



ENERGY SAVINGS PLAN



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ENERGY SAVINGS PLAN

SECTION 1 – PROJECT OVERVIEW

Project Overview

The Energy Savings Plan (ESP) is the core of the Energy Savings Improvement Program (ESIP) process. It describes Washington Township School District's preferred Energy Conservation Measures (ECMs), the budget cost for each ECM and the ECM energy savings calculations that self-fund the project via reduced operating costs. The ESP provides Washington Township School District with the necessary information to decide which proposed ECMs to implement as part of your (ESIP) project. Washington Township Public Schools has decided to utilize the Hybrid ESIP model, with DCO Energy preparing the Energy Savings Plan, Remington and Vernick Engineers is the district's engineer of record, Pheonix Advisors, LLC. is the financial advisor and Wilentz, Goldman & Spitzer, P.A. is the bond counsel. Working with the School District's staff, your selected ESIP project would:

1. Self-fund a \$23,584,888 project.
2. Generate \$1,393,850 in annual energy and solar savings– 45% of current utility spend.
3. Eligible for \$658,126 in rebates and incentives
4. Reduce utility related annual CO2 emissions by 7,159 metric tons – a 61% reduction.

NOTE: This submitted ESP doesn't constitute any contractual obligation between Washington Township School District and DCO Energy (DCO). Any contractual obligations will be performed under separate legal documents per mutually signed agreement of the parties involved and subject to the applicable laws and requirements of the ESIP legislation and State of New Jersey.

To ensure conformance with the requirements of Public Finance Notice LFN 2009-11, the ESP must address the following elements:

- *The results of the energy audit (APPENDIX H)*
- *A description of the energy conservation measures that will comprise the program; (Section 3)*
- *An estimate of greenhouse gas reductions resulting from those energy savings; (Section 3)*
- *Identification of all design and compliance issues and identification of who will provide these services; (Section 5)*
- *An assessment of risks involved in the successful implementation of the plan; (Section 5)*
- *Identify the eligibility for, and costs and revenues associated with the PJM Independent System Operator for demand response and curtailable service activities; (Section 3)*

- *Schedules showing calculations of all costs of implementing the proposed energy conservation measures and the projected energy savings; (Section 3)*
- *Maintenance requirements necessary to ensure continued energy savings, and describe how they will be provided; and (Section 6)*
- *If developed by an ESCO, a description of, and cost estimates of, a proposed energy savings guarantee. (Section 7)*

In addition, and per LFN 2009-11, the ESP requires several other important elements:

- *The calculations of energy savings must be made in accordance with protocols for their calculation adopted by the BPU. The calculation shall include all applicable State and federal rebates and tax credits but shall not include the cost of an energy audit and the cost of verifying energy savings. (Section 3)*
- *An independent third party must review the plan and certify that the plan savings were properly calculated pursuant to the BPU protocols.*
- *If an ESCO is used to prepare the plan, the ESCO must provide an estimate of the cost of a guarantee of energy savings. When adopting the plan, the local unit must decide whether to accept the guarantee (covered below). (Section 7)*
- *The plan must be verified by an independent third party to ensure that the calculations were made in accordance with the BPU standards and that all required elements of the ESP are covered.*
- *After verification is completed, the governing body must formally adopt the plan. At that point, the plan must be submitted to the Board of Public Utilities where it will be posted on the BPU website. BPU approval is not required. If the contracting unit maintains its own website, the plan must also be posted on that site.*

Washington Township High School

Washington Township High School, located in Sewell, NJ, comprises three interconnected two-story buildings: the 9/10 building, the 11/12 building, and the core building, totaling approximately 450,130 square feet. Originally constructed in 1961 and renovated in 1996, the facility includes classrooms, gymnasiums, auditoriums, offices, cafeterias, kitchens, and mechanical areas. The school operates Monday through Friday, with full occupancy during the academic year and limited use during the summer. Weekend use is minimal and primarily limited to extracurricular activities in the gym and theater. The building envelope consists of CMU walls with brick veneer, EPDM rubber roofing, and double-pane aluminum-framed windows. Emergency generators are installed in all three buildings to support lighting and critical systems during outages.



Description of Building HVAC

The HVAC systems vary across the three buildings. The 11/12 and core buildings are primarily heated by hot water boilers, while the 9/10 building relies on individual heat pumps, resistance heaters, and rooftop units (RTUs). Unit ventilators in the 11/12 building are connected to rooftop condensing units and hot water loops, while the 9/10 building uses a combination of air-source and water-source heat pumps. Packaged rooftop units (ranging from 3 to 60 tons) serve various areas, including the gym, kitchen, and classrooms. Most units are equipped with economizers and are controlled via a Siemens building automation system (BAS), which also manages air handlers, chillers, boilers, and exhaust fans. The BAS provides scheduling and temperature control, with occupied setpoints at 71°F (cooling) and 69°F (heating). The heating hot water system includes eight 3,000 MBh condensing boilers in the 11/12 building and two 5,125 MBh Bryan boilers in the core building. Both systems use VFD-controlled pumps in lead-lag configurations. The chilled water system consists of two Trane air-cooled chillers (250 and 275 tons) serving the core building, with VFD-controlled pumps and temperature modulation based on outdoor air conditions.

Description of Building Lighting

Interior lighting is primarily provided by 32W T8 linear fluorescent fixtures with electronic ballasts. Some areas still use T12 fixtures, while others have been retrofitted with LED tubes. Additional lighting types include CFLs, incandescent bulbs, and high-bay LED fixtures in the gym. Exit signs are LED, and occupancy sensors control lighting in most classrooms and restrooms. Manual switches are used in common areas such as hallways and offices. Exterior lighting includes a mix of HID and LED wall packs, these are controlled by photocells or manual switches.

Chestnut Ridge Middle School

Chestnut Ridge Middle School, located in Sewell, New Jersey, is a two-story educational facility encompassing 108,813 square feet. Constructed in 1989, the building includes a variety of spaces such as classrooms, a gymnasium, a theater stage, offices, a cafeteria, corridors, stairwells, a commercial kitchen, and mechanical/janitorial rooms. Typical weekday occupancy is 89 staff and 648 students. A natural gas generator is also installed for emergency power.



Description of Building HVAC

The HVAC system at Chestnut Ridge is a combination of hot and chilled water systems connected to rooftop-mounted air handlers and packaged units, providing full heating and cooling coverage throughout the building. Most spaces are conditioned using variable air volume (VAV) boxes connected to rooftop air handlers. Additional HVAC components include a ceiling-mounted unit heater in a second-floor storage room, a Fujitsu split-system air-source heat pump for a storage room, and a wall-mounted electric resistance heater in the mechanical room. Larger spaces are served by multiple rooftop packaged units, some of which are equipped with variable frequency drives (VFDs). The building also features seven rooftop York air-handling units and one located in the mechanical room, all of which are equipped with supply and exhaust fans, chilled water coils, and hot water coils. Three non-condensing HB-Smith 3,101 MBh hot water boilers serve the building's heating load. The boilers are configured in an automated control scheme. Multiple boilers are required under high load conditions. The chiller plant consists of a two, 225-ton, Carrier, R-22, air-cooled screw chillers. The chillers are supplied by two, 60.0 hp pumps, with both pumps being VFD-controlled.

Description of Building Lighting

Lighting throughout the school primarily consists of 32-watt linear fluorescent T8 lamps in various configurations, including recessed and surface-mounted fixtures. Some areas, such as the gymnasiums, restrooms, and classrooms, have been upgraded to LED high bay fixtures or LED panels. Incandescent and compact fluorescent lamps (CFLs) are still present in select locations like janitorial closets and the kitchen. Lighting controls include a mix of manual wall switches and occupancy sensors, which are either wall- or ceiling-mounted. Exterior lighting is provided by LED wall packs and pole-mounted LED retrofit bulbs, controlled by photocells and timeclocks.

Orchard Valley Middle School

Orchard Valley Middle School is a two-story facility encompassing 108,813 square feet, originally constructed in 1969. The building houses a variety of spaces including classrooms, a gymnasium, an auditorium, administrative offices, a cafeteria, a kitchen, and mechanical rooms. It operates on a weekday schedule aligned with school hours, with occasional use on weekends. The building envelope is composed of concrete masonry unit (CMU) walls with a brick veneer, a flat EPDM roof, and double-paned aluminum-framed windows.



Description of Building HVAC

The building is served by seven rooftop-mounted air handling units (AHUs), each equipped with supply and return fans, hot water heating coils, and chilled water coils. These units are controlled by a Siemens building automation system (BAS) and include variable frequency drives (VFDs). Zone-level control is provided through variable air volume (VAV) boxes located in classrooms and corridors. Packaged rooftop units (RTUs) provide heating and cooling to the gymnasium, kitchen, cafeteria, locker rooms, faculty room, and computer labs. They are controlled by the BAS and include economizers. A wall-mounted split air conditioning system from Fujitsu serves the office area. The heating hot water system consists of three HB Smith non-condensing boilers, each rated at 3,101 MBh. These boilers operate in a lead-lag configuration. Hot water is circulated through the building by two 40-horsepower VFD-controlled pumps. The hot water is distributed to both AHUs and RTUs. The chilled water system consists of two 225-ton Carrier air-cooled chillers with variable-speed drives. Chilled water is circulated by two 60-horsepower VFD-controlled pumps.

Description of Building Lighting

Interior lighting throughout the building primarily consists of 32-watt T8 linear fluorescent fixtures in 2-, 3-, and 4-lamp troffer configurations. Some restrooms have been upgraded with 2x4 LED fixtures, and the gymnasium is illuminated with high-bay LED lights. All exit signs are LED. Lighting controls include manual wall switches and occupancy sensors in select areas.

Exterior lighting includes LED wall packs, pole-mounted LED floodlights, and incandescent canopy lights. These fixtures are controlled by photocells.

Bunker Hill Middle School

Bunker Hill Middle School is a two-story, 106,574 square foot facility constructed in 1996. It includes classrooms, a gymnasium, offices, a cafeteria, corridors, stairwells, a garage, a commercial kitchen, and mechanical spaces. The building is fully occupied for 11 months of the year, with 99 staff and 459 students, and is used for summer school and weekend gym activities. The facility is served by single electric and gas meters and includes a natural gas emergency generator.



Description of Building HVAC

Heating is provided by two Weil-McLain non-condensing hot water boilers rated at 3,000 MBh. These serve a two-pipe hydronic system with VFD-controlled pumps. Cooling is delivered by a 200-ton Trane air-cooled screw chiller with VFD-controlled pumps. Chilled water is distributed to rooftop air handlers and blower coil units. Air handling includes unit ventilators in classrooms and offices, two Trane rooftop AHUs for the gymnasium, each with 7.5 hp VFD-controlled fans, and four rooftop heat recovery units (HRUs) with constant-speed fans. Additional equipment includes split-system heat pumps in two classrooms, packaged RTU for one science classroom, and a unit heater in the greenhouse.

Description of Lighting

Interior Lighting: Predominantly 32W T8 fluorescent lamps in 1-, 2-, and 4-lamp configurations. Some areas, including the gym and weight room, have been upgraded to LED. Controls consist of a mix of manual switches and occupancy sensors. Exit signs are LED. Exterior Lighting is a combination of metal halide spotlights and LED wall packs, with controls via photocells or timeclocks.

Thomas Jefferson Elementary School

Thomas Jefferson Elementary School is a two-story, 72,396 square foot facility constructed in 1980 and located in Turnersville, New Jersey. The building includes classrooms, a gymnasium, offices, a cafeteria, stairwells, a garage, and a commercial kitchen. The facility is typically occupied by 116 staff and 490 students during weekdays from 6:00 AM to 10:00 PM, with no weekend activities. Summer occupancy is limited to maintenance operations.



Description of Building HVAC

The HVAC systems at Thomas Jefferson Elementary consist of a mix of electric heat pumps and gas-fired rooftop units. Classrooms and offices are served by packaged air-source, ground-source, and water-source heat pumps, many of which are past their expected useful life.

Supplemental heating in stairwells, storage areas, and offices is provided by electric resistance heaters rated between 3.3 kW and 15 kW. These are manually controlled and infrequently used. The gymnasium and cafeteria are served by four rooftop units (RTUs), each rated at 10 tons cooling and 200 MBh heating, equipped with economizers and controlled via a Honeywell Building Automation System (BAS). The BAS manages HVAC scheduling, temperature, humidity, and loop temperatures.

Description of Lighting

Interior lighting is primarily provided by 32-watt linear fluorescent T8 fixtures, with some areas upgraded to LED panels and high bay fixtures, particularly in the gymnasium and cafeteria. LED lamps have replaced incandescent bulbs in many locations, though some remain in maintenance areas. All exit signs are LED. Lighting controls include wall switches and occupancy sensors, which are either wall- or ceiling-mounted. Exterior lighting includes metal halide wall packs and canopy lights, as well as pole-mounted LED fixtures for parking lots. These are controlled by photocells or timeclocks.

Hurffville Elementary School

Hurffville Elementary School is a one-story, 65,655 square foot facility originally constructed in 1955, with a temporary classroom unit (TCU) added between 2021–2022. The building includes classrooms, a gymnasium, a multipurpose room/cafeteria with a stage, offices, corridors, a commercial kitchen, restrooms, a library, and mechanical spaces. It is fully occupied for 10 months of the year, with 82 staff and 566 students. After-hours use extends to 10:00 PM for maintenance, but there are no weekend or summer activities. The facility is served by single electric and gas meters.



Description of Building HVAC

Heating is provided by two Weil-McLain and one HB Smith non-condensing hot water boilers rated at 1,632 MBh and 1,340 MBh respectively. These serve a two-pipe hydronic system with constant-speed pumps. Cooling is provided by multiple split-system and packaged rooftop units (RTUs). The TCU is served by six 3-ton Bard through-the-wall packaged units with 9 SEER and 10 kW electric heat.

Air handling includes unit ventilators in classrooms, several split-system AHUs with rooftop condensing units, and three RTUs: one 20-ton Carrier for the gym and two 6-ton Lennox units for the cafeteria. Additional HVAC Equipment includes a ceiling-mounted hydronic unit heaters in the kitchen and mechanical room.

Description of Lighting Systems

Interior Lighting Predominantly consists of 32W T8 fluorescent lamps in 1-, 2-, 3-, and 4-lamp configurations. Some areas, including the gym and cafeteria, have been upgraded to LED. The TCU uses 2x4 and 2x2 LED panels. A mix of manual switches and occupancy sensors are used. All exit signs are LED. Exterior Lighting includes high-pressure sodium and metal halide wall packs, with some screw-in LEDs. Fixtures are controlled by photocells

Whitman Elementary School

Whitman Elementary is a one-story, 59,411 square foot school built in 1965, consisting of eastern and western wings connected by vestibules. It includes classrooms, a gymnasium, a multipurpose cafeteria with a stage, offices, corridors, restrooms, a media center/library, a commercial kitchen, and mechanical/storage areas. A natural gas generator is available for emergency power. A separate 5,000 square foot permanent storage shed, also built in 1965, is used for paper record storage and is not heated or cooled.



Description of Building HVAC

The heating system consists of five Hydrotherm condensing hot water boilers, two rated at 510 MBh, two rated at 1,480 MBh, and one rated at 927 MBH. The hot water boilers serve the building's heating needs via a 2-pipe hydronic system. Heating is delivered through unit ventilators, hydronic unit heaters, radiators, and air handling units. Cooling System includes unit ventilators Located in the eastern wing, equipped with DX condensing units. Western wing uses hot water radiators only. Split Systems serve various classrooms, offices, and the multipurpose room. Packaged Rooftop Units (RTUs): Provide most of the building's cooling. Units range from 3 to 20 tons, with some equipped with VFDs. Two air handling units serve the multipurpose/cafeteria area, connected to 7.5-ton York condensing units.

Description of Lighting Description

Interior Lighting consists of 32W T8 linear fluorescent lamps in 1-, 2-, and 4-lamp configurations. Some areas have U-bend fluorescents, CFLs, and LED screw-in lamps. The gymnasium and some service areas have been upgraded to LED fixtures. Controlled mostly by manual wall switches. Exit signs are LED. Exterior Lighting Includes wall packs, canopy lights (CFL, MH, and LED), and pole-mounted LED corn-bulb fixtures. Controlled by photocells and timeclocks.

Birches Elementary School

Birches Elementary School is a one-story, 63,411 square foot facility built in 1968, located in Turnersville, NJ. Typical weekday occupancy is 103 staff and 609 students. The building includes a southern-facing original academic wing and a newer northern-facing wing, connected by vestibules. Spaces include classrooms, a gymnasium, offices, a multipurpose cafeteria, corridors, a commercial kitchen, and mechanical areas. The building envelope consists of concrete masonry units (CMUs) with brick veneer on the original wing and painted CMUs on the newer wing. Windows are mostly double-glazed with aluminum frames and thermal breaks. The roof is a mix of flat and pitched sections, covered with black EPDM.



Description of Building HVAC

The heating system consists of five Hydrotherm condensing hot water boilers, two rated at 510 MBh, two rated at 1,480 MBh, and one rated at 927 MBH. The system uses a variable flow primary loop with VFD-controlled pumps. Unit Ventilators Serve classrooms and offices, connected to hot water coils and DX cooling via rooftop condensing units. Unitary HVAC Equipment Includes split AC systems and rooftop packaged units (RTUs) ranging from 1 to 20 tons. Two air handling units serve the multipurpose/cafe area, with DX cooling and hot water heating coils.

Description of Lighting Description

Interior lighting primarily consists of 32W T8 linear fluorescent lamps, with some areas already retrofitted with LED fixtures. The gymnasium and cafeteria have LED high bay and panel fixtures, respectively. Exit signs are LED. Lighting controls include manual switches and occupancy sensors (wall- and ceiling-mounted).

Exterior lighting includes wall packs and canopy lights using CFL, HPS, and MH lamps, controlled by photocells.

Bells Elementary School

Bells Elementary School is a one-story, 62,617 square foot facility built in 1967, located in Turnersville, NJ. Typical weekday occupancy is 94 staff and 551 students. The building comprises an original southern-facing academic wing and a newer northern-facing wing, connected by vestibules. It includes classrooms, a gymnasium, offices, a multipurpose cafeteria, corridors, a commercial kitchen, and mechanical spaces. The building envelope features concrete masonry units (CMUs) with a brick veneer on the original wing and painted CMUs on the newer wing. The roof is primarily flat with pitched sections over the gym and cafeteria. Windows are mostly double-glazed with aluminum frames and thermal breaks, while exterior doors are aluminum-framed.



Description of Building HVAC

The heating system consists of five Hydrotherm condensing hot water boilers, two rated at 510 MBh, two rated at 1,480 MBh, and one rated at 927 MBH. The system uses a variable flow primary loop and VFD-controlled pumps. Classrooms and offices are served by unit ventilators with hot water coils and DX cooling via rooftop condensing units. Additional HVAC systems include split AC units and through-the-wall heat pumps. Packaged rooftop units (RTUs) serve larger spaces. Two air handling units (AHUs) above the stage serve the multipurpose/cafeteria area.

Description of Lighting Description

Interior lighting primarily uses 32W T8 linear fluorescent lamps, with some areas already retrofitted with LED fixtures. The gymnasium and cafeteria feature LED high bay and panel fixtures, respectively. Exit signs are LED. Lighting controls include manual switches and occupancy sensors (wall- and ceiling-mounted).

Exterior lighting includes wall packs and canopy lights using CFL, HPS, and MH lamps, controlled by photocells. The facility also uses pole-mounted LED corn-bulb lights for roadways and parking lots.

Wedgwood Elementary School

Wedgwood Elementary School, located in Sewell, NJ, is a one-story, 60,697-square-foot facility constructed in 1969. The building includes classrooms, a gymnasium, offices, a multipurpose-cafeteria area, corridors, a kitchen, and mechanical spaces. The school operates Monday through Friday during regular business hours, with no weekend activities. The building envelope consists of CMU walls with brick veneer, a flat EPDM rubber roof, and double-paned aluminum-framed windows.



HVAC Description

The HVAC system at Wedgwood Elementary is composed of a mix of unitary and centralized systems. Cooling is primarily provided by unit ventilators connected to DX condensing units and packaged rooftop units (RTUs). Some spaces, such as offices and classrooms, use through-the-wall or window AC units. The heating system consists of five Hydrotherm condensing hot water boilers, two rated at 510 MBh, two rated at 1,480 MBh, and one rated at 927 MBH. The boilers serve unit ventilators, air handling units (AHUs), and RTUs. The boilers are fully modulating and controlled via a lead-lag sequence through the BAS. Ventilation is managed by unit ventilators and AHUs, with some areas using demand control ventilation (DCV). A Siemens BAS controls HVAC components, including temperature setpoints, scheduling, and monitoring.

Lighting Description

Interior lighting is primarily provided by 32-watt linear fluorescent T8 fixtures, with some compact fluorescent lamps (CFLs) and LED lamps in offices and restrooms. Gymnasium lighting consists of manually controlled high-bay LED fixtures, and all exit signs are LED. Some classrooms and restrooms use occupancy sensors, while others rely on manual wall switches.

Exterior lighting includes a mix of HID and LED wall packs and floodlights, controlled by photocells.

Grenloch Early Elementary School

Grenloch Terrace Early Childhood Center consists of two connected structures: a 16,136-square-foot multi-story building constructed in 1936 and a 23,800-square-foot addition built in 1980. The facility includes classrooms, a multipurpose gymnasium, offices, corridors, stairwells, a library, kitchen, and mechanical spaces. The school operates 11 months per year with weekday occupancy of approximately 93 staff and 246 students. There is minimal after-hours use and no weekend or summer occupancy.



HVAC Description

The HVAC systems vary between the two buildings. The older building is heated by a Weil McLain natural draft steam boiler with a capacity of 1,629 MBh. Heating is distributed through a two-pipe system to unit ventilators in classrooms. These ventilators are equipped with supply fans and pneumatically controlled dampers and valves. The second floor is cooled by six DX condensing units connected to attic-mounted air handlers, while the first floor relies on window-mounted AC units. In the newer building, classrooms are served by unit ventilators with DX cooling and electric resistance heating strips. Corridors are conditioned by two York split-system heat pumps.

Lighting Description

Lighting throughout both buildings primarily consists of 32-watt linear fluorescent T8 fixtures, with some compact fluorescent, incandescent, and LED lamps in restrooms and storage areas. Exit signs are LED. Exterior lighting includes a mix of HID, CFL, and LED fixtures, controlled by time clocks or photocells.

O'Brien Hall

O'Brien Hall is a one-story, 22,900 square foot facility constructed in 1980 and located in Sewell, New Jersey. The building includes a gymnasium, offices, locker rooms, restrooms, and the adjacent Pride Pavilion, which serves the high school's athletic center. The facility is typically occupied Monday through Friday from 2:00 PM to 8:00 PM and on weekends from 9:00 AM to 2:00 PM, primarily for after-school activities and athletic events. Occupancy is intermittent outside of these hours for maintenance and operations.



HVAC Description

The HVAC systems in O'Brien Hall consist of a mix of electric and gas-fired unitary equipment. Office spaces, primarily used by coaching staff, are cooled by window air conditioning units ranging from 0.5 to 0.75 tons in capacity. Heating is provided by wall-mounted electric unit heaters in the offices and bathrooms, and by natural gas-fired makeup air unit heaters in the locker rooms and wrestling arena, with capacities ranging from 80 MBh to 400 MBh. The Pride Pavilion is heated exclusively by electric unit heaters, ranging from 1.5 kW to 15 kW.

Lighting Description

Lighting throughout the facility is primarily provided by 32-watt linear fluorescent T8 fixtures with electronic ballasts. High bay LED round fixtures are installed in the wrestling arena, and all exit signs are LED. Most lighting fixtures are controlled by wall switches. Exterior lighting includes wall-mounted fixtures with a mix of metal halide and LED lamps, all controlled by photocells.

Administration Building

The Administration Building is a one-story, 20,000 square foot facility constructed in 1991 and located in Sewell, New Jersey. The building houses administrative offices, a cafeteria, corridors, and a conference room. It is typically occupied Monday through Friday from 7:00 AM to 4:30 PM, with no regular weekend activities. Occupancy outside of these hours is minimal and primarily for maintenance or special events



HVAC Description

The HVAC systems at the Administration building consist of a mix of electric and gas-fired unitary equipment. Most of the building is served by nine Trane packaged rooftop units (RTUs), ranging from 3 to 6 tons in cooling capacity and 64.8 to 96 MBh in gas-fired heating capacity. These units are controlled by a Siemens Building Automation System (BAS), which manages temperature setpoints and scheduling. The BAS allows for occupied cooling and heating setpoints of 71°F and 69°F, respectively, and unoccupied setpoints of 85°F and 65°F.

Lighting Description

Interior lighting is primarily provided by 32-watt linear fluorescent T8 fixtures with electronic ballasts. Some areas, such as the conference room and select offices, have been upgraded to 2x4 LED fixtures and 9-watt LED lamps. All exit signs are LED.

Exterior lighting includes wall-mounted fixtures and floodlights using high-intensity discharge (HID) lamps, with some LED replacements. These are controlled by either switches or photocells depending on the fixture type.

Operations Building

The Operations Building, located in Sewell, New Jersey, is a two-story, 5,625 square foot facility constructed in 1980. It houses administrative offices, a break room, a lobby, and restrooms. The building is occupied Monday through Friday during regular business hours, with intermittent use on weekends. The weekday operating schedule runs from 5:30 AM to 11:00 PM, while there are no scheduled operations on weekends.



HVAC Description

The HVAC system consists of three split-system air source heat pumps, ranging from 2 to 4 tons in cooling capacity and 24 to 48 MBh in heating capacity. A 2-ton window air conditioning unit provides cooling for the bus drivers' office, while electric resistance unit heaters serve the restroom and office areas. All HVAC units are controlled by remote or manual thermostats.

Lighting Description

Lighting throughout the facility is primarily provided by 32-watt linear fluorescent T8 fixtures with electronic ballasts. Some compact fluorescent lamps (CFLs) and LED lamps are also installed in select offices and restrooms. Exit signs are LED, and most lighting is controlled by manual wall switches. Exterior lighting includes a floodlight with a high-intensity discharge (HID) lamp, controlled by a photocell.

Warehouse

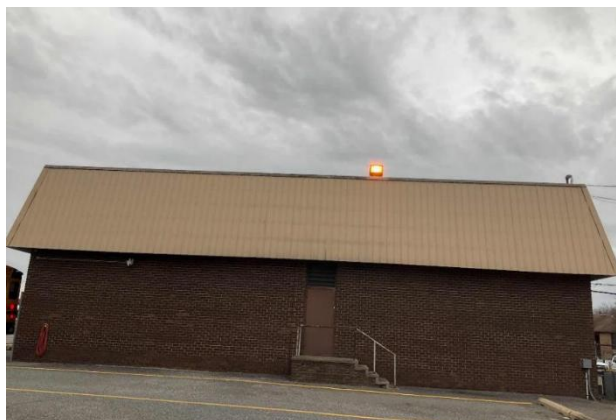
The Warehouse is a one-story, 5,400-square-foot facility constructed in 1975. It includes office space, a warehouse area, and restrooms. The building is occupied Monday through Friday during regular business hours and remains unoccupied on weekends. The structure features CMU walls with a brick veneer, a flat metal roof, and single-pane wood-framed windows. Exterior doors are aluminum-framed.

HVAC Description

The HVAC system includes a window air conditioning unit serving the lock shop office, rated at 8,000 Btu. Heating for the office is provided by a 4 kW electric resistance unit heater. The warehouse area is heated by two suspended gas-fired forced air heaters. Ventilation in the warehouse is provided by three wall-mounted exhaust fans. A 3.4 kW electric tankless water heater serves the facility. Domestic hot water piping is uninsulated.

Lighting Description

Lighting throughout the facility is primarily provided by 32-watt linear fluorescent T8 fixtures, with some U-bend T8 fixtures and LED linear tubes installed in the warehouse. Fixtures are surface-mounted and controlled by wall switches. Exterior lighting includes a floodlight with a high-intensity discharge (HID) lamp and a LED fixture, both controlled by photocells.



Bus Garage

The Bus Garage is a one-story, 4,500-square-foot facility built in 1978. It includes office space, a garage area, and a restroom. The building is occupied Monday through Friday from 4:30 AM to 8:00 PM and remains unoccupied on weekends. The front garage section is constructed with insulated metal framing, while the rear section is made of CMUs with a brick veneer. The roof is a pitched metal deck with standing seam metal roofing. Windows are single-pane with aluminum frames.



HVAC Description

The HVAC system consists of a mix of electric and gas-fired equipment. The office area is cooled by a 6,000 Btu window air conditioning unit and heated by two electric resistance unit heaters rated at 2 kW and 4 kW. The garage area is heated by three gas-fired infrared heaters and one forced-air furnace. All heating equipment is controlled by manual dial thermostats. The garage is not cooled, but ventilation is provided by an exhaust fan and two large destratification fans.

Lighting Description

Lighting throughout the facility is primarily provided by 32-watt linear fluorescent T8 fixtures with electronic ballasts. A T5 fixture is used for task lighting in the garage, and a T8 U-bend fixture is installed in the restroom. Most fixtures are surface-mounted and controlled by manual wall switches. Exterior lighting includes wall packs with metal halide and LED lamps, controlled by photocells.

Washington Township High School Stadium

Washington Township High School Stadium, located in Sewell, New Jersey, serves as the centerpiece of the school's athletic complex. Known as Tom Brown Field, in honor of the legendary Minutemen football coach, the synthetic-turf main stadium accommodates more than 2,500 spectators for games under the Friday night lights. The facility hosts a variety of athletic programs including football, track and field, field hockey, and boys' and girls' lacrosse, with occasional soccer matches also held on the turf.



Description of Lighting

The stadium lighting system consists of forty-two (42) 1,500-watt luminaires with a total connected load of approximately 67.5 kW. The non-LED fixtures are mounted on poles surrounding the field to provide uniform illumination for evening games and events.



ENERGY SAVINGS PLAN

SECTION 2 – ENERGY BASELINE

Total Utility Consumption and Site EUI

The Washington Township School District Energy Savings Plan includes 16 buildings and 1 stadium. There are 6 Elementary Schools, 3 Middle Schools, 1 High School, 1 Stadium, 1 Early Childhood Center, and 5 Operation Buildings. To develop the ESP, DCO Energy was provided with all available utility data (electric, natural gas, and water). DCO Energy tracked and documented this utility data from January through December of 2025. A listing of the buildings, the total utility consumption, and Energy Usage Index for the 17 sites are detailed below.

