for start-up in a minimal amount of time, saving valuable time and money at your installation.

When it comes to low emission requirements, Webster should be your choice. The JB(X) series burner offers optional low NOx configurations. Depending on the application, the JB(X) is available with and without Induced Flue Gas Recirculation for 30ppm requirements. Webster has been providing low emission units for more than 25 years and understands what it takes to meet your compliance requirements.

JB and JBX Features

Versatile

- Available in multiple housing and control panel configurations
- Fires multiple fuels
- Designed for all types of boilers, heaters and furnaces
- Proven performance in all types of applications

Reliable

- Outstanding flame stability
- High combustion efficiency
- Designed for ease of service
- Quiet operation
- UL & ULC Listed

Adaptable

- Standard or inverted housing
- Burner mounted or remote control panels
- Standard or low NOx designs available

Efficient

- Linkageless control options
- Add Temp A Trim for most efficient operation and quick payback

Webster Combustion has the best lead times in the industry. To configure the perfect JB(X) burner for your application and obtain current scheduling information, contact Webster or visit www.webster-engineering.com to locate a sales office in your area.

JB(X) Series Maximum Input Capacity Ratings

Burner Model	Min Req'd Gas Press	Std Gas Train Size	Max Firing Rate (MBH) Std	Max Firing Rate (MBH) w/FGR	Fan Motor HP
JB(X)1*-02	6"wc	1"	1000	800	1/4
JB(X)1*-03	8"wc	1-1/4"	1500	1200	1/3
JB(X)1*-05	8"wc	1-1/2"	2100	1680	1/2
JB(X)1*-07	11"wc	1-1/2"	2500	2000	3/4
JB(X)2*-07	13"wc	1-1/2"	2800	2240	3/4
JB(X)2*-10	14"wc	2"	3500	2800	1
JB(X)2*-15	14"wc	2"	3500	2800	1-1/2
JB(X)2*-20	14"wc	2"	4200	3360	2
JB(X)2*-30	14"wc	2-1/2"	5300	4240	3
JB(X)2*-50	18"wc	2-1/2"	6000	4800	5
JB(X)3*-30	1 psig	2-1/2"	6300	5040	3
JB(X)3*-50	1 psig	3"	8300	6640	5
JB(X)3*-75	1 psig	3"	10,500	8400	7-1/2
JB(X)3*-100	1.5 psig	3"	12,600	10,080	10

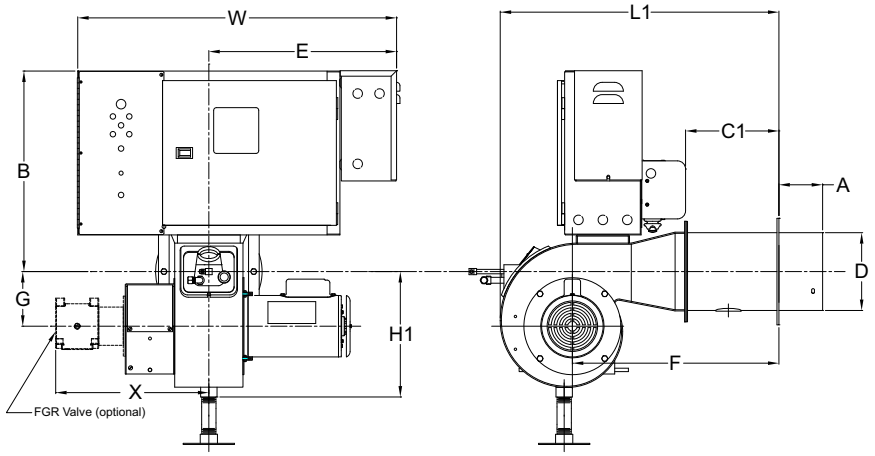
* Can be "G" (Gas), "O" (Oil) or "C" (Combination Gas/Oil)

JB(X) Series Typical Dimensions (Inches)

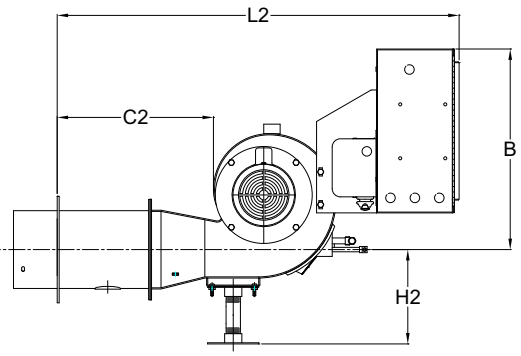
Model	A	B1	B2	C1	C2	D	E	F**	G**	H1***	H2***	L1*	L2	W***	X**
JB(X)1	4	18 3/8	18 3/8	8 1/4	14 3/8	7 1/4	11 7/16	18 15/16	5	15 11/16	11 3/8	26 5/8	36 15/16	21 7/8	13 3/4
JB(X)2	4	19 1/16	18 1/2	9 1/2	14	9 1/8	17 3/4	20	6 5/8	19	12 1/8	28 5/8	39 1/4	30 11/16	24 1/4
JB(X)3	4	19 15/16	19 9/16	15 5/16	19 1/4	11 1/4	23 1/4	26 15/16	8 5/16	22 1/2	14 3/4	38 1/4	48	36 3/4	29 1/2

* Add 1/4 " to Dimension L1 for heavy oil burners. Use Dimension L2 for alternate control cabinet location.
** On units with FGR for NOx reduction, FGR valve will emerge from side of burner opposite blower motor.
*** Extra ground clearance & width may be required for the addition of FGR. Consult factory for details.

JB(X) STANDARD ARRANGEMENT



JB(X) INVERTED ARRANGEMENT (OPTIONAL)



WEBSTER COMBUSTION
A Selas Heat Technology Company

The *Better* Boiler Burner.

Represented By

619 Industrial Road, Winfield, KS 67156 / Phone: 620-221-7464 / Fax: 620-221-9447
www.webster-engineering.com / sales@webster-engineering.com

Bulletin #950094

VANTAGE™

ROBERTS GORDON®

Modulating Infrared Heater

MODEL CTH3

Precise Air-to-Gas Ratio Provides Fuel Savings

- Fuel efficient operation with fully automatic or manual control of burner modulation
- Efficient and optimum combustion throughout full range of burner inputs ensured by pre-programmed burner controls that adjust both fuel and air
- System information and ease of service provided by comprehensive on-board diagnostics for fault and system status
- Burner box design with protective enclosure for controls minimizes exposure to dirt and moisture from combustion air
- Longer life provided by durable components

DESIGN CERTIFIED®

CSA CERTIFIED®

THE INDUSTRY LEADER

RADIANT EFFICIENCY™

800.828.7450

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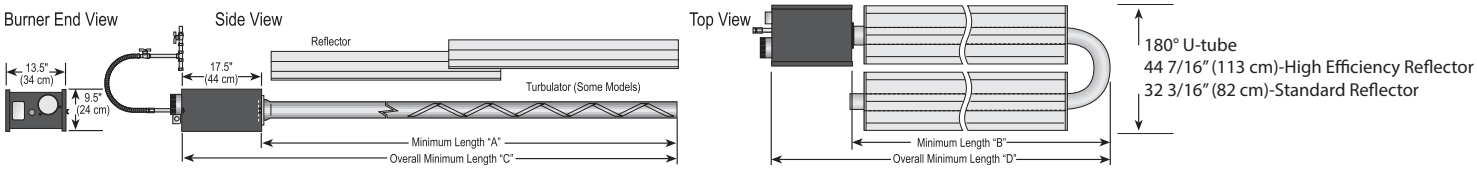
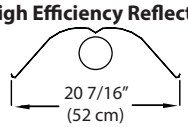
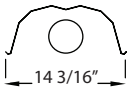


High Efficiency Reflector



Standard Reflector



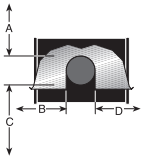
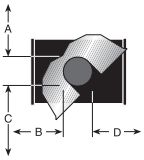
		VANTAGE® CTH3			
Model		**CTH3-80**	**CTH3-115**	**CTH3-150**	**CTH3-200**
Minimum Length of Straight Tube*	[ft] A	20	30	40	50
Minimum Length of U-tube*	[ft, in] B	11, 7	16, 7	21, 7	26, 7
Overall Minimum Length of Straight Tube	[ft, in] C	21, 5.5	31, 5.5	41, 5.5	51, 5.5
Overall Minimum Length of U-tube	[ft, in] D	13, 0.5	18, 0.5	23, 0.5	28, 0.5

*For additional lengths, please see the current Installation, Operation and Service Manual.

Minimum Input (Btu/h) x (1000)	**(NG/LP)**	**52/55**		**75/78**	**100/105**		**130/135**
Maximum Input (Btu/h) x (1000)		**80**		**115**	**150**		**200 (NG)/190 (LP)**
Inlet Pressure	[in wc]NG min.	5.5		5.5	5.5		6.0
	LPG Propane min.	12		12	12		12
	NG & LPG Propane max.	14		14	14		14
Gas Connection	NPT	½"		½"	¾"		¾"
Exhaust Flue	dia	4"		4"	4"		4"
Combustion Air Inlet	dia	4"		4"	5"		5"
Weights							
Aluminized Tube and Accessory Packages	**[ft]**	**20**	**30**	**40**	**50**	**60**	**70**
High Efficiency Aluminum Reflector	[lb]	89	124	167	213	248	291
Standard Aluminum Reflector	[lb]	86	120	161	206	240	281
Burner	**[lb]**	40					
U-tube Packages							
Aluminized U-tube for High Efficiency Reflector	[lb]	23					
Aluminized U-tube for Standard Reflector	[lb]	19					

All Models	
Fuel	NG or LPG Propane
Electrical Supply	120 V, 60 Hz, 1.3 A (Run) 4.8 A (Start)
Heat Exchanger Tubing	10 ft Sections, 4" dia, 16 Gauge, First 10 ft ALUMI-THERM® Steel Tubing [Remaining Heat Treated Aluminized Steel Tubing]
Reflector and End Caps	.024 Aluminum [Optional - .024 Stainless Steel Type 304]
Control System	Modulating Gas Valve and Hot Surface Electronic Ignition Control Four-Try, 100% Shut-Off, Prepurge, Post-purge, Auto Reset, Tri-Color LED Status/ Fault Indicator
Control Options	Zone Sensor, Thermostat, Modulating Thermostat, 10 K ohm Potentiometer, Remote 0-10 Vdc or 4-20 mA Signal
Approved As	Indoor (Vented or Unvented)
Certification	ANSI Z83.20/CSA 2.34
Warranty	Three-Year Limited (Refer to Installation, Operation and Service Manual for Details)

Clearances to Combustibles **[in]

Model			**CTH3-80**		**CTH3-115**		**CTH3-150**		**CTH3-200**	
Horizontal	45°		Horiz.	45°	Horiz.	45°	Horiz.	45°	Horiz.	45°
		A	6	8	6	10	6	12	8	12
		B	38	8	46	8	50	8	52	10
		C	66	66	77	78	80	84	96	85
		D	38	60	46	69	50	74	52	79

**Clearances B, C and D can be reduced by 50% for locations 25 ft (7 m) or more downstream of the burner. For other mounting options and associated clearances, complete installation, operation and service criteria, please see the current issue of the Installation, Operation and Service Manual.

This product is not for residential use.
This document is intended to assist licensed professionals in the exercise of their professional judgment.

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Fax: +1.716.852.0854
Toll Free: 800.828.7450
www.robertsgordon.com

CONDENSING COMMERCIAL GAS WATER HEATERS

ARMOR®
WALL MOUNT WATER HEATER

SMART SYSTEM™
OPERATING CONTROL FEATURING
A BUILT-IN CASCADING SEQUENCER

2 WALL MOUNT SPACE SAVING MODELS—
125,000 BTU/HR AND 199,999 BTU/HR

FIRING RATE MODULATION TO 5:1

LESS THAN 20 ppm NOx

DIRECT-VENT FLEXIBILITY TO 100 FEET

LOW NOx Certified
PROTECTING THE ENVIRONMENT

96%
THERMAL EFFICIENCY

Lochinvar®
HIGH EFFICIENCY BOILERS & WATER HEATERS

Lochinvar.com

ARMOR®
WALL MOUNT WATER HEATER

A Wall Mounted Water Heater

Lochinvar has added to its successful stainless steel, condensing Armor water heater series with wall mounted models. The Armor Wall Mount is available in two sizes, 125,000 and 199,999 Btu/hr input. The light weight but powerful water heaters hang on any wall to give you more free space in your mechanical room.

The "Better Idea" System and Instantaneous Water Heaters

The water heater and tank combination is the heart of Lochinvar's "BETTER IDEA" water heating philosophy. The ARMOR water heater is always installed with a separate storage tank to provide an effective water heating package for commercial domestic water systems. The industry has made a few unsuccessful attempts at applying residential instantaneous water heating to commercial applications. Instantaneous products are outmatched by the faster, larger and variable hot water demands of a commercial application. Storage is essential to supply the water to a system at a variety of speeds and volumes. What's more, the ARMOR "BETTER IDEA" system delivers lower equipment costs and lower installation costs than a comparable instantaneous package.

Fully Modulating with 5:1 Turndown

ARMOR features advanced Negative Regulation (Neg/Reg) sealed combustion technology, permitting fan speed to constantly adjust the volume of fuel and air entering the burner. This ensures that ARMOR can safely and reliably operate with supply gas pressure as low as 4 inches water column.