BUILDINGS & FACILITIES		
BUILDING #	BUILDING/FACILITY NAME	SQFT
1	Washington Township High School	450,130
2	Chestnut Ridge Middle School	108,813
3	Orchard Valley Middle School	108,813
4	Bunker Hill Middle School	106,574
5	Thomas Jefferson Elementary School	72,396
6	Hurffville Elementary School	65,655
7	Whitman Elementary School	64,411
8	Birches Elementary School	63,411
9	Bells Elementary School	62,617
10	Wedgwood Elementary School	60,697
11	Grenloch Early Childhood Center	39,936
12	O'Brien Hall	22,900
13	Administration Building	20,000
14	Operations Building	5,625
15	Warehouse	5,400
16	Bus Garage	4,500
17	Washington Township High School Stadium	-

Washington Township School District- Energy Use Summary

Washington Township Public Schools BUILDINGS/FACILITIES		ELECTRIC			
BUILDING/FACILITY NAME	SQFT	CONSUMPTION kWh	DEMAND kW	USAGE BTU / SQFT	TOTAL COST \$\$
Washington Township High School	450,130	5,783,922	2,092	43,842	\$1,025,463
Chestnut Ridge Middle School	108,813	1,313,283	535	41,180	\$236,123
Orchard Valley Middle School	108,813	1,332,711	464	41,789	\$230,162
Bunker Hill Middle School	106,574	1,153,652	434	36,935	\$200,314
Thomas Jefferson Elementary School	72,396	759,917	418	35,815	\$142,320
Hurffville Elementary School	65,655	603,353	271	31,355	\$112,868
Whitman Elementary School	64,411	499,191	254	26,443	\$95,707
Birches Elementary School	63,411	523,960	305	28,193	\$111,046
Bells Elementary School	62,617	503,904	279	27,458	\$100,978
Wedgwood Elementary School	60,697	603,796	395	33,942	\$128,750
Grenloch Early Childhood Center	39,936	272,544	199	23,285	\$57,483
O'Brien Hall	22,900	103,080	120	15,358	\$20,206
Administration Building	20,000	156,294	72	26,664	\$31,218
Operations Building	5,625	54,883	33	33,291	\$9,838
Warehouse	5,400	74,820	18	47,275	\$14,581
Bus Garage	4,500	35,886	26	27,210	\$6,137
Washington Township High School Stadium	-	18,207	26	-	\$4,754
TOTALS	1,261,878	13,793,403	2,092	37,296	\$ 2,527,948

Washington Township Public Schools BUILDINGS/FACILITIES		NATURAL GAS		
BUILDING/FACILITY NAME	SQFT	USAGE THERMS	USAGE BTU / SQFT	TOTAL COST \$\$
Washington Township High School	450,130	156,947	34,867	\$183,135
Chestnut Ridge Middle School	108,813	53,868	49,505	\$80,808
Orchard Valley Middle School	108,813	44,681	41,063	\$68,983
Bunker Hill Middle School	106,574	44,745	41,985	\$63,550
Thomas Jefferson Elementary School	72,396	3,542	4,892	\$5,902
Hurffville Elementary School	65,655	14,181	21,599	\$21,958
Whitman Elementary School	64,411	21,041	32,667	\$32,116
Birches Elementary School	63,411	18,915	29,829	\$29,269
Bells Elementary School	62,617	18,642	29,771	\$28,715
Wedgwood Elementary School	60,697	19,087	31,446	\$28,676
Grenloch Early Childhood Center	39,936	8,268	20,702	\$12,908
O'Brien Hall	22,900	4,679	20,431	\$5,910
Administration Building	20,000	4,089	20,446	\$6,623
Operations Building	5,625	0	0	\$0
Warehouse	5,400	2,342	43,365	\$4,097
Bus Garage	4,500	3,274	72,761	\$5,515
Washington Township High School Stadium	-	0	-	
TOTALS	1,261,878	418,298	33,149	\$578,165

Washington Township Public Schools BUILDINGS/FACILITIES		TOTAL ENERGY	TOTAL COST
BUILDING/FACILITY NAME	SQFT	USAGE BTUs	\$
Washington Township High School	450,130	35,429,418,064	\$1,208,598
Chestnut Ridge Middle School	108,813	9,867,671,596	\$316,931
Orchard Valley Middle School	108,813	9,015,354,932	\$299,145
Bunker Hill Middle School	106,574	8,410,730,624	\$263,864
Thomas Jefferson Elementary School	72,396	2,947,012,804	\$148,221
Hurffville Elementary School	65,655	3,476,704,436	\$134,827
Whitman Elementary School	64,411	3,807,328,692	\$127,823
Birches Elementary School	63,411	3,679,236,520	\$140,314
Bells Elementary School	62,617	3,583,480,448	\$129,694
Wedgwood Elementary School	60,697	3,968,817,952	\$157,426
Grenloch Early Childhood Center	39,936	1,756,674,128	\$70,391
O'Brien Hall	22,900	819,572,760	\$26,116
Administration Building	20,000	942,187,128	\$37,841
Operations Building	5,625	187,260,796	\$9,838
Warehouse	5,400	489,455,840	\$18,678
Bus Garage	4,500	449,868,032	\$11,653
Washington Township High School Stadium	-	62,122,284	\$4,754
TOTALS	1,261,878	88,892,897,036	\$3,106,113

Washington Township School District– Energy Use & Cost Index

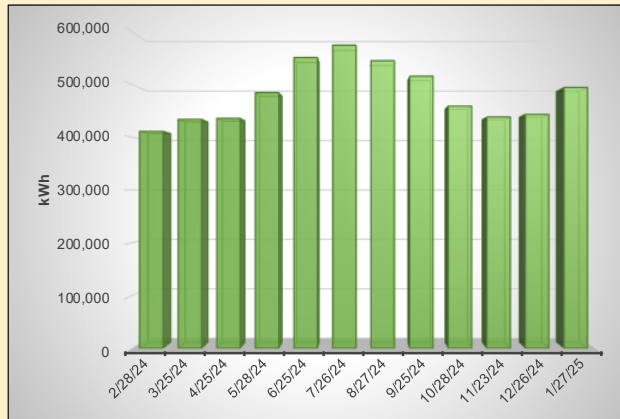
Washington Township Public Schools BUILDINGS/FACILITIES		SITE EUI		
BUILDING/FACILITY NAME	SQFT	USAGE BTU / SQFT	NATIONAL MEDIAN BTU / SQFT	NATIONAL MEDIAN +/- %
Washington Township High School	450,130	78,709	69,400	-13%
Chestnut Ridge Middle School	108,813	90,685	69,400	-31%
Orchard Valley Middle School	108,813	82,852	69,400	-19%
Bunker Hill Middle School	106,574	78,919	69,400	-14%
Thomas Jefferson Elementary School	72,396	40,707	69,400	41%
Hurffville Elementary School	65,655	52,954	69,400	24%
Whitman Elementary School	64,411	59,110	69,400	15%
Birches Elementary School	63,411	58,022	69,400	16%
Bells Elementary School	62,617	57,229	69,400	18%
Wedgwood Elementary School	60,697	65,387	69,400	6%
Grenloch Early Childhood Center	39,936	43,987	69,400	37%
O'Brien Hall	22,900	35,789	68,800	48%
Administration Building	20,000	47,109	35,600	-32%
Operations Building	5,625	33,291	35,600	6%
Warehouse	5,400	90,640	35,600	-156%
Bus Garage	4,500	99,971	35,600	-181%
Washington Township High School Stadium	-	-	-	0%
TOTALS	1,261,878	70,445	68,800	-2%

Washington Township Public Schools BUILDINGS/FACILITIES		SITE ECI		
BUILDING/FACILITY NAME	SQFT	COST \$/ SQFT	NATIONAL MEDIAN \$/ SQFT	NATIONAL MEDIAN +/- %
Washington Township High School	450,130	\$2.68	\$1.56	-72%
Chestnut Ridge Middle School	108,813	\$2.91	\$1.56	-87%
Orchard Valley Middle School	108,813	\$2.75	\$1.56	-77%
Bunker Hill Middle School	106,574	\$2.48	\$1.56	-59%
Thomas Jefferson Elementary School	72,396	\$2.05	\$1.56	-31%
Hurffville Elementary School	65,655	\$2.05	\$1.56	-32%
Whitman Elementary School	64,411	\$1.98	\$1.56	-27%
Birches Elementary School	63,411	\$2.21	\$1.56	-42%
Bells Elementary School	62,617	\$2.07	\$1.56	-33%
Wedgwood Elementary School	60,697	\$2.59	\$1.56	-67%
Grenloch Early Childhood Center	39,936	\$1.76	\$1.56	-13%
O'Brien Hall	22,900	\$1.14	\$1.54	26%
Administration Building	20,000	\$1.89	\$0.80	-137%
Operations Building	5,625	\$1.75	\$0.80	-119%
Warehouse	5,400	\$3.46	\$0.80	-333%
Bus Garage	4,500	\$2.59	\$0.80	-224%
Washington Township High School Stadium	-	-	-	0%
TOTALS	1,261,878	\$2.46	\$1.54	-59%

Washington Township High School

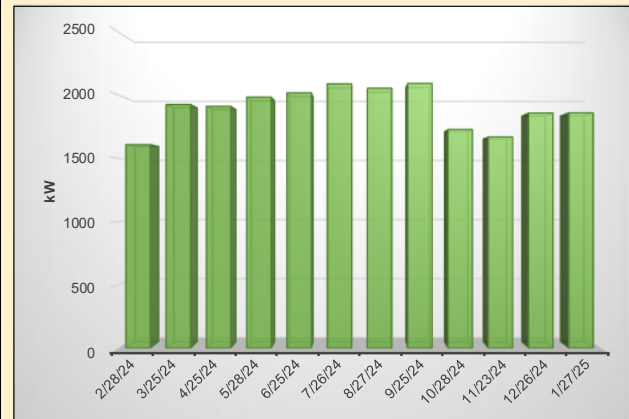
Washington Township High School

BASELINE kWh USAGE



Washington Township High School

BASELINE kW DEMAND

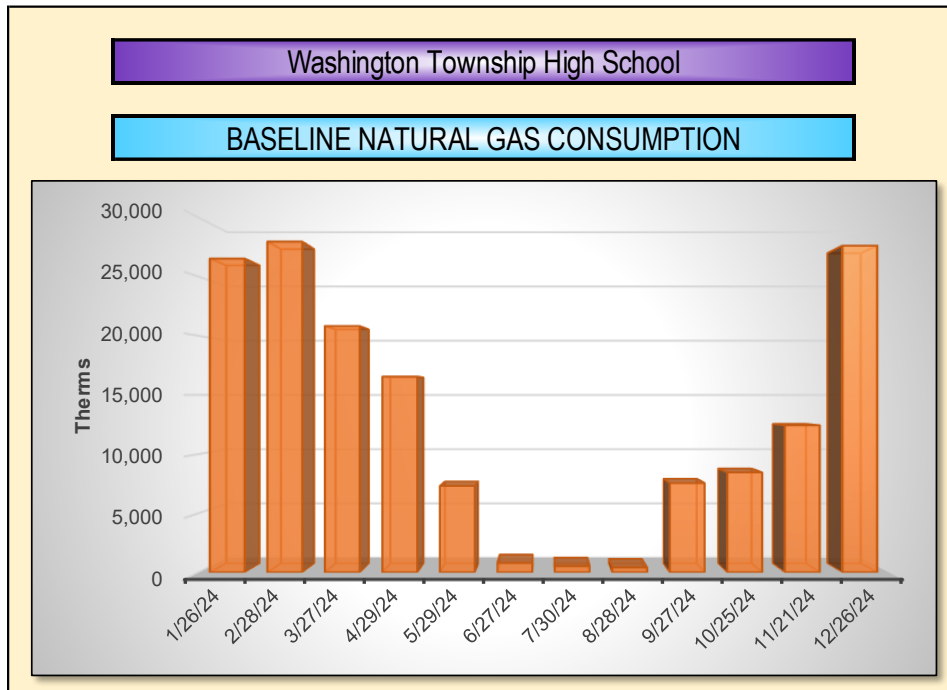


Washington Township High School					ELECTRIC METER #1						
Provider:	Atlantic City Electric			Account #	55000027346				Meter #	KZD396283470	
Commodity:				Location	9/10 Bldg				Meter #		
Billing Period Start Date	Actual Reading	Usage kWh	Demand kW	Electric Delivery Charges	Electric Commodity Charges	Electric Demand Charges	Fixed Customer Charges	Total Electric Charges	Days	Load Factor	BTU
1/27/24	2/28/24	134,700	300	\$3,295	\$12,222	\$6,266	\$213	\$21,996	33	57%	459,596,400
2/29/24	3/25/24	91,800	540	\$2,252	\$8,330	\$6,435	\$167	\$17,184	26	27%	313,221,600
3/26/24	4/25/24	125,100	462	\$2,928	\$12,032	\$7,330	\$213	\$22,503	31	36%	426,841,200
4/26/24	5/28/24	125,100	462	\$3,017	\$12,032	\$7,330	\$213	\$22,592	33	34%	426,841,200
6/26/24	6/25/24	121,800	474	\$2,710	\$11,052	\$6,083	\$180	\$20,025	0	\$0.00	415,581,600
6/26/24	7/26/24	137,307	463	\$3,141	\$12,459	\$6,575	\$200	\$22,375	31	40%	468,491,484
7/27/24	8/27/24	126,896	428	\$2,885	\$11,514	\$6,281	\$206	\$20,885	32	39%	432,969,152
8/28/24	9/25/24	121,038	467	\$2,743	\$10,983	\$6,201	\$187	\$20,114	29	37%	412,981,656
9/26/24	10/28/24	135,180	432	\$3,159	\$12,524	\$6,529	\$213	\$22,424	33	40%	461,234,160
10/29/24	11/23/24	104,061	379	\$2,396	\$9,641	\$4,557	\$167	\$16,761	26	44%	355,056,132
11/24/24	12/26/24	151,899	616	\$3,459	\$14,073	\$9,320	\$213	\$27,065	33	31%	518,279,388
12/27/24	1/27/25	177,911	649	\$4,300	\$20,289	\$9,512	\$206	\$34,308	31	37%	607,032,332
TOTALS		1,552,792	649	\$36,286	\$147,151	\$82,419	\$2,377	\$268,232	338	30%	5,298,126,304

Washington Township High School						ELECTRIC METER #2					
Provider:	Atlantic City Electric				Account #	55000309033			Meter #	KZD380390574	
Commodity:					Location	11/12 HS			Meter #		
Billing Period Start Date	Actual Reading	Usage kWh	Demand kW	Electric Delivery Charges	Electric Commodity Charges	Electric Demand Charges	Fixed Customer Charges	Total Electric Charges	Days	Load Factor	BTU
1/31/24	2/28/24	84,946	243	\$ 2,212	\$7,708	\$7,433	\$187	\$17,540	29	50%	289,835,752
2/29/24	3/27/24	81,580	319	\$ 2,157	\$7,402	\$7,180	\$180.34	\$16,920	28	38%	278,350,960
3/28/24	4/29/24	101,777	497	\$ 2,698	\$9,235	\$8,462	\$212.54	\$20,608	33	26%	347,263,124
4/30/24	5/30/24	114,172	456	\$ 2,956	\$10,360	\$7,949	\$199.66	\$21,465	31	34%	389,554,864
5/31/24	6/27/24	140,103	478	\$ 3,307	\$12,713	\$7,180	\$180.34	\$23,380	28	44%	478,031,436
6/28/24	7/30/24	182,029	559	\$ 4,260	\$16,157	\$8,462	\$212.54	\$29,091	33	41%	621,082,948
7/31/24	8/29/24	172,113	559	\$ 3,804	\$15,617	\$7,895	\$193.22	\$27,510	30	43%	587,249,556
8/30/24	9/29/24	142,034	559	\$ 3,327	\$12,888	\$7,949	\$199.66	\$24,364	31	34%	484,620,008
9/30/24	10/30/24	110,872	422	\$ 2,730	\$10,272	\$5,993	\$199.66	\$19,195	31	35%	378,295,264
10/31/24	11/26/24	88,054	438	\$ 2,201	\$8,158	\$5,415	\$173.90	\$15,948	27	31%	300,440,248
11/27/24	12/30/24	88,159	422	\$ 2,149	\$8,168	\$6,573	\$218.98	\$17,109	34	26%	300,798,508
12/31/24	1/29/25	77,580	422	\$ 2,019	\$9,752	\$5,800	\$193.22	\$17,765	31	25%	264,702,960
TOTALS		1,383,419	559	\$33,820	\$128,429	\$86,293	\$2,351	\$250,893	366	28%	4,720,225,628

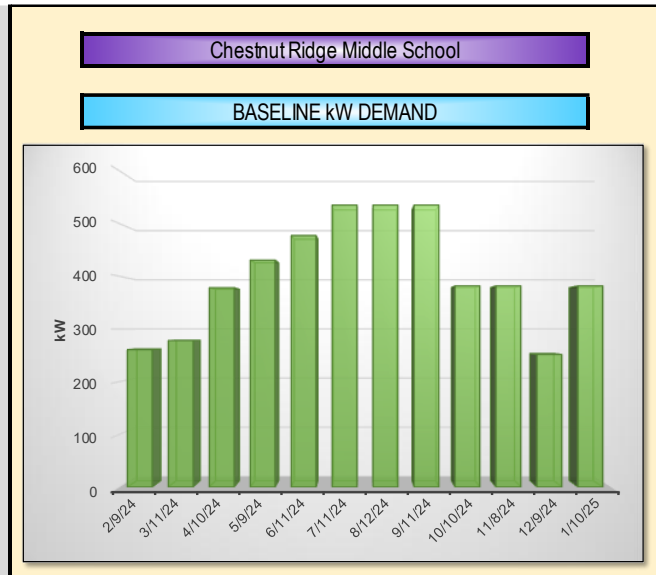
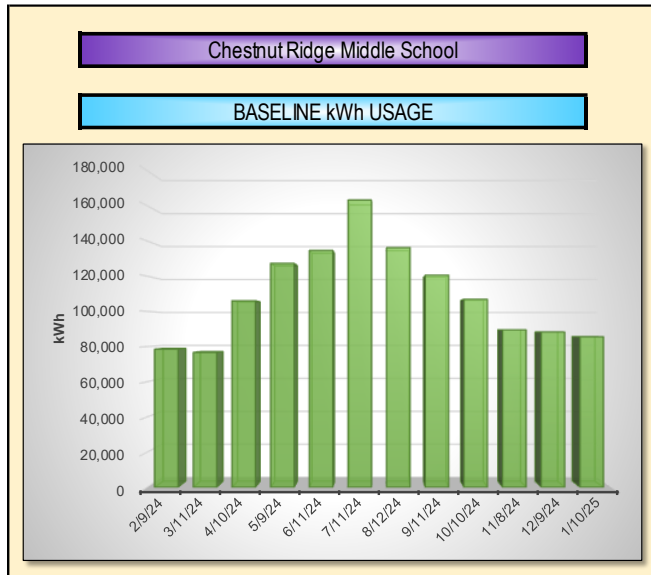
Washington Township High School						ELECTRIC METER #3					
Provider:	Atlantic City Electric				Account #	55000027619			Meter #	KZD310023292	
Commodity:					Location	11/12 Link			Meter #		
Billing Period Start Date	Actual Reading	Usage kWh	Demand kW	Electric Delivery Charges	Electric Commodity Charges	Electric Demand Charges	Fixed Customer Charges	Total Electric Charges	Days	Load Factor	BTU
12/28/23	1/26/24	134,100	739	\$3,242	\$12,168	\$10,134	\$193	\$25,738	30	25%	457,549,200
1/27/24	2/28/24	192,000	739	\$4,837	\$17,421	\$11,156	\$213	\$33,626	33	33%	655,104,000
2/29/24	3/25/24	154,800	739	\$3,791	\$14,046	\$8,809	\$167	\$26,814	26	34%	528,177,600
3/26/24	4/25/24	181,455	739	\$4,389	\$16,465	\$10,580	\$200	\$31,634	31	33%	619,124,460
4/26/24	5/28/24	222,133	739	\$5,431	\$20,156	\$11,180	\$213	\$36,979	33	38%	757,917,796
5/29/24	6/25/24	187,812	739	\$4,266	\$17,042	\$9,486	\$180	\$30,975	28	38%	640,814,544
6/26/24	7/26/24	185,141	739	\$4,173	\$16,799	\$10,503	\$200	\$31,675	31	34%	631,701,092
7/27/24	8/27/24	190,840	739	\$4,278	\$17,316	\$10,842	\$206	\$32,642	32	34%	651,146,080
8/28/24	9/25/24	155,090	548	\$3,497	\$14,073	\$7,287	\$187	\$25,043	29	41%	529,167,080
9/26/24	10/28/24	174,696	618	\$13,604	\$16,185	\$9,415	\$213	\$39,416	33	36%	596,062,752
10/29/24	11/23/24	143,677	584	\$3,371	\$13,311	\$6,954	\$167	\$23,803	26	39%	490,225,924
11/24/24	12/26/24	161,440	564	\$3,784	\$14,957	\$8,529	\$213	\$27,482	31	38%	550,833,280
TOTALS		2,083,184	739	\$58,664	\$189,939	\$114,874	\$2,351	\$365,828	363	32%	7,107,823,808

Washington Township High School					ELECTRIC METER #4						
Provider:	Atlantic City Electric			Account #	55000028898			Meter #	KZD396283459		
Commodity:				Location	11/12 Bldg			Meter #			
Billing Period Start Date	Actual Reading	Usage kWh	Demand kW	Electric Delivery Charges	Electric Commodity Charges	Electric Demand Charges	Fixed Customer Charges	Total Electric Charges	Days	Load Factor	BTU
12/28/23	1/26/24	57,300	326	\$1,549	\$5,199	\$4,423	\$193	\$11,364	30	24%	195,507,600
1/27/24	2/28/24	68,400	326	\$1,678	\$6,206	\$4,926	\$213	\$13,023	33	26%	233,380,800
2/29/24	3/25/24	54,000	213	\$1,325	\$4,900	\$3,890	\$167	\$10,282	26	41%	184,248,000
3/26/24	4/25/24	63,592	326	\$1,541	\$5,770	\$4,638	\$200	\$12,148	31	26%	216,975,904
4/26/24	5/28/24	66,823	326	\$1,647	\$6,063	\$4,937	\$180	\$12,828	33	26%	228,000,076
5/29/24	6/25/24	67,053	326	\$1,482	\$6,084	\$4,189	\$180	\$11,935	28	31%	228,784,836
6/26/24	7/26/24	60,564	326	\$1,328	\$5,495	\$4,638	\$200	\$11,660	31	25%	206,644,368
7/27/24	8/30/24	61,435	326	\$1,334	\$5,574	\$4,787	\$206	\$11,902	35	22%	209,616,220
8/31/24	9/25/24	57,625	326	\$1,250	\$5,230	\$4,338	\$187	\$11,004	26	28%	196,616,500
9/26/24	10/28/24	71,312	234	\$4,817	\$6,607	\$352	\$213	\$11,989	33	38%	243,316,544
10/29/24	11/23/24	59,345	236	\$1,364	\$5,498	\$2,814	\$167	\$9,843	26	40%	202,485,140
11/24/24	12/26/24	77,078	225	\$1,774	\$7,141	\$3,403	\$213	\$12,531	31	46%	262,990,136
TOTALS		764,527	326	\$21,089	\$69,769	\$47,334	\$2,319	\$140,510	363	27%	2,608,566,124



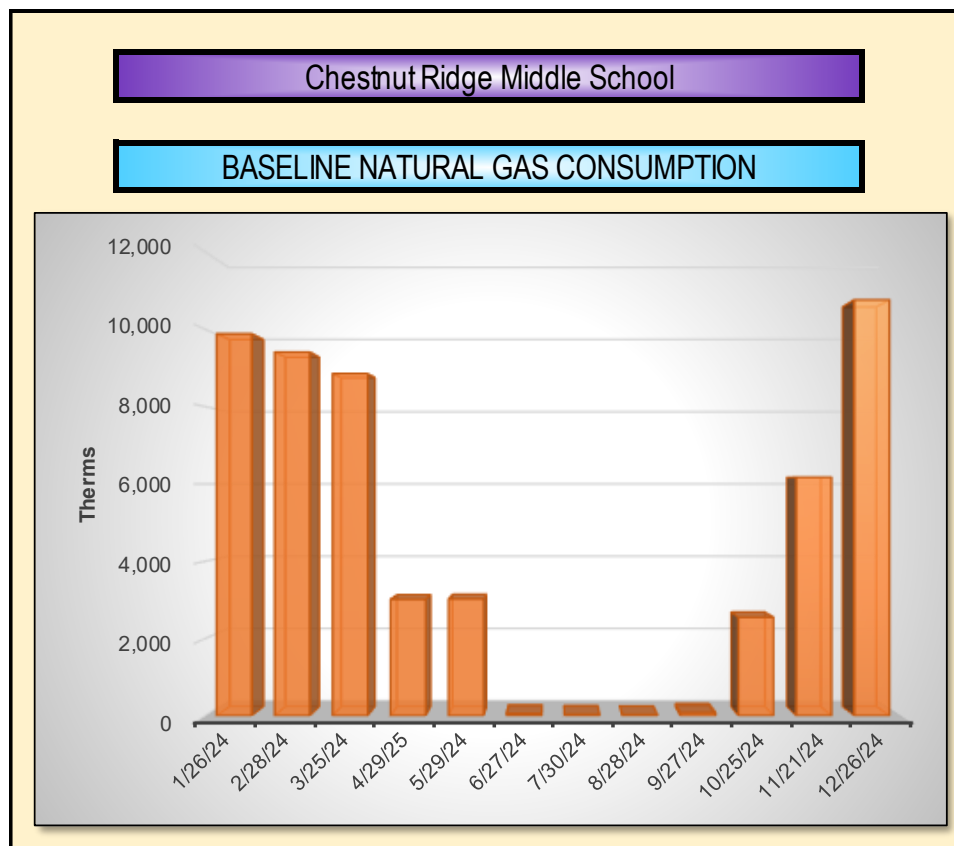
Washington Township High School						Natural Gas Meter #1		
Provider	SJG		Account #	4856710465		Meter #	636770	
Commodity			Account #			Meter #		
Billing Period Start Date	Actual Reading	Therms	Gas Delivery Charges	Gas Commodity Charges	Fixed Customer Charge	Gas Total Charges	Cost/Therm Checksum	BTU
12/27/23	1/26/24	26,527	\$18,508	\$11,971	\$217	\$30,695	\$1.15	2,652,743,500
1/27/24	2/28/24	27,966	\$19,851	\$12,063	\$251	\$32,166	\$1.14	2,796,615,600
2/29/24	3/27/24	20,825	\$14,838	\$8,430	\$203	\$23,472	\$1.12	2,082,548,000
3/28/24	4/29/24	16,556	\$12,009	\$6,702	\$253	\$18,963	\$1.13	1,655,627,700
4/30/24	5/29/24	7,303	\$5,783	\$2,220	\$225	\$8,228	\$1.10	730,330,900
5/30/24	6/27/24	792	\$1,409	\$333	\$213	\$1,956	\$2.20	79,233,100
6/28/24	7/30/24	525	\$1,242	\$233	\$338	\$1,813	\$2.81	52,479,500
7/31/24	8/28/24	412	\$1,058	\$190	\$293	\$1,541	\$3.03	41,160,200
8/29/24	9/27/24	7,543	\$5,862	\$2,343	\$309	\$8,514	\$1.09	754,257,200
9/28/24	10/25/24	8,450	\$6,419	\$3,282	\$283	\$9,984	\$1.15	845,016,000
10/26/24	11/21/24	12,430	\$9,032	\$4,942	\$278	\$14,252	\$1.12	1,243,032,500
11/22/24	12/26/24	27,616	\$19,936	\$11,270	\$346	\$31,552	\$1.13	2,761,632,000
TOTALS		156,947	\$115,946	\$63,980	\$3,208	\$183,135	\$1.15	15,694,676,200

Chestnut Ridge Middle School



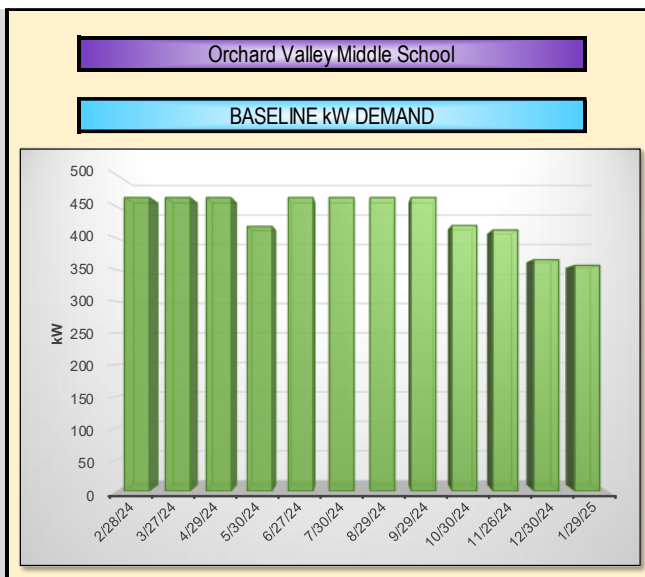
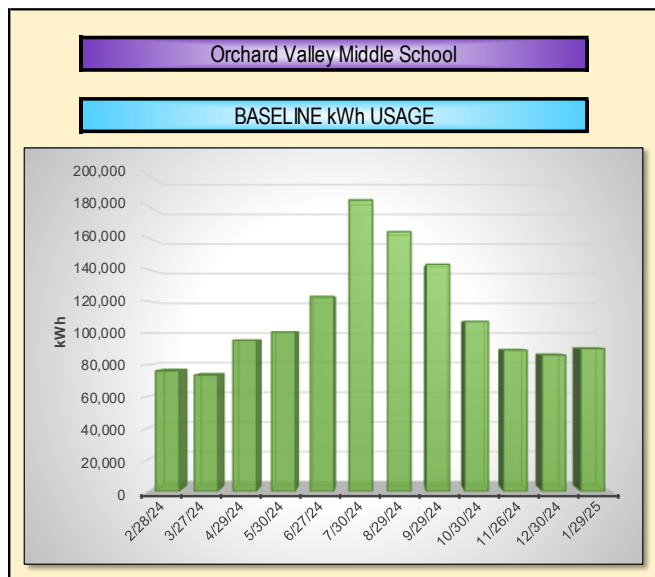
Chestnut Ridge Middle School					ELECTRIC METER #1						
Provider:	Atlantic City Electric			Account #	55010588014				Meter #	N/A	
Commodity:				Location					Meter #		
Billing Period Start Date	Actual Reading	Usage kWh	Demand kW	Electric Delivery Charges	Electric Commodity Charges	Electric Demand Charges	Fixed Customer Charges	Total Electric Charges	Days	Load Factor	BTU
1/11/24	2/9/24	571		\$32	\$86		\$5	\$123	30	\$0.00	1,948,252
2/10/24	3/11/24	559		\$32	\$88		\$5	\$125	31	\$0.00	1,907,308
3/12/24	4/10/24	553		\$31	\$87		\$6	\$124	30	\$0.00	1,886,836
4/11/24	5/9/24	535		\$30	\$84		\$6	\$119	29	\$0.00	1,825,420
5/10/24	6/11/24	608		\$33	\$99		\$7	\$140	33	\$0.00	2,074,496
6/12/24	7/11/24	553		\$31	\$62		\$5	\$98	30	\$0.00	1,886,836
7/12/24	8/12/24	590		\$39	\$66		\$5	\$110	32	\$0.00	2,013,080
8/13/24	9/11/24	553		\$31	\$62		\$5	\$98	30	\$0.00	1,886,836
9/12/24	10/10/24	553		\$31	\$55		\$5	\$91	29	\$0.00	1,886,836
10/11/24	11/8/24	553		\$31	\$55		\$5	\$91	29	\$0.00	1,886,836
11/9/24	12/9/24	553		\$32	\$52		\$5	\$89	31	\$0.00	1,886,836
12/10/24	1/10/25	590		\$34	\$56		\$5	\$95	32	\$0.00	2,013,080
TOTALS		6,771	0	\$386	\$851	\$0	\$66	\$1,303	366	\$0.00	23,102,652

Chestnut Ridge Middle School						ELECTRIC METER #2					
Provider:	Atlantic City Electric				Account #	55010588428			Meter #	KZD381145757	
Commodity:					Location				Meter #		
Billing Period Start Date	Actual Reading	Usage kWh	Demand kW	Electric Delivery Charges	Electric Commodity Charges	Electric Demand Charges	Fixed Customer Charges	Total Electric Charges	Days	Load Factor	BTU
1/31/24	2/28/24	77,975	261	1,917	\$7,075	\$7,109	\$187	\$16,288	29	43%	266,050,700
2/29/24	3/27/24	76,115	278	1,871	\$6,906.52	\$6,867.17	\$180.34	\$15,826	28	41%	259,704,380
3/28/24	4/29/24	105,442	378	2,554	\$9,567.59	\$8,093.45	\$212.54	\$20,428	33	35%	359,768,104
4/30/24	5/30/24	126,786	431	3,059	\$11,504.29	\$7,602.93	\$199.66	\$22,366	31	40%	432,593,832
5/31/24	6/27/24	134,059	477	2,961	\$12,164.23	\$6,867.17	\$180.34	\$22,173	28	42%	457,409,308
6/28/24	7/30/24	162,673	535	3,586	\$14,760.60	\$8,093.45	\$212.54	\$26,653	33	38%	555,040,276
7/31/24	8/29/24	135,602	535	2,979	\$12,304.24	\$7,357.68	\$193.22	\$22,835	30	35%	462,674,024
8/30/24	9/29/24	119,958	535	2,622	\$10,884.73	\$7,602.93	\$199.66	\$21,310	31	30%	409,296,696
9/30/24	10/30/24	106,319	382	2,433	\$9,850.08	\$5,425.31	\$199.66	\$17,908	31	37%	362,760,428
10/31/24	11/26/24	88,932	382	2,035	\$8,239.24	\$4,730.56	\$173.90	\$15,179	27	36%	303,435,984
11/27/24	12/30/24	87,709	252	1,990	\$8,125.93	\$5,950.34	\$218.98	\$16,285	34	43%	299,263,108
12/31/24	1/29/25	84,942	382	2,051	\$10,075.20	\$5,250.30	\$193.22	\$17,570	30	31%	289,822,104
TOTALS		1306512	535	\$30,062	\$121,458	\$80,950	\$2,351	\$234,820	365	28%	4,457,818,944

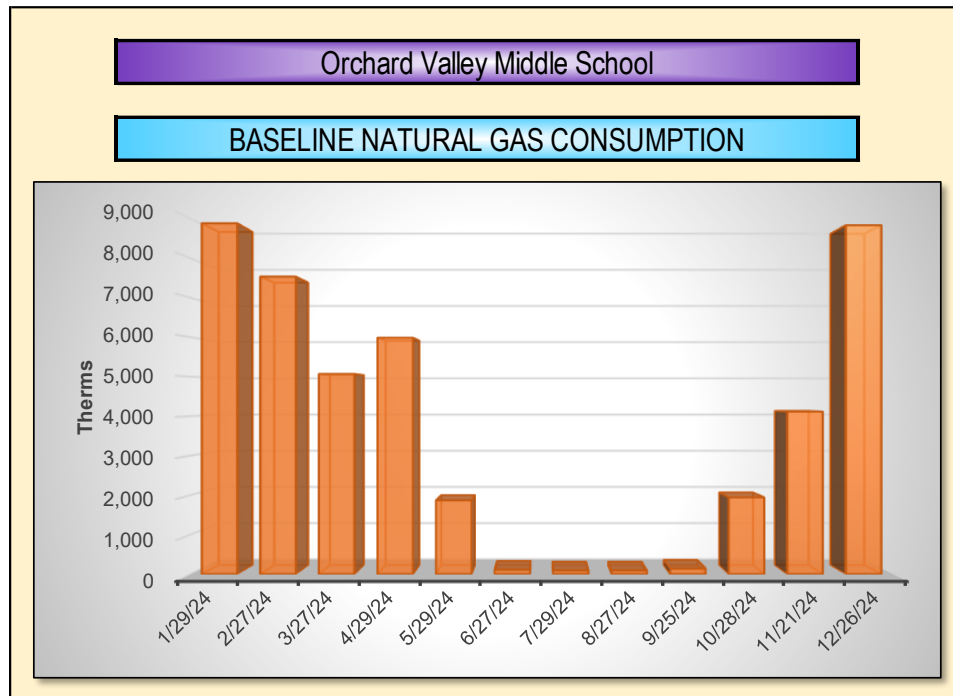


Chestnut Ridge Middle School						Natural Gas Meter #1		
Provider	SJG		Account #	5060032016			Meter #	573961
Commodity			Account #				Meter #	
Billing Period Start Date	Actual Reading	Therms	Gas Delivery Charges	Gas Commodity Charges	Fixed Customer Charge	Gas Total Charges	Cost/Therm Checksum	BTU
12/27/23	1/26/24	9,886	\$10,687	\$4,301	\$41	\$15,028	\$1.52	988,581,000
1/27/24	2/28/24	9,412	\$10,292	\$3,982	\$45	\$14,319	\$1.52	941,184,000
2/29/24	3/25/24	8,856	\$9,704	\$3,230	\$35	\$12,970	\$1.46	885,598,000
3/26/24	4/29/25	3,015	\$3,304	\$1,100	\$47	\$4,451	\$1.46	301,476,000
4/30/25	5/29/24	3,027	\$3,317	\$899	\$41	\$4,256	\$1.39	302,669,000
5/30/24	6/27/24	51	\$56	\$23	\$39	\$119	\$1.54	5,145,000
6/28/24	7/30/24	31	\$34	\$15	\$45	\$93	\$1.58	3,087,000
7/31/24	8/28/24	21	\$23	\$9	\$39	\$71	\$1.54	2,058,000
8/29/24	9/27/24	82	\$90	\$39	\$41	\$170	\$1.57	8,232,000
9/28/24	10/25/24	2,549	\$2,781	\$1,202	\$38	\$4,021	\$1.56	254,944,000
10/26/24	11/21/24	6,174	\$6,731	\$2,323	\$36	\$9,090	\$1.47	617,400,000
11/22/24	12/26/24	10,764	\$11,781	\$4,392	\$47	\$16,221	\$1.50	1,076,376,000
TOTALS		53,868	\$58,800	\$21,516	\$493	\$80,808	\$1.49	5,386,750,000

Orchard Valley Middle School

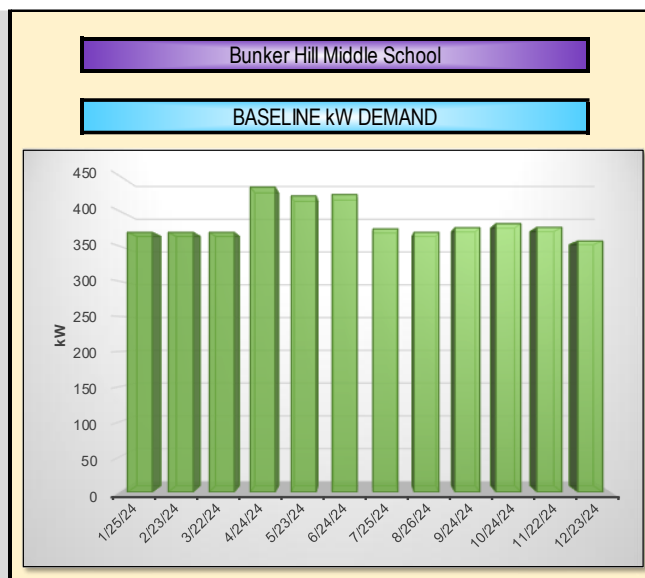
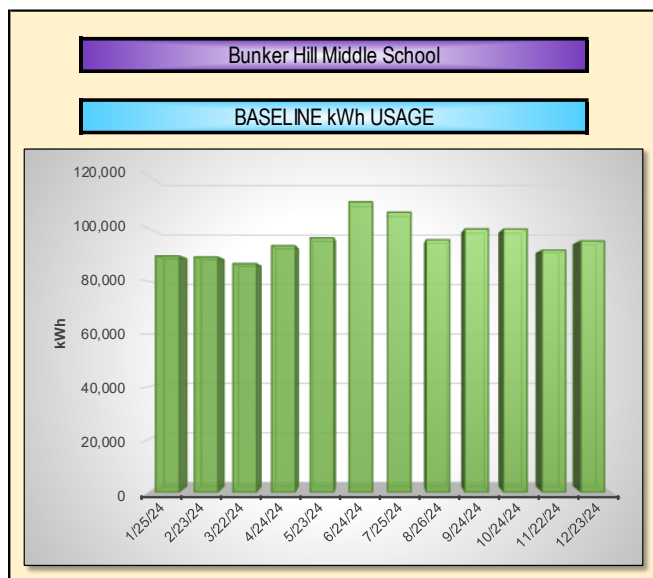


Orchard Valley Middle School				ELECTRIC METER #1							
Provider:	Atlantic City Electric			Account #	55010983892				Meter #	KZD385269163	
Commodity:				Location					Meter #		
Billing Period Start Date	Actual Reading	Usage kWh	Demand kW	Electric Delivery Charges	Electric Commodity Charges	Electric Demand Charges	Fixed Customer Charges	Total Electric Charges	Days	Load Factor	BTU
1/31/24	2/28/24	76,099	464	\$1,869	\$6,905	\$6,164	\$187	\$15,125	29	24%	259,649,788
2/29/24	3/27/24	73,366	464	\$1,802	\$6,657	\$5,955	\$180	\$14,594	28	24%	250,324,792
3/28/24	4/29/24	95,378	464	\$2,310	\$8,654	\$7,018	\$213	\$18,195	33	26%	325,429,736
4/30/24	5/30/24	100,688	419	\$2,431	\$9,136	\$6,593	\$200	\$18,360	31	32%	343,547,456
5/31/24	6/27/24	123,130	464	\$2,724	\$11,173	\$5,955	\$180	\$20,032	28	39%	420,119,560
6/28/24	7/30/24	183,962	464	\$4,083	\$16,692	\$7,018	\$213	\$28,006	33	50%	627,678,344
7/31/24	8/29/24	163,956	464	\$3,639	\$14,877	\$6,380	\$193	\$25,089	30	49%	559,417,872
8/30/24	9/29/24	143,339	464	\$3,166	\$13,006	\$6,593	\$200	\$22,965	31	42%	489,072,668
9/30/24	10/30/24	107,337	420	\$2,450	\$9,944	\$5,967	\$200	\$18,561	31	34%	366,233,844
10/31/24	11/26/24	89,190	413	\$2,036	\$8,263	\$5,107	\$174	\$15,580	27	33%	304,316,280
11/27/24	12/30/24	86,081	366	\$1,955	\$7,975	\$5,700	\$219	\$15,848	34	29%	293,708,372
12/31/24	1/29/25	90,185	357	\$2,186	\$10,399	\$5,029	\$193	\$17,806	30	35%	307,711,220
TOTALS		1,332,711	464	\$30,650	\$123,682	\$73,479	\$2,351	\$230,162	365	33%	4,547,209,932

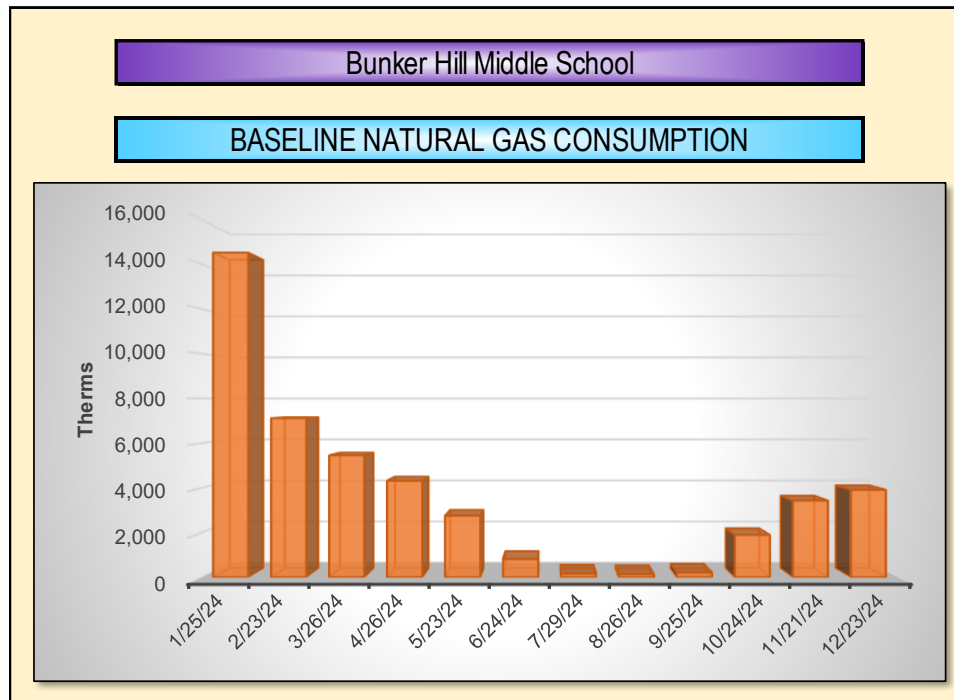


Orchard Valley Middle School						Natural Gas Meter #1		
Provider	SJG		Account #	1563720000		Meter #	573954	
Commodity			Account #			Meter #		
Billing Period Start Date	Actual Reading	Therms	Gas Delivery Charges	Gas Commodity Charges	Fixed Customer Charge	Gas Total Charges	Cost/Therm Checksum	BTU
12/22/23	1/29/24	8,884	\$9,604	\$4,083	\$51	\$13,738	\$1.54	888,380,000
1/30/24	2/27/24	7,534	\$8,248	\$3,441	\$39	\$11,728	\$1.55	753,360,000
2/28/24	3/27/24	5,071	\$5,596	\$2,411	\$39	\$8,046	\$1.58	507,093,000
3/28/24	4/29/24	5,988	\$6,562	\$2,848	\$45	\$9,454	\$1.57	598,808,000
4/30/24	5/29/24	1,870	\$2,089	\$605	\$41	\$2,735	\$1.44	186,973,000
5/30/24	6/27/24	113	\$124	\$50	\$39	\$214	\$1.54	11,319,000
6/28/24	7/29/24	93	\$101	\$43	\$43	\$188	\$1.56	9,261,000
7/30/24	8/27/24	93	\$101	\$43	\$39	\$184	\$1.56	9,261,000
8/28/24	9/25/24	144	\$158	\$67	\$39	\$264	\$1.56	14,406,000
9/26/24	10/28/24	1,943	\$2,120	\$822	\$45	\$2,986	\$1.51	194,292,000
10/29/24	11/21/24	4,116	\$4,487	\$1,643	\$32	\$6,163	\$1.49	411,600,000
11/22/24	12/26/24	8,834	\$9,630	\$3,605	\$47	\$13,282	\$1.50	883,392,000
TOTALS		44,681	\$48,820	\$19,663	\$499	\$68,983	\$1.53	4,468,145,000

Bunker Hill Middle School



Bunker Hill Middle School					ELECTRIC METER #1						
Provider:	Atlantic City Electric			Account #	55000027924				Meter #	KZD310024932	
Commodity:				Location					Meter #		
Billing Period Start Date	Actual Reading	Usage kWh	Demand kW	Electric Delivery Charges	Electric Commodity Charges	Electric Demand Charges	Fixed Customer Charges	Total Electric Charges	Days	Load Factor	BTU
12/22/23	1/25/24	89,600	370	\$2,125	\$8,130	\$5,935	\$225	\$16,416	35	29%	305,715,200
1/26/24	2/23/24	89,178	370	\$2,184	\$8,092	\$4,958	\$187	\$15,420	29	35%	304,275,336
2/24/24	3/22/24	86,657	370	\$2,122	\$7,862	\$4,793	\$180	\$14,957	28	35%	295,673,684
3/23/24	4/24/24	93,451	434	\$2,266	\$8,480	\$6,658	\$213	\$17,617	33	27%	318,854,812
4/25/24	5/23/24	96,427	421	\$2,326	\$8,750	\$5,684	\$187	\$16,947	29	33%	329,008,924
5/24/24	6/24/24	110,038	423	\$2,559	\$9,985	\$6,209	\$206	\$18,959	32	34%	375,449,656
6/25/24	7/25/24	106,121	375	\$2,459	\$9,629	\$5,322	\$200	\$17,610	31	38%	362,084,852
7/26/24	8/26/24	95,692	370	\$2,220	\$8,683	\$5,421	\$206	\$16,530	32	34%	326,501,104
8/27/24	9/24/24	99,764	376	\$2,293	\$9,052	\$5,001	\$187	\$16,533	29	38%	340,394,768
9/25/24	10/24/24	99,733	382	\$2,266	\$9,240	\$5,349	\$193	\$17,048	30	36%	340,288,996
10/25/24	11/22/24	91,765	377	\$2,198	\$8,502	\$5,004	\$187	\$15,891	29	35%	313,102,180
11/23/24	12/23/24	95,226	357	\$2,288	\$8,822	\$5,076	\$200	\$16,386	31	36%	324,911,112
TOTALS		1,153,652	434	\$27,307	\$105,226	\$65,411	\$2,370	\$200,314	368	30%	3,936,260,624

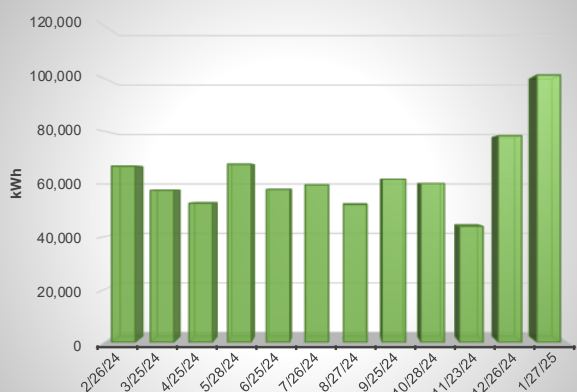


Bunker Hill Middle School						Natural Gas Meter #1		
Provider	SJG		Account #	6272520000			Meter #	622946
Commodity			Account #				Meter #	
Billing Period Start Date	Actual Reading	Therms	Gas Delivery Charges	Gas Commodity Charges	Fixed Customer Charge	Gas Total Charges	Cost/Therm Checksum	BTU
12/21/23	1/25/24	14,524	\$15,701	\$5,819	\$47	\$21,568	\$1.48	1,452,398,000
1/26/24	2/23/24	7,121	\$7,781	(\$86)	\$39	\$7,734	\$1.08	712,080,000
2/24/24	3/26/24	5,455	\$5,977	\$2,118	\$43	\$8,138	\$1.48	545,462,000
3/27/24	4/26/24	4,320	\$4,734	\$1,677	\$42	\$6,453	\$1.48	432,012,000
4/27/24	5/23/24	2,758	\$3,022	\$793	\$36	\$3,852	\$1.38	275,811,000
5/24/24	6/24/24	813	\$891	\$23	\$43	\$957	\$1.12	81,291,000
6/25/24	7/29/24	165	\$180	\$74	\$47	\$301	\$1.54	16,464,000
7/30/24	8/26/24	144	\$158	\$67	\$38	\$263	\$1.56	14,406,000
8/27/24	9/25/24	216	\$237	\$101	\$41	\$378	\$1.56	21,609,000
9/26/24	10/24/24	1,892	\$2,064	\$738	\$39	\$2,841	\$1.48	189,152,000
10/25/24	11/21/24	3,427	\$3,773	\$1,317	\$38	\$5,128	\$1.49	342,657,000
11/22/24	12/23/24	3,911	\$4,307	\$1,586	\$43	\$5,937	\$1.51	391,128,000
TOTALS		44,745	\$48,826	\$14,228	\$497	\$63,550	\$1.41	4,474,470,000

Thomas Jefferson Elementary School

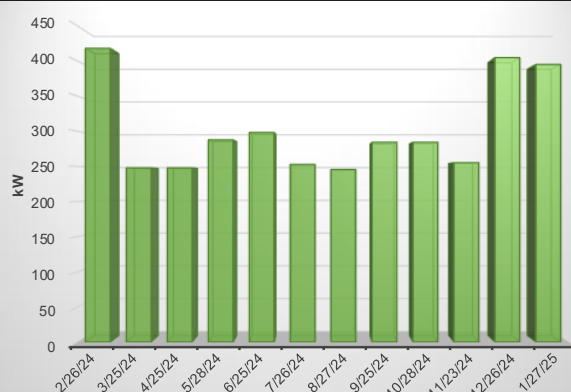
Thomas Jefferson Elementary School

BASELINE kWh USAGE

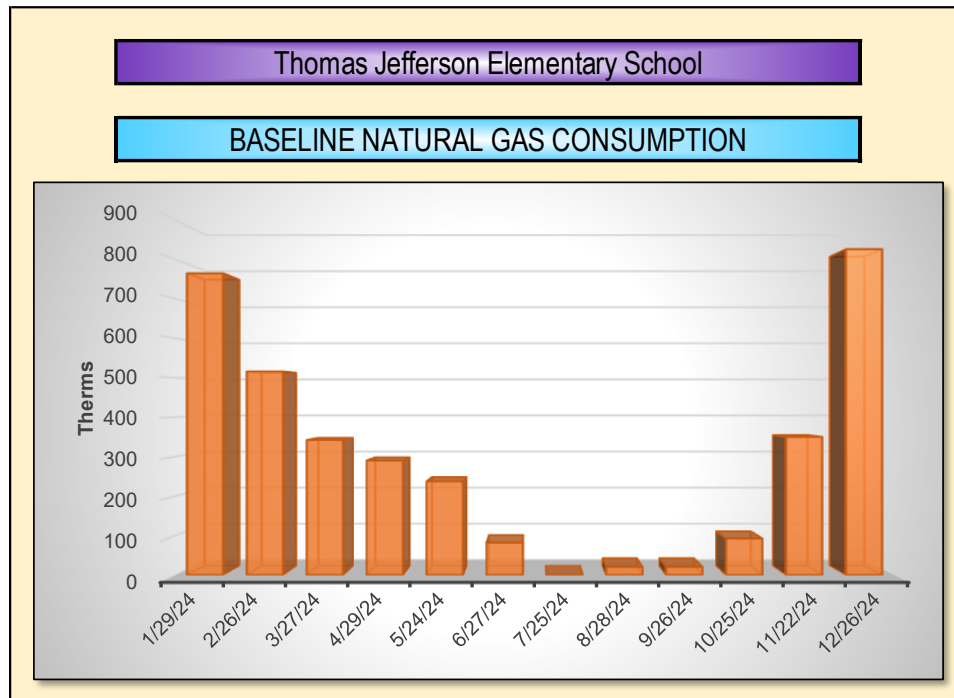


Thomas Jefferson Elementary School

BASELINE kW DEMAND



Thomas Jefferson Elementary School					ELECTRIC METER #1						
Provider:	Atlantic City Electric			Account #	55000309652				Meter #	KZD310020930	
Commodity:				Location					Meter #		
Billing Period Start Date	Actual Reading	Usage kWh	Demand kW	Electric Delivery Charges	Electric Commodity Charges	Electric Demand Charges	Fixed Customer Charges	Total Electric Charges	Days	Load Factor	BTU
1/30/24	2/26/24	66,800	418	\$1,641	\$6,061	\$5,359	\$180	\$13,241	28	24%	227,921,600
2/27/24	3/25/24	57,600	248	\$1,410	\$5,227	\$3,183	\$180	\$10,000	28	35%	196,531,200
3/26/24	4/25/24	52,675	248	\$1,276	\$4,780	\$3,524	\$200	\$9,779	31	29%	179,727,100
4/26/24	5/28/24	67,521	288	\$1,630	\$6,127	\$4,353	\$213	\$12,322	33	30%	230,381,652
5/29/24	6/25/24	57,933	298	\$1,280	\$5,257	\$3,829	\$180	\$10,546	28	29%	197,667,396
6/26/24	7/26/24	59,666	253	\$1,306	\$5,414	\$3,594	\$200	\$10,514	31	32%	203,580,392
7/27/24	8/27/24	52,187	246	1,135	\$4,735	\$3,637	\$206	\$9,714	32	28%	178,062,044
8/28/24	9/25/24	61,815	284	\$1,352	\$5,609	\$3,779	\$187	\$10,927	29	31%	210,912,780
9/26/24	10/28/24	60,217	284	\$1,355	\$5,579	\$4,301	\$213	\$11,448	33	27%	205,460,404
10/29/24	11/23/24	43,943	255	\$996	\$4,071	\$3,043	\$167	\$8,278	26	28%	149,933,516
11/24/24	12/26/24	78,292	405	1,765	\$7,253	\$6,122	\$213	\$15,353	33	24%	267,132,304
12/27/24	1/27/25	101,268	395	\$2,444	\$11,756	\$5,793	\$206	\$20,199	32	33%	345,526,416
TOTALS		759,917	418	\$17,590	\$71,869	\$50,517	\$2,344	\$142,320	364	21%	2,592,836,804

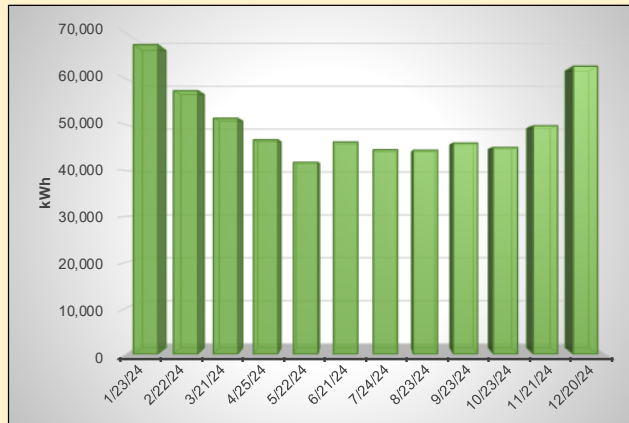


Thomas Jefferson Elementary School						Natural Gas Meter #1		
Provider	SJG		Account #	9574720000		Meter #	623406	
Commodity			Account #			Meter #		
Billing Period Start Date	Actual Reading	Therms	Gas Delivery Charges	Gas Commodity Charges	Fixed Customer Charge	Gas Total Charges	Cost/Therm Checksum	BTU
12/27/23	1/29/24	764	\$826	\$354	\$45	\$1,225	\$1.54	76,442,000
1/30/24	2/26/24	516	\$565	\$248	\$38	\$851	\$1.58	51,600,000
2/27/24	3/27/24	342	\$375	\$167	\$41	\$582	\$1.58	34,221,000
3/28/24	4/29/24	290	\$318	\$142	\$45	\$504	\$1.58	29,008,000
4/30/24	5/24/24	238	\$260	\$68	\$34	\$362	\$1.38	23,759,000
5/25/24	6/27/24	82	\$90	\$34	\$46	\$171	\$1.51	8,232,000
6/28/24	7/25/24	0	\$0	\$0	\$38	\$38	\$0.00	0
7/26/24	8/28/24	21	\$23	\$10	\$46	\$78	\$1.57	2,058,000
8/29/24	9/26/24	21	\$23	\$7	\$39	\$68	\$1.41	2,058,000
9/27/24	10/25/24	93	\$101	\$40	\$39	\$180	\$1.52	9,252,000
10/26/24	11/22/24	350	\$381	\$140	\$38	\$559	\$1.49	34,986,000
11/23/24	12/26/24	826	\$900	\$339	\$46	\$1,284	\$1.50	82,560,000
TOTALS		3,542	\$3,862	\$1,547	\$493	\$5,902	\$1.53	354,176,000