ARMOR is equipped with fully modulating combustion with 5:1 turndown. This means ARMOR can fire as low as 20% of maximum input when water heating demand is lowest, and increase the firing rate up to 100% as demand increases. The result is better overall efficiency and less cycling, compared to all other tank-type units which are "on-off," which means they can only fire at 100% of maximum input.

Stainless Steel Condensing Heat Exchanger

The stainless steel design provides superior resistance to corrosion caused by condensation from low entering water temperatures. Traditional commercial water heaters will fail early with low entering water temperatures; however, with the ARMOR the lower the supply water temperature the more efficiently it performs throughout the life of the heater.

A Stainless Steel Storage Tank

Available in 60, 80 and 119 gallon capacities, Lochinvar's Lock-Temp Stainless Steel storage tank makes a perfect companion to the Armor Floor Mount and Wall Mount water heaters. 14 gauge 316L stainless is formed, cut and fully welded into a light weight tank.

The stainless steel is "passivated" with a nitric acid treatment to re-establish the oxide level of the metal after welding and to ensure corrosion resistance. The tank is finished with a dent resistant polypropylene jacket and high density expanded foam insulation rated to exceed ASHRAE Energy Efficiency Standards for standby losses. Lochinvar backs its Stainless Steel Storage Tank with a 10 year limited warranty.

Lochinvar SMART SYSTEM

The Ultimate Water Heater Operating Control with Graphic LCD Display

Water heaters with different inputs can be cascaded together to maximize turndown capability

Compatibility with Copper-Fin II® non-condensing water heater to create a front end loading system

Night Setback Capabilities
- Setback of Storage Tank Temperature

Water heater pump control
- Pump delay with freeze protection
- Building Recirculation Pump Control*
- Pump exercise

High-voltage terminal strip
- 110 Vac input to water heater
- Dry Contacts for Water Heater Pump Control
- Dry Contacts for Building Recirc. Pump Control *

Low-voltage terminal strip with 28 points of connection
- 0-10 VDC Water Heater Rate Output
- 0-10 VDC Heat Demand Input
- Modbus Contacts

USB Connection Point for optional SMART SYSTEM PC software with advanced setup and diagnostics

Modbus Compatibility (Optional)

** Exclusive to Lochinvar Smart System*

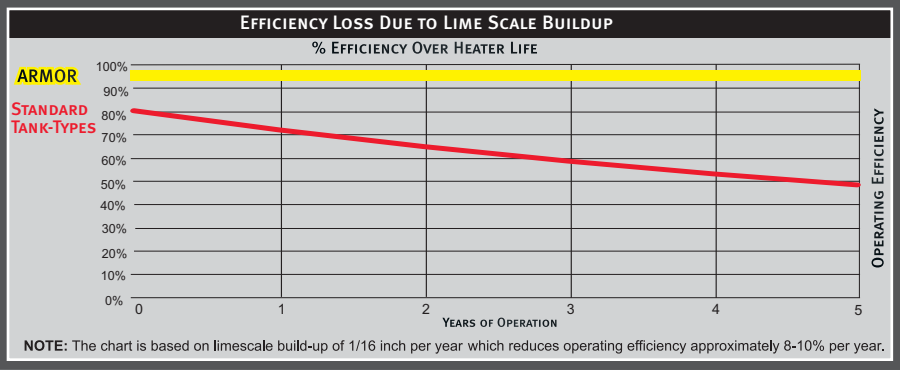
Long-Lasting "Life Cycle" Efficiency

In a standard tank-type water heater, lime scale builds up over time on important heat transfer surfaces, insulating the water from the heat source. This buildup in the bottom of the tank and around the flue tubes can cause tank-type heaters to fail in as little as 2-3 years. This decreases thermal efficiency and increases operating cost. Just 1/4" of lime scale in the tank can increase operating costs as much as 25%!

ARMOR's "Better Idea" concept eliminates the impact of lime scale, maintaining a high-rated thermal efficiency and low operating cost throughout its long life cycle.

The chart below illustrates how ARMOR is a better way, delivering true "life cycle efficiency" compared to standard tank-type units.

Traditional tank-type water heater flue tubes with nearly 6" of lime scale buildup



NOTE: The chart is based on limescale build-up of 1/16 inch per year which reduces operating efficiency approximately 8-10% per year.

Flexible Venting Options - Up to 100 feet of air intake and 100 feet of exhaust vent with PVC, CPVC, Polypropylene or SS.

ARMOR offers 5 venting options and tremendous flexibility for placement of units within the building, because it permits direct-vent air intake and exhaust runs up to 100 equivalent feet using either PVC, CPVC, Polypropylene or AL29-4C stainless steel vent pipe. Intake and exhaust runs can terminate horizontally through a sidewall or vertically through the roof.

Direct Vent Sidewall

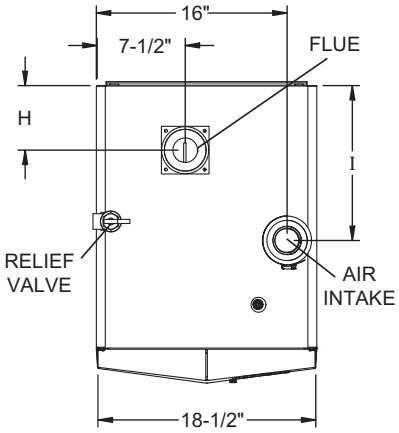
Direct Vent Vertical

Vertical w/Sidewall Air

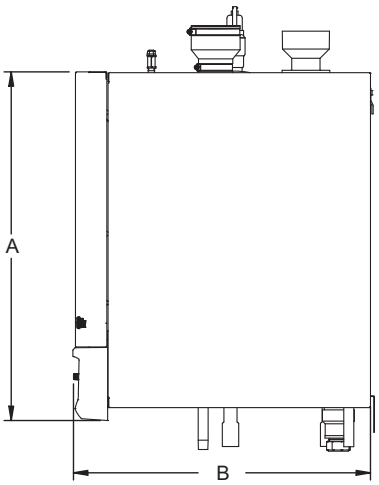
Concentric Direct Vent Vertical

Concentric Direct Vent Sidewall

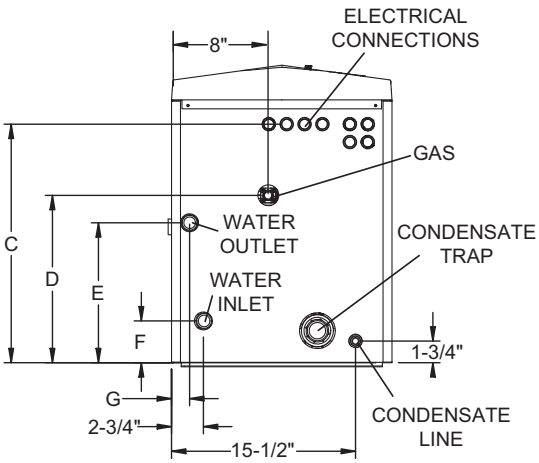
ARMOR™ WALL MOUNT WATER HEATER DIMENSIONS AND SPECIFICATIONS



TOP



SIDE



BOTTOM

Model Number Guide

WA	N	125	PM
Model	Natural Gas	Btu/hr Input	Pump Mount

***W**all Mount **A**rmor Water Heater,*
***N**atural Gas,*
***125**,000 Btu/hr Input,*
***P**ump **M**ount*

Model Number	Btu/hr Input	GPH @ 100° Rise	A	B	C	D	E	F	G	H	I	Gas Conn.	Water Conn.	Air Inlet	Vent Size	Shipping Wt. (lbs.)
WAN125PM	125,000	145	29-1/4"	18"	13"	7"	13"	3-1/2"	2-3/4"	5-1/2"	6"	1/2"	1"	3"	3"	145
WAN200PM	199,999	233	29-1/4"	25"	20"	14"	11-3/4"	3-1/2"	1-1/2"	5-1/2"	13"	1/2"	1-1/4"	3"	3"	177

STANDARD FEATURES

- **AHRI Certified 96% Thermal Efficiency**
- **Wall Mounted Models**
- **Modulating Burner with 5:1 Turndown**
  - Direct-Spark Ignition
  - Low NOx Operation
  - Sealed Combustion
  - Low Gas Pressure Operation
- **Vertical & Horizontal Direct-Vent**
  - PVC/CPVC, Polypropylene or SS up to 100 Feet
  - PVC/CPVC, Polypropylene Sidewall Vent Termination
- **Stainless Steel Heat Exchanger**
  - All Welded Construction, Gasketless Design
  - 160 psi Working Pressure
  - Natural to L.P. Conversion Kit
  - Stainless Steel Circulating Pump
  - Flow Switch
  - Temperature & Pressure Relief Valve
  - Tank Sensor
  - Adjustable High Limit w/ Manual Reset
  - Automatic Reset High Limit
  - Condensate Trap
  - Zero Clearances to Combustible Material
  - 5 Year Limited Warranty (See Warranty for Details)
  - 1 Year Parts Warranty (See Warranty for Details)

SMART SYSTEM™ FEATURES

- **SMART SYSTEM™ Digital Operating Control**
- Multi Color Graphic LCD Display
- **Built in Cascading Sequencer for up to 8 Water Heaters**
  - Multiple Size Water Heater Cascade
  - Lead Lag
  - Efficiency Optimization
- **Building Management System Integration**
  - Modbus Communication (Optional)
  - 0-10 VDC Input to Control Modulation or Set point
  - 0-10 VDC Modulation Rate Output
  - 0-10 VDC Input to Enable/Disable call for heat
- Access to BMS Settings Through Graphic LCD Display
- Low Water Flow Safety Control & Indication
- Inlet & Outlet Temperature Sensors & Readout
- Flue Temperature Sensor
- Water Heater Pump Control
- Pump Delay with Freeze Protection
- Pump Exercise
- Night Setback
- Building Recirculation Loop Pump Control
- Time Clock
- **Maintenance Reminder**
  - Ability to program installer name and number into the product as service contact
- **High Voltage Terminal Strip**
  - 120 VAC / 60 Hertz / 1 Phase Power Supply
  - Pump Control Contacts
    - Water Heater Pump Control Contacts
    - Building Recirculation Pump Control Contacts
- **Low Voltage Terminal Strip**
  - 24 VAC Louver Relay
  - Louver Proving Switch Contacts
  - Flow Switch Contacts
  - Alarm on Any Failure Contacts
  - Runtime Contacts
  - Tank Sensor Contacts
  - Cascade Contacts
  - 0-10 VDC BMS External Control Contacts
  - 0-10 VDC Boiler Rate Output Contacts

FIRING CONTROL SYSTEMS

- M9 Standard Construction

OPTIONAL EQUIPMENT

- Alarm Bell
- Condensate Neutralization Kit
- Concentric Vent Kit (3" PVC/CPVC only)
- ModBus Communications
- BMS Gateway to LON or BacNet
- SMART SYSTEM PC Software

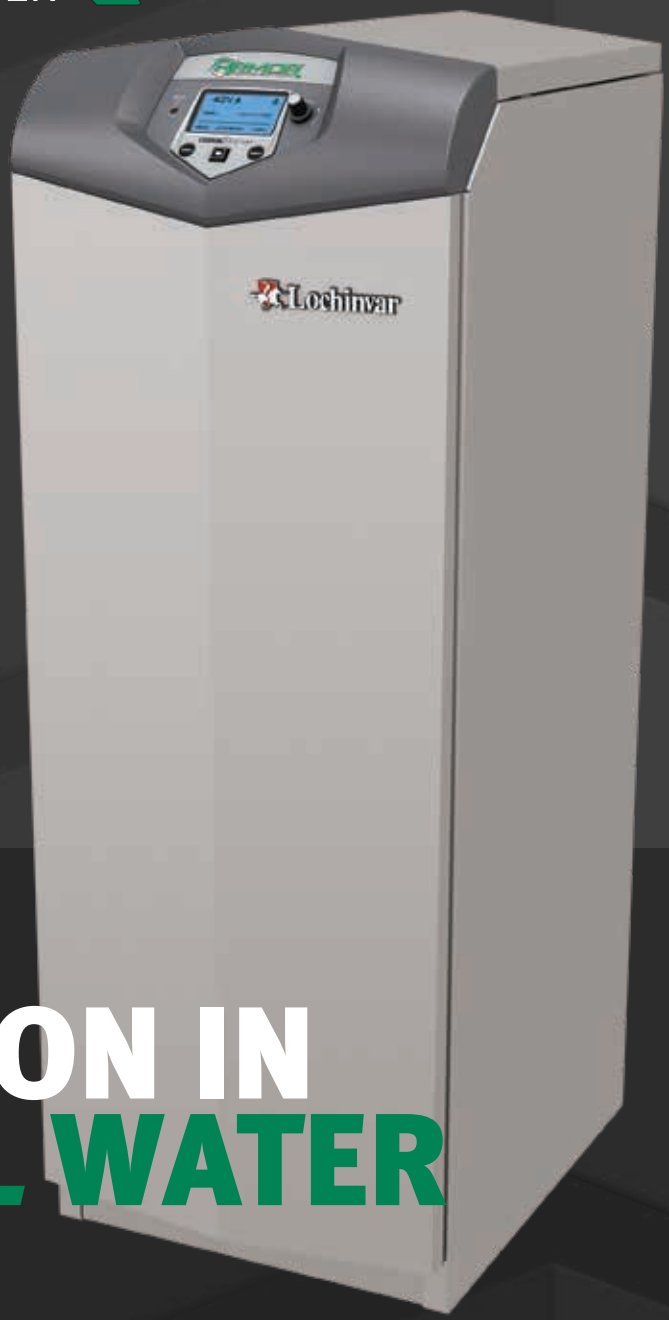
Lochinvar®
HIGH EFFICIENCY BOILERS & WATER HEATERS

Lochinvar, LLC
300 Maddox Simpson Parkway
Lebanon, Tennessee 37090
P: 615.889.8900 / F: 615.547.1000
Lochinvar.com

CONDENSING COMMERCIAL GAS WATER HEATERS

ARMOR®

CONDENSING WATER HEATER



8 MODELS FROM 150,000 TO 800,000 BTU/HR

96% THERMAL EFFICIENCY

5:1 TURNDOWN RATIO

CONDENSING STAINLESS STEEL
HEAT EXCHANGER

SMART SYSTEM™
W/CASCADING SEQUENCER

CONXUS®
REMOTE CONNECT CAPABLE

AN INNOVATION IN COMMERCIAL WATER HEATING

DESIGNED ★ ENGINEERED ★ ASSEMBLED
USA

Lochinvar®

ARMOR®
CONDENSING WATER HEATER

A BETTER WAY TO ACHIEVE 96% THERMAL EFFICIENCY

ARMOR is a fully condensing commercial gas water heater. Available in eight models with inputs ranging from 150,000 to 800,000 Btu/hr, the ARMOR achieves 96% thermal efficiency.