Hurffville Elementary School

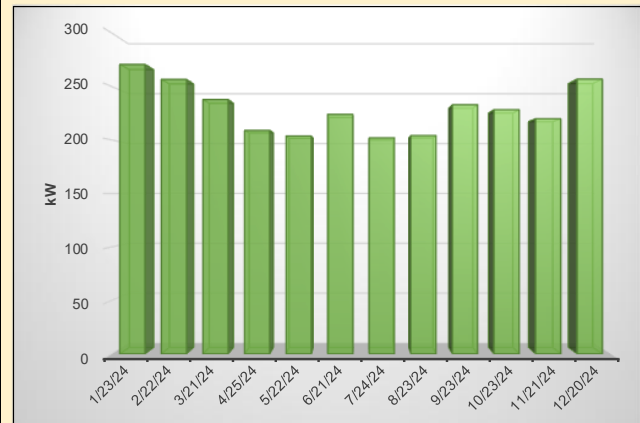
Hurffville Elementary School

BASELINE kWh USAGE



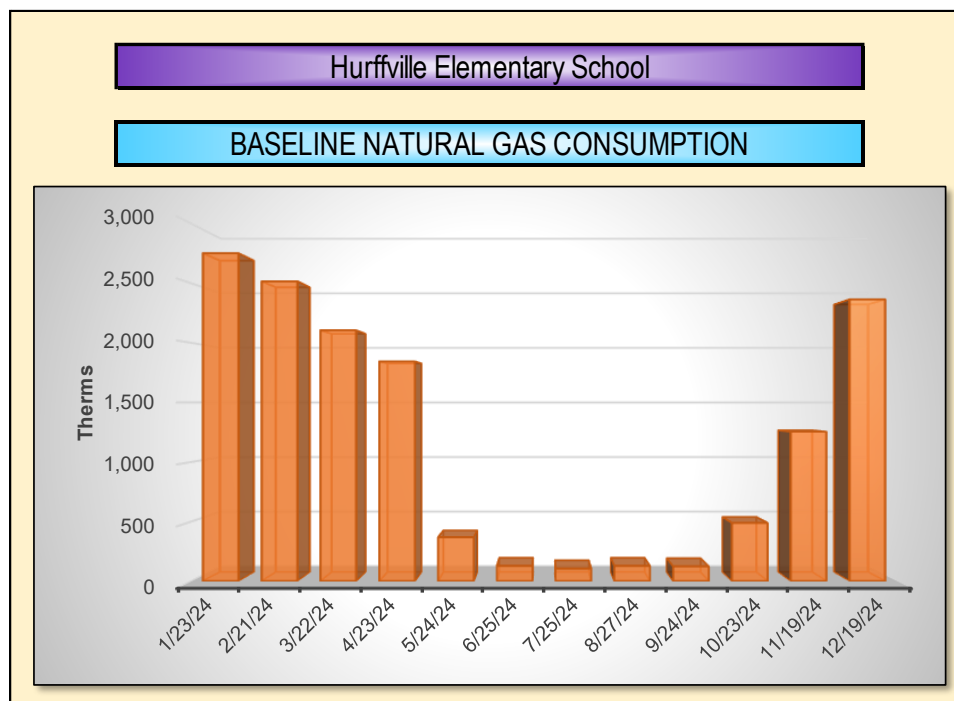
Hurffville Elementary School

BASELINE kW DEMAND



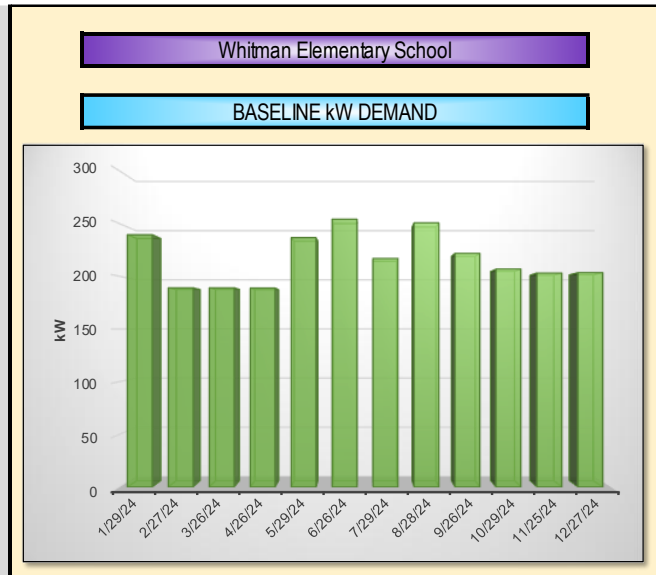
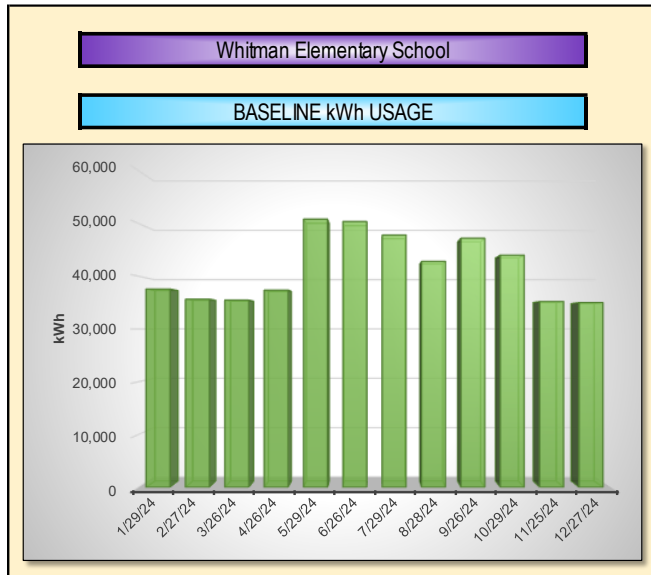
Hurffville Elementary School					ELECTRIC METER #1							
Provider:	Atlantic City Electric			Account #	55002762700				Meter #	Meter #	KZD310020952	
Commodity:				Location					Meter #	Meter #		
Billing Period Start Date	Actual Reading	Usage kWh	Demand kW	Electric Delivery Charges	Electric Commodity Charges	Electric Demand Charges	Fixed Customer Charges	Total Electric Charges	Cost / kWh Checksum	Days	Load Factor	BTU
12/20/23	1/23/24	58,000	238	\$1,367	\$5,263	\$3,756	\$225	\$10,611	\$0.114	35	29%	197,896,000
1/24/24	2/22/24	49,600	238	\$1,216	\$4,501	\$3,145	\$187	\$9,049	\$0.115	30	29%	169,235,200
2/23/24	3/21/24	46,880	190	\$1,148	\$4,254	\$2,526	\$187	\$8,115	\$0.115	28	37%	159,954,560
3/22/24	4/25/24	44,689	172	\$1,084	\$4,055	\$2,875	\$213	\$8,226	\$0.115	35	31%	152,478,868
4/26/24	5/22/24	39,373	188	\$951	\$3,573	\$2,526	\$187	\$7,236	\$0.115	27	32%	134,340,676
5/23/24	6/21/24	42,462	203	\$955	\$3,853	\$2,788	\$193	\$7,789	\$0.113	30	29%	144,880,344
6/22/24	7/24/24	42,426	190	\$924	\$3,850	\$2,875	\$213	\$7,861	\$0.113	33	28%	144,757,512
7/25/24	8/23/24	42,140	190	\$921	\$3,824	\$2,614	\$193	\$7,552	\$0.113	30	31%	143,781,680
8/24/24	9/23/24	43,911	198	\$959	\$3,984	\$2,814	\$200	\$7,957	\$0.113	31	30%	149,824,332
9/24/24	10/23/24	40,527	195	\$911	\$3,755	\$2,679	\$193	\$7,538	\$0.115	30	29%	138,278,124
10/24/24	11/21/24	38,773	183	\$882	\$3,592	\$2,435	\$187	\$7,096	\$0.115	29	30%	132,293,476
11/22/24	12/20/24	46,234	207	\$1,054	\$4,283	\$2,751	\$187	\$8,275	\$0.115	29	32%	157,750,408
TOTALS		535,015	238	\$12,372	\$48,786	\$33,784	\$2,364	\$97,305	\$0.114	367	26%	1,825,471,180

Hurffville Elementary School						ELECTRIC METER #2					
Provider:	Atlantic City Electric				Account #	55034810055			Meter #	KZD310020990	
Commodity:					Location				Meter #		
Billing Period Start Date	Actual Reading	Usage kWh	Demand kW	Electric Delivery Charges	Electric Commodity Charges	Electric Demand Charges	Fixed Customer Charges	Total Electric Charges	Days	Load Factor	BTU
1/24/24	2/21/24	9,400	33	634	\$1,001	\$93	\$14	\$1,741	29	41%	32,072,800
2/22/24	3/21/24	7,800	19	527	\$768	\$53.45	\$14.11	\$1,363	29	59%	26,613,600
3/22/24	4/23/24	4,509	48	304	\$733	\$152.68	\$16.06	\$1,206	33	12%	15,384,708
4/24/24	5/22/24	2,015	37	135	\$404	\$103.23	\$14.11	\$656	29	8%	6,875,180
5/23/24	6/21/24	2,439	16	522	\$344	\$38.89	\$14.60	\$919	30	22%	8,321,868
6/22/24	7/24/24	3,768	21	119	\$558	\$219.77	\$16.06	\$912	33	22%	12,856,416
7/25/24	8/23/24	2,092	12	855	\$491	\$42.13	\$14.60	\$1,403	30	24%	7,137,904
8/24/24	9/23/24	2,270	14	154	\$336	\$51.22	\$15.09	\$556	31	22%	7,745,240
9/24/24	10/23/24	2,089	35	132	\$443	\$106.69	\$14.60	\$696	30	8%	7,127,668
10/24/24	11/21/24	4,502	33	280	\$625	\$93.95	\$14.11	\$1,013	29	19%	15,360,824
11/22/24	12/20/24	10,977	37	683	\$1,216	\$103.23	\$14.11	\$2,016	29	43%	37,453,524
12/21/24	1/23/25	16,477	50	\$1,042	\$1,859	\$165	\$17	\$3,082	34	40%	56,219,524
TOTALS		68,338	50	\$5,388	\$8,775	\$1,222	\$178	\$15,563	366	16%	233,169,256



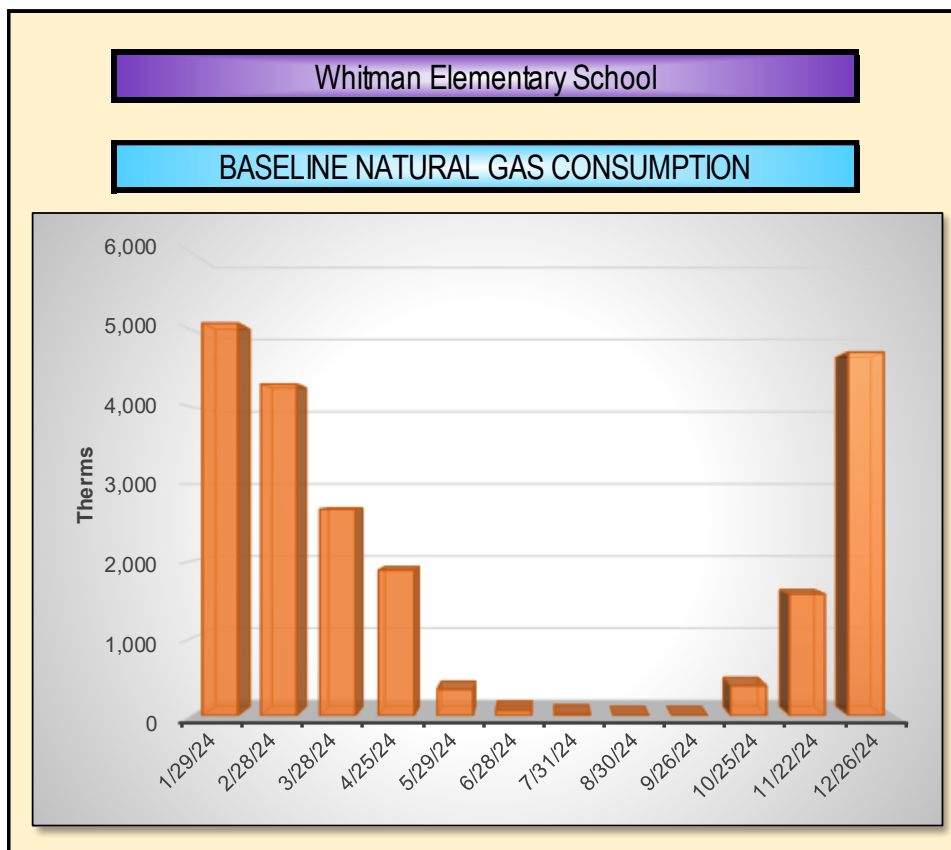
Hurffville Elementary School						Natural Gas Meter #1		
Provider	SJG		Account #	2584520000			Meter #	787612
Commodity			Account #				Meter #	
Billing Period Start Date	Actual Reading	Therms	Gas Delivery Charges	Gas Commodity Charges	Fixed Customer Charge	Gas Total Charges	Cost/Therm Checksum	BTU
12/19/23	1/23/24	2,753	\$2,976	\$1,269	\$47	\$4,292	\$1.54	275,295,000
1/24/24	2/21/24	2,517	\$2,748	\$1,115	\$39	\$3,902	\$1.53	251,705,000
2/22/24	3/22/24	2,106	\$2,308	\$894	\$41	\$3,243	\$1.52	210,615,000
3/23/24	4/23/24	1,844	\$2,021	\$783	\$43	\$2,847	\$1.52	184,408,000
4/24/24	5/24/24	369	\$404	\$124	\$42	\$570	\$1.43	36,878,000
5/25/24	6/25/24	128	\$140	\$45	\$43	\$228	\$1.45	12,760,000
6/26/24	7/25/24	105	\$115	\$41	\$41	\$197	\$1.49	10,496,000
7/26/24	8/27/24	128	\$140	\$45	\$45	\$229	\$1.44	12,760,000
8/28/24	9/24/24	123	\$135	\$48	\$38	\$222	\$1.49	12,348,000
9/25/24	10/23/24	488	\$533	\$197	\$39	\$769	\$1.49	48,830,000
10/24/24	11/19/24	1,254	\$1,367	\$497	\$36	\$1,901	\$1.49	125,435,000
11/20/24	12/19/24	2,365	\$2,579	\$940	\$41	\$3,559	\$1.49	236,534,000
TOTALS		14,181	\$15,466	\$5,999	\$494	\$21,958	\$1.51	1,418,064,000

Whitman Elementary School



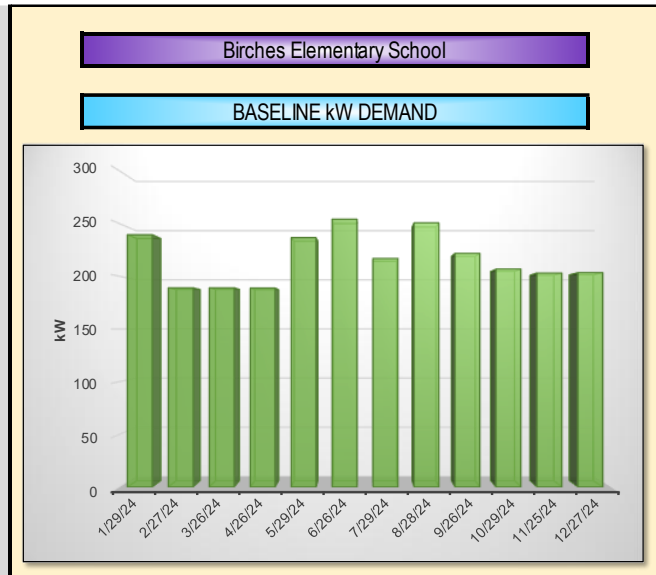
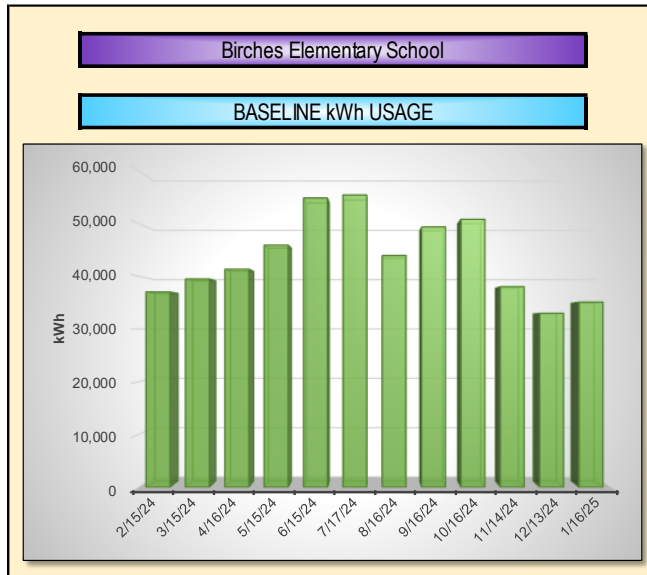
Whitman Elementary School					ELECTRIC METER #1						
Provider:	Atlantic City Electric			Account #	5500 1098 189				Meter #	KZD 310021191	
Commodity:				Location					Meter #		
Billing Period Start Date	Actual Reading	Usage kWh	Demand kW	Electric Delivery Charges	Electric Commodity Charges	Electric Demand Charges	Fixed Customer Charges	Total Electric Charges	Days	Load Factor	BTU
12/29/23	1/29/24	37,280	207	\$906	\$3,383	\$3,006	\$206	\$7,501	32	23%	127,199,360
1/30/24	2/27/24	35,355	188	\$867	\$3,208	\$2,505	\$187	\$6,767	29	27%	120,631,260
2/28/24	3/26/24	35,319	188	\$866	\$3,205	\$2,441	\$180	\$6,692	28	28%	120,508,428
3/27/24	4/26/24	37,246	188	\$902	\$3,380	\$2,711	\$200	\$7,192	31	27%	127,083,352
4/27/24	5/29/24	50,789	236	\$1,227	\$4,608	\$3,621	\$213	\$9,669	33	27%	173,292,068
5/30/24	6/26/24	50,295	253	\$1,151	\$4,564	\$3,252	\$180	\$9,147	28	30%	171,606,540
6/27/24	7/29/24	47,735	216	\$1,103	\$4,331	\$3,265	\$213	\$8,911	33	28%	162,871,820
7/30/24	8/28/24	42,754	250	\$972	\$3,879	\$3,432	\$193	\$8,477	30	24%	145,876,648
8/29/24	9/26/24	47,055	221	\$1,075	\$4,270	\$2,939	\$187	\$8,470	29	31%	160,551,660
9/27/24	10/29/24	43,910	205	\$990	\$4,068	\$3,147	\$213	\$8,418	33	27%	149,820,920
10/30/24	11/25/24	35,189	203	\$836	\$3,260	\$2,509	\$174	\$6,779	27	27%	120,064,868
11/26/24	12/27/24	34,690	203	\$800	\$3,214	\$2,973	\$206	\$7,193	32	22%	118,362,280
TOTALS		497,617	253	\$11,695	\$45,370	\$35,800	\$2,351	\$95,216	365	22%	1,697,869,204

Whitman Elementary School					ELECTRIC METER #2						
Provider:	Atlantic City Electric				Account #	50027832950			Meter #	1ND396818498	
Commodity:					Location				Meter #		
Billing Period Start Date	Actual Reading	Usage kWh	Demand kW	Electric Delivery Charges	Electric Commodity Charges	Electric Demand Charges	Fixed Customer Charges	Total Electric Charges	Days	Load Factor	BTU
1/30/24	2/27/24	296	32	20	\$25	\$0	\$12	\$57	29	1%	1,009,952
2/28/24	3/26/24	297	1	45	\$24.97	\$2.18	\$11.71	\$84	28	55%	1,013,364
3/27/24	4/26/24	154	1	14	\$12.81	\$2.40	\$21.97	\$51	31	24%	525,448
4/27/24	5/29/24	118	1	32	\$9.80	\$6.11	\$13.81	\$61	33	23%	402,616
5/30/24	6/26/24	15	1	2	\$1.30	\$2.60	\$11.72	\$17	28	3%	51,180
6/24/24	7/29/24	55	1	10	\$5.91	\$2.73	\$13.81	\$32	36	9%	187,660
7/30/24	8/28/24	53	1	0	\$9.29	\$3.90	\$12.55	\$26	30	7%	180,836
8/29/24	9/26/24	55	1	4	\$5.91	\$3.77	\$12.13	\$26	29	7%	187,660
9/27/24	10/29/24	130	1	7	\$11.67	\$0.85	\$13.80	\$34	33	28%	443,560
10/30/24	11/25/24	79	2	5	\$6.90	\$4.19	\$11.30	\$27	27	8%	269,548
11/26/24	12/27/24	13	0	1	\$1.15	\$0.00	\$13.39	\$15	32	5%	44,356
12/28/24	1/28/25	309	1	20	\$27.02	\$0.00	\$13.39	\$60	32	57%	1,054,308
TOTALS		1574	32	\$159	\$142	\$29	\$162	\$491	368	1%	5,370,488

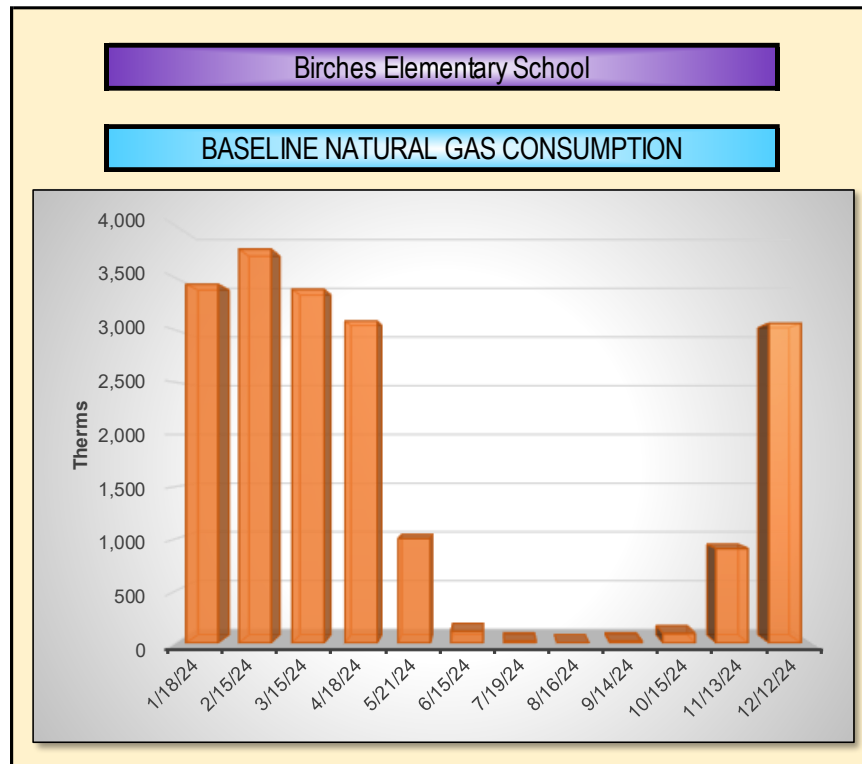


Whitman Elementary School						Natural Gas Meter #1		
Provider	SJG		Account #	5372820000		Meter #	788806	
Commodity			Account #			Meter #		
Billing Period Start Date	Actual Reading	Therms	Gas Delivery Charges	Gas Commodity Charges	Fixed Customer Charge	Gas Total Charges	Cost/Therm Checksum	BTU
12/28/23	1/29/24	5,082	\$5,494	\$2,191	\$43	\$7,728	\$1.51	508,236,000
1/30/24	2/28/24	4,293	\$4,700	\$1,824	\$41	\$6,564	\$1.52	429,312,000
2/29/24	3/28/24	2,675	\$2,932	\$1,114	\$39	\$4,085	\$1.51	267,546,000
3/29/24	4/25/24	1,886	\$2,066	\$785	\$38	\$2,889	\$1.51	188,552,000
4/26/24	5/29/24	341	\$434	\$119	\$46	\$598	\$1.62	34,089,000
5/30/24	6/28/24	72	\$79	\$32	\$41	\$152	\$1.54	7,203,000
6/29/24	7/31/24	21	\$23	\$10	\$45	\$77	\$1.57	2,058,000
8/1/24	8/30/24	0	\$0	\$0	\$41	\$41	\$0.00	0
8/31/24	9/26/24	0	\$0	\$0	\$36	\$36	\$0.00	0
9/27/24	10/25/24	391	\$426		\$39	\$465	\$1.09	39,064,000
10/26/24	11/22/24	1,574	\$1,707	\$629	\$38	\$2,375	\$1.48	157,437,000
11/23/24	12/26/24	4,706	\$5,130	\$1,930	\$46	\$7,106	\$1.50	470,592,000
TOTALS		21,041	\$22,991	\$8,634	\$491	\$32,116	\$1.50	2,104,089,000

Birches Elementary School

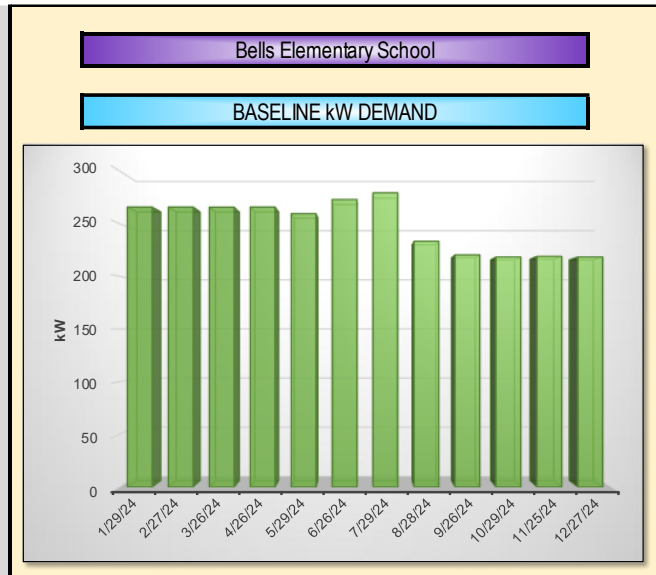
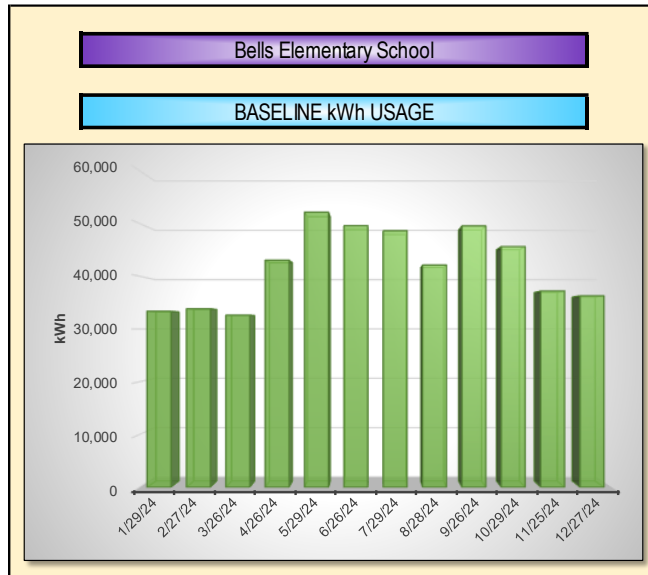


Birches Elementary School					ELECTRIC METER #1							
Provider:	Atlantic City Electric			Account #	55010960098				Meter #	Meter #	KZD396308234	
Commodity:				Location					Meter #	Meter #		
Billing Period Start Date	Actual Reading	Usage kWh	Demand kW	Electric Delivery Charges	Electric Commodity Charges	Electric Demand Charges	Fixed Customer Charges	Total Electric Charges	Cost / kWh Checksum	Days	Load Factor	BTU
1/18/24	2/15/24	37,021	305	\$912	\$3,359	\$4,046	\$187	\$8,505	\$0.115	29	17%	126,315,652
2/16/24	3/15/24	39,471	305	\$972	\$3,582	\$4,089	\$187	\$8,829	\$0.115	29	19%	134,675,052
3/16/24	4/16/24	41,331	305	\$1,010	\$3,750	\$4,517	\$206	\$9,483	\$0.115	32	18%	141,021,372
4/17/24	5/15/24	45,899	305	\$1,111	\$4,165	\$4,095	\$187	\$9,558	\$0.115	29	22%	156,607,388
5/16/24	6/15/24	54,822	305	\$1,255	\$4,974	\$4,377	\$200	\$10,806	\$0.114	31	24%	187,052,664
6/16/24	7/17/24	55,371	305	\$1,246	\$5,024	\$4,477	\$206	\$10,954	\$0.113	32	24%	188,925,852
7/18/24	8/16/24	43,907	305	\$1,000	\$3,984	\$4,198	\$193	\$9,375	\$0.114	30	20%	149,810,684
8/17/24	9/16/24	49,324	225	\$1,119	\$4,476	\$3,196	\$200	\$8,991	\$0.113	31	29%	168,293,488
9/17/24	10/16/24	50,767	229	\$4,510	\$4,703	\$3,184	\$193	\$12,591	\$0.181	30	31%	173,217,004
10/17/24	11/14/24	38,011	282	\$858	\$3,522	\$2,902	\$187	\$7,468	\$0.115	29	19%	129,693,532
11/15/24	12/13/24	32,964	131	\$751	\$3,054	\$2,861	\$187	\$6,853	\$0.115	29	36%	112,473,168
12/14/24	1/16/25	35,072	215	\$809	\$3,249	\$3,355	\$219	\$7,632	\$0.116	34	20%	119,665,664
TOTALS		523,960	305	\$15,555	\$47,842	\$45,297	\$2,351	\$111,046	\$0.121	365	20%	1,787,751,520

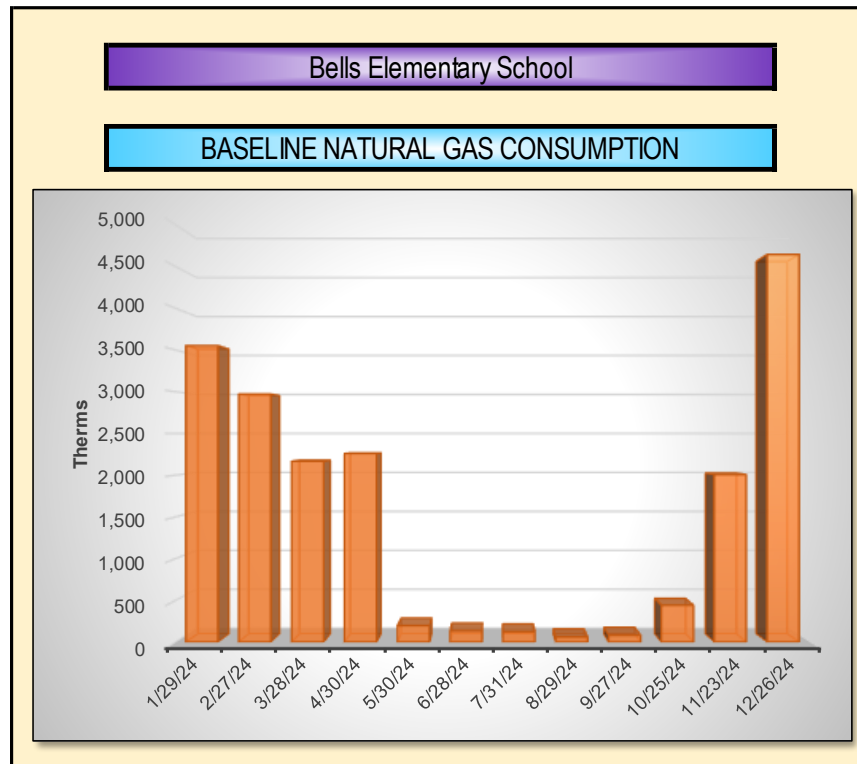


Birches Elementary School						Natural Gas Meter #1		
Provider	SJG		Account #	852372000		Meter #	623097	
Commodity			Account #			Meter #		
Billing Period Start Date	Actual Reading	Therms	Gas Delivery Charges	Gas Commodity Charges	Fixed Customer Charge	Gas Total Charges	Cost/Therm Checksum	BTU
12/15/24	1/18/24	3440	\$3,719	\$1,665	\$46	\$5,429	\$1.56	343,989,000
1/19/24	2/15/24	3777	\$4,113	\$1,705	\$38	\$5,855	\$1.54	377,712,000
2/16/24	3/15/24	3391	\$3,716	\$1,454	\$39	\$5,209	\$1.52	339,099,000
3/16/24	4/18/24	3087	\$3,383	\$1,324	\$46	\$4,753	\$1.52	308,728,000
4/19/24	5/21/24	1002	\$1,098	\$303	\$36	\$1,437	\$1.40	100,201,000
5/22/24	6/15/24	113	\$124	\$40	\$42	\$206	\$1.45	11,319,000
6/16/24	7/19/24	21	\$23	\$10	\$46	\$78	\$1.57	2,058,000
7/20/24	8/16/24	0	\$0	\$0	\$38	\$38	\$0.00	0
8/17/24	9/14/24	21	\$23	\$10	\$39	\$71	\$1.57	2,058,000
9/15/24	10/15/24	93	\$101	\$43	\$42	\$186	\$1.56	9,252,000
10/16/24	11/13/24	906	\$987	\$405	\$39	\$1,432	\$1.54	90,565,000
11/14/24	12/12/24	3,065	\$3,341	\$1,193	\$39	\$4,573	\$1.48	306,504,000
TOTALS		18,915	\$20,627	\$8,151	\$490	\$29,269	\$1.52	1,891,485,000