SEPARATE TANK FOR FLEXIBILITY, LOWER REPLACEMENT COSTS

With standard tank-type water heaters, your choices are limited when it comes to matching input with storage capacity to meet "peak demand" delivery requirements. With ARMOR, you can match one or more water heaters with one or more storage tanks in a wide variety of sizes. Lochinvar Lock-Temp® tanks are available from our 80-gallon vertical to the 5000-gallon vertical or horizontal model. Another advantage of the ARMOR "dual component" system is lower replacement costs. Standard tank-type designs require replacement of the entire water heater. With ARMOR, you'll save time and money by only replacing individual components as needed, such as the pump or storage tank.

AW (286-801)

FULLY MODULATING WITH 5:1 TURNDOWN

ARMOR features advanced Negative Regulation (Neg/Reg) sealed combustion technology, permitting fan speed to constantly adjust the volume of fuel and air entering the burner. This ensures that ARMOR can safely and reliably operate with supply gas pressure as low as 4 inches water column.

ARMOR is equipped with fully modulating combustion with 5:1 turndown. This means ARMOR can fire as low as 20% of maximum input when water heating demand is lowest, and increase the firing rate up to 100% as demand increases. The result is better overall efficiency and less cycling, compared to "on-off"tank-type units which can only fire at 100% input.

STAINLESS STEEL CONDENSING HEAT EXCHANGER

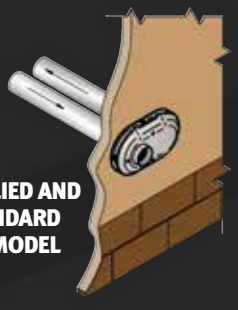
The ARMOR's stainless steel heat exchanger is built to ASME Section IV requirements. Its design provides superior resistance to corrosion caused by condensation from low entering water temperatures. Non - Condensing commercial water heaters will fail early with low entering water temperatures; however, with the ARMOR the lower the supply water temperature the more efficiently it performs throughout the life of the heater.

DIRECT-VENTING UP TO 100 FEET

Sidewall Vent Termination

ARMOR offers 7 venting options and tremendous flexibility for placement of units within the building, because it permits direct-vent air intake and exhaust runs up to 100 equivalent feet using either PVC, CPVC, Polypropylene or AL29-4C stainless steel vent pipe. Intake and exhaust runs can terminate horizontally through a sidewall or vertically through the roof.

**Optional Concentric Vent Kit Sold Separately (for 151-601 Models)*



FACTORY SUPPLIED AND SHIPPED STANDARD WITH EVERY MODEL

Lochinvar SMART SYSTEM™

WATER HEATER CONTROL, FROM ANYWHERE.

ARMOR features the next generation of Lochinvar's all-in-one SMART SYSTEM operating control with an advanced multi-color LCD interface. SMART SYSTEM provides outstanding functionality, and can be integrated directly into a Building Management System via ModBus and other communication protocols. And now, the CON·X·US mobile communication platform allows SMART SYSTEM to go where no other water heater has gone before.†

CON·X·US provides the ability to monitor and manage Armor water heaters without ever stepping into the mechanical room. CON·X·US will send alerts via text or e-mail with notification of changes in system status, and anytime, from anywhere, a user can check system status and re-program water heater functions. Once downloaded, the free CON·X·US mobile application allows for remote access to all SMART SYSTEM functions using any internet-capable device.

CON·X·US®

† CON·X·US board sold separately. See back cover for a complete list of SMART SYSTEM features.

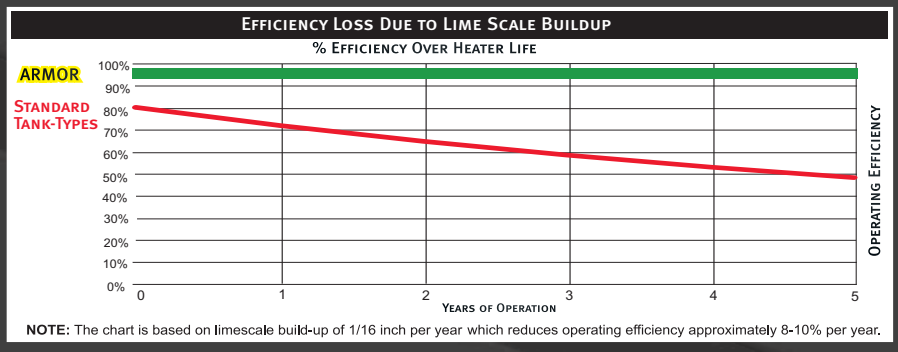
LONG-LASTING "LIFE CYCLE" EFFICIENCY

In a standard tank-type water heater, lime scale builds up over time on important heat transfer surfaces, insulating the water from the heat source. This decreases thermal efficiency and increases operating cost. Just 1/4" of lime scale can increase operating costs as much as 25%! This buildup in the bottom of the tank and around the flue tubes can cause tank-type heaters to fail in as little as 2-3 years.

ARMOR's "Better idea" concept eliminates the impact of lime scale, maintaining a high-rated thermal efficiency and low operating cost throughout its long life cycle.

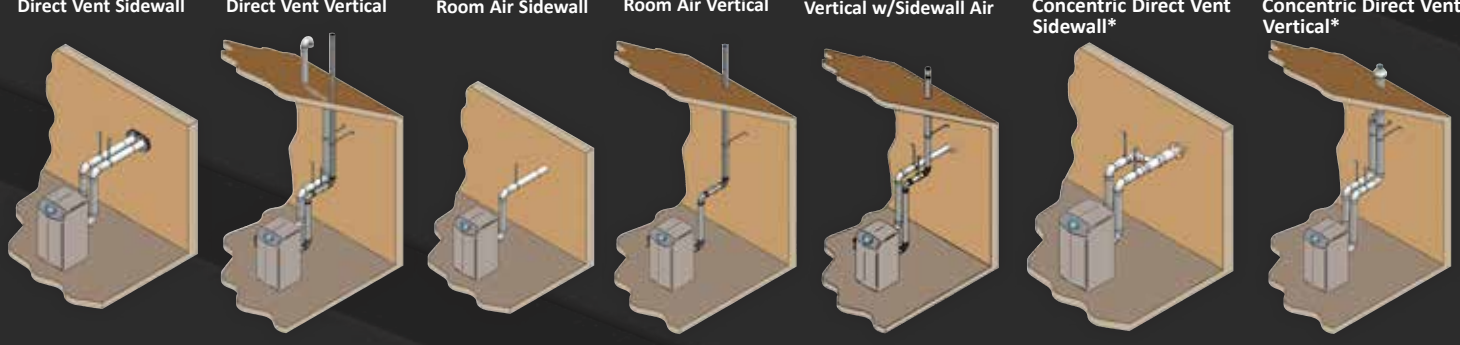
The chart below illustrates how ARMOR is a better way, delivering true "life cycle efficiency" compared to standard tank-type units.

Traditional tank-type water heater flue tubes with nearly 6" of lime scale buildup



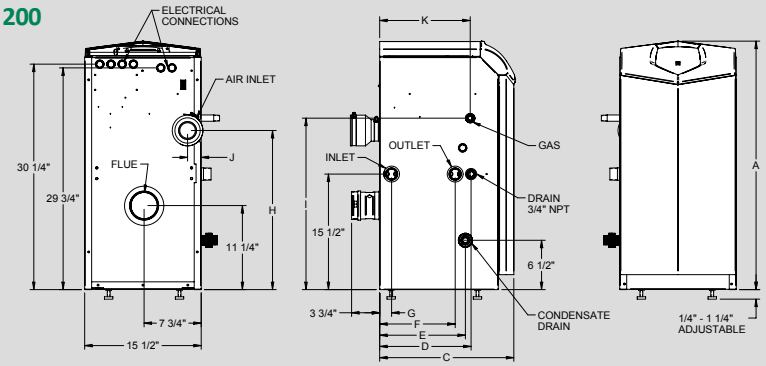
NOTE: The chart is based on limescale build-up of 1/16 inch per year which reduces operating efficiency approximately 8-10% per year.

7 FLEXIBLE VENTING OPTIONS - Up to 100 feet of air intake and 100 feet of exhaust vent with PVC, CPVC, Polypropylene or Stainless Steel.

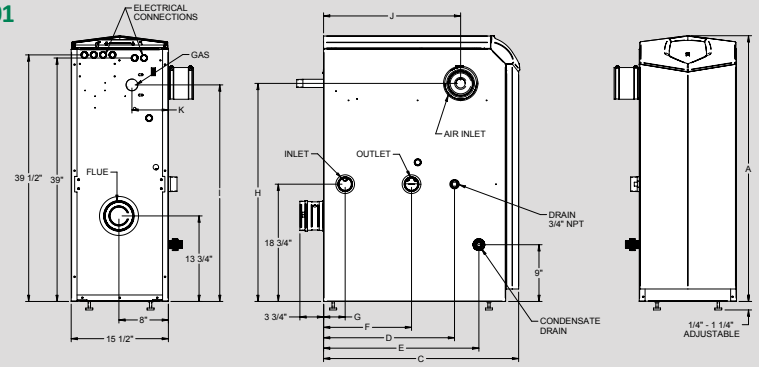


ARMOR™ WATER HEATER DIMENSIONS AND SPECIFICATIONS

MODELS 151 & 200



MODELS 286-801



Model Number Guide

AW	N	151	PM
Armor Water Heater	Natural Gas	Btu/hr Input	Pump Mount

***A**rmor **W**ater Heater,*
***N**atural Gas,*
***150**,000 Btu/hr Input,*
***P**ump **M**ount*

ARMOR WATER HEATER

AHRI CERTIFIED

DIMENSIONS & SPECIFICATIONS

Model Number	Btu/hr Input	GPH @ 100° Rise	A	C	D	E	F	G	H	I	J	K	Gas Conn.	Water Conn.	Air Inlet	Vent Size	Shipping Wt. (lbs.)
AWN151PM	150,000	175	33-1/4"	18"	12-1/4"	11-1/2"	10"	1-1/2"	21-1/4"	23"	1-3/4"	12"	1/2"	1-1/4"	3"	3"	165
AWN200PM	199,000	232	33-1/4"	22-1/4"	16-1/2"	15-3/4"	14-1/4"	5-1/4"	21-1/4"	23"	1-3/4"	16-1/4"	1/2"	1-1/4"	3"	3"	181
AWN286PM	285,000	332	42-1/2"	19-3/4"	12-3/4"	13-1/2"	6"	2"	34"	31"	11-3/4"	4-1/4"	3/4"	2"	4"	4"	236
AWN400PM	399,000	464	42-1/2"	27"	21"	20-3/4"	14"	3-1/2"	34"	34"	18-3/4"	2"	1"	2"	4"	4"	306
AWN501PM	500,000	582	42-1/2"	31-1/2"	21"	25"	14"	3-1/2"	35"	35"	22"	5-3/4"	1"	2"	4"	4"	339
AWN601PM	600,000	699	42-1/2"	36-1/4"	21"	25"	14"	3-1/2"	36"	32-3/4"	19-1/2"	5-1/2"	1"	2"	4"	4"	380
AWN701PM	700,000	815	42-1/2"	40-1/4"	23"	29"	17"	3-1/2"	36"	32-3/4"	23-1/2"	3-1/4"	1"	2"	4"	6"	461
AWN801PM	800,000	931	42-1/2"	45-1/4"	23"	33-1/4"	17"	3-1/2"	36"	32-3/4"	27-3/4"	3-1/4"	1"	2"	4"	6"	527

STANDARD FEATURES

- **› 96% Thermal Efficiency (AHRI Certified)**
- **› Modulating Burner with 5:1 Turndown**
  - Direct-Spark Ignition
  - Low NOx Operation
  - Sealed Combustion
  - Low Gas Pressure Operation
- **› Vertical & Horizontal Direct-Vent**
  - PVC, CPVC, Polypropylene or Stainless Steel up to 100 Feet
  - PVC/CPVC Sidewall Vent Termination
- **› Stainless Steel Heat Exchanger**
  - All Welded Construction, Gasketless Design
  - 160 psi Working Pressure
  - ASME Construction (AW 286-801)
  - Natural to L.P. Conversion Kit
  - Stainless Steel Circulating Pump
  - On/Off Switch
  - Flow Switch
  - ASME Temperature & Pressure Relief Valve (286-801)
  - Downstream Test Valves (AW 501-801)
  - Adjustable Leveling Legs
  - Tank Sensor
  - Adjustable High Limit w/ Manual Reset
  - Automatic Reset High Limit
  - Condensate Trap
  - Zero Clearances to Combustible Material
  - 5 Year Limited Warranty (See Warranty for Details)
  - 1 Year Parts Warranty (See Warranty for Details)

SMART SYSTEM FEATURES

- **› SMART SYSTEM Digital Operating Control**
  - Multi Color Graphic LCD Display
- **› Built in Cascading Sequencer for up to 8 Water Heaters**
  - Multiple Size Water Heater Cascade
  - Lead Lag
  - Efficiency Optimization
  - Front-End Loading Capability with CopperFin II
- **› Building Management System Integration**
  - 0-10 VDC Input to Control Modulation or Set point
  - 0-10 VDC Modulation Rate Output
  - 0-10 VDC Input to Enable/Disable call for heat
- Access to BMS Settings Through Graphic LCD Display
- Low Water Flow Safety Control & Indication
- Inlet & Outlet Temperature Sensors & Readout
- Flue Temperature Sensor
- Water Heater Pump Control
- Pump Delay with Freeze Protection
- Pump Exercise
- Night Setback
- Building Recirculation Loop Pump Control
- Night Setback of Building Recirculation Loop
- Time Clock
- **› Maintenance Reminder**
  - Ability to program installer name and number into the product as service contact
- **› High Voltage Terminal Strip**
  - 120 VAC / 60 Hertz / 1 Phase Power Supply
  - Water Heater Pump Control Contacts
  - Building Recirculation Pump Control Contacts
- **› Low Voltage Terminal Strip**
  - 24 VAC Auxiliary Device Relay
  - Auxiliary Proving Switch Contacts
  - Flow Switch Contacts
  - Alarm on Any Failure Contacts
  - Runtime Contacts
  - Tank Sensor Contacts
  - Cascade Contacts
  - 0-10 VDC BMS External Control Contacts
  - 0-10 VDC Boiler Rate Output Contacts

FIRING CONTROL SYSTEMS

M9 Standard Construction

OPTIONAL EQUIPMENT

- CON·X·US® Remote Connectivity
- Alarm on any failure
- Condensate Neutralization Kit
- High & Low Gas Pressure Switches (AW 501-801)
- Concentric Vent Kit (3" & 4" PVC/CPVC only)
- BMS Gateway to LON
- BACnet Communication
- ModBus Communication
- SMART SYSTEM PC Software
- Room Air Vent Kits
- Stack Frame

Lochinvar®

Lochinvar, LLC
300 Maddox Simpson Parkway
Lebanon, Tennessee 37090
P: 615.889.8900 / F: 615.547.1000
Lochinvar.com

LOW LEAD CONTENT

HLW

Z1000 Family of AC Drives for Building Automation

200V Class: 1/2 to 150 HP
400V Class: 1/2 to 500 HP

YASKAWA

IT'S PERSONAL
YASKAWA

"It's Personal" means each Yaskawa associate is committed to providing you with a great experience every time you deal with us.

We train our people, we treat our customers, we design, engineer and manufacture our products in ways that say everything we do matters. And, when your job is to make sure that everything that matters is done well, you take that pretty personally.

We commit to that at Yaskawa. We can make it happen. Because to us, our relationship with you is personal.

Pushing Expectations

Yaskawa America, Inc. has been building packages for the HVAC industry since 1988. Over that time, we have worked rigorously to evolve our products and exceed industry standards, while ensuring an exceptional customer experience.

Our latest offering for the HVAC industry, the Z1000 family of drives, pushes past the industry requirements to establish a new benchmark for expectations within the industry.

Yaskawa embraces the challenge of supplying an essential product into a growing and changing market. Customers of all types are demanding more flexibility, more control, more power, less downtime and more packaging options. The Z1000 family of drives is able to address and exceed all of these expectations.

Performance

Whether you are the building owner, facility manager or mechanical contractor specifying the drive, we know you need drive performance you can trust. Yaskawa is widely used in HVAC applications because we offer great benefits, including:

- Industry Experience. We're hands on. We have the knowledge to match the right drive to your specific custom design. And, our distributors are consistent in their service quality and strong support.
- Easy-to-Program, Easy-to-Use. Our drives are easy to get up and running with simple programming and maintainability.
- Quick Delivery. Most times, the turnaround time for HVAC drives is short. Yaskawa typically delivers in one-third the time of our competition.
- No Worries. Once you plug a Yaskawa drive into your system, you won't have to worry about reliability. Our product quality far exceeds industry standards.

Z1000 Family of Drives

Z1000: Uniquely Designed For Building Automation Applications.

The Z1000 variable frequency drive provides many benefits for building automation applications that require reliable motor control.

Listen and Evolve

In order to serve the HVAC industry, an organization must first understand its customers. Yaskawa's building automation group is dedicated to listening to each of our different customer types to better understand each of their needs. This enables us to evolve products and services that exceed the expectations of each of the following customers.

Building Owners
Expect maximum customer comfort at minimal cost.

Facility Managers
Expect specifications to be met, simple maintenance, and error free operation.

Specifying Engineers
Expect compliance to industry trends, customer acceptance, and quick and accurate commissioning.

Mechanical or Electrical Contractors
Expect easy installation and programming and quick response to any questions.

Temperature Control Contractors
Expect integrated control, stable software, and compatibility across various platforms.

After-Sales Service Contractors
Expect to easily identify problems and quickly resolve them by replacement or field maintenance.

Intelligent Building Design

Energy Costs

Energy usage in a typical office building costs the owner between $1 to $3 per square foot. Air handling systems account for approximately 25% and cooling systems for about 14% of the electricity consumed. These systems represent key focus areas for cost reduction. You have the means of reducing air handling and cooling energy costs by 20%. For a 100,000 sq. ft. building, total savings can range from $10,000 to $30,000 every year. The key to savings is the judicious use of variable frequency drives (VFDs).

Variable Frequency Drives Reduce Energy Use

The primary reason VFDs reduce energy and improve system efficiency is due to the elimination of throttling. Throttling has been the historic method of mechanically adjusting air or water flow in a system. VFDs electronically control the speed of fans, pumps, and compressors. **A typical fan or pump running at 75% speed will use half as much energy compared to systems using mechanical control methods.**

Payback on a system utilizing VFDs is typically less than two years and installations with payback less than one year are common. Rebates and other benefits justify installing the Z1000 family of drives and will only improve the financial payback.

Other Benefits

- Precise motor control will result in less mechanical and electrical stress on the system
- Reductions of excess capacities at peak periods
- Reduction or elimination of demand charges
- Improvement in Power Factor
- Total control and monitoring via the facility's preferred communication protocol
- Soft Starting eliminates stress on equipment that historically was started or connected across-the-line, including fan belts, compressors and pumps
- Trimming the impellers on pumps may be eliminated. Water hammering will be eliminated

Our "Green" Future

Over the next 20 years, it can be argued that variable frequency drives will become the most important technology to gain acceptance and help intelligent buildings truly become intelligent. Building owners continue to strive toward "green" or any energy efficiency goals that reduce their carbon footprint and help meet corporate sustainability goals. The Z1000 family of drives contributes towards LEED credits and certification and will also be a key technology to help buildings meet or exceed the requirements for Energy Star Certification.

Intelligent Building Design

Top Applications for Variable Frequency Drives

- Supply & return fans
- Cooling tower fans
- Condenser water pumps
- Chiller compressors
- Condensing fans
- Fan walls
- Chilled water pumps

Building Types that Will Benefit

While it is a priority to improve occupant comfort while reducing electrical consumption in office buildings, other building types offer ideal opportunities for energy savings and carbon footprint reduction.

- Government facilities
- Medical facilities
- Data centers
- Educational facilities
- Parking structures

A Yaskawa representative or partner can help you identify where drives will have the biggest payback.

Commitment to Quality

All phases of Yaskawa's business, including research and development, supply chain management, production and quality control, sales and marketing, as well as technical service and distribution, are committed to delivering high quality products and services.

With ISO 9001 certification, a Supplier Rating Program, and rigorous testing, Yaskawa ensures that quality and reliability are designed and built in. Field data confirms that calculated MTBF (Mean Time Between Failure) targets are exceeded in actual production units. Yaskawa is the only manufacturer in the field of industrial electronic equipment to receive the Deming Prize for Quality.

Conformance to Industry Standards

Z1000 drives conform to a variety of industry standards from various governing bodies.

Network Compatibility

Z1000 drives are compatible with the most popular HVAC protocols

Environmental Considerations

Yaskawa maintains a corporate commitment to sustainability goals with an emphasis on the following environmental guidelines

RoHS

Restriction of Hazardous Sustances

Leadership in Energy and Environmental Design

LEARN MORE AT energystar.gov

EPA program to promote superior energy efficiency

Energy Efficiency with Reduction of Carbon Footprint

Merging Green and Technology

Yaskawa Advantages

Exceptional Design

Enjoy peace of mind by knowing that you are considering a product from Yaskawa, the factory automation controls company with the highest reputation for quality and reliability. Historically, Yaskawa drives have demonstrated extremely high reliability with an average MTBF (Mean Time Between Failure) of 28 years or more. The new 1000 series products take reliability to the next level with a calculated design life that is twice as long as previous generations.

Highly Integrated Design results in fewer parts and interconnections, reducing the number of failure points.

Component Derating extends the life of any single part by selecting higher specifications (e.g., voltage, current) than what a circuit requires for normal operation.

Latest Generation IGBT Power Modules, capable of four times more thermal cycles than previous designs.

Enhanced Short Circuit Detection and Self Diagnostics provide additional protection against severe catastrophic conditions.

Inclusive power solutions ensure protection and error free operation due to the use of integrated EMI/RFI filters, integrated line impedance, and integrated superior MOVs.

Z1000 Intelligent Bypass

Yaskawa offers the Z1000 in a Bypass Package. The intelligent bypass, when enabled, can transfer the motor across the line when the application requires 60Hz. Most HVAC systems require 60Hz at peak demand (summer months, daytime). The removal of the drive at 60Hz saves energy and reduces utility costs for the user.
Flawless Transitions into and out of intelligent bypass mode.

Field Programming is quick and intuitive. The fully functional keypad allows the user to adjust the sensitivity of the drive to determine when the bypass engages and disengages.

Serial Communications maintained in bypass mode.

Safety Circuits supported in bypass mode.

Power Loss, Harmonic Distortion, and EMI/RFI completely eliminated in bypass mode.

Operation	Normal Operation	Bypass Engaged
Power Loss	3.5% or more	0
Harmonic Distortion	30%	0
EMI/RFI	Compliant to IEC 61800-3	0

Yaskawa Advantages

Features for HVAC

The Z1000 features an array of important features that have been designed specifically for the Building Automation/HVAC industry.

Integrated EMI/RFI Filters ensure the drive does not contribute towards an electrical noise problem.

Integrated Line Impedance of 5% which reduces line harmonics, reduces ripple on the DC bus and provides light buffering from transient power fluctuations.

Integrated and improved MOV protection provides quick and reliable protection against surge events.

Internal Phase Sensing protects your Z1000 investment from premature failures.

Premature Contactor Coil Failure is eliminated in the Z1000 bypass. Low voltage threshold is selectable and sensitivity is adjustable. The Z1000 bypass will stop and open all contactors when this condition is detected.

Building Communication Protocols support more than 100 data points ensuring maximum flexibility.

Pass Thru I/O Support through facilities preferred communication protocol

- Digital Inputs: 8 Bypass, 6 Drive
- Digital Outputs: 4 Bypass, 3 Drive
- Analog Inputs: 2 Drive
- Analog Outputs: 2 Drive

Bypass Sync speeds up start up and commissioning by verifying bypass rotation without actually viewing motor rotation.

Belt Break Indication thru keypad, digital output or building's communication protocol indication of fan belt has failed.

Stand Alone Operation enables continued operation of the Z1000 bypass while the Z1000 drive has been removed for maintenance or service. All bypass features continue to function including serial communications.

LCD Keypad is standard on every Z1000. It features HVAC-specific application macros, an easy-to-read LCD display that provides Hand-Off-Auto interface, and a real time clock.

Easy To Commission

Yaskawa Drives are factory-programmed and ready to run. The LCD keypad enhances ease of use with its parameter copy feature that allows duplication of settings between drives. In addition, a portable USB Copy Unit provides a very convenient method of desktop configuration, transportable to the factory floor.