Bells Elementary School

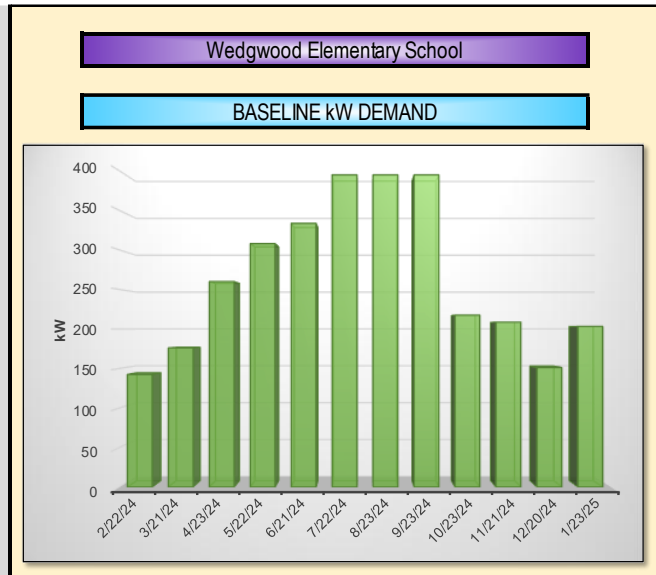
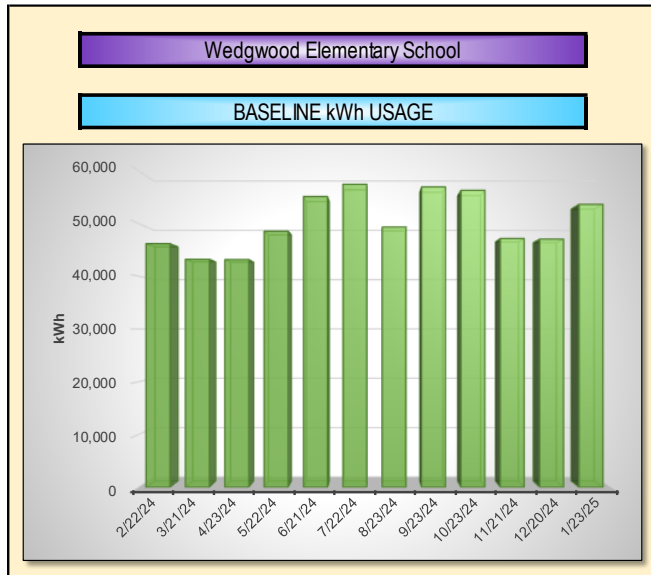


Bells Elementary School					ELECTRIC METER #1						
Provider:	Atlantic City Electric			Account #	55003234600				Meter #	KZD310021008	
Commodity:				Location					Meter #		
Billing Period Start Date	Actual Reading	Usage kWh	Demand kW	Electric Delivery Charges	Electric Commodity Charges	Electric Demand Charges	Fixed Customer Charges	Total Electric Charges	Days	Load Factor	BTU
12/30/23	1/29/24	33,360	266	\$1,011	\$3,027	\$3,566	\$200	\$7,804	31	17%	113,824,320
1/30/24	2/27/24	33,840	266	\$833	\$3,071	\$3,566	\$187	\$7,657	29	18%	115,462,080
2/28/24	3/26/24	32,640	266	\$804	\$2,962	\$3,446	\$180	\$7,392	28	18%	111,367,680
3/27/24	4/26/24	43,040	266	\$1,045	\$3,905	\$3,774	\$200	\$8,923	31	22%	146,852,480
4/27/24	5/29/24	52,127	259	\$1,260	\$4,730	\$3,975	\$213	\$10,178	33	25%	177,857,324
5/30/24	6/26/24	49,569	273	\$1,136	\$4,498	\$3,501	\$180	\$9,315	28	27%	169,129,428
6/27/24	7/29/24	48,609	279	\$1,324	\$4,411	\$3,236	\$213	\$9,183	33	22%	165,853,908
7/30/24	8/28/24	42,115	233	\$957	\$3,821	\$3,206	\$193	\$8,177	30	25%	143,696,380
8/29/24	9/26/24	49,521	220	\$1,085	\$4,493	\$2,972	\$187	\$8,737	29	32%	168,965,652
9/27/24	10/29/24	45,611	218	\$1,027	\$4,226	\$3,341	\$213	\$8,806	33	26%	155,624,732
10/30/24	11/25/24	37,186	219	\$880	\$3,445	\$2,708	\$174	\$7,207	27	26%	126,878,632
11/26/24	12/27/24	36,286	218	\$829	\$3,362	\$3,201	\$206	\$7,598	32	22%	123,807,832
TOTALS		503,904	279	\$12,190	\$45,951	\$40,494	\$2,344	\$100,978	364	21%	1,719,320,448

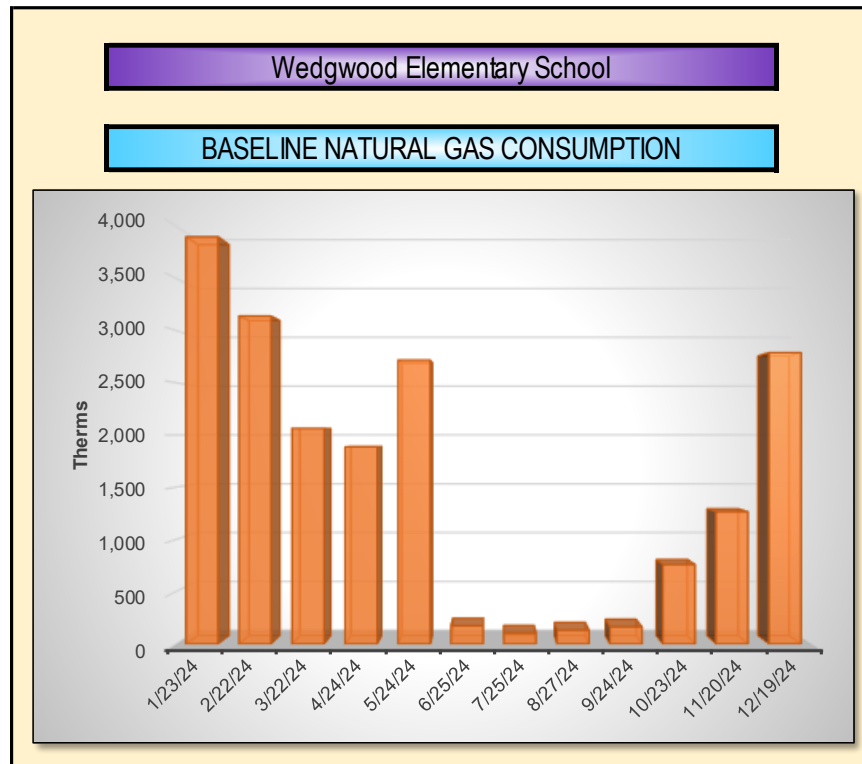


Bells Elementary School						Natural Gas Meter #1		
Provider	SJG		Account #	8469310000		Meter #	623085	
Commodity			Account #			Meter #		
Billing Period Start Date	Actual Reading	Therms	Gas Delivery Charges	Gas Commodity Charges	Fixed Customer Charge	Gas Total Charges	Cost/Therm Checksum	BTU
12/29/23	1/29/24	3,554	\$3,841	\$1,577	\$42	\$5,460	\$1.52	355,352,000
1/30/24	2/27/24	2,972	\$3,254	\$1,312	\$39	\$4,605	\$1.54	297,216,000
2/28/24	3/28/24	2,167	\$2,375	\$925	\$41	\$3,341	\$1.52	216,733,000
3/29/24	4/30/24	2,258	\$2,475	\$964	\$45	\$3,484	\$1.52	225,848,000
5/1/24	5/30/24	196	\$215	\$80	\$41	\$335	\$1.50	19,627,000
5/31/24	6/28/24	134	\$147	\$48	\$39	\$233	\$1.45	13,371,000
6/29/24	7/31/24	123	\$135	\$57	\$45	\$236	\$1.55	12,348,000
8/1/24	8/29/24	62	\$68	\$29	\$39	\$136	\$1.57	6,174,000
8/30/24	9/27/24	82	\$90	\$34	\$39	\$163	\$1.51	8,232,000
9/28/24	10/25/24	442	\$482	\$188	\$38	\$708	\$1.52	44,204,000
10/26/24	11/23/24	2,007	\$2,187	\$766	\$39	\$2,992	\$1.47	200,655,000
11/24/24	12/26/24	4,644	\$5,063	\$1,914	\$45	\$7,021	\$1.50	464,400,000
TOTALS		18,642	\$20,332	\$7,893	\$490	\$28,715	\$1.51	1,864,160,000

Wedgwood Elementary School

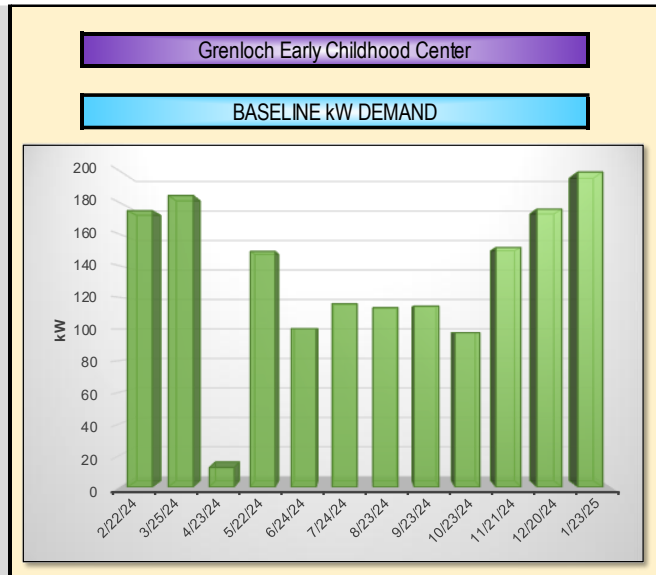
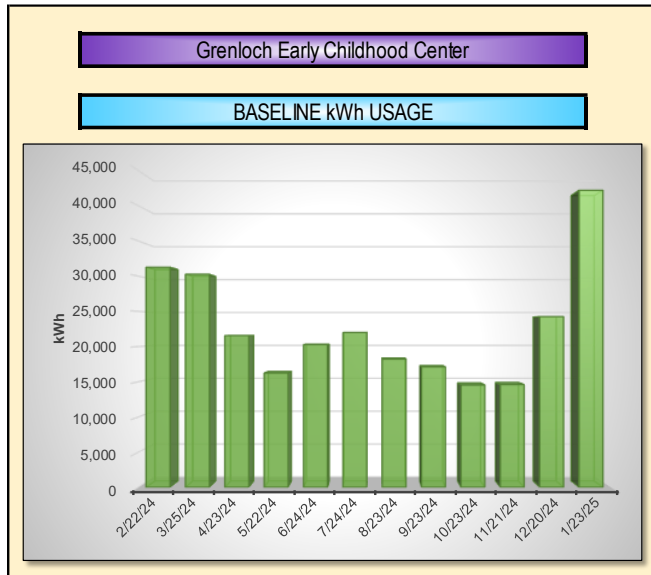


Wedgwood Elementary School					ELECTRIC METER #1						
Provider:	Atlantic City Electric			Account #	55002813404				Meter #	KZD396283314	
Commodity:				Location					Meter #		
Billing Period Start Date	Actual Reading	Usage kWh	Demand kW	Electric Delivery Charges	Electric Commodity Charges	Electric Demand Charges	Fixed Customer Charges	Total Electric Charges	Days	Load Factor	BTU
1/24/24	2/22/24	46,160	142	\$1,139	\$4,188	\$5,409	\$193	\$10,929	30	45%	157,497,920
2/23/24	3/21/24	43,200	176	\$1,066	\$3,920	\$5,068	\$180	\$10,233	28	37%	147,398,400
3/22/24	4/23/24	43,162	260	\$1,078	\$3,916	\$5,973	\$213	\$11,180	33	21%	147,268,744
4/24/24	5/22/24	48,525	308	\$1,208	\$4,403	\$5,249	\$187	\$11,046	29	23%	165,567,300
5/23/24	6/21/24	55,087	334	\$1,257	\$4,998	\$5,430	\$193	\$11,878	30	23%	187,956,844
6/22/24	7/22/24	57,412	395	\$1,270	\$5,209	\$5,973	\$213	\$12,664	31	20%	195,889,744
7/23/24	8/23/24	49,313	395	\$1,089	\$4,475	\$5,430	\$193	\$11,186	32	16%	168,255,956
8/24/24	9/23/24	56,915	395	\$1,259	\$5,164	\$5,611	\$200	\$12,233	31	19%	194,193,980
9/24/24	10/23/24	56,271	218	\$1,277	\$5,213	\$3,023	\$193	\$9,706	30	36%	191,996,652
10/24/24	11/21/24	47,136	209	\$1,075	\$4,367	\$2,796	\$187	\$8,425	29	32%	160,828,032
11/22/24	12/20/24	47,012	151	\$1,080	\$4,356	\$2,701	\$187	\$8,324	29	45%	160,404,944
12/21/24	1/23/25	53,603	203	\$1,281	\$6,278	\$3,167	\$219	\$10,945	34	32%	182,893,436
TOTALS		603,796	395	\$14,078	\$56,488	\$55,827	\$2,357	\$128,750	366	17%	2,060,151,952



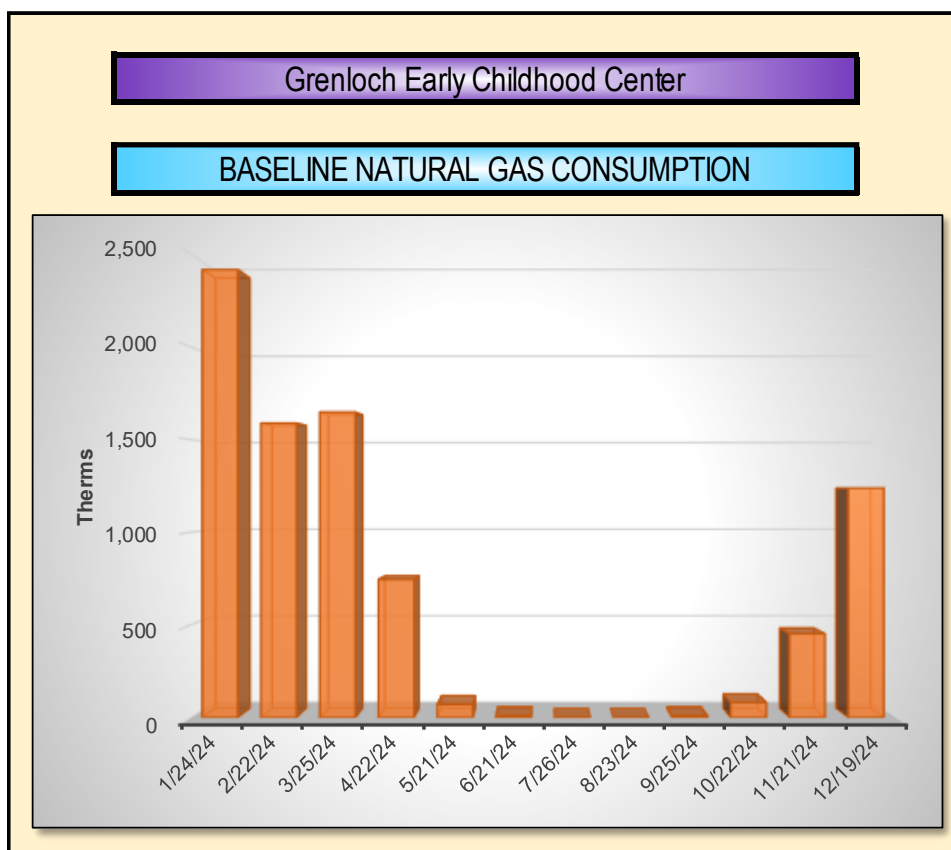
Wedgwood Elementary School						Natural Gas Meter #1		
Provider	SJG		Account #	4983620000		Meter #	629098	
Commodity			Account #			Meter #		
Billing Period Start Date	Actual Reading	Therms	Gas Delivery Charges	Gas Commodity Charges	Fixed Customer Charge	Gas Total Charges	Cost/Therm Checksum	BTU
12/21/23	1/23/24	3,894	\$4,210	\$1,766	\$45	\$6,020	\$1.53	389,441,000
1/24/24	2/22/24	3,137	\$3,425	\$1,424	\$41	\$4,890	\$1.55	313,728,000
2/23/24	3/22/24	2,064	\$2,261	\$947	\$39	\$3,248	\$1.55	206,363,000
3/23/24	4/24/24	1,886	\$2,066	\$866	\$45	\$2,976	\$1.55	188,552,000
4/25/24	5/24/24	2,717	\$2,977	\$741	\$41	\$3,758	\$1.37	271,679,000
5/25/24	6/25/24	175	\$192	(\$470)	\$43	(\$235)	-\$1.59	17,493,000
6/26/24	7/25/24	103	\$113	\$40	\$41	\$194	\$1.49	10,290,000
7/26/24	8/27/24	134	\$147	\$46	\$45	\$237	\$1.44	13,377,000
8/28/24	9/24/24	165	\$180	\$62	\$38	\$280	\$1.47	16,464,000
9/25/24	10/23/24	761	\$830	\$302	\$39	\$1,172	\$1.49	76,072,000
10/24/24	11/20/24	1,266	\$1,380	\$528	\$38	\$1,945	\$1.51	126,567,000
11/21/24	12/19/24	2,786	\$3,038	\$1,113	\$39	\$4,190	\$1.49	278,640,000
TOTALS		19,087	\$20,819	\$7,366	\$491	\$28,676	\$1.48	1,908,666,000

Grenloch Early Childhood Center



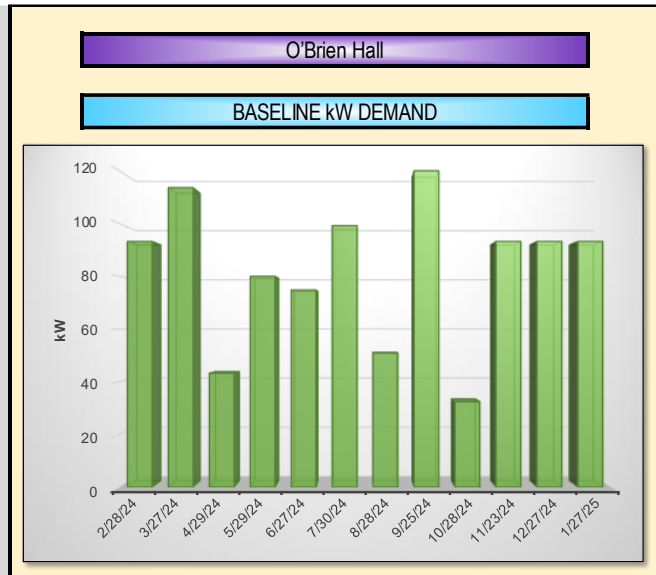
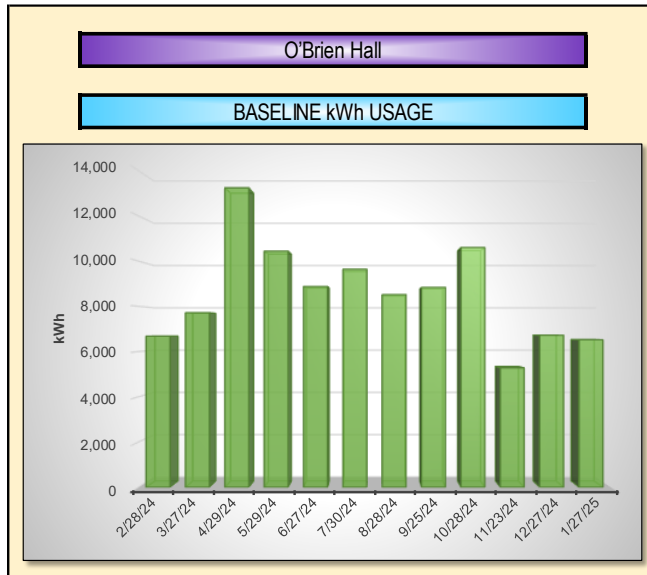
Grenloch Early Childhood Center					ELECTRIC METER #1						
Provider:	Atlantic City Electric			Account #	55002196081				Meter #	KZD310023774	
Commodity:				Location					Meter #		
Billing Period Start Date	Actual Reading	Usage kWh	Demand kW	Electric Delivery Charges	Electric Commodity Charges	Electric Demand Charges	Fixed Customer Charges	Total Electric Charges	Days	Load Factor	BTU
1/25/24	2/22/24	6,880	28	\$464	\$624	\$77	\$14	\$1,180	29	36%	23,474,560
2/23/24	3/25/24	9,800	39	\$662	\$889	\$120	\$16	\$1,688	32	33%	33,437,600
3/26/24	4/23/24	7,640	5	\$514	\$693	\$15	\$14	\$1,236	29	211%	26,067,680
4/24/24	5/22/24	7,925	50	\$533	\$719	\$142	\$14	\$1,408	29	23%	27,040,100
5/23/24	6/24/24	11,682	51	\$791	\$1,060	\$171	\$15	\$2,037	33	29%	39,858,984
6/25/24	7/24/24	13,285	52	\$902	\$1,205	\$202	\$16	\$2,326	30	35%	45,328,420
7/25/24	8/23/24	10,387	50	\$705	\$943	\$175	\$15	\$1,837	30	29%	35,440,444
8/24/24	9/23/24	8,588	50	\$583	\$779	\$185	\$15	\$1,562	31	23%	29,302,256
9/24/24	10/23/24	6,147	40	\$480	\$570	\$35	\$15	\$1,099	30	21%	20,973,564
10/24/24	11/21/24	5,543	33	\$345	\$514	\$94	\$14	\$966	29	24%	18,912,716
11/22/24	12/20/24	5,439	29	\$338	\$504	\$82	\$14	\$938	29	27%	18,557,868
12/21/24	1/23/25	5,997	28	\$487	\$744	\$91	\$17	\$1,338	34	27%	20,461,764
TOTALS		99313	52	\$6,804	\$9,244	\$1,389	\$178	\$17,615	365	22%	338,855,956

Grenloch Early Childhood Center					ELECTRIC METER #2							
Provider:	Atlantic City Electric				Account #	55000826481			Meter #	Meter #	KZD310023697	
Commodity:					Location				Meter #	Meter #		
Billing Period Start Date	Actual Reading	Usage kWh	Demand kW	Electric Delivery Charges	Electric Commodity Charges	Electric Demand Charges	Fixed Customer Charges	Total Electric Charges	Cost / kWh Checksum	Days	Load Factor	BTU
1/25/24	2/22/24	24,400	147	137	\$2,214	\$1,950	\$187	\$4,488	0.10	29	24%	83,252,800
2/23/24	3/25/24	20,480	146	504	\$1,858.32	\$2,135.47	\$206.10	\$4,704	0.12	32	18%	69,877,760
3/26/24	4/23/24	13,920	7	337	1,263	\$859.18	\$186.78	\$2,646	0.11	29	278%	47,495,040
4/24/24	5/22/24	8,314	99	203	\$754.92	\$1,312.16	\$186.78	\$2,457	0.12	29	12%	28,367,368
5/23/24	6/21/24	8,588	49	190	\$779.26	\$888.80	\$193.22	\$2,051	0.11	30	24%	29,302,256
6/22/24	7/24/24	8,708	64	184	\$791	\$968	\$213	\$2,156	0.11	33	17%	29,711,696
7/25/24	8/23/24	7,825	64	166	\$710.01	\$880.00	\$193.22	\$1,949	0.11	30	17%	26,698,900
8/24/24	9/23/24	8,519	64	181	\$773.00	\$909.33	\$199.66	\$2,063	0.11	31	18%	29,066,828
9/24/24	10/23/24	8,391	57	186	\$777.40	\$787.16	\$193.22	\$1,943	0.11	30	20%	28,630,092
10/24/24	11/21/24	9,057	118	192	\$839.10	\$1,571.19	\$186.78	\$2,789	0.11	29	11%	30,902,484
11/22/24	12/20/24	18,824	147	417	\$1,743.98	\$1,989.29	\$186.78	\$4,337	0.11	29	18%	64,227,488
12/21/24	1/23/25	36,205	172	\$857	\$4,534	\$2,675	\$219	\$8,284	0.15	34	26%	123,531,460
TOTALS		173231	172	\$3,555	\$17,038	\$16,925	\$2,351	\$39,868	0.12	365	12%	591,064,172

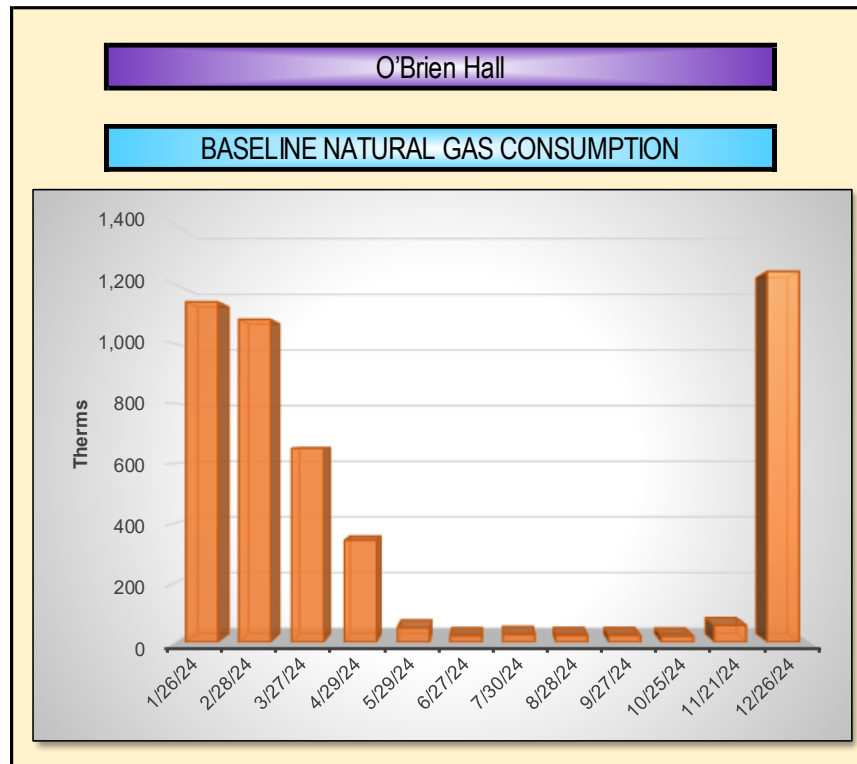


Grenloch Early Childhood Center						Natural Gas Meter #1		
Provider	SJG		Account #	5539310000		Meter #	623058	
Commodity			Account #			Meter #		
Billing Period Start Date	Actual Reading	Therms	Gas Delivery Charges	Gas Commodity Charges	Fixed Customer Charge	Gas Total Charges	Cost/Therm Checksum	BTU
12/20/23	1/24/24	2,417	\$2,613	\$1,024	\$47	\$3,684	\$1.50	241,722,000
1/25/24	2/22/24	1,589	\$1,736	\$690	\$39	\$2,465	\$1.53	158,928,000
2/23/24	3/25/24	1,649	\$1,806	\$631	\$43	\$2,480	\$1.48	164,883,000
3/26/24	4/22/24	746	\$817	\$285	\$38	\$1,141	\$1.48	74,592,000
4/23/24	5/21/24	72	\$79	\$29	\$39	\$147	\$1.50	7,231,000
5/22/24	6/21/24	10	\$11	\$5	\$42	\$58	\$1.59	1,029,000
6/22/24	7/26/24	0	\$0	\$0	\$47	\$47	\$0.00	0
7/27/24	8/23/24	0	\$0	\$0	\$38	\$38	\$0.00	0
8/24/24	9/25/24	10	\$11	\$5	\$45	\$61	\$1.59	1,029,000
9/26/24	10/22/24	82	\$90	\$39	\$36	\$165	\$1.56	8,224,000
10/23/24	11/21/24	453	\$494	\$202	\$41	\$737	\$1.54	45,276,000
11/22/24	12/19/24	1,238	\$1,350	\$497	\$38	\$1,885	\$1.49	123,840,000
TOTALS		8,268	\$9,007	\$3,408	\$493	\$12,908	\$1.50	826,754,000