USB Copy Unit
(For Z1000 series)

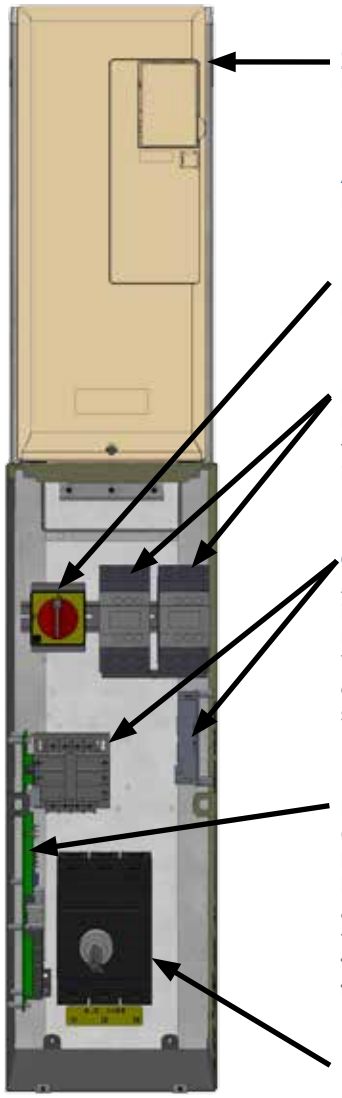
Yaskawa Advantages

Easy to Install and Service

All Z1000 drives and packages come with a standard LCD alpha-numeric keypad. This keypad provides a real time clock and Hand-Off-Auto interface. Start-up and configuration are simplified by the intuitive programming menu. With minimal information, these packages are ready to run and integrate into the building owner's system. Additionally, this keypad can be configured to display information in user defined units, information regarding maintenance data, diagnostics, and status.

Control field wiring is made simple by easy to access terminals with ample flexibility to meet your application needs.

For long term maintenance, detachable cooling fans are easy to replace and on/off fan control can extend operating life. Accumulated operation time and cooling fan run time are recorded and can be displayed for preventive maintenance programs. Stand-Alone operation is supported to keep your motors running while maintenance or service is provided on the variable frequency drive



Z1000 Drive
Fully functional Z1000 VFD

Alpha-Numeric LCD Display
Provides real-time clock and Hand-Off-Auto Interface

Drive Service Switch
Provides isolation for VFD

Drive/Bypass Output Contactors
Electrically interlocked arrangement to allow mutually exclusive operation in Drive or Bypass modes

Control and Power Transformer
A Control Power Transformer (CPT) is provided to power the Z1000 Bypass 120 Vac control circuit. The VA capacity is determined by the control circuit and optional functions specified for the unit.

Bypass Control Module
Operating elements such as indicating LEDs, selector buttons, and control logic are incorporated into a PCB assembly to eliminate the potential for loose wires after shipment. **TB1 through TB3 provide for easy access to the control circuit field wiring.**

Input Circuit Breaker
Provides 100K AIC protection

TB1: Field Programmable Digital Outputs
- Damper Actuator
- Loss of Load Detected (Broken Belt)
- Drive or Bypass Fault Active

TB2: Field Programmable Digital Inputs
- BAS Interlock Circuit/Damper Interlock
- Remote Transfer to Bypass
- Smoke Purge Operation
- Safety Interlock Circuit
  - Freeze-up thermostats
  - Smoke/fire sensors
  - High pressure limits
  - Temperature limits
  - Vibration detectors

TB3: RS-485 Building Automation Protocol
All serial communications platforms supported in bypass mode
- BACnet
- Metasys
- Apogee
- Modbus

Example of Z1000 Bypass Package: Easy Power and Control Terminal Access

Yaskawa Advantages

Technical Training

Both standard and customized courses are available with hands-on activities and demonstrations. Instruction is offered at Yaskawa locations as well as traveling road schools, and is supplemented by live web classes and e-Learning Modules / Videos to provide the right level of training to fit your needs. Trainers are degreed engineers with extensive industry experience.

Traveling Road Show Van

Worldwide Services

Yaskawa offers worldwide support with application assistance, start-up, maintenance, troubleshooting and repair, as well as internet tools and telephone support. Sales and service offices are located around the world.

Through one website address, yaskawa.com, customers can access several Yaskawa global websites that best service their geographic area, in several languages. The websites have an extensive document and knowledge database. Customers can easily locate information, select products, as well as maintain products. Our FAQs cover many facets of ownership and are derived from our field and telephone assistance with our customers.

In the Americas, telephone assistance is available 24/7/365 at 800-YASKAWA (927-5292). Our phone support group is product certified to assist you with current and legacy drive requirements.

Yaskawa's Field Service personnel and local Authorized Service Providers can provide on-site start-up assistance, troubleshooting, and repair. Same day exchange units or fast turnaround repairs are available.

HVAC Software Tools

DriveWizard HVAC

Innovative software tool that allows users to commission, startup and diagnose the Yaskawa family of HVAC drives in a quick and easy manner. Built-in features include a monitor panel, status panel, 6 channel trend recorder, and application wizard.

Energy Savings Predictor

Predicts energy savings achieved when using a Yaskawa HVAC drives instead of conventional control methods in HVAC applications. The results can be viewed in graphical and text format with built-in functions to generate an energy prediction report especially designed for consultants.

Harmonics Estimator

Estimates total harmonic distortion when using Yaskawa HVAC drives and references IEEE519 to determine if the defined system meets the required standard. The results can be viewed in graphical and text format with built-in functions to generate an energy prediction report especially designed for consultants.

Packages for any Environment

NEMA 1 Packages

Yaskawa offers a standard NEMA 1 (UL Type 1) package for Z1000 bypass and configured units.

All units are UL rated, with the bypass and configured packages built to UL 508A (Industrial Control Panel) standards.

Installation, setup, service, and quick delivery have all been considered in these package designs.

Available options include:
- 100K AIC Rated Package with Circuit Breaker Option
- 2 or 3 Contactor Bypass Options
- Custom Nameplates
- Serial Communication Network Cards including LonWorks and Ethernet/IP

NEMA 12 Packages

Z1000 bypass and configured packages are available with a NEMA 12 (UL Type 12) enclosure option.

Fans, when required are provided with Type 12 rated filters to maintain a Type 12 rating on the enclosure.

The bypass comes standard as a 2-contactor style with input disconnect switch.

The configured unit comes standard with an input disconnect.

Both offer several commonly used options in their standard packages.

Standard Construction Features include:
- 12 Gauge Steel
- Padlock Hasp
- Integral ¼ Turn Door Latches
- Whole Door Gasket
- Lifting Eyes
- Removable Air Filter from Outside of Cabinet

Packages for any Environment

NEMA 3R Packages

Z1000 bypass and configured packages are offered with a NEMA 3R (UL Type 3R) enclosure option.

The bypass comes standard with a flange mount main input circuit breaker and a 3-contactor style, allowing motor operation from either the drive or across the line.

The configured unit comes standard with an input disconnect.

Both have been designed for flexibility in providing the features and options commonly specified by facility designers.

Standard Construction Features include:
- 12 Gauge Steel
- Padlock Hasp
- Integral ¼ Turn Door Latches
- Whole Door Gasket
- Brass Hinges
- UV/Type 3R Keypad Membrane
- Lifting Eyes
- Stainless Steel Hardware
- Sun Reflective White Powder Coat Paint

Engineered Packages

Both end users and OEM customers have come to rely on our fully-engineered products. These products are based off of our standard configurations but evolve into a customized package just for you.

Engineered packages include:
- Redundant Drive Packages
- 12 or 18 Pulse Configurations
- Soft Start Bypass Packages
- Integrated Trap Filter Packages
- Multiple Motor Configurations (2 motor “OR”, 2 motor “AND”, and fan array)

Engineered packages can be provided as NEMA 1, 12 or 3R. They are supported with custom engineered drawings and documentation.

Z1000 AC Drive

3 - 500 HP

Advanced Fan/Pump Control

The Z1000 variable frequency drive is designed for building automation applications such as fans, pumps, and cooling towers through 500 HP. The Z1000 features an easy-to-read LCD keypad that provides Hand-Off-Auto interface and a real-time clock. These features make the Z1000 perfect for most building automation applications that require reliable motor control.

Harmonic Mitigation*

Built-in 5% line impedance for input harmonic reduction.

Noise Filter*

On board EMI/RFI filter complies with IEC 61800-3 restricted distribution for first environment.

Serial Communications

Embedded BACnet communications (BTL Certified), with Apogee, Metasys, Modbus/Memobus.

Industry Compliance

Plenum Rated (UL 1995). Seismic Rated (IBC 2012), OSHPD (OSP-0293-10). Made with RoHS compliant materials.

Internal Real-Time Clock

Time and date stamping for events, along with timer controls for starting stopping and speed changes without the need for external controls.

PI Feature

Maintains a set point for closed loop control of fans and pumps for pressure, flow or temperature regulation and eliminates the need for a closed loop output signal from a BAS. Independent PI to control an external device in the system.

LCD Operator

5-Line 16 character alpha-numeric, easy to read and understand display, with copy and Hand-Off-Auto functions.

Carrier Frequency

5 kHz carrier frequency with dynamic noise control for quiet motor operation.

Application Macros

Choose from pre-configured set up macros to match the application for quick and easy set up.

Sealed Heatsink*

Allows for drive to be mounted in a NEMA 12 enclosure with heatsink external.

* Available only as options, 300-500HP ratings.

APPLICATIONS

- **Supply and Return Fans**
- **Cooling Tower Fans**
- **Condensing Fans**
- **Fan Walls**
- **Condenser Water Pumps**
- **Chilled Water Pumps**
- **Chiller Compressors**

Model Number Designation

CIMR - Z U 2 A 0021 F A A

- AC Drive
- Z1000 Series
- Region Code

No.	Region Code
U	United States

- Voltage Class

No.	Voltage Class
2	3-phase, 200-240 VAC
4	3-phase, 380-480 VAC

- Standard Model
- Output Current Code (A)

No.	Output Current Code (A)
See Models and Ratings.	

- Design Revision
- Environmental Specification

No.	Environmental Specification
A	Standard

- Enclosure Type

No.	Enclosure Type
A	IP00
F	NEMA Type1

Models and Ratings

208V Models

CIMR-ZU2A AA		0011F	0017F	0024F	0031F	0046F	0059F	0075F	0088F	0114F	0143F	0169F	0211F	0273F	0343A	0396A
Rated Output Current (A)		10.6	16.7	24.2	30.8	46.2	59.4	74.8	88.0	114	143	169	211	273	343	396
Nominal HP		3	5	7.5	10	15	20	25	30	40	50	60	75	100	125	150
Dim (in)	Height	14.06		17.60		20.08		21.33			30.47				31.5	
	Width	4.88				7.87		10.04			13.39				19.69	
	Depth	8.58		9.17		9.35		10.37			15.75				13.78	
Weight (lb)		12.3	13.0	16.3	17.2	26.5	28.7	59.5	61.7	63.9	143.3	149.9	154.3	160.9	216	218
Heat Loss (W)	Heatsink	121	176	280	378	396	542	557	670	864	1191	1447	1753	2378	1964	2435
	Internal	28	37	55	73	86	116	132	157	200	307	365	471	625	655	829
	Total	148	214	335	451	482	658	688	827	1064	1499	1811	2224	3003	2620	3264

480V Models

CIMR-ZU4A		0005FAA	0008FAA	0011FAA	0014FAA	0021FAA	0027FAA	0034FAA	0040FAA	0052FAB	0052FAA	0065FAA	0077FAA
Rated Output Current (A)		4.8	7.6	11.0	14.0	21.0	27.0	34.0	40.0	52.0	52.0	65.0	77.0
Nominal HP		3	5	7.5	10	15	20	25	30	40	40	50	60
Dim (in)	Height	14.06			17.60			20.08			21.33		
	Width	4.88						7.87			10.04		
	Depth	8.58			9.17			9.35			10.37		
Weight (lb)		11.9	12.6	13.4	16.1	16.8	18.5	28.7			59.5	63.9	68.3
Heat Loss (W)	Heatsink	93	143	184	231	306	390	457	558	584	463	576	891
	Internal	24	33	38	52	69	85	105	118	151	130	161	225
	Total	117	178	222	283	375	475	562	677	734	594	737	1116

CIMR-ZU4A AA		0096F	0124F	0156F	0180F	0240F	0302F	0361A	0414A	0480A	0590A
Rated Output Current (A)		96.0	124	156	180	240	302	361	414	480	590
Nominal HP		75	100	125	150	200	250	300	350	400	500
Dim (in)	Height	21.33	27.56	30.47			41.14	31.50	37.40	44.88	
	Width	10.04	10.87	13.39			17.91	19.70		26.38	
	Depth	10.37	11.38	15.75			18.90	13.78	14.57		
Weight (lb)		70.5	101.4	160.9	167.6	174.2	286.6	236.0	275.0	476.0	487.0
Heat Loss (W)	Heatsink	1131	1581	1929	2342	2863	3278	3009	3206	3881	4130
	Internal	288	398	535	621	790	929	1157	1633	2011	1964
	Total	1419	1979	2464	2963	3653	4207	4166	4840	5893	6094

Note: Data subject to change.

Z1000 Bypass Package

1 - 500 HP

HVAC Optimized with Intelligent Bypass and Advanced BAS Interface

Features

- Two Contactor Bypass
- 100K AIC Package Rating
- Input “Non-Fused” Disconnect
- Drive H-O-A Keypad used for Bypass
- Standard Digital Inputs (5)
  - Run
  - Safety
  - BAS Interlock
  - Auto Transfer to Bypass
  - Smoke Purge
- Programmable Digital Inputs (3)
- Form “C” Programmable Relays (4)
- Built-in BACnet protocol (BTL certified), Apogee, Metasys, Modbus/Memobus accessible via RS-422/485 communication, which is standard
- All Bypass Functions Work with Serial Communications
- Phase Loss & Low Voltage Monitor – Protects Against Contactor Coil Burn-out
- Motor Amp Display in Bypass
- Duct Pressurization Function (Pre-run)
- Bypass Sync

NEMA 1 Wall-Mount Enclosed

- ***50 – 100HP, 208V***
- ***100 – 200HP, 480V***

NEMA 1 Floor Mount

- ***125 - 150HP, 208V***
- ***250 – 500HP, 480V***

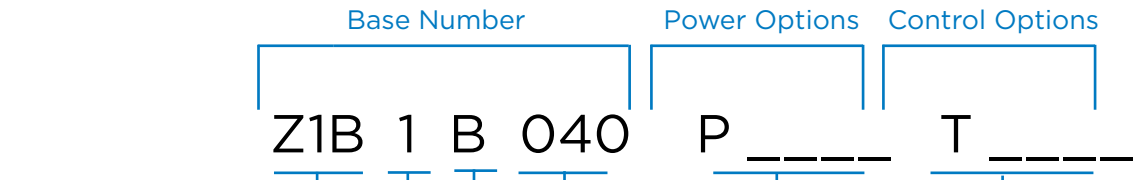
OPTIONS

- Circuit Breaker - 100K AIC
- Drive Service Switch
- Three Contactor Bypass
- Custom Nameplate
- EtherNet/IP
- LonWorks

Z1000 Bypass Package

How to Select a Z1000 Bypass Package

To construct a Bypass model number, find the base number for the required enclosure type, voltage, and current rating. Add the option code for each required option. Power options are preceded by P and Control options are preceded by T.



Z1000 Bypass

No.	Enclosure and Duty
1	NEMA 1
2	NEMA 12
3	NEMA 3R

No.	Voltage Class
A	208 V
B	480 V

Current
Rated Amps: (Example. “040” = 40 A)

Note: There is a special cost reduced model of the 480 V, 52 A Bypass Package, which is denoted by “52L”

Control/Communication Options (T).		
W	Custom Nameplate	Choose none or one
D	Ethernet/IP	Choose none or one
L	LonWorks	
M (3)	Keypad Viewing Window	Choose none or one

Power Options (P).		
M (1)	Circuit Breaker	Choose none or one
F (2)	Input Fuses	Choose none or one
B (1)	3-Contactor Bypass	Choose none or one
G (1)	Drive Service Switch	
R	Input Reactor 3%	Choose none or one
A (2)	Two Motor “AND”	
Y (2)	Two Motor “OR”	
K (2)	Output Reactor	
N	Noise Filter	Choose none or one
2 (3)	Surge Suppressor	Choose none, any, or both
3 (3)	Space Heater	

(1) Type 1 and 12 enclosures only
(2) Type 12 and 3R enclosures only
(3) Type 3R enclosures only.

Note: Contact Yaskawa representative for possible exclusions.

Z1000 Bypass Package

Models and Ratings

208V Models

Base No.: Z1Bx (x denotes enclosure type)		D002	D003	D004	D007	D010	D016	D024	D030	D046	D059
Rated Output Current (A)		2.4	3.5	4.6	7.5	10.6	16.7	24.2	30.8	46.2	59.4
Nominal HP		0.5	0.75	1	2	3	5	7.5	10	15	20
Dimensions (in) and Weight (lb)	Type 1 Height	41.60						45.10		48.20	
	Type 1 Width	6.77								10.18	
	Type 1 Depth	12.92								13.19	
	Type 1 Weight	70						80		90	
	Type 12 Height	28.8						34.8		39.8	
	Type 12 Width	17.9						20.5		25.5	
	Type 12 Depth	17.9								17.3	
	Type 12 Weight	150						210		275	
	Type 3R Height	29.1						34.8		40.1	
	Type 3R Width	21.2						23.7		28.7	
	Type 3R Depth	21.4									
	Type 3R Weight	150						210		275	

Base No.: Z1Bx (x denotes enclosure type)		D074	D088	D114	D143	D169	D211	D273	D343	D396
Rated Output Current (A)		74.8	88.0	114.0	143.0	169.0	211.0	273	343	396
Nominal HP		25	30	40	50	60	75	100	125	150
Dimensions (in) and Weight (lb)	Type 1 Height	52.80	42.79		49.09		84.16			
	Type 1 Width	12.68	25.80		28.41		41.26			
	Type 1 Depth	14.20	16.06		20.87		33.94			
	Type 1 Weight	160	280		380		950	1250	1650	1700
	Type 12 Height	39.8	51.2		84.2					
	Type 12 Width	25.5	32.7		41.3					
	Type 12 Depth	17.3	22.8		32.0					
	Type 12 Weight	275	420	490	850	945		1215	1300	1350
	Type 3R Height	40.1	51.1		91.1					
	Type 3R Width	28.7	39.0		41.3					
	Type 3R Depth	21.4			50.7				46.6	
	Type 3R Weight	275	420	490	850	945		1215	1300	1350

Note: Data subject to change.

NEMA1

NEMA 12

NEMA 3R

Z1000 Bypass Package

Models and Ratings

480V Models

Base No.: Z1Bx ☐☐☐ (x denotes enclosure)			B001	B002	B003	B004	B007	B011	B014	B021	B027	B034	B040	B52L	B052
Rated Output Current (A)			1.6	2.1	3.2	4.8	7.6	11.0	14.0	21.0	27.0	34.0	40.0	52.0	52.0
Nominal HP			0.5 / 0.75	1	2	3	5	7.5	10	15	20	25	30	40	40
Dimensions (in) and Weight (lb)	Type 1	Height	41.60						45.10			48.20			52.80
		Width	6.77									10.18			12.68
		Depth	12.92									13.19			14.20
		Weight	70						80			90			160
	Type 12	Height	28.8						34.8			39.8			
		Width	17.9						20.5			25.5			
		Depth	17.9									17.3			
		Weight	150						210			275			
	Type 3R	Height	29.1						34.8			40.1			
		Width	21.2						23.7			28.7			
		Depth	21.4												
		Weight	150						210			275			

Base No.: Z1Bx ☐☐☐ (x denotes enclosure type)			B065	B077	B096	B124	B156	B180	B240	B302	B361	B414	B477	B590
Rated Output Current (A)			65.0	77.0	96.0	124.0	156.0	180.0	240.0	302	361	414	477	590
Nominal HP			50	60	75	100	125	150	200	250	300	350	400	500
Dimensions (in) and Weight (lb)	Type 1	Height	52.80		42.79		49.09		84.16					
		Width	12.68		25.80		28.41		41.26				69.76	
		Depth	14.20		16.06		20.87		33.94				30.50	
		Weight	160		280		380		1250	1600	1700	1800	2100	2200
	Type 12	Height	51.2				84.2							
		Width	32.7				41.3		69.8					
		Depth	22.8				32.0		30.5					
		Weight	410	475	500	550	850	950		1200	1300	1315	1900	2100
	Type 3R	Height	51.1				91.1							
		Width	39.0				41.3						66.3	
		Depth	21.4				50.7				46.6		43.5	
		Weight	410	475	500	550	850	950		1200	1300	1315	1900	2100

Note: Data subject to change.

NEMA1

NEMA 12

NEMA 3R

Z1000 Configured Package

1 - 500 HP

The Z1000 drive sets a new benchmark for cost, performance, benefits and quality.

Features

- Lockable main input disconnect switch
- Drive internal PI closed loop control with selectable engineering units
- Independent PI control for use with external device
- Differential PI feedback feature
- Sleep function in both closed loop and open loop control
- 24 Vdc, 150 mA transmitter power supply
- Input and output terminal status indication
- Serial communication loss detection and selectable response strategy
- Serial communication status
- Built-in BACnet protocol (BTL certified), Apogee, Metasys, Modbus/Memobus accessible via RS-422/485 communication, which is standard
- LCD keypad: Hand/Off/Auto functions with built-in copy feature
- Flash upgradeable firmware
- “Bumpless” transfer between Hand and Auto modes
- Emergency override can be used as “smoke purge” function

NEMA 12 Z1000 Configured

NEMA 3R Z1000 Configured

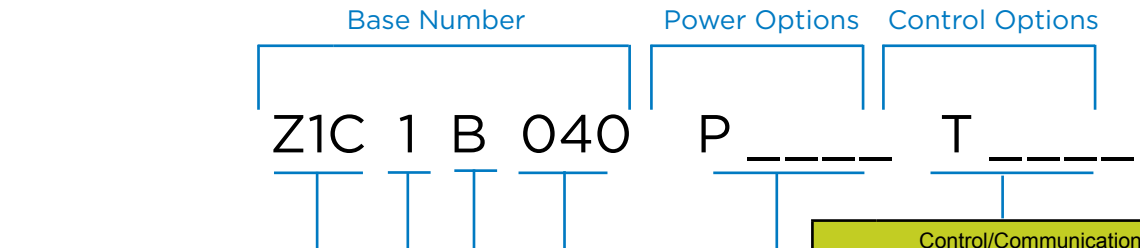
OPTIONS

- Circuit Breaker - (65K AIC or 100K AIC)
- Input Fuses
- Input Reactor
- Input Filter
- Custom Nameplate
- LonWorks
- EtherNet/IP

Z1000 Configured Package

How to Select a Z1000 Configured Package

To construct a Configured model number, find the base number for the required enclosure type, voltage, and current rating. Add the option code for each required option. Power options are preceded by P and Control options are preceded by T.



No.	Enclosure and Duty
1	NEMA 1
2	NEMA 12
3	NEMA 3R

No.	Voltage Class
A	208 V
B	480 V

Current
Rated Amps: (Example. “040” = 40 A)

Note: There is a special cost reduced model of the 480 V, 52 A Configured Package, which is denoted by “52L”

Control/Communication Options (T).		
W	Custom Nameplate	Choose none or one
D	Ethernet/IP	Choose none or one
L	LonWorks	
M (2)	Keypad Viewing Window	Choose none or one
Z (1)	Speed Pot	Choose none or one
K (1)	200 VA Transformer	Choose none or one

Power Options (P).		
C	Circuit Breaker 65K	Choose none or one
M	Circuit Breaker 100K	
F	Input Fuses	Choose none or one
R	Input Reactor 3%	Choose none or one
A (1)	Two Motor “AND”	
Y (1)	Two Motor “OR”	
K (1)	Output Reactor	
N	Noise Filter	Choose none or one
2 (2)	Surge Suppressor	Choose none, any, or both
3 (2)	Space Heater	

(1) Type 12 and 3R enclosures only
(2) Type 3R enclosures only.

Note: Contact Yaskawa representative for possible exclusions.

Z1000 Configured Package

Models and Ratings

208V Models

Base No.: Z1Cx (x denotes enclosure type)		D002	D003	D004	D007	D010	D016	D024	D030	D046	D059
Rated Output Current (A)		2.4	3.5	4.6	7.5	10.6	16.7	24.2	30.8	46.2	59.4
Nominal HP		0.5	0.75	1	2	3	5	7.5	10	15	20
Dimensions (in) and Weight (lb)	Type 1 Height	41.60						45.10		48.20	
	Type 1 Width	6.77								10.18	
	Type 1 Depth	12.92								13.19	
	Type 1 Weight	65						75		85	
	Type 12 Height	29.00						35.0		40.00	
	Type 12 Width	18.00						20.50		25.50	
	Type 12 Depth	17.9								17.3	
	Type 12 Weight	140						200		260	
	Type 3R Height	29.00						35.00		40.00	
	Type 3R Width	21.2						23.7		28.7	
	Type 3R Depth	21.50									
	Type 3R Weight	140						200		260	

Base No.: Z1Cx (x denotes enclosure type)		D074	D088	D114	D143	D169	D211	D273	D343	D396
Rated Output Current (A)		74.8	88.0	114.0	143.0	169.0	211.0	273	343	396
Nominal HP		25	30	40	50	60	75	100	125	150
Dimensions (in) and Weight (lb)	Type 1 Height	52.80			49.09				84.00	
	Type 1 Width	12.68			28.41				41.50	
	Type 1 Depth	14.20			20.87				34.00	
	Type 1 Weight	150	155	160	360	370	385	450	1150	1300
	Type 12 Height	40.00	51.00		84.00					
	Type 12 Width	25.50	33.00		41.50					
	Type 12 Depth	17.3	22.8		32.0					
	Type 12 Weight	260	395	465	800	910		1150	1200	1250
	Type 3R Height	40.00	51.00		91.00					
	Type 3R Width	28.7	39.0		41.3					
	Type 3R Depth	21.50			50.50					
	Type 3R Weight	260	395	465	800	910		1150	1200	1250

Note: Data subject to change.