O'Brien Hall

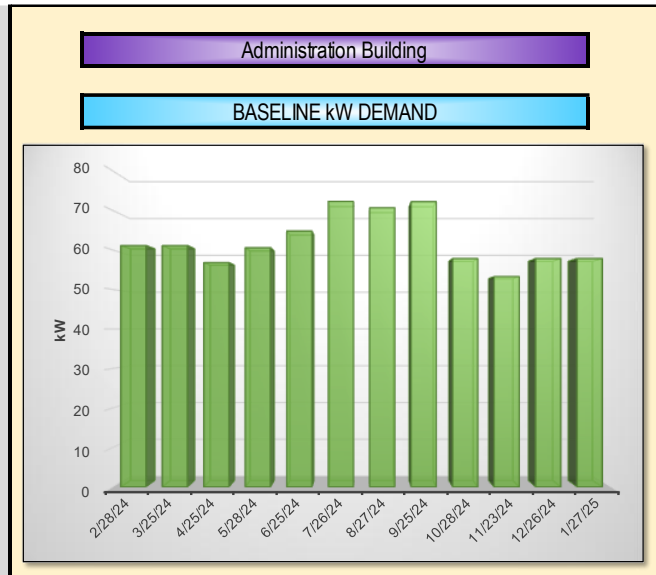
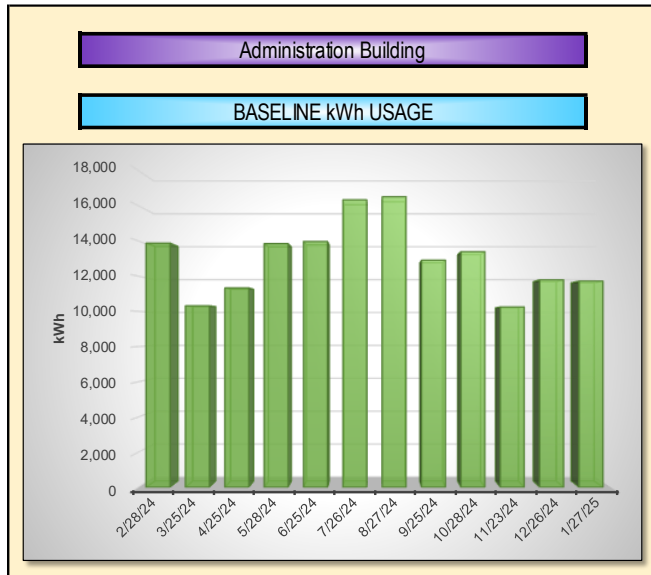


O'Brien Hall					ELECTRIC METER #3						
Provider:	Atlantic City Electric			Account #	55000743074				Meter #	99D35592594	
Commodity:				Location	O'Brien				Meter #		
Billing Period Start Date	Actual Reading	Usage kWh	Demand kW	Electric Delivery Charges	Electric Commodity Charges	Electric Demand Charges	Fixed Customer Charges	Total Electric Charges	Days	Load Factor	BTU
1/27/24	2/28/24	6,680	93	\$451	\$557	\$298	\$16	\$1,322	33	9%	22,792,160
2/29/24	3/27/24	7,720	114	\$522	\$700	\$309	\$14	\$1,544	28	10%	26,340,640
3/28/24	4/29/24	13,240	43	\$891	\$1,201	\$138	\$16	\$2,246	33	39%	45,174,880
4/30/24	5/29/24	10,440	80	\$702	\$947	\$233	\$15	\$1,897	30	18%	35,621,280
5/30/24	6/27/24	8,880	75	\$602	\$806	\$253	\$14	\$1,675	29	17%	30,298,560
6/28/24	7/30/24	9,640	99	\$654	\$875	\$386	\$16	\$1,931	33	12%	32,891,680
7/31/24	8/28/24	8,520	51	\$578	\$773	\$174	\$14	\$1,539	29	24%	29,070,240
8/29/24	9/25/24	8,840	120	\$600	\$802	\$396	\$14	\$1,812	28	11%	30,162,080
9/26/24	10/28/24	10,600	32	\$669	\$982	\$107	\$16	\$1,774	33	41%	36,167,200
10/29/24	11/23/24	5,280	93	\$329	\$489	\$235	\$13	\$1,065	26	9%	18,015,360
11/24/24	12/27/24	6,720	93	\$418	\$623	\$298	\$16	\$1,355	34	9%	22,928,640
12/28/24	1/27/25	6,520	93	\$414	\$1,326	\$289	\$16	\$2,045	31	9%	22,246,240
TOTALS		103080	120	\$6,829	\$10,082	\$3,117	\$179	\$20,206	367	10%	351,708,960

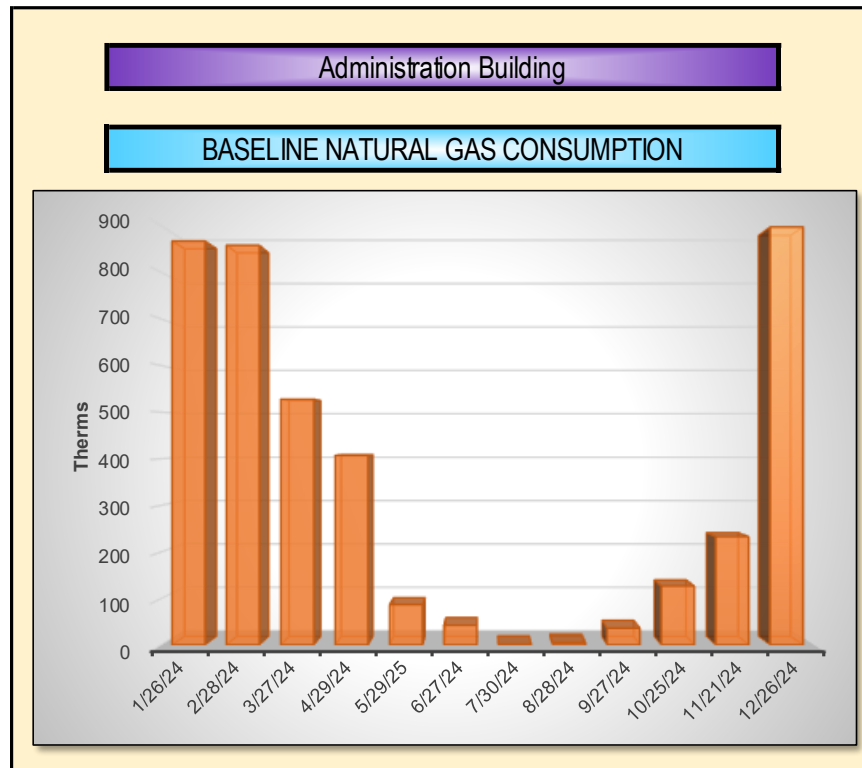


O'Brien Hall						Natural Gas Meter #1		
Provider	SJG		Account #	4856710465			Meter #	636770
Commodity			Account #				Meter #	
Billing Period Start Date	Actual Reading	Therms	Gas Delivery Charges	Gas Commodity Charges	Fixed Customer Charge	Gas Total Charges	Cost/Therm Checksum	BTU
12/27/23	1/26/24	1,141	\$794	\$515	\$47	\$1,356	\$1.15	114,146,500
1/27/24	2/28/24	1,083	\$768	\$467	\$39	\$1,275	\$1.14	108,258,400
2/29/24	3/27/24	651	\$464	\$263	\$43	\$770	\$1.12	65,079,000
3/28/24	4/29/24	342	\$248	\$138	\$38	\$424	\$1.13	34,192,300
4/30/24	5/29/24	49	\$38	\$15	\$39	\$92	\$1.10	4,855,100
5/30/24	6/27/24	22	\$38	\$9	\$42	\$89	\$2.20	2,160,900
6/28/24	7/30/24	26	\$61	\$11	\$47	\$120	\$2.81	2,572,500
7/31/24	8/28/24	23	\$58	\$10	\$38	\$106	\$3.03	2,263,800
8/29/24	9/27/24	23	\$18	\$7	\$45	\$69	\$1.09	2,263,800
9/28/24	10/25/24	21	\$16	\$8	\$36	\$60	\$1.15	2,056,000
10/26/24	11/21/24	57	\$41	\$22	\$41	\$104	\$1.12	5,659,500
11/22/24	12/26/24	1,244	\$898	\$507	\$38	\$1,443	\$1.13	124,356,000
TOTALS		4,679	\$3,442	\$1,975	\$492	\$5,910	\$1.16	467,863,800

Administration Building

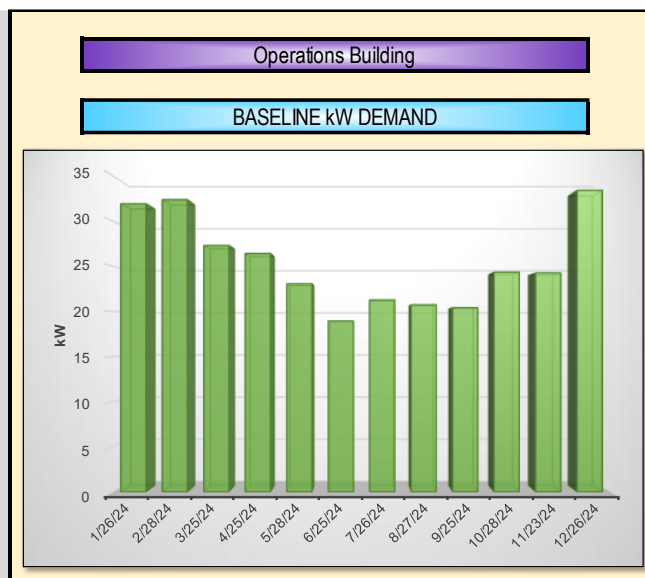
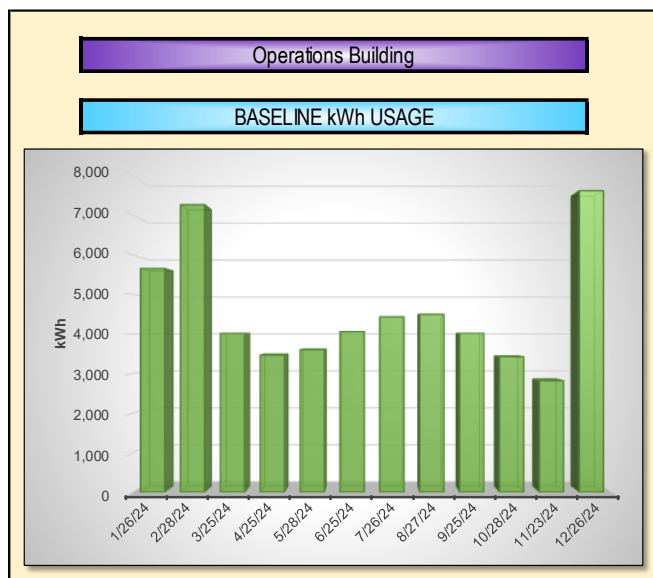


Administration Building					ELECTRIC METER #1						
Provider:	Atlantic City Electric			Account #	55005655984				Meter #	KZD396284087	
Commodity:				Location					Meter #		
Billing Period Start Date	Actual Reading	Usage kWh	Demand kW	Electric Delivery Charges	Electric Commodity Charges	Electric Demand Charges	Fixed Customer Charges	Total Electric Charges	Days	Load Factor	BTU
1/26/24	2/28/24	13,880	61	\$280	\$1,259	\$950	\$279	\$2,769	34	28%	47,358,560
2/29/24	3/25/24	10,320	61	\$253	\$936	\$728	\$167	\$2,085	26	27%	35,211,840
3/26/24	4/25/24	11,341	57	\$275	\$1,029	\$868	\$200	\$2,372	31	27%	38,695,492
4/26/24	5/28/24	13,854	61	\$335	\$1,257	\$924	\$213	\$2,729	33	29%	47,269,848
5/29/24	6/25/24	13,974	65	\$310	\$1,268	\$831	\$180	\$2,589	28	32%	47,679,288
6/26/24	7/26/24	16,343	72	\$357	\$1,483	\$1,027	\$200	\$3,067	31	30%	55,762,316
7/27/24	8/27/24	16,514	71	\$361	\$1,498	\$1,037	\$206	\$3,102	32	30%	56,345,768
8/28/24	9/25/24	12,910	72	\$280	\$1,171	\$960	\$187	\$2,598	29	26%	44,048,920
9/26/24	10/28/24	13,392	58	\$303	\$1,241	\$874	\$213	\$2,630	33	29%	45,693,504
10/29/24	11/23/24	10,249	53	\$233	\$950	\$689	\$167	\$2,039	26	31%	34,969,588
11/24/24	12/26/24	11,794	58	\$267	\$1,093	\$874	\$213	\$2,446	33	26%	40,241,128
12/27/24	1/27/25	11,723	58	\$280	\$1,458	\$848	\$206	\$2,792	32	26%	39,998,876
TOTALS		156294	72	\$3,533	\$14,644	\$10,612	\$2,430	\$31,218	368	24%	533,275,128



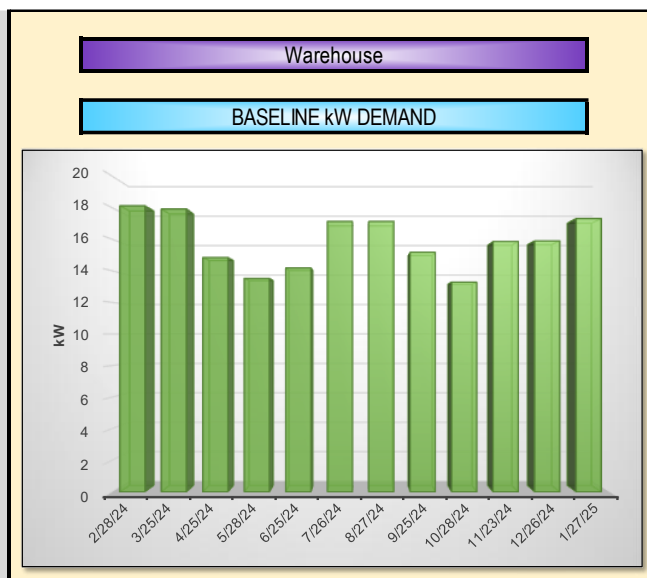
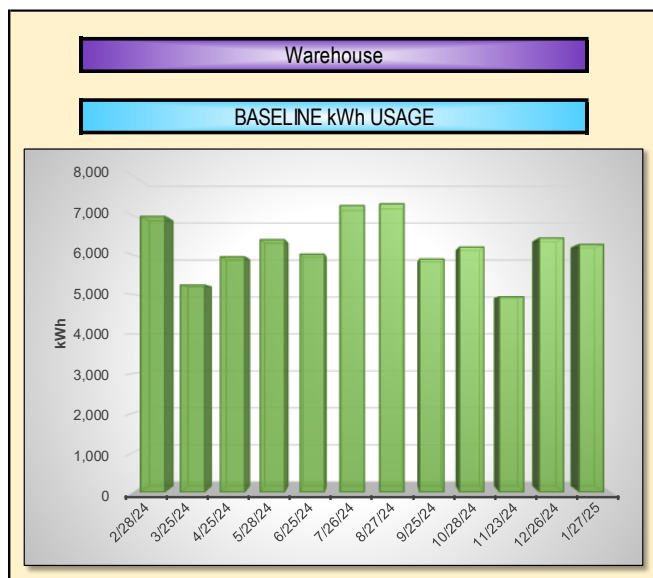
Administration Building						Natural Gas Meter #1		
Provider	SJG		Account #	8784520000		Meter #	636769	
Commodity			Account #			Meter #		
Billing Period Start Date	Actual Reading	Therms	Gas Delivery Charges	Gas Commodity Charges	Fixed Customer Charge	Gas Total Charges	Cost/Therm Checksum	BTU
12/27/23	1/26/24	868	\$938	\$375	\$41	\$1,353	\$1.51	86,772,000
1/27/24	2/28/24	859	\$939	\$358	\$45	\$1,341	\$1.51	85,862,000
2/29/24	3/27/24	528	\$578	\$210	\$38	\$826	\$1.49	52,783,000
3/28/24	4/29/24	407	\$446	\$162	\$45	\$652	\$1.49	40,715,000
4/30/24	5/29/25	87	\$95	\$29	\$41	\$164	\$1.43	8,677,000
5/30/25	6/27/24	42	\$46	\$19	\$39	\$104	\$1.55	4,219,000
6/28/24	7/30/24	1	\$1	\$0	\$45	\$46	\$1.55	103,000
7/31/24	8/28/24	5	\$6	\$2	\$39	\$47	\$1.54	515,000
8/29/24	9/27/24	36	\$39	\$13	\$41	\$93	\$1.46	3,602,000
9/28/24	10/25/24	126	\$138	\$51	\$38	\$227	\$1.50	12,644,000
10/26/24	11/21/24	233	\$253	\$96	\$36	\$385	\$1.50	23,255,000
11/22/24	12/26/24	898	\$972	\$364	\$47	\$1,383	\$1.49	89,765,000
TOTALS		4,089	\$4,452	\$1,678	\$493	\$6,623	\$1.50	408,912,000

Operations Building

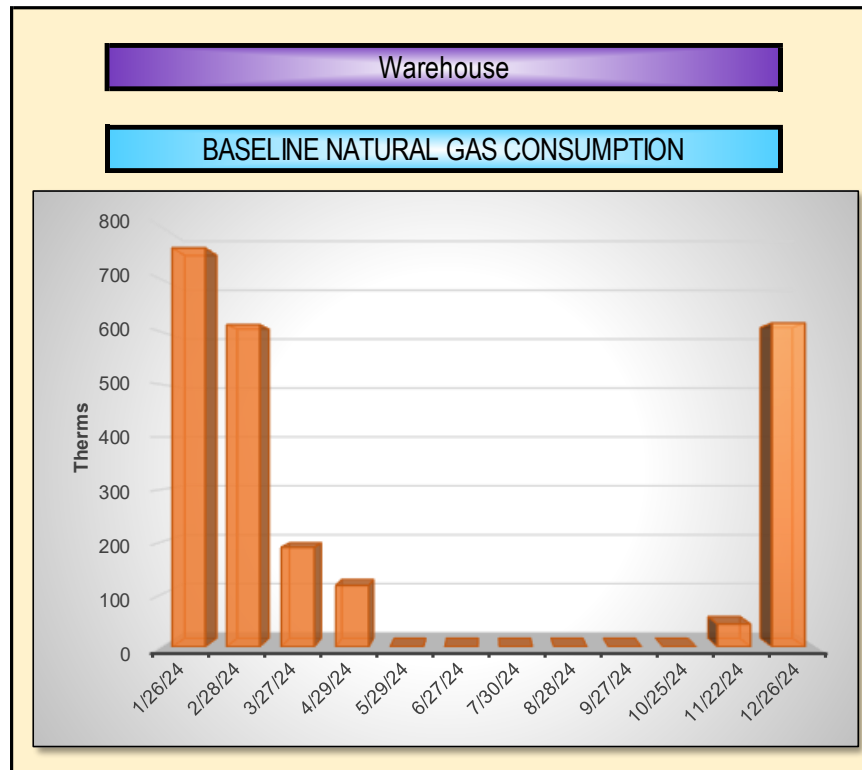


Operations Building					ELECTRIC METER #1						
Provider:	Atlantic City Electric			Account #	55001556335				Meter #	99F105759192	
Commodity:				Location					Meter #		
Billing Period Start Date	Actual Reading	Usage kWh	Demand kW	Electric Delivery Charges	Electric Commodity Charges	Electric Demand Charges	Fixed Customer Charges	Total Electric Charges	Days	Load Factor	BTU
12/23/23	1/26/24	5,656	32	\$378	\$513	\$107	\$15	\$1,013	35	21%	19,298,272
1/27/24	2/28/24	7,266	32	\$490	\$659	\$104	\$14	\$1,267	33	28%	24,791,592
2/29/24	3/25/24	4,017	27	\$272	\$364	\$69	\$11	\$716	26	24%	13,706,004
3/26/24	4/25/24	3,470	26	\$234	\$315	\$79	\$13	\$641	31	18%	11,839,640
4/26/24	5/28/24	3,601	23	\$242	\$327	\$74	\$14	\$657	33	20%	12,286,612
5/29/24	6/25/24	4,060	19	\$281	\$368	\$56	\$12	\$717	28	32%	13,852,720
6/26/24	7/26/24	4,435	21	\$301	\$402	\$78	\$13	\$794	31	28%	15,132,220
7/27/24	8/27/24	4,501	21	\$305	\$408	\$78	\$13	\$805	32	28%	15,357,412
8/28/24	9/25/24	4,018	20	\$273	\$365	\$70	\$12	\$719	29	28%	13,709,416
9/26/24	10/28/24	3,423	24	\$281	\$317	\$15	\$14	\$628	33	18%	11,679,276
10/29/24	11/23/24	2,816	24	\$247	\$261	\$61	\$11	\$580	26	19%	9,608,192
11/24/24	12/26/24	7,620	33	\$474	\$706	\$107	\$14	\$1,301	33	29%	25,999,440
TOTALS		54883	33	\$3,778	\$5,006	\$898	\$155	\$9,838	370	19%	187,260,796

Warehouse

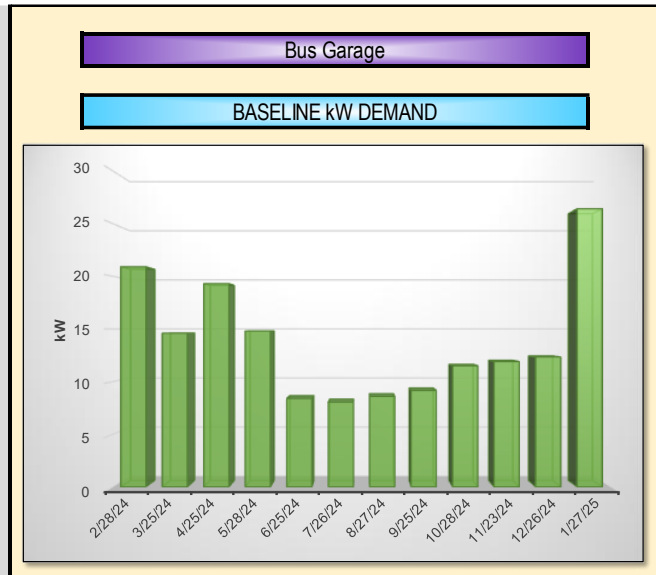
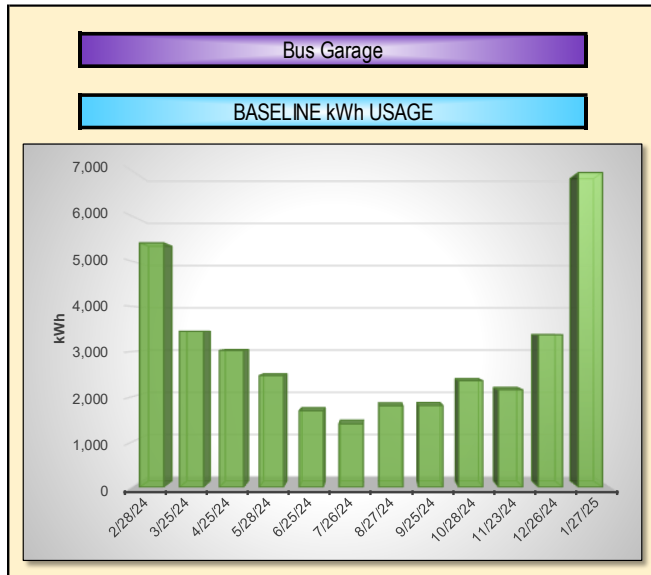


Warehouse					ELECTRIC METER #1						
Provider:	Atlantic City Electric			Account #	5500 0024 814				Meter #	NXA185043571	
Commodity:				Location					Meter #		
Billing Period Start Date	Actual Reading	Usage kWh	Demand kW	Electric Delivery Charges	Electric Commodity Charges	Electric Demand Charges	Fixed Customer Charges	Total Electric Charges	Days	Load Factor	BTU
1/27/24	2/28/24	6,972	18	\$470	\$633	\$58	\$14	\$1,175	33	49%	23,788,464
2/29/24	3/25/24	5,237	18	\$311	\$475	\$45	\$11	\$843	26	47%	17,868,644
3/26/24	4/25/24	5,951	15	\$400	\$825	\$45	\$13	\$1,282	31	54%	20,304,812
4/26/24	5/28/24	6,387	14	\$429	\$1,595	\$43	\$14	\$2,081	33	60%	21,792,444
5/29/24	6/25/24	6,017	14	\$412	\$546	\$42	\$12	\$1,012	28	63%	20,530,004
6/26/24	7/26/24	7,246	17	\$492	\$657	\$63	\$13	\$1,225	31	57%	24,723,352
7/27/24	8/27/24	7,289	17	\$495	\$661	\$65	\$13	\$1,234	32	55%	24,870,068
8/28/24	9/25/24	5,895	15	\$1,100	\$535	\$52	\$12	\$1,699	29	56%	20,113,740
9/26/24	10/28/24	6,197	13	\$391	\$574	\$44	\$14	\$1,023	33	59%	21,144,164
10/29/24	11/23/24	4,941	16	\$308	\$458	\$40	\$11	\$816	26	50%	16,858,692
11/24/24	12/26/24	6,425	16	\$400	\$595	\$51	\$14	\$1,060	33	51%	21,922,100
12/27/24	1/27/25	6,263	17	\$397	\$668	\$54	\$13	\$1,132	32	47%	21,369,356
TOTALS		74820	18	\$5,605	\$8,222	\$600	\$154	\$14,581	367	47%	255,285,840



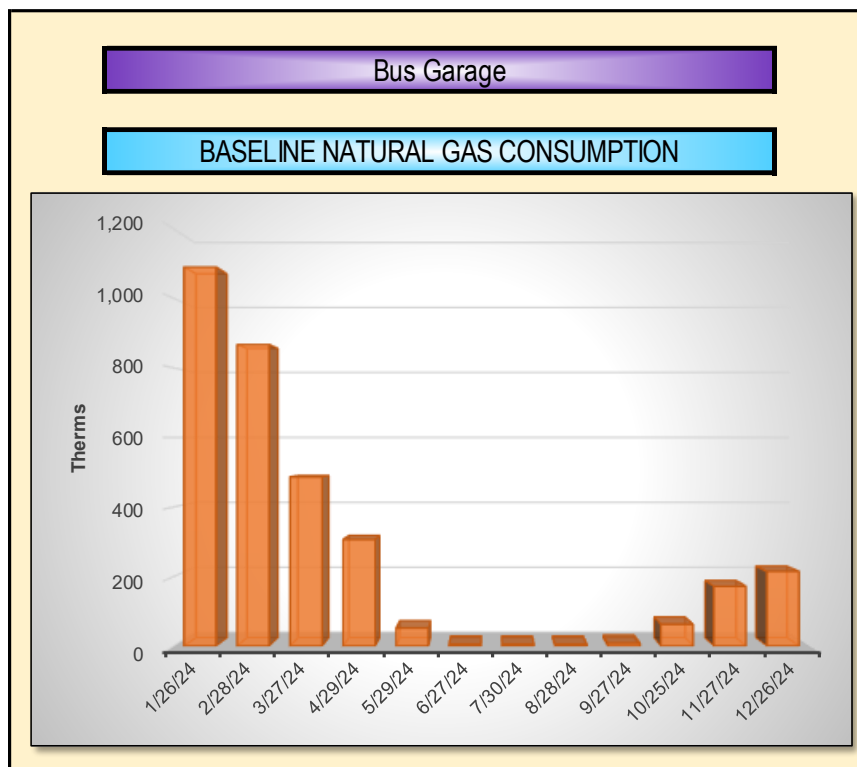
Warehouse						Natural Gas Meter #1		
Provider	SJG		Account #	4192520000		Meter #	776124	
Commodity			Account #			Meter #		
Billing Period Start Date	Actual Reading	Therms	Gas Delivery Charges	Gas Commodity Charges	Fixed Customer Charge	Gas Total Charges	Cost/Therm Checksum	BTU
12/22/23	1/26/24	760	\$822	\$340	\$47	\$1,209	\$1.53	76,029,000
1/27/24	2/28/24	614	\$671	\$268	\$45	\$984	\$1.53	61,404,000
2/29/24	3/27/24	190	\$208	\$95	\$38	\$340	\$1.59	18,977,000
3/28/24	4/29/24	117	\$128	\$58	\$45	\$231	\$1.59	11,707,000
4/30/24	5/29/24	0	\$0	\$0	\$41	\$41	\$0.00	0
5/30/24	6/27/24	0	\$0	\$0	\$39	\$39	\$0.00	0
6/28/24	7/30/24	0	\$0	\$0	\$39	\$39	\$0.00	0
7/31/24	8/28/24	0	\$0	\$0	\$39	\$39	\$0.00	0
8/29/24	9/27/24	0	\$0	\$0	\$41	\$41	\$0.00	0
9/28/24	10/25/24	0	\$0	\$0	\$38	\$38	\$0.00	0
10/26/24	11/22/24	43	\$54	\$23	\$38	\$115	\$1.77	4,339,000
11/23/24	12/26/24	617	\$673	\$262	\$46	\$981	\$1.52	61,714,000
TOTALS		2,342	\$2,556	\$1,047	\$494	\$4,097	\$1.54	234,170,000

Bus Garage



Bus Garage					ELECTRIC METER #1						
Provider:	Atlantic City Electric			Account #	55001908924				Meter #	NXA185043569	
Commodity:				Location					Meter #	99F105737304	
Billing Period Start Date	Actual Reading	Usage kWh	Demand kW	Electric Delivery Charges	Electric Commodity Charges	Electric Demand Charges	Fixed Customer Charges	Total Electric Charges	Days	Load Factor	BTU
1/27/24	2/28/24	3,181	13	\$215	\$289	\$41	\$14	\$558	33	31%	10,853,572
2/29/24	3/25/24	2,337	12	\$158	\$212	\$29	\$11	\$410	26	32%	7,973,844
3/26/24	4/25/24	2,333	11	\$157	\$212	\$34	\$13	\$416	31	28%	7,960,196
4/26/24	5/28/24	2,033	14	\$137	\$184	\$35	\$14	\$370	33	19%	6,936,596
5/29/24	6/25/24	1,667	8	\$115	\$151	\$25	\$12	\$303	28	30%	5,687,804
6/26/24	7/26/24	1,382	8	\$94	\$125	\$29	\$13	\$261	31	23%	4,715,384
7/27/24	8/27/24	1,777	8	\$121	\$161	\$30	\$13	\$325	32	29%	6,063,124
8/28/24	9/25/24	1,781	8	\$121	\$162	\$27	\$12	\$322	29	32%	6,076,772
9/26/24	10/28/24	2,335	11	\$147	\$216	\$38	\$14	\$415	33	26%	7,967,020
10/29/24	11/23/24	2,131	12	\$133	\$198	\$30	\$11	\$371	26	29%	7,270,972
11/24/24	12/26/24	3,353	12	\$209	\$311	\$39	\$14	\$573	33	34%	11,440,436
12/27/24	1/27/25	4,211	17	\$268	\$489	\$54	\$13	\$824	32	32%	14,367,932
TOTALS		28521	17	\$1,873	\$2,710	\$412	\$154	\$5,148	367	19%	97,313,652