NEMA1

NEMA 12

NEMA 3R

Z1000 Configured Package

Models and Ratings

480V Models

Base No.: Z1Cx (x denotes enclosure)			B001	B002	B003	B004	B007	B011	B014	B021	B027	B034	B040	B52L	B052
Rated Output Current (A)			1.6	2.1	3.2	4.8	7.6	11.0	14.0	21.0	27.0	34.0	40.0	52.0	52.0
Nominal HP			0.5 / 0.75	1	2	3	5	7.5	10	15	20	25	30	40	40
Dimensions (in) and Weight (lb)	Type 1	Height	41.60						45.10			48.20			52.80
		Width	6.77									10.18			12.68
		Depth	12.92									13.19			14.20
		Weight	65						75			85			150
	Type 12	Height	29.00						35.00			40.00			
		Width	18.00						20.50			25.50			
		Depth	18.00									17.50			
		Weight	140						200			260			
	Type 3R	Height	29.00						35.00			40.00			
		Width	21.2						23.7			28.7			
		Depth	21.50												
		Weight	140						200			260			

Base No.: Z1Cx (x denotes enclosure type)			B065	B077	B096	B124	B156	B180	B240	B302	B361	B414	B477	B590
Rated Output Current (A)			65.0	77.0	96.0	124.0	156.0	180.0	240.0	302	361	414	477	590
Nominal HP			50	60	75	100	125	150	200	250	300	350	400	500
Dimensions (in) and Weight (lb)	Type 1	Height	52.80			42.79	49.09			84.0			92.0	
		Width	12.68			25.80	28.41			42.00			41.5	
		Depth	14.20			16.06	20.87			34.0			32.0	
		Weight	155	160	180	240	355	385	450	1150	1300	1400	1500	1600
	Type 12	Height	40.00	51.00			84.00						92.00	
		Width	25.50	33.00			41.50							
		Depth	17.50	23.00			32.50						32.00	
		Weight	260	435	465	505	795	895		1100	1200	1250	1500	1600
	Type 3R	Height	51.00				91.00							
		Width	39.0				41.3						66.3	
		Depth	21.50				50.50				46.50		43.50	
		Weight	375	435	465	505	795	895		1100	1200	1250	1700	1900

Note: Data subject to change.

NEMA1

NEMA 12

NEMA 3R

Z1000U HVAC Matrix Drive

Power Range
- 208 - 240 V : 10 - 100 HP
- 380 - 480 V : 7.5 - 350 HP

Available Packages
- Bypass,
- Configured,

Enclosures
- Open Type (IP00)
- NEMA 1 Kit

APPLICATIONS

- **Supply and Return Fans**
- **Cooling Tower Fans**
- **Chilled Water Pumps**
- **Chiller Compressors**

Increase your green space with the Yaskawa HVAC Matrix Drive (Z1000U), the product that that goes beyond conventional drives by combining excellent harmonic mitigation, input power factor control and energy saving capabilities.

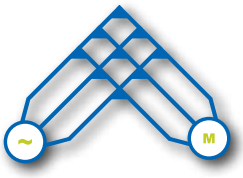
The HVAC Matrix drive (Z1000U) provides extremely low harmonic distortion in a space-saving design, along with the same HVAC-specific features as the standard Z1000. This single component solution achieves excellent low distortion levels all by itself, completely without the need for additional countermeasures such as passive filters or multi-pulse arrangements. Unlike conventional drives, Yaskawa's matrix technology creates a variable output by switching directly from the input power (no DC bus). Not only does the Matrix drive provide outstanding harmonic performance, but being a member of the Z1000 family, it provides the same user experience for those already familiar with commissioning and maintaining the standard Z1000.

Primary Features and Benefits:

- Low Input Distortion Across a Wide Load and Speed Range
- IEEE-519 Compliant (<5% THD)
- Eco-Mode to Achieve Near Across-the-Line THD
- High Efficiency Design Provides Extra Energy Savings as Compared to Other Low Harmonic Solutions
- Near Unity True Power Factor at Full Load
- 0.98 Displacement Power Factor Throughout Entire Load and Speed Range
- Integrated Input Fusing Provides 100kA SCCR
- Integrated C2 EMC Filter
- Compact Design
- High Reliability with an MTBF of 28 Years
- Embedded BACnet Communications (BTL Certified)
- Embedded Real Time Clock for Event Stamping
- High Carrier Frequency (Low Motor Noise) Capability
- 0-400 Hz Output Frequency
- 120% Overload for 60 Seconds
- Motor Auto-tuning
- Multi-language LCD Display, with Hand/Off/Auto and Copy function
- DriveWizard® HVAC Software
- Embedded Timer Functions for Starting, Stopping and Speed Changes
- Start into Spinning Load (Speed Search)
- Both Induction and Permanent Magnet Motor Control
- Available I/O:
  - (8) Multi-function digital inputs,
  - (3) Multi-function analog inputs,
  - (3) Multi-function relay outputs,
  - (2) Multi-function 0-10 VDC or 4-20 mA analog outputs,
  - (1) Fault relay

Z1000U HVAC Matrix Drive

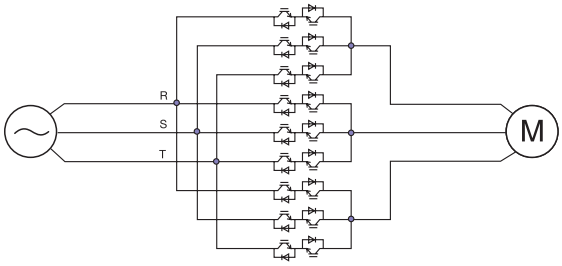
Matrix Innovation

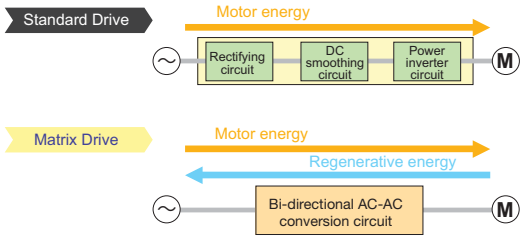


Yaskawa's development of matrix converter technology in 2006 made it possible to overcome traditional issues caused by the harmonic distortion created by variable frequency drives. Further refinement of this technology has resulted in the Z1000U HVAC Matrix Drive.

How is Matrix Technology Different?

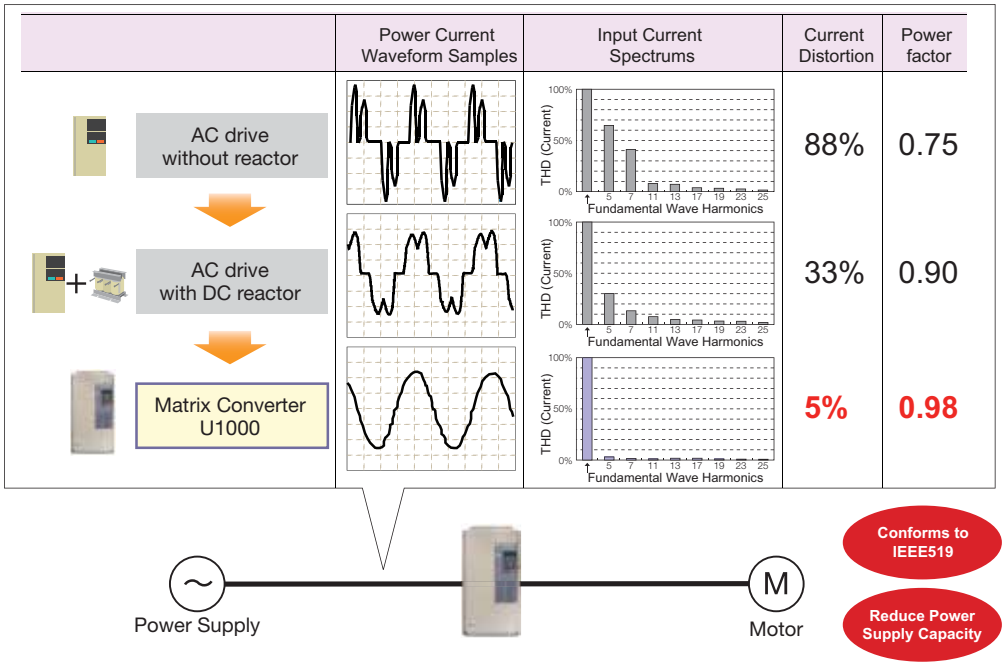
Matrix technology employs a system of 9 bi-directional switches that are arranged in a matrix to convert a three-phase AC input voltage directly into a three phase AC output voltage. It eliminates the need for a rectifying circuit and a DC smoothing circuit that are used in traditional AC drive "inverters". This results in a compact drive with power regenerative capability and reduced harmonic distortion.





Reduced Harmonic Distortion to Increase Power Quality

When a conventional AC drive converts power, the input current becomes distorted, resulting in reduced power quality. Matrix technology reduces total harmonic distortion levels to 5%, without the need for reactors and filters. The result is a smoother current waveform that reduces stress on the system power supply and infrastructure. Additionally, reduced distortion equals improved power factor and thus, reduced energy costs.



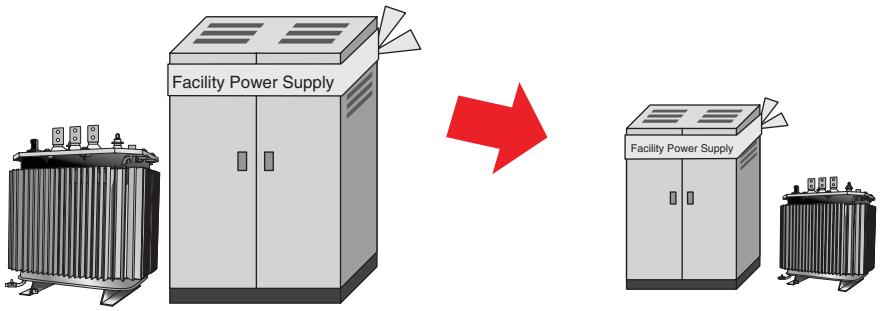
Z1000U HVAC Matrix Drive

Reduce Power Supply Capacity

The increased power factor enables the use of a lower power supply capacity, which reduces cost. Additional cost savings come from a reduction in wire sizes and generator capacity.

Conventional AC Drive
Power Factor = **0.75**
at rated current load

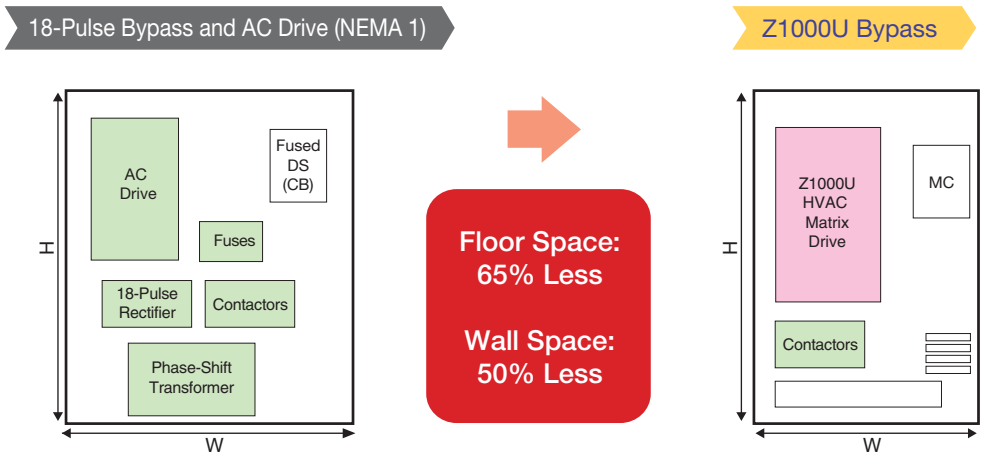
Z1000U Matrix Drive
Power Factor = **0.98**
at rated current load



Compact Design

Harmonic countermeasures that were previously required, such as input AC reactors, harmonic filter reactors, and capacitors, are not necessary, which helps you save wiring, space, and energy costs.

Integrating the attributes of multi-pulse into one compact package dramatically reduces cabinet space.



HP	18 Pulse Bypass			Z1000U Bypass		
	H	W	D	H	W	D
50	78.7	31.5	33.2	62	20	19
125	79	64	35	74	35	21

Z1000U HVAC Matrix Drive

Model Number Designation

CIMR - Z U 4 E 0096 A U A

- AC Drive
- Z1000 Series
- Design Revision

No.	Region Code
U	United States

No.	Voltage Class
2	3-phase, 200-240 VAC
4	3-phase, 380-480 VAC

No.	Custom Specs
E	Z1000U with EMC Noise Filter

No.	Output Current Code (A)
	See Models and Ratings.

No.	Environmental Specification
U	Humidity and dust-resistant

No.	Enclosure Type
A	IP00

Note: Separately sold kit available for UL Type 1

Models and Ratings

208 - 240V Class

CIMR-ZU2E AUA		0028	0042	0054	0068	0081	0104	0130	0154	0192	0248
Rated Output Current (A)		28	42	54	68	81	104	130	154	192	248
Nominal HP 240V (208V)		10 (7.5)	15 (10)	20 (15)	25 (20)	30 (25)	40 (30)	50 (40)	60 (50)	75 (60)	100 (75)
Dim (in)	Height	19	26				32		39		45
	Width	10	10				10		16		19
	Depth	14	17				18		16		18
Weight (lb)		46	73		79		139		254		399
Heat Loss (W)	Heatsink	659	854	1037	1295	1420	1696	2157	2441	3064	3785
	Internal	103	168	195	225	238	282	341	366	447	578
	Total	762	1022	1232	1520	1658	1978	2498	2807	3511	4363

480V Class

CIMR-ZU4E AUA		0011	0014	0021	0027	0034	0040	0052	0065	0077
Rated Output Current (A)		11	14	21	27	34	40	52	65	77
Nominal HP		7.5	10	15	20	25	30	40	50	60
Dim (in)	Height	19					26			
	Width	10					10			
	Depth	14					17			
Weight (lb)		46					73		79	
Heat Loss (W)	Heatsink	452	459	641	675	798	877	1109	1369	1479
	Internal	80	79	105	106	124	174	209	240	251
	Total	532	538	746	781	922	1051	1318	1609	1730

CIMR-ZU4E AUA		0096	0124	0156	0180	0216	0240	0302	0361	0414
Rated Output Current (A)		96	124	156	180	216	240	302	361	414
Nominal HP		75	100	125	150	175	200	250	300	350
Dim (in)	Height	32		39		45		45		
	Width	10		16		19		27		
	Depth	18		16		18		18		
Weight (lb)		139		254		399		589		
Heat Loss (W)	Heatsink	1715	2256	2857	3316	3720	3897	5202	5434	6444
	Internal	290	362	421	482	587	600	857	863	1012
	Total	2005	2618	3278	3798	4307	4497	6059	6297	7456

Note: Data subject to change.

Notes

Notes

We take quality personally at Yaskawa. Our drives and servo packages offer the highest MTBF in the world. The relationships we have with our customers ensure mutual benefits. The partnerships we cultivate with our distributors add value to the way we work with you. We hire great people and continuously train them to be able to serve your needs better. We deliver product on time. It works out of the box. We answer questions promptly and never say, “we can’t.”

To us, quality means doing everything we can to make our customer, partner, and employee experiences great.

We commit to that philosophy every day. We make it happen. We can because, to us, IT’S PERSONAL.

YASKAWA

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Drives & Motion Division

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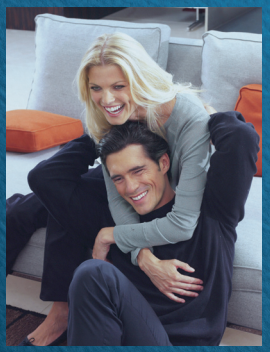
Waukegan, IL 60085
1-800-YASKAWA (927-5292) • Local: 847-887-7000 • Fax: 1-847-887-7310

www.yaskawa.com

Document BL.Z1000.01 03/12/2015 •

DAIKIN
AIR INTELLIGENCE™

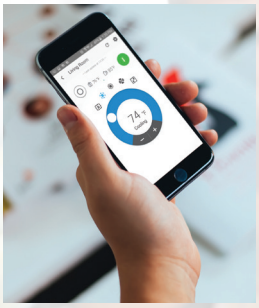


SINGLE AND MULTI-ZONE HEATING AND COOLING SYSTEMS

WHY INSTALL A DAIKIN SINGLE AND/OR MULTI-ZONE HEATING AND COOLING SYSTEM?

EASY LIKE SUNDAY MORNING.

Daikin single and multi-zone systems offer built-in *AIR INTELLIGENCE™* that allows the control systems to make subtle and continuous adjustments to ensure you can stay comfortable at the touch of a button.



With innovative control solutions, such as the Daikin Comfort Control App, you can control the temperature of your home from anywhere with an internet connection.

I CAN BARELY HEAR IT. IS IT WORKING?

Yes! With Daikin inverter (variable-speed) technology, Daikin single and multi-zone systems feature low operational sound levels. Some Daikin units also feature our quiet mode function, that allows the system to lower the sound level of the indoor unit even more.

HOW EFFICIENT ARE THEY, AND HOW MUCH WILL I SAVE?

Daikin single and multi-zone systems offer SEER options up to 26.1 and state-of-the-art technology to help with efficiency. In addition to low operational sound levels, Daikin inverter technology also allows the system to deliver the capacity required to maintain the desired room temperatures. This function typical reduces energy consumption by up to 30% or more (compared to traditional fixed-speed ducted systems).

Intelligent eye sensor

Select Daikin systems offer our intelligent eye sensor. The intelligent eye is an infrared sensor with the ability to sense movement in the room. When you are in the room, the system operates normally. If you leave the room for more than 20 minutes, the system automatically changes to an energy-saving operation. The intelligent eye can offer savings up to 20% in cooling and up to 30% in heating, compared to units without this feature.

LEARN MORE AT

https://daikincomfort.com/products/heating-cooling

> “We purchased a Daikin ductless heat pump and absolutely love it. This is the best investment we’ve made in the 30 years we’ve lived in our house. Our house is warm this winter and I don’t have to worry about turning down the thermostat.”
>
> — Homeowner
> Washington State

INSTALLATION THAT SAVES TIME AND MONEY.

Rather than extending the home's existing ductwork, or adding electric resistance heaters, you can provide direct heating and/or cooling to the spaces where you need it most. Daikin single and multi-zone systems have just two primary components and no ductwork, which means installations, can often occur in a single day. The indoor unit is typically mounted on a centrally-located wall within your home that easily connects to an outdoor unit.

THERE'S A DAIKIN SYSTEM FOR YOU!

Where do you spend the most time?

Like most homeowners, you may argue over temperatures in your home and/or have rooms that go unused for extended periods. Now you can control temperatures independently, in up to eight separate zones, with a single outdoor unit. Imagine, it's always just the right temperature, for you.

Do you have electric baseboards, wall heaters or ceiling units?

A Daikin single and/or multi-zone heat pump system can be a cost-effective solution to heat and cool an average home while still using existing baseboards or wall heaters when needed.

Building an addition or converting a garage or basement?

A single and/or multi-zone heat pump system is a great solution when adding onto your home or converting an existing attic, garage, or basement into a living space. Daikin offers a range of indoor unit options to meet the unique needs of your project.

Planning a new home?

New home designs can be easily adapted to take full advantage of a whole home single and/or multi-zone heating and cooling system. No matter the size of the home, a Daikin single and/or multi-zone system can be designed to help maximize energy savings and add room-to-room comfort and control.

Concerns with Indoor Air Quality (IAQ)?

Here are just a few of the intelligent features available in select Daikin single and multi-zone systems:

Air-Purifying Filter with Photocatalytic Deodorizing Function

This combination operates as a highly-effective unit and can be used for up to three years if periodic maintenance is performed.

Titanium Apatite Photocatalytic Air-Purifying Filter

This filter combines the air-purifying filter and titanium apatite photocatalytic deodorizing filter in a single highly effective unit. The filter can last for up to three years without replacement if washed once every six months.

Specialized Air Filter

The pre-filter net is impregnated with a safe, colorless and odorless agent that is intended to help reduce mold on the filter itself.

Wipe-Clean Flat Panel

The flat panel models can be cleaned with only the single pass of a cloth across their smooth surface. The flat panel can also be easily removed for more thorough cleaning.

DAIKIN
AIR INTELLIGENCE™

COMFORT MAKES A HOUSE A HOME.

Fluctuating indoor temperatures and noisy, inefficient systems can result in high utility bills and uncomfortable living spaces. These are things we can all live without. Simply stated, a Daikin single and/or multi-zone heating and cooling system helps to keep your home at a consistent comfort level. Whether you're looking to replace an existing inefficient ducted system, condition an addition or you're building a brand-new house, Daikin single and multi-zone heating and cooling systems provide year-round comfort and the potential for outstanding energy savings.

To find a local dealer, visit www.daikincomfort.com/find-dealer/locator

Contact Daikin North America Consumer Affairs at consumeraffairs@daikincomfort.com or 1.855.770.5678

Why choose Daikin?

Daikin is the world leader when it comes to heating and cooling. Thanks to our constant innovation in comfort, energy efficiency, control and reliability, we define the benchmarks for quality within the industry.

Expert reviews from our most important critics.

Daikin offers a wide selection of choices for energy-efficient indoor comfort. As a worldwide leader in heating and cooling technology, Daikin is also a highly-rated brand. See for yourself at www.daikincomfort.com/reviews.

ADVANCED TECHNOLOGY

The level of air conditioning being sought around the world can dramatically change according to country, region, and even culture. Using our advanced technology and expertise, Daikin has earned a reputation for excellence as an air conditioning specialist in countries and regions spanning the globe by providing the precise solution for every air conditioning need of our customers.

ADDITIONAL INFORMATION

Before purchasing this appliance, read important information about its estimated annual energy consumption, yearly operating cost, or energy efficiency rating that is available from your retailer.

PRODUCT DEVELOPMENT

With numerous production bases throughout the world, Daikin designs and quickly delivers products to match the specific needs of local customers. Daikin has earned a high reputation for promptness and reliability through an independent network of home comfort professionals.

BERT® Smart Plug Series Data Sheet

Plug-in measurement and control for individual 110V/15A devices

	BERT 110 M	BERT 110 X
BERT		
Dimensions	3.5″ W x 3.5″ H x 2″ D	3.5″ W x 3.5″ H x 2″ D
Weight	4.2 Ounces	4.4 Ounces
Voltage	120 Volts	120 Volts
Amperage	Up to 15 Amps	Up to 15 Amps
Operating Environment	Indoor Use Only	Indoor Use Only
Manual Override Button	Yes	Yes
BAS Integration	BACnet/IP	BACnet/IP
Standard Software	Measurement, Analysis and Control	Measurement, Analysis and Control
Intelligent Control Options	Threshold and Temperature	Threshold and Temperature
Measurement Accuracy	+/-5%	+/-5%
Measurement Update Frequency	Configurable: 1 to 999 seconds	Configurable: 1 to 999 seconds
Stored Measurement Data - Server	Unlimited	Unlimited
Stored Measurement Data - Bert	14-Day Rolling Log	14-Day Rolling Log
M & V Reporting	Daily, Weekly, Monthly, Yearly or User Defined	Daily, Weekly, Monthly, Yearly or User Defined
Wireless Specifications	2.4 GHz, 802-11 b/g	2.4/5 GHz, 802.11 a/b/g/n
Communication Protocol	UDP	UDP
Network Security	WPA/WPA2-PSK	WPA/WPA2-PSK, WPA/WPA2-Enterprise
Certifications	UL 916 and 60950-1, FCC	UL 916 and 60950-1, FCC

RECOMMENDED DEVICES FOR USE WITH BERT SMART PLUGS

Printers, Copiers, Projectors, Charging Carts, Vending Machines,
Large Coffeemakers, Hot/Cold Beverage Dispensers, Window AC units

Utility Baseline Data

Pennsylvania Fish & Boat Commission

Utility Baseline Data

	Baseline Data	Electric								Natural Gas			Fuel Oil			Total Utility Cost
	Facility Name	Peak Monthly kW	Annual kw	Total kw $	$/kw	Annual kWh	Total kwh $	Total $	$/kWH	Therms	Total $	$/Unit	Annual Gallons	Total $	$/Unit	
1	Bellefonte SFH	220	2,114	$5,941	$2.81	1,264,446	$83,342	$89,284	$0.066	18,255	$20,722	$ 1.14	-	$0	$ -	$110,005
2	Benner Spring SFH	158	1,629	$4,579	$2.81	881,113	$56,743	$61,322	$0.064	-	$0	$ -	5,732	$14,331	$ 2.50	$75,653
3	Corry SFH	170	1,313	$5,986	$4.56	682,406	$52,369	$58,355	$0.077	5,820	$3,923	$ 0.67	-	$0	$ -	$62,277
4	Fairview SFH	26	255	$1,606	$6.30	76,203	$4,671	$6,277	$0.061	6,590	$4,629	$ 0.70	-	$0	$ -	$10,906
5	Huntsdale SFH	205	2,069	$0	$0.00	1,153,980	$82,457	$82,457	$0.071	-	$0	$ -	5,837	$13,331	$ 2.28	$95,788
6	Linesville SFH	118	1,273	$8,039	$6.31	591,547	$37,738	$45,776	$0.064	62,152	$37,310	$ 0.60	-	$0	$ -	$83,086
7	Oswayo SFH	45	447	$4,760	$10.64	184,852	$15,619	$20,380	$0.084	7,679	$6,200	$ 0.81	-	$0	$ -	$26,580
8	PFBC HQ Harrisburg	273	2,634	$0	$0.00	1,012,800	$73,812	$73,812	$0.073	18,259	$15,977	$ 0.88	-	$0	$ -	$89,788
9	Pleasant Gap SFH	76	558	$1,567	$2.81	210,736	$13,968	$15,534	$0.066	9,985	$8,881	$ 0.89	-	$0	$ -	$24,416
10	Pleasant Mount SFH	44	457	$0	$0.00	240,900	$19,857	$19,857	$0.082	-	$0	$ -	20,994	$52,671	$ 2.51	$72,529
11	Reynoldsdale SFH	135	1,383	$8,713	$6.30	636,091	$40,529	$49,242	$0.064	-	$0	$ -	2,961	$8,290	$ 2.80	$57,532
12	Tionesta SFH	82	786	$2,719	$3.46	430,553	$36,695	$39,414	$0.085	4,226	$3,411	$ 0.81	-	$0	$ -	$42,825
13	Tylersville SFH	127	1,177	$0	$0.00	596,640	$42,574	$42,574	$0.071	-	$0	$ -	3,660	$9,601	$ 2.62	$52,175
14	Union City SFH	26	237	$1,493	$6.30	82,069	$5,453	$6,946	$0.066	22,027	$14,320	$ 0.65	-	$0	$ -	$21,266
	Totals	**1,703**	**16,332**	**$45,402**	**$2.78**	**8,044,336**	**$ 565,826**	**$ 611,229**	**$0.070**	**154,992**	**$ 115,373**	**$0.744**	**39,185**	**$ 98,225**	**$2.51**	**$824,826**