Bus Garage						ELECTRIC METER #2					
Provider:	Atlantic City Electric				Account #	50016355260			Meter #	NYA171152698	
Commodity:					Location				Meter #		
Billing Period Start Date	Actual Reading	Usage kWh	Demand kW	Electric Delivery Charges	Electric Commodity Charges	Electric Demand Charges	Fixed Customer Charges	Total Electric Charges	Days	Load Factor	BTU
12/28/23	1/25/24	2,222	8	149	\$219	\$21	\$12	\$252	29	40%	7,581,464
1/26/24	2/28/24	1,111	3	75	\$97.52	\$11.52	\$14.22	\$123	34	45%	3,790,732
2/29/24	3/25/24	693	8	47	\$87.79	\$19.42	\$10.88	\$118	26	14%	2,364,516
3/26/24	4/25/24	436	1	29	\$36.36	\$3.91	\$12.97	\$53	31	59%	1,487,632
4/26/24	5/28/24	23	0	2	\$1.91	\$0.32	\$13.81	\$16	33	29%	78,476
5/29/24	6/25/24	20	0	0	\$2.10	\$1.02	\$11.72	\$15	28	60%	68,240
6/26/24	7/26/24	23	1	17	\$2.48	\$2.56	\$12.97	\$18	31	4%	78,476
7/27/24	8/27/24	25	1	2	\$2.68	\$4.53	\$13.39	\$21	32	3%	85,300
8/28/24	9/25/24	21	0	0	2	\$1.22	\$12.13	\$16	29	75%	71,652
9/26/24	10/28/24	24	0	1	\$2.18	\$0.23	\$13.80	\$16	33	76%	81,888
10/29/24	11/23/24	19	0	1	\$1.66	\$0.00	\$10.88	\$13	26	61%	64,828
11/24/24	12/26/24	2,748	9	171	\$287.83	\$27.21	\$13.81	\$329	33	39%	9,376,176
TOTALS		7365	9	\$494	\$744	\$93	\$153	\$989	365	9%	25,129,380

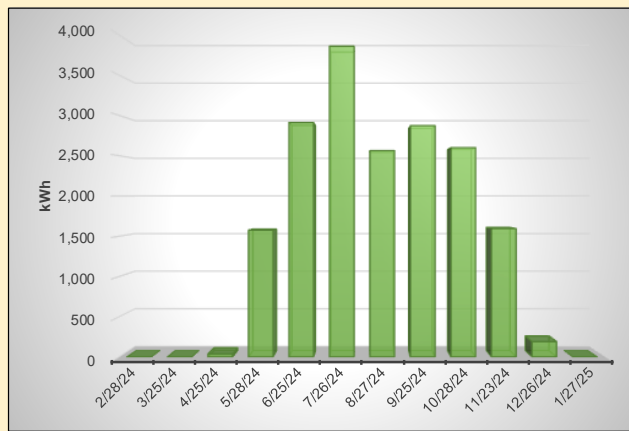


Bus Garage						Natural Gas Meter #1		
Provider	SJG		Account #	3192520000		Meter #	788197	
Commodity			Account #			Meter #		
Billing Period Start Date	Actual Reading	Therms	Gas Delivery Charges	Gas Commodity Charges	Fixed Customer Charge	Gas Total Charges	Cost/Therm Checksum	BTU
12/22/23	1/26/24	1,090	\$1,178	\$482	\$47	\$1,708	\$1.52	108,982,000
1/27/24	2/28/24	867	\$948	\$376	\$45	\$1,369	\$1.53	86,688,000
2/29/24	3/27/24	486	\$533	\$219	\$38	\$790	\$1.55	48,635,000
3/28/24	4/29/24	307	\$336	\$138	\$45	\$519	\$1.55	30,666,000
4/30/24	5/29/24	52	\$57	\$19	\$41	\$117	\$1.47	5,165,000
5/30/24	6/27/24	5	\$6	\$3	\$39	\$47	\$1.59	515,000
6/28/24	7/30/24	5	\$6	\$3	\$45	\$53	\$1.63	515,000
7/31/24	8/28/24	5	\$6	\$2	\$39	\$47	\$1.54	515,000
8/29/24	9/27/24	8	\$9	\$4	\$41	\$53	\$1.54	823,000
9/28/24	10/25/24	63	\$68	\$30	\$38	\$136	\$1.56	6,271,000
10/26/24	11/27/24	172	\$187	\$81	\$38	\$306	\$1.56	17,184,000
11/28/24	12/26/24	215	\$234	\$90	\$46	\$370	\$1.51	21,466,000
TOTALS		3,274	\$3,567	\$1,448	\$499	\$5,515	\$1.53	327,425,000

Washington Township High School Stadium

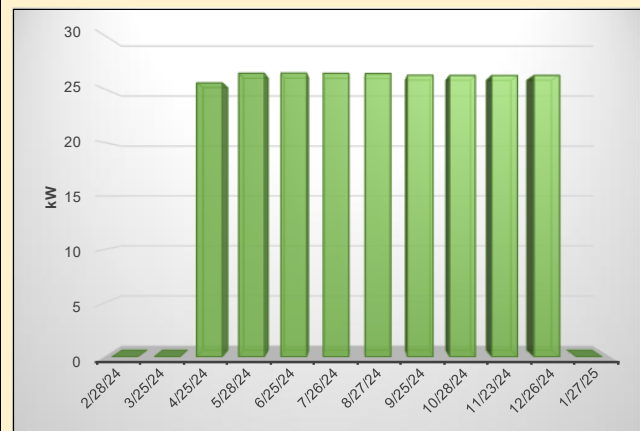
Washington Township High School Stadium

BASELINE kWh USAGE



Washington Township High School Stadium

BASELINE kW DEMAND



Washington Township High School Stadium					ELECTRIC METER #1						
Provider:	Atlantic City Electric			Account #	55000028609				Meter #	TED3988945	
Commodity:				Location	11/12 Athletic Field						
Billing Period Start Date	Actual Reading	Usage kWh	Demand kW	Electric Delivery Charges	Electric Commodity Charges	Electric Demand Charges	Fixed Customer Charges	Total Electric Charges	Days	Load Factor	BTU
1/26/24	2/28/24	0	0	\$0	\$0	\$0	\$17	\$17	34	\$0.00	0
2/29/24	3/25/24	0	0	\$0	\$0	\$0	\$13	\$13	26	\$0.00	0
3/26/24	4/25/24	39	26	\$3	\$0	\$77	\$15	\$94	31	0%	133,068
4/26/24	5/28/24	1,574	26	\$106	\$0	\$85	\$16	\$206	33	8%	5,370,488
5/29/24	6/25/24	2,912	26	\$292	\$0	\$86	\$14	\$391	28	16%	9,935,744
6/26/24	7/26/24	3,859	26	\$262	\$599	\$97	\$15	\$973	31	20%	13,166,908
7/27/24	8/27/24	2,564	26	\$640	\$0	\$100	\$16	\$755	32	13%	8,748,368
8/28/24	9/25/24	2,873	26	\$687	\$0	\$90	\$14	\$791	29	16%	9,802,676
9/26/24	10/28/24	2,600	26	\$591	\$0	\$87	\$16	\$694	33	13%	8,871,200
10/29/24	11/23/24	1,595	26	\$99	\$298	\$66	\$13	\$476	26	10%	5,442,140
11/24/24	12/26/24	191	26	\$18	\$217	\$84	\$10	\$329	33	1%	651,692
12/27/24	1/27/25	0	0	\$0	\$0	\$0	\$16	\$16	32	\$0.00	0
TOTALS		18207	26	\$2,698	\$1,114	\$770	\$173	\$4,754	368	8%	62,122,284

Energy Saving Utility Rates

DCO Energy used the following marginal rates to calculate energy cost savings. Due to the BPU approved electric utility rate increase in July of 2025, the electric rates were updated from the baseline period of January through December 2025. Electric rates were calculated from bills dated July through September 2025, natural gas rates were calculated from January to December 2025. This methodology has been reviewed and approved by Washington Township School District.

CALCULATED UTILITY RATES BY BUILDING			
BUILDING/FACILITY	ELECTRIC		NATURAL GAS
	\$\$ / kW	\$\$ / kWh	Therms
Washington Township High School	\$13.410	\$0.132	\$1.15
Chestnut Ridge Middle School	\$13.21	\$0.129	\$1.49
Orchard Valley Middle School	\$13.188	\$0.138	\$1.53
Bunker Hill Middle School	\$13.486	\$0.119	\$1.41
Thomas Jefferson Elementary School	\$13.178	\$0.112	\$1.53
Hurffville Elementary School	\$12.471	\$0.121	\$1.51
Whitman Elementary School	\$13.343	\$0.115	\$1.50
Birches Elementary School	\$13.447	\$0.114	\$1.52
Bells Elementary School	\$13.423	\$0.115	\$1.51
Wedgwood Elementary School	\$13.424	\$0.119	\$1.48
Grenloch Early Childhood Center	\$8.347	\$0.124	\$1.50
O'Brien Hall	\$3.614	\$0.195	\$1.16
Administration Building	\$13.211	\$0.133	\$1.50
Operations Building	\$3.625	\$0.190	\$0.00
Warehouse	\$3.613	\$0.177	\$1.54
Bus Garage	\$3.619	\$0.161	\$1.53
Washington Township High School Stadium	\$3.619	\$0.170	



ENERGY SAVINGS PLAN

SECTION 3 – ENERGY CONSERVATION MEASURES

Energy Conservation Measure Breakdown by Building

The matrix below details which ECMs were applied and evaluated by building.

Washington Township Public Schools ECM MATRIX ECM was evaluated ECM included in the project		Washington Township High School	Chestnut Ridge Middle School	Orchard Valley Middle School	Bunker Hill Middle School	Thomas Jefferson Elementary School	Hurffville Elementary School	Whitman Elementary School	Birches Elementary School	Bells Elementary School	Wedgwood Elementary School	Grenloch Early Childhood Center	O'Brien Hall	Administration Building	Operations Building	Warehouse	Bus Garage	Washington Township High School Stadium
		ECM	ECM DESCRIPTION															
1	LED Lighting Tube Retrofit																	
2	LED Lighting Volumetric Kit Retrofit																	
3	Lighting Controls																	
4	Roof Renovations																	
5	Pipe and Valve Insulation																	
6	Building Envelope Weatherization																	
7	Plug Load Controls																	
8	Etemp																	
9	Walk-In Refrigeration Controls																	
10	Retro-Commissioning																	
11	Combined Heating & Power																	
12	Hot Water Boiler Plant Replacement																	
13	Steam Boiler Replacements																	
14	Chiller Replacements																	
15	Unit Ventilator Replacements																	
16	Solar PPA																	
17	Stadium Lighting																	
18	Practice Field Lighting																	
19	Destratification Fans																	
20	Window Film																	
21	HVAC Armor																	
22	Threatre Electrical Upgrades																	

ECM Breakdown by Cost & Savings

Washington Township Public Schools		INSTALLED COST	ANNUAL ELECTRIC COST SAVINGS	ANNUAL NATURAL GAS COST SAVINGS	ANNUAL ENERGY COST SAVINGS
ECM #	ENERGY CONSERVATION MEASURE	\$	\$	\$	\$
2	LED Lighting Volumetric Kit Retrofit	\$3,582,387	\$461,883	(\$6,488)	\$455,395
3	Lighting Controls	\$448,725	\$53,396	\$0	\$53,396
4	Roof Renovations	\$4,334,650	\$4	\$1,627	\$1,631
5	Pipe and Valve Insulation	\$100,442	\$0	\$7,663	\$7,663
6	Building Envelope Weatherization	\$882,246	\$13,835	\$52,980	\$66,815
7	Plug Load Controls	\$259,517	\$25,138	\$0	\$25,138
8	Etemp	\$82,936	\$20,329	\$0	\$20,329
9	Walk-In Refrigeration Controls	\$107,648	\$8,028	\$0	\$8,028
10	Retro-Commissioning	\$361,036	\$23,198	\$9,099	\$32,298
11	Combined Heating & Power	\$205,101	\$2,933	(\$551)	\$2,382
12	Hot Water Boiler Plant Replacement	\$1,912,880	\$0	\$8,902	\$8,902
16	Solar PPA	\$0	\$543,587	\$0	\$543,587
17	Stadium Lighting	\$346,000	\$823	\$0	\$823
19	Destratification Fans	\$212,050	(\$1,667)	\$22,249	\$20,581
20	Window Film	\$792,004	\$84,720	\$1,971	\$86,691
21	HVAC Armor	\$858,225	\$60,191	\$0	\$60,191
TOTALS		\$14,485,847	\$1,296,397	\$97,453	\$1,393,850

Washington Township Public Schools		ELECTRIC CONSUMPTION SAVINGS	ELECTRIC DEMAND SAVINGS	NATURAL GAS SAVINGS
ECM #	ENERGY CONSERVATION MEASURE	kWh	kW	THERMS
2	LED Lighting Volumetric Kit Retrofit	2,874,463	617	(4,830)
3	Lighting Controls	320,314	82	0
4	Roof Renovations	33	0	1,269
5	Pipe and Valve Insulation	0	0	5,499
6	Building Envelope Weatherization	111,240	0	38,254
7	Plug Load Controls	194,842	0	0
8	Etemp	163,427	0	0
9	Walk-In Refrigeration Controls	58,397	1	0
10	Retro-Commissioning	182,643	0	6,738
11	Combined Heating & Power	16,914	4	(481)
12	Hot Water Boiler Plant Replacement	0	0	5,888
16	Solar PPA	0	0	0
17	Stadium Lighting	4,843	0	0
19	Destratification Fans	(13,376)	0	16,339
20	Window Film	449,293	184	2,086
21	HVAC Armor	170,288	249	0
TOTALS		4,533,320	1,137	70,762

Washington Township Public Schools		TOTAL SITE ENERGY SAVINGS	TOTAL SOURCE ENERGY SAVINGS
ECM #	ENERGY CONSERVATION MEASURE	MMBTU	MMBTU
2	LED Lighting Volumetric Kit Retrofit	9,325	32,252
3	Lighting Controls	1,093	3,650
4	Roof Renovations	127	133
5	Pipe and Valve Insulation	550	576
6	Building Envelope Weatherization	4,205	5,273
7	Plug Load Controls	665	2,220
8	Etemp	558	1,862
9	Walk-In Refrigeration Controls	199	666
10	Retro-Commissioning	1,297	2,787
11	Combined Heating & Power	10	142
12	Hot Water Boiler Plant Replacement	589	616
16	Solar PPA	0	60,499
17	Stadium Lighting	17	55
19	Destratification Fans	1,588	1,558
20	Window Film	1,742	5,339
21	HVAC Armor	581	1,941
TOTALS		22,543.9	119,570.0

ECM Breakdown by Greenhouse Gas Reduction

Washington Township Public Schools		Reduction of CO ₂	Reduction of NO _x	Reduction of SO ₂	Reduction of Hg
ECM #	ENERGY CONSERVATION MEASURE	LBS	LBS	LBS	LBS
2	LED Lighting Volumetric Kit Retrofit	4,312,677	8,004	18,684	1.0
3	Lighting Controls	486,877	897	2,082	0.1
4	Roof Renovations	14,899	12	0	0.0
5	Pipe and Valve Insulation	64,339	51	0	0.0
6	Building Envelope Weatherization	616,651	663	723	0.0
7	Plug Load Controls	296,160	546	1,266	0.1
8	Etemp	248,408	458	1,062	0.1
9	Walk-In Refrigeration Controls	88,764	164	380	0.0
10	Retro-Commissioning	356,450	573	1,187	0.1
11	Combined Heating & Power	16,231	10	11	0.0
12	Hot Water Boiler Plant Replacement	68,891	54	0	0.0
16	Solar PPA	8,069,320	14,865	34,507	1.9
17	Stadium Lighting	7,361	14	31	0.0
19	Destratification Fans	170,830	113	-87	0.0
20	Window Film	707,333	1,277	2,920	0.2
21	HVAC Armor	258,838	477	1,107	0.1
TOTALS		15,784,028.2	28,175.5	63,874.9	3.5

Note:

➤ Factors used to calculate Greenhouse Gas Reductions are as follows:

- $CO_2 = (1.52 * kWh \text{ Savings}) + (11.7 * Therm \text{ Savings})$
- $NO_x = (0.0028 * kWh \text{ Savings}) + (0.0092 * Therm \text{ Savings})$
- $SO_2 = (0.0065 * kWh \text{ Savings})$
- $Hg = (0.000000356 * kWh \text{ Savings})$

See Combined Heat and Power ECM for emission calculation per NJ BPU Protocols.

ECM Breakdown by Building

Please see Appendix F for ECM Breakdown by Building.

ECM Budgeting Narrative

Detailed plans, schematics and specifications for Washington Township School District were not available to deliver a cost estimate for each ECM. The budgetary costs carried out in the project are based on good faith estimates, contractor supplied budgets for similar ECMs on other recent projects and a database of actual installed costs for various ECMs.

Washington Township Public Schools		INSTALLED COST
ECM #	ENERGY CONSERVATION MEASURE	\$
2	LED Lighting Volumetric Kit Retrofit	\$3,582,387
3	Lighting Controls	\$448,725
4	Roof Renovations	\$4,334,650
5	Pipe and Valve Insulation	\$100,442
6	Building Envelope Weatherization	\$882,246
7	Plug Load Controls	\$259,517
8	Etemp	\$82,936
9	Walk-In Refrigeration Controls	\$107,648
10	Retro-Commissioning	\$361,036
11	Combined Heating & Power	\$205,101
12	Hot Water Boiler Plant Replacement	\$1,912,880
16	Solar PPA	\$0
17	Stadium Lighting	\$346,000
19	Destratification Fans	\$212,050
20	Window Film	\$792,004
21	HVAC Armor	\$858,225
TOTALS		\$14,485,847

Incentives



As part of the Energy Savings Plan for Washington Township School District, prescriptive & custom rebates through Atlantic City Electric and South Jersey Gas were investigated. The estimated incentive amount is listed below. Upon final selection of the project scope and award of subcontractor bids, the incentive applications will be filed.

Incentive Calculations

Washington Township Public Schools			Estimated Incentive
ECM #	BUILDING/FACILITY	ENERGY CONSERVATION MEASURE	\$
2	Washington Township High School	LED Lighting Volumetric Kit Retrofit	183,827.70
5	Washington Township High School	Pipe and Valve Insulation	5,809.69
6	Washington Township High School	Building Envelope Weatherization	46,706.88
9	Washington Township High School	Walk-In Refrigeration Controls	300.00
2	Chestnut Ridge Middle School	LED Lighting Volumetric Kit Retrofit	42,253.20
5	Chestnut Ridge Middle School	Pipe and Valve Insulation	1,878.27
6	Chestnut Ridge Middle School	Building Envelope Weatherization	11,827.18
9	Chestnut Ridge Middle School	Walk-In Refrigeration Controls	150.00
12	Chestnut Ridge Middle School	Hot Water Boiler Plant Replacement	10,304.24
2	Orchard Valley Middle School	LED Lighting Volumetric Kit Retrofit	44,595.00
5	Orchard Valley Middle School	Pipe and Valve Insulation	2,961.90
6	Orchard Valley Middle School	Building Envelope Weatherization	14,290.09
9	Orchard Valley Middle School	Walk-In Refrigeration Controls	150.00
12	Orchard Valley Middle School	Hot Water Boiler Plant Replacement	10,304.24
2	Bunker Hill Middle School	LED Lighting Volumetric Kit Retrofit	49,620.60
5	Bunker Hill Middle School	Pipe and Valve Insulation	1,444.48
6	Bunker Hill Middle School	Building Envelope Weatherization	17,437.40
9	Bunker Hill Middle School	Walk-In Refrigeration Controls	150.00
2	Thomas Jefferson Elementary School	LED Lighting Volumetric Kit Retrofit	20,071.80
6	Thomas Jefferson Elementary School	Building Envelope Weatherization	398.54
9	Thomas Jefferson Elementary School	Walk-In Refrigeration Controls	150.00
2	Hurffville Elementary School	LED Lighting Volumetric Kit Retrofit	19,314.90
5	Hurffville Elementary School	Pipe and Valve Insulation	2,922.16
6	Hurffville Elementary School	Building Envelope Weatherization	11,009.39
9	Hurffville Elementary School	Walk-In Refrigeration Controls	150.00

Washington Township Public Schools			Estimated Incentive
ECM #	BUILDING/FACILITY	ENERGY CONSERVATION MEASURE	\$
2	Whitman Elementary School	LED Lighting Volumetric Kit Retrofit	21,357.90
5	Whitman Elementary School	Pipe and Valve Insulation	765.29
6	Whitman Elementary School	Building Envelope Weatherization	12,214.46
9	Whitman Elementary School	Walk-In Refrigeration Controls	150.00
2	Birches Elementary School	LED Lighting Volumetric Kit Retrofit	21,187.80
5	Birches Elementary School	Pipe and Valve Insulation	1,291.29
6	Birches Elementary School	Building Envelope Weatherization	11,488.23
2	Bells Elementary School	LED Lighting Volumetric Kit Retrofit	17,290.80
5	Bells Elementary School	Pipe and Valve Insulation	746.62
6	Bells Elementary School	Building Envelope Weatherization	11,941.29
2	Wedgwood Elementary School	LED Lighting Volumetric Kit Retrofit	16,792.20
5	Wedgwood Elementary School	Pipe and Valve Insulation	1,061.28
6	Wedgwood Elementary School	Building Envelope Weatherization	11,016.46
2	Grenloch Early Childhood Center	LED Lighting Volumetric Kit Retrofit	12,177.90
5	Grenloch Early Childhood Center	Pipe and Valve Insulation	365.61
6	Grenloch Early Childhood Center	Building Envelope Weatherization	2,637.52
2	O'Brien Hall	LED Lighting Volumetric Kit Retrofit	2,052.00
2	Administration Building	LED Lighting Volumetric Kit Retrofit	10,453.50
6	Administration Building	Building Envelope Weatherization	675.22
2	Operations Building	LED Lighting Volumetric Kit Retrofit	1,980.00
6	Operations Building	Building Envelope Weatherization	43.23
2	Warehouse	LED Lighting Volumetric Kit Retrofit	1,470.60
9	Warehouse	Walk-In Refrigeration Controls	150.00
2	Bus Garage	LED Lighting Volumetric Kit Retrofit	789.30

Estimated incentive values for the Washington Township School District ESIP project were calculated using prescriptive & custom rebates through Atlantic City Electric and South Jersey Gas. The total incentive amount was calculated to be \$658,126.

No implied and/or written guarantee is made regarding the receipt of incentives. All incentives estimates carry inherent risks that may jeopardize the receipt of them. Therefore, Washington Township School District acknowledges and accepts that any project proposed should not rely on the receipt of incentives as a reason to implement it.

Combined Heat & Power

One of the goals of the State of New Jersey is to enhance energy efficiency through on-site power generation with recovery and productive use of waste heat, and to reduce existing and new demands to the electric power grid. The Board of Public Utilities seeks to accomplish this goal by providing generous financial incentives for Combined Heat & Power (CHP) and Fuel Cell (FC) installations.

Eligible CHP or Waste Heat to Power (WHP) projects must achieve an annual system efficiency of at least 60% (Higher Heating Value - HHV), based on total energy input and total utilized energy output. Mechanical energy may be included in the efficiency evaluation.

In order to qualify for incentives, systems must operate a minimum of 5,000 full-load equivalent hours per year (i.e. run at least 5,000 hours per year at full rated kW output). The Office of Clean Energy (OCE) may grant exceptions to this minimum operating hours requirement for Critical Facilities, provided the proposed system operates a minimum of 3,500 full-load equivalent hours per year and is equipped with blackstart and islanding capability. For this program, a Critical Facility is defined as any:

- (a) public facility, including any federal, state, county, or municipal facility,
- (b) non-profit and/or private facility, including any hospital, police station, fire station, water/wastewater treatment facility, school, multifamily building, or similar facility that:
 - (A) is determined to be either Tier 1 or critical infrastructure by the New Jersey Office of Emergency Management or the State Office of Homeland Security and Preparedness or
 - (B) could serve as a Shelter during a power outage. A Shelter is a facility able to provide food, sleeping arrangements, and other amenities to its residents and the community.

The CHP, FC, or WHP system must have a ten (10) year all-inclusive warranty. The warranty must cover the major components of the system eligible for the incentive, to protect against breakdown or degradation in electrical output of more than ten percent from the originally rated electrical output. The warranty shall cover the full cost of repair or replacement of defective components or systems, including coverage for labor costs to remove and reinstall defective components or systems. In the event the system warranty does not meet program requirements, customer must purchase an extended warranty or a ten (10) year maintenance/service contract. The cost of the ten (10) year warranty or service contract may be considered as part of the cost of the project. Notwithstanding the foregoing, public entities that are prohibited from entering into agreements for the full ten (10) years may comply with the 10-year requirement by:

- (a) providing an agreement for the longest lawful term,

(b) committing the entity to purchase an agreement for the remaining years, and

(c) either:

(i) providing the vendor's commitment for specific pricing for those remaining years, or

(ii) assuming the pricing for the remaining years will increase by 2.5% each year

Incentive Structure:

Eligible Technologies	Size (Installed Rated Capacity)	Incentive (\$/kW)	% of Total Cost Cap per project ³	\$ Cap per project ³
Powered by non-renewable or renewable fuel source, or combination ⁴ : Gas Internal Combustion Engine Gas Combustion Turbine Microturbine Fuel Cells with Heat Recovery (FCHR)	≤500 kW	\$2,000	30-40% ²	\$2 million
	>500 kW - 1 MW	\$1,000		
	> 1 MW - 3 MW	\$550	30%	\$3 million
	>3 MW	\$350		
Fuel Cell without Heat Recover (FCwoHR)	Same as above(1)	Applicable amount above	30%	\$1 million
Waste Heat to Power	≤ 1MW	\$1,000	30%	\$2 million
	> 1MW	\$500		\$3 million

Footnotes:

- (1) Incentives are tiered, which means the incentive levels vary based upon the installed rated capacity, as listed in the chart above. For example, a 4 MW CHP system would receive \$2.00/watt for the first 500 kW, \$1.00/watt for the second 500 kW, \$0.55/watt for the next 2 MW and \$0.35/watt for the last 1 MW (up to the caps listed).
- (2) The maximum incentive will be limited to 30% of total project. For CHP-FC projects up to 1 MW, this cap will be increased to 40% where a cooling application is used or included with the CHP system (e.g. absorption chiller).
- (3) Projects will be eligible for incentives shown above, not to exceed the lesser of % of total project cost per project cap or maximum \$ per project cap. Projects installing CHP or FC with WHP will be eligible for incentive shown above, not to exceed the lesser caps of the CHP or FC incentive. Minimum efficiency will be calculated based on annual total electricity generated, utilized waste heat at the host site (i.e. not lost/rejected), and energy input.
- (4) Systems fueled by a Class 1 Renewable Fuel Source, as defined by N.J.A.C. 14:8-2.5, are eligible for a 30% incentive bonus. If the fuel is mixed, the bonus will be prorated accordingly. For example, if the mix is 60/40 (60% being a Class 1 renewable), the bonus will be 18%. This bonus will be included in the final performance incentive payment, based on system performance and fuel mix consumption data. Total incentive, inclusive of bonus, shall not exceed above stipulated caps.
- (5) CHP or FC systems located at Critical Facility and incorporating blackstart and islanding technology are eligible for a 25% incentive bonus. This bonus incentive will be paid with the second/Installation incentive payment. Total incentive, inclusive of bonus, shall not exceed above stipulated caps.

Incentive Payment Schedule

The total incentive is divided into three partial payments. Each stage of payment requires additional documentation and/or has conditions that must be met. At approval, the maximum incentive partial payment amounts are calculated by multiplying the total incentive by the ratios listed in the following table.

Purchase	Installation	Acceptance of 12 months post-installation performance data
30%	50%	20%

(e.g., for the purpose of calculating a payback period)

ECM 2 & 3–LED Lighting Volumetric Kit Retrofit & Lighting Controls

Washington Township Public Schools ECM MATRIX ☒ ECM was evaluated ☒ ECM included in the project		Washington Township High School	Chestnut Ridge Middle School	Orchard Valley Middle School	Bunker Hill Middle School	Thomas Jefferson Elementary School	Hurffville Elementary School	Whitman Elementary School	Birches Elementary School	Bells Elementary School	Wedwood Elementary School	Grenloch Early Childhood Center	O'Brien Hall	Administration Building	Operations Building	Warehouse	Bus Garage
ECM #	ECM DESCRIPTION																
2	LED Lighting Volumetric Kit Retrofit	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
3	Lighting Controls	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☐	☒	☒	☒	☒

Lighting upgrades can greatly reduce energy consumption and lower energy bills, while maintaining lighting levels and quality by upgrading lighting components to more efficient and advanced technologies. Upgrading technologies can also offer employees greater control over lighting, allowing for additional energy savings.

Improvements in lighting technologies have led to increased lifetimes for components that will result in fewer failures and lengthen the time between maintenance activities.

The implementation of a routine maintenance program in addition to the lighting retrofit will greatly simplify the maintenance practices and reduce the operational costs.



Lighting controls can save energy and reduce peak demand in offices and other facilities. Controls save money while providing the user convenience and an improved lighting environment. There are several different kinds of controls. The choice of control type should be based on lighting usage patterns and the type of space served.

Areas with intermittent occupancy are well-suited to occupancy sensors. In large, open office areas with many occupants, scheduled switching (“time scheduling”) is often an effective energy-saving strategy. In daylight offices, properly adjusted daylight sensors with dimming ballasts make sense. Because some workers prefer lower lighting levels, bi-level manual switching is another option. Advanced lighting controls can be used for demand limiting to allow building managers to reduce lighting loads when electricity demand costs are high.



Existing Conditions



Scope of Work – LED Lighting Tube Retrofit & LED Lighting Flat Panel Replacement

Retrofit or replace existing interior and exterior fixtures with LED bulbs/fixtures as proposed in the line-by-lines provided in Appendix G – Energy Savings Supplemental Information. The new LED tube retrofits do not require the existing fluorescent ballasts to operate (Type B retrofit). The existing ballasts across the district will be removed during this implementation.

Scope of Work – Lighting Controls

Add vacancy sensors to existing spaces to control LED tubes. Refer to appendix G for additional details.

ECM Calculations

BPU Protocols were used to calculate LED lighting retrofit and control savings. A coincidence factor is applied to estimate peak demand savings. The impact on the HVAC systems is captured as well. See Appendix G for Lighting Line-by-Lines.

LED Lighting Volumetric Kit Retrofit Savings													
BUILDING	SQFT	SPACE	kW _b	kW _t	ΔkW	CF	Hours per Year	HVAC _d	HVAC _e	HVAC _g	Peak Demand Savings (kW)	Replacement Energy Savings (kWh)	Replacement Fuel Savings (Therms)
Washington Township High School	450,130	INTERIOR	495.398	156.96	338.438	0.5	2575	0.44	0.1	-0.00023	243.7	958,625.6	-2,004.4
		EXTERIOR	56.736	19.588	37.148	0.5	4380					162,708.2	0.0
Chestnut Ridge Middle School	108,813	INTERIOR	111.679	39.048	72.631	0.5	2575	0.44	0.1	-0.00023	52.3	205,727.3	-430.2
		EXTERIOR	13.063	4.127	8.936	0.5	4380					39,139.7	0.0
Orchard Valley Middle School	108,813	INTERIOR	118.655	40.347	78.308	0.5	2575	0.44	0.1	-0.00023	56.4	221,807.4	-463.8
		EXTERIOR	13.143	4.126	9.017	0.5	4380					39,494.5	0.0
Bunker Hill Middle School	106,574	INTERIOR	140.522	41.06	99.462	0.5	2575	0.44	0.1	-0.00023	71.6	281,726.1	-589.1
		EXTERIOR	24.155	7.162	16.993	0.5	4380					74,429.3	0.0
Thomas Jefferson Elementary School	72,396	INTERIOR	59.378	20.945	38.433	0.5	2575	0.44	-0.04		27.7	95,006.4	0.0
		EXTERIOR	6.086	1.67	4.416	0.5	4380					19,342.1	0.0
Hurffville Elementary School	65,655	INTERIOR	68.969	22.0705	46.8985	0.5	2575	0.44	0.1	-0.00023	33.8	132,840.0	-277.8
		EXTERIOR	0	0	0	0.5	4380					0.0	0.0
Whitman Elementary School	64,411	INTERIOR	74.988	38.62125	36.36675	0.5	2575	0.44	0.1	-0.00023	26.2	103,008.8	-215.4
		EXTERIOR	3.794	0.865	2.929	0.5	4380					12,829.0	0.0
Birches Elementary School	63,411	INTERIOR	60.157	19.913	40.244	0.5	2575	0.44	0.1	-0.00023	29.0	113,991.1	-238.3
		EXTERIOR	10.856	2.469	8.387	0.5	4380					36,735.1	0.0
Bells Elementary School	62,617	INTERIOR	54.478	17.963	36.515	0.5	2575	0.44	0.1	-0.00023	26.3	103,428.7	-216.3
		EXTERIOR	9.751	2.389	7.362	0.5	4380					32,245.6	0.0
Wedgwood Elementary School	60,697	INTERIOR	59.632	20.306	39.326	0.5	2575	0.44	0.1	-0.00023	28.3	111,390.9	-232.9
		EXTERIOR	0	0	0	0.5	4380					0.0	0.0
Grenloch Early Childhood Center	39,936	INTERIOR	30.435	21.6733	8.7617	0.5	2575	0.44	0.1	-0.00023	6.3	24,817.5	-51.9
		EXTERIOR	8.176	2.1775	5.9985	0.5	4380					26,273.4	0.0
O'Brien Hall	22,900	INTERIOR	10.64	3.99	6.65	0.5	2575	0.44	0.1	-0.00023	4.8	18,836.1	-39.4
		EXTERIOR	0	0	0	0.5	4380					0.0	0.0
Administration Building	20,000	INTERIOR	28.005	18.106	9.899	0.5	2575	0.44	0.1	-0.00023	7.1	28,038.9	-58.6
		EXTERIOR	5.471	2.4525	3.0185	0.5	4380					13,221.0	0.0
Operations Building	5,625	INTERIOR	6.09	2.5575	3.5325	0.5	2575	0.44	-0.04		2.5	8,732.3	0.0
		EXTERIOR	0	0	0	0.5	4380					0.0	0.0
Warehouse	5,400	INTERIOR	3.333	1.577	1.756	0.5	2575	0.44	0.1	-0.00023	1.3	4,973.9	-10.4
		EXTERIOR	0.59	0.28	0.31	0.5	4380					1,357.8	0.0
Bus Garage	4,500	INTERIOR	0.375	0.146	0.229	0.5	2575	0.44	0.1	-0.00023	0.2	648.6	-1.4
		EXTERIOR	1.075	0.37	0.705	0.5	4380					3,087.9	0.0

Lighting Control Savings											
BUILDING	SPACE	CF	Hours per Year	HVAC _d	HVAC _e	HVAC _g	kWc (Lighting Controls)	SVG	Lighting Control Demand Savings (kW)	Lighting Control Electric Savings (kWh)	Lighting Control Fuel Savings (Therms)
Washington Township High School	INTERIOR	0.5	2575	0.44	0.1	-0.00023	176.548	0.24	30.51	120,017.33	-25.09
Chestnut Ridge Middle School	INTERIOR	0.5	2575	0.44	0.1	-0.00023	43.175	0.24	7.46	29,350.37	-6.14
Orchard Valley Middle School	INTERIOR	0.5	2575	0.44	0.1	-0.00023	44.473	0.24	7.68	30,232.75	-6.32
Bunker Hill Middle School	INTERIOR	0.5	2575	0.44	0.1	-0.00023	48.222	0.24	8.33	32,781.32	-6.85
Thomas Jefferson Elementary School	INTERIOR	0.5	2575	0.44	-0.04	0	22.615	0.24	3.91	13,417.03	0.00
Hurffville Elementary School	INTERIOR	0.5	2575	0.44	0.1	-0.00023	22.0705	0.24	3.81	15,003.53	-3.14
Whitman Elementary School	INTERIOR	0.5	2575	0.44	0.1	-0.00023	26.6125	0.24	4.60	18,091.18	-3.78
Birches Elementary School	INTERIOR	0.5	2575	0.44	0.1	-0.00023	22.382	0.24	3.87	15,215.28	-3.18
Bells Elementary School	INTERIOR	0.5	2575	0.44	0.1	-0.00023	20.352	0.24	3.52	13,835.29	-2.89
Wedgwood Elementary School	INTERIOR	0.5	2575	0.44	0.1	-0.00023	20.306	0.24	3.51	13,804.02	-2.89
Grenloch Early Childhood Center	INTERIOR	0.5	2575	0.44	0.1	-0.00023	13.5845	0.24	2.35	9,234.74	-1.93
O'Brien Hall	INTERIOR	0.5	2575	0.44	0.1	-0.00023	3.99	0.24	0.69	2,712.40	-0.57
Administration Building	INTERIOR	0.5	2575	0.44	0.1	-0.00023	9.865	0.24	1.70	6,706.23	-1.40
Operations Building	INTERIOR	0.5	2575	0.44	-0.04	0	1.705	0.24	0.29	1,011.54	0.00
Warehouse	INTERIOR	0.5	2575	0.44	0.1	-0.00023	1.857	0.24	0.32	1,262.39	-0.26
Bus Garage	INTERIOR	0.5	2575	0.44	0.1	-0.00023	0.516	0.24	0.09	350.78	-0.07

Lighting Retrofit

Annual Energy Savings

Replacement/Midstream Interior Lighting:

$$\Delta kWh = \frac{Qty_b \times W_b - Qty_q \times W_q}{1,000} \times Hrs \times (1 + HVAC_e)$$

Replacement/Midstream Exterior Lighting:

$$\Delta kWh = \frac{Qty_b \times W_b - Qty_q \times W_q}{1,000} \times Hrs$$

Annual Fuel Savings

Replacement/Midstream Interior Lighting:

$$\Delta Therms = (Qty_b \times W_b - Qty_q \times W_q) \times Hrs \times HVAC_g \times 10$$

Note: No fuel impacts are claimed in exterior lighting installation.

Peak Demand Savings

Retrofit Interior Lighting:

$$\Delta kW_{Peak} = \frac{Qty_b \times W_b - Qty_q \times W_q}{1,000} \times CF \times (1 + HVAC_d)$$

Retrofit Exterior Lighting:

$$\Delta kW_{Peak} = \frac{Qty_b \times W_b - Qty_q \times W_q}{1,000} \times CF$$

Definitions of Variables

Variable	Description	Value	Units	Ref
W_q	Wattage of Energy Efficient Fixture	Site-specific	W	
LPD_q	Installed lighting power density	Site-specific	W/Sq Ft	
LPD_b	Baseline lighting power density	Site-specific, if unknown look up in Table 3-193, Table 3-194, Table 3-196	W/Sq Ft	
LPA_b	Baseline lighting power allowance	Site-specific, if unknown look up in Table 3-196	W/Sq Ft or W/Linear Ft	[39]
LPA_q	Installed lighting power allowance	Site-specific, if unknown look up in Table 3-196	W/Sq Ft or W/Linear Ft	[39]
AL	If LPA unit is W/Sq Ft: AL is Area If LPA Unit is W/linear ft: AL is linear ft	Site-specific	Sq Ft or Linear Ft	
A	Area in Square Feet	Site-Specific	Square Foot	
Hrs	Annual Hours of Operation	Site-specific, if unknown use Table 3-197	Hrs/yr	[30]
LPD_{adj} (interior)	Interior Lighting LPD adjustment factor (25% better)	0.75	N/A	[44]
LPA_{adj} (exterior)	Exterior Lighting LPA adjustment factor (35% better)	0.65	N/A	[44]
$HVAC_e$	HVAC Interactive Factor for Annual Energy Savings	Look up in Table 3-198	N/A	[58][60]
$HVAC_f$	HVAC Interactive Factor for Annual Fuel Savings	Look up in Table 1 -8	N/A	[61]
$HVAC_d$	HVAC Interactive Factor for Peak Demand Savings	Look up in Table 3-198	N/A	[58][60]
CF	Coincidence Factor	Look up in Table 3-197	N/A	[30]
SVG_b	Savings control factor	Look up in Table 3-200		[47]
PDF	Gas peak day factor	Look up in Table 3-201		
RUL	Remaining useful life of existing equipment	Site-specific, if unknown use EUL/3	Years	
EUL	Effective useful life of new measure	See	Years	
1,000	Conversion from watts to kW	1,000	W/kW	
10	Conversion from MMBtu to therms	10	Therms/MMBtu	

Reference Tables

Building Type	Sector	CF	Hours
Retail	Large Commercial/Industrial	0.96	4,920
	Small Commercial	0.86	4,926
School	Large Commercial/Industrial & Small Commercial	0.50	2,575
Warehouse/ Industrial	Large Commercial/Industrial	0.7	4,116
	Small Commercial	0.68	3,799
Outside/Outdoor Area	All	0.11	3604
Parking Garage	All	0.98	8678
Multifamily – Common Areas ¹⁰⁸	Multifamily	0.86	5,950
Multifamily – In-Unit	Multifamily	0.59	679
Multifamily – Exterior	Multifamily	0.00	3,338
College/University - Cafeteria ¹⁰⁹	All	0.79	2,713
College/University – Classes ³	All	0.54	2,586
College/University - Dormitory ³	All	0.92	3,066
Religious Building ³	All	0.89	1,955
Nursing Home ³	All	0.92	5,840

Building Type	HVAC Interactive Factor for Peak Demand Savings (HVAC _d)		HVAC Interactive Factor for Annual Energy Savings (HVAC _e)			
	AC (Utility)	AC (PJM)	AC/NonElec	AC/ElecRes	Heat Pump	NoAC/ElecRes
Office	0.35	0.32	0.10	-0.15	-0.06	-0.25
Retail	0.27	0.26	0.06	-0.17	-0.05	-0.23
Education	0.44	0.44	0.10	-0.19	-0.04	-0.29
Warehouse	0.22	0.23	0.02	-0.25	-0.11	-0.27

Project Type	Fuel Type	HVAC _e
Large Retrofit (>200kW)	C&I Gas Heat	-0.00023
Large Retrofit (>200kW)	Oil	-0.00046
Small Retrofit (≤ 200kW)	Gas Heat	-0.001075
Small Retrofit (> 200kW)	Oil Heat	-0.000120

Note: These values only apply for conditioned spaces. For unconditioned spaces, the interactive factors are equal to zero.

Lighting Controls

Annual Energy Savings

$$\Delta kWh = kW_c \times Hrs \times SVG_{nl} \times (1 + HVAC_e)$$

Annual Fuel Savings

$$\Delta Therms = kW_c \times Hrs \times SVG_{nl} \times \frac{HVAC_g}{10}$$

Peak Demand Savings

$$\Delta kW_{peak} = kW_c \times SVG_{nl} \times CF \times (1 + HVAC_d)$$

Reference Tables

Lighting Control Type	SVG
Networked lighting controls (NLC)	0.49
Luminaire-level lighting controls (LLLC) – Networked & Commissioned	0.49
Integrated fixture with room-based controls	0.38 ¹¹³
Dual occupancy and daylight sensors	0.38
Combination of high-end trim and daylight dimming	0.35
Combination of high-end trim and occupancy sensors	0.33
Daylight dimming	0.28
Occupancy sensors	0.24
No lighting controls	0.00

Building Type	HVAC Interactive Factor for Peak Demand Savings (HVAC _d)		HVAC Interactive Factor for Annual Energy Savings (HVAC _e)			
	AC (Utility)	AC (PJM)	AC/NonElec	AC/ElecRes	Heat Pump	No AC/ElecRes
Office	0.35	0.32	0.10	-0.15	-0.06	-0.25
Retail	0.27	0.26	0.06	-0.17	-0.05	-0.23
Education	0.44	0.44	0.10	-0.19	-0.04	-0.29
Warehouse	0.22	0.23	0.02	-0.25	-0.11	-0.27
Other ¹¹⁴	0.34	0.32	0.08	-0.18	-0.07	-0.26

Project Type	Fuel Type	HVAC _g
Large Retrofit (>200kW)	C&I Gas Heat	-0.00023
Large Retrofit (>200kW)	Oil	-0.00046
Small Retrofit ($\leq$ 200kW)	Gas Heat	-0.001075
Small Retrofit (> 200kW)	Oil Heat	-0.000120

ECM 4 – Roof Renovations

Washington Township Public Schools ECM MATRIX		Washington Township High School	Chestnut Ridge Middle School	Orchard Valley Middle School	Bunker Hill Middle School	Thomas Jefferson Elementary School	Hurffville Elementary School	Whitman Elementary School	Birches Elementary School	Bells Elementary School	Wedwood Elementary School	Grenloch Early Childhood Center	O'Brien Hall	Administration Building	Operations Building	Warehouse	Bus Garage
✓	ECM was evaluated																
✓	ECM included in the project																
ECM	ECM DESCRIPTION																
4	Roof Renovations	✓	✓	✓	✓	✓	✓	✓			✓						

Roof Refurbishment Options:

The purpose for addressing existing roofing relates to increasing warranty life to accommodate roof mounted solar photovoltaic across the systems useful life (most commonly 15 years).

These options for guaranteeing this warranty include:

Single Ply Membrane Roof Restoration

Year after year, reflective elastomeric coatings continue to be used as a viable option for many roofing substrates, and single-ply membranes are no different. This system addresses all seams and penetrations that could potentially be a leak point while protective elastomeric coating maintains and restores the membrane. Single ply membrane restorations include the following benefits: Performance watertight, addresses all sources of roof leaks by sealing all seams and fasteners. Durable resistance to damage from roof traffic and storm damage. UV resistant designed for the harshest UV conditions. Light weight, very low impact on your overall roof weight-load. High reflectivity, nearly 85% of all UV light is reflected and the high emissivity gives the coating and emissivity the ability to release any heat that is absorbed which keeps the roof surface +/- 10 degrees from ambient temperature. Disruption free installation is completed without bothering building occupants. Extends building life cool roof surface will reduce expansion and contraction stresses on the building. Value energy savings reduced solar heat gain will cut summer energy costs by up to 30%. Typically, no costly tear off required. Low cost keeps more money in your pocket compared to replacement systems.

Performance

Watertight

Addresses all sources of roof leaks by sealing all seams and fasteners.

Durable

Resistant to damage from roof traffic and storm damage.

UV Resistant

Designed for the harshest UV conditions.

Light Weight

Very low impact on your overall roof weight-load.

High Reflectivity

Nearly 85% of all UV light is reflected and the High Emissivity gives the coating and Emissivity the ability to release any heat that is absorbed which keeps the roof surface +/- 10 degrees from ambient temperature.

Disruption Free

Installation is completed without bothering building occupants.

Extends Building Life

Cool roof surface will reduce expansion and contraction stresses on the building.

Value

Energy Savings

Reduced solar heat gain will cut summer energy costs by up to 30%.

No Tear Off

Typically no costly tear off required.

Low Cost

Keeps more money in your pocket compared to replacement systems.

Low Life Cycle Cost

With no tear-off and by simply maintaining the protective surface coating on your roof every 10-15 years, your roof can last indefinitely.

Rebates

Many local and federal rebates are available.

Tax Benefits

Can often be fully covered in the year of installation.

Environment

No Tear Off

Typically no need to remove roof and fill our landfills with roof waste.

Water-based

Non-hazardous, non-flammable and easy cleanup.

Low VOC

Meets the most stringent VOC requirements in the U.S.

Low Odor

Can be installed in situations where rooftop air handlers cannot be turned off.

Sustainable

Simply maintaining the protective surface coating on your roof every 10-15 years, your roof will last indefinitely.



Sample Installation Process (EPDM/BUR style roof restoration)

- Identify the coating system to be used. Adhesion test most likely necessary.
- Identify wet insulation to be replaced using infrared scans.
- Address all deficient seams and penetrations. Repair with “like” materials. Probe and inspect all seams.
- Power washes the roof to wash away all contaminants including dirt and loose particulates.
- Apply wash primer. Allow to sit for 10 minutes and begin washing off with high pressure power wash. (Only prime what you plan to coat that day)
- Apply thick bead of sealant to seam and feather out with a chip brush to a width of 3”.
- Apply desired basecoat.
- Apply desired topcoat.

Sample Installation Process (Metal roof coating)

- Identify the coating system to be used. Adhesion test most likely necessary.
- Address all deficient seams and penetrations. Repair with “like” materials. Probe and inspect all seams.
- Power washes the roof to wash away all contaminants including dirt and loose particulates.
- Apply metal wash primer. Allow to sit for 10 minutes and begin washing off with high pressure power wash. (Only prime what you plan to coat that day)
- Apply thick bead of sealant to seam and feather out with a chip brush to a width of 3”.
- Apply desired basecoat.
- Apply desired topcoat.

Scope of Work

See the following chart for the roofing scope of work. Roof sections and areas were identified by a roofing subcontractor to coincide with the installation of solar PV. The current scope of work has solar and roof upgrades for the following schools:

BUILDING	ROOF SQFT
Washington Township High School	330,895
Chestnut Ridge Middle School	22,841
Orchard Valley Middle School	22,509
Thomas Jefferson Elementary School	44,710
Hurffville Elementary School	44,112
Whitman Elementary School	65,527
Wedgwood Elementary School	62,506

ECM Calculations

ECM calculations are conservative and are shown below.

Roof Renovations - Heating Savings								
BUILDING	ROOF SQFT	Heating Type	R VALUE (BEFORE)	R VALUE (AFTER)	ANNUAL HEATING DEGREE DAYS	HEATING EFFICIENCY (%AFUE or HSPF)	TOTAL HEATING SAVINGS (Therms)	TOTAL HEATING SAVINGS (Kwh)
Washington Township High School	330,895	Gas	13.5	13.8	4,891	80%	782	0
Chestnut Ridge Middle School	22,841	Gas	13.5	13.8	4,891	81%	54	0
Orchard Valley Middle School	22,509	Gas	13.5	13.8	4,891	81%	53	0
Thomas Jefferson Elementary School	44,710	Electric	13.5	13.8	4,891	10.92	0	8
Hurffville Elementary School	44,112	Gas	13.5	13.8	4,891	80%	105	0
Whitman Elementary School	65,527	Gas	13.5	13.8	4,891	88%	141	0
Wedgwood Elementary School	62,506	Gas	13.5	13.8	4,891	88%	135	0

Roof Renovations - Cooling Savings						
BUILDING	ROOF SQFT	R VALUE (BEFORE)	R VALUE (AFTER)	ANNUAL COOLING DEGREE DAYS	EER	TOTAL COOLING SAVINGS (kWh)
Washington Township High School	330,895	13.5	13.8	1,067	10.02	14
Chestnut Ridge Middle School	22,841	13.5	13.8	1,067	10.25	1
Orchard Valley Middle School	22,509	13.5	13.8	1,067	10.28	1
Thomas Jefferson Elementary School	44,710	13.5	13.8	1,067	9.46	2
Hurffville Elementary School	44,112	13.5	13.8	1,067	9.70	2
Whitman Elementary School	65,527	13.5	13.8	1,067	9.52	3
Wedgwood Elementary School	62,506	13.5	13.8	1,067	9.59	3

Annual Energy Savings Algorithms

Annual Electric Energy Savings

$$\Delta kWh = \Delta kWh_{cooling} + \Delta kWh_{heating}$$

Where,

$$\text{Central cooling: } \Delta kWh_{cooling} = \left(\left(\frac{1}{R_{existing}} \right) - \left(\frac{1}{R_{new}} \right) \right) \times \text{Area} \times EFLH_{cooling} \times \frac{\Delta T_{FL,cooling}}{1,000 \times \eta_{cooling}}$$

$$\text{No central cooling: } \Delta kWh_{cooling} = 0$$

Where,

$$\text{Electric heat: } \Delta kWh_{heating} = \left(\left(\frac{1}{R_{existing}} \right) - \left(\frac{1}{R_{new}} \right) \right) \times Area \times EFLH_{heating} \times \frac{\Delta T_{FL,heating}}{1,000 \times \eta_{elecheat}}$$

$$\text{Gas furnace (savings due to reduced fan operation): } \Delta kWh_{heating} = \Delta Therms \times Fe \times 29.3$$

Annual Fuel Savings

$$\text{Non-electric heat: } \Delta Therms = \left(\left(\frac{1}{R_{existing}} \right) - \left(\frac{1}{R_{new}} \right) \right) \times Area \times EFLH_{heating} \times \frac{\Delta T_{FL,heating}}{100,000 \times \eta_{fuelheat}}$$

$$\text{Electric heat: } \Delta Therms = 0$$

Peak Demand Savings

$$\Delta kW = \frac{\Delta kWh_{cooling}}{EFLH_{cooling}} \times CF$$

Daily Peak Fuel Savings

$$\Delta Therms_{peak} = \Delta Therms \times PDF$$

Lifetime Energy Savings Algorithms

Lifetime Electric Energy Savings

$$\Delta kWh_{Life} = \Delta kWh \times EUL$$

Lifetime Fuel Savings

$$\Delta Therms_{Life} = \Delta Therms \times EUL$$

ECM 5 – Pipe and Valve Insulation

Washington Township Public Schools ECM MATRIX		Washington Township High School	Chestnut Ridge Middle School	Orchard Valley Middle School	Bunker Hill Middle School	Thomas Jefferson Elementary School	Hurffville Elementary School	Whitman Elementary School	Birches Elementary School	Bells Elementary School	Wedgwood Elementary School	Grenloch Early Childhood Center	O'Brien Hall	Administration Building	Operations Building	Warehouse	Bus Garage
ECM #	ECM DESCRIPTION																
5	Pipe and Valve Insulation	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓					

Piping insulation is a critical part of energy management. It controls condensation, pipe freezing, and noise amongst other things. A percentage of heating (or cooling) can be lost through conduction if a pipe is not properly insulated.

Higher operational costs are a direct result of this for both heating and cooling systems. This ECM entails wrapping the existing bare metal pipe with an approved high-performance fiberglass insulation jacketing material.

Existing Conditions



Scope of Work

Insulation will be installed on exposed pipes and valves. Failed insulation will be replaced. Poorly insulated pipes in the heating and cooling distribution system are leading to unnecessary distribution losses and wasted energy. The scope of work will include.

- Installation of pipe insulation to meet the insulation requirements of the fluid temperature in the pipe.
- Utilize and install pipe wrap covering and jackets to protect the insulation material as required in the work area.
- Materials will vary by the application and workspace.
 - Fiberglass, mineral wool, foam glass, Styrofoam, urethane, closed cell rubber

ECM Calculations

Pipe and Valve Insulation savings are calculated using NJ BPU Protocols. A summary of the savings is shown below, see saving calculations in Appendix G for more details.

Pipe and Valve Insulation Savings				
BUILDING	NATURAL GAS SAVINGS (Th)	NATURAL GAS SAVINGS (Th)	NATURAL GAS SAVINGS (Th)	NATURAL GAS SAVINGS (Th)
	MTHW	DHW	LPS	Cond
Bells Elementary School	213	0	0	0
Birches Elementary School	369	0	0	0
Bunker Hill Middle School	344	68	0	0
Chestnut Ridge Middle School	537	0	0	0
Grenloch Early Childhood Center	0	0	44	61
Hurffville Elementary School	758	77	0	0
Orchard Valley Middle School	846	0	0	0
Washington Township High School	1610	50	0	0
Wedgwood Elementary School	303	0	0	0
Whitman Elementary School	219	0	0	0

Pipe Insulation

Annual Energy Savings Algorithm

Annual Electric Energy Savings

$$\Delta kWh = \frac{\left[\left(\frac{UA}{L} \right)_b - \left(\frac{UA}{L} \right)_q \right] \times L \times (T_{pipe} - T_{amb}) \times hrs \times SF_{elec}}{Et_{elec} \times 3,412}$$

Annual Fuel Savings

$$\Delta Therms = \frac{\left[\left(\frac{UA}{L} \right)_b - \left(\frac{UA}{L} \right)_q \right] \times L \times (T_{pipe} - T_{amb}) \times hrs \times SF_{fuel}}{Et_{fuel} \times 100,000}$$

Peak Demand Savings

$$\Delta kW_{peak} = \frac{\Delta kWh}{8,760} \times CF$$

Definitions of Variables

Variable	Description	Value	Units	Ref
		Operating Hours Chillers: Look up chilled water pump hrs in Appendix D: HVAC Fan and Pump Operating Hours		
$(UA/L)_b$	Product of Overall Heat Transfer Coefficient and Pipe Area (UA) per foot from uninsulated pipe ²³³	Calculated in 3EPlus based on site-specific conditions. If site-specific conditions are unknown, look ups for some common conditions for steel, copper, and CPVC/PEX are provided in Table 3-431	Btu/hr-°F-ft	[918]
$(UA/L)_i$	Product of Overall Heat Transfer Coefficient and Pipe Area (UA) per foot from insulated pipe ²³³	Calculated in 3EPlus based on site-specific conditions. If site-specific conditions are unknown, look ups for some common conditions are provided in Table 2-207	Btu/hr-°F-ft	[926]
$S_{F_{elec}}$	Adjustment to electric water heating energy savings when water heating fuel is unknown, or to account for chilled water having an bare surface temperature below the ambient temperature.	Electric WH: 1.0 Unknown WH: 0.55 Chilled Water: -1.0	N/A	[919]
$S_{F_{fuel}}$	Adjustment to fossil fuel water heating energy savings based on water heating fuel	Fossil Fuel WH & Space Heating: 1.0 Unknown WH: 0.56	N/A	[919]
CF	Electric coincidence factor	See Peak Factors Section	N/A	
PDF	Gas peak day factor	See Appendix G	N/A	
EUL	Effective useful life	See Measure Life section	Years	

Variable	Description	Value	Units	Ref
ΔkWh	Annual electric energy savings	Calculated	kWh/yr	
$\Delta Therms$	Annual fuel savings	Calculated	Therms/yr	
ΔkW_{peak}	Peak Demand Savings	Calculated	kW	
$\Delta Therms_{peak}$	Daily peak fuel savings	Calculated	Therms/day	
ΔkWh_{life}	Lifetime electric energy savings	Calculated	kWh	
$\Delta Therms_{life}$	Lifetime fuel savings	Calculated	Therms	
L	Length of installed insulation	Site-specific	ft	
T_{pipe}	Average temperature of hot water or steam in distribution system piping	Site-specific, if unknown look up in Table 3-437	°F	[916] [917] [920]
T_{amb}	Surrounding average ambient air temperature	Site-specific, if unknown: DHW: 70 Space Heat: 80 Process Heat: 80 Chilled Water: 70	°F	[924]
$E_{t_{fuel}}$	Recovery Efficiency of fuel water heaters or AFUE of boiler for space heating	Site-specific, if unknown: DHW ²³¹ : 0.8 Space Heating Boilers: Look up in Table 3-435	N/A	[921] [922]
$E_{t_{elec}}$	Recovery Efficiency of electric water heaters	Site-specific, if unknown: Non-Heat Pump DHW ²³² : 0.98 Heat Pump DHW: Look up in Table 3-436	N/A	[915]
hrs	System run hours	Site-specific, if unknown: DHW: 8,760 Boilers: Look up hot water pump hrs in Appendix D: HVAC Fan and Pump	hrs	

Reference tables

Nominal Pipe Diameter (in)	Fiberglass						Rigid Foam/Cellular Glass					
	0.5 in	1 in	1.5 in	2 in	2.5 in	3 in	0.5 in	1 in	1.5 in	2 in	2.5 in	3 in
0.50	0.13	0.09	0.08	0.07	0.06	0.06	0.15	0.12	0.10	0.09	0.09	0.08
0.75	0.14	0.11	0.09	0.08	0.07	0.07	0.17	0.13	0.11	0.10	0.10	0.09
1.00	0.17	0.12	0.10	0.09	0.08	0.07	0.19	0.15	0.13	0.12	0.11	0.10
1.25	0.20	0.14	0.11	0.10	0.09	0.08	0.23	0.17	0.15	0.13	0.12	0.11

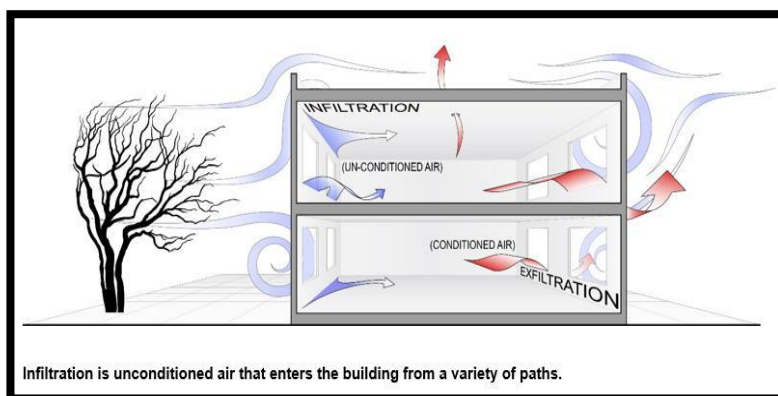
Nominal Pipe Diameter (in)	Fiberglass						Rigid Foam/Cellular Glass					
	0.5 in	1 in	1.5 in	2 in	2.5 in	3 in	0.5 in	1 in	1.5 in	2 in	2.5 in	3 in
1.50	0.22	0.15	0.12	0.11	0.10	0.09	0.25	0.19	0.16	0.14	0.13	0.12
2.00	0.26	0.18	0.14	0.12	0.11	0.10	0.29	0.22	0.18	0.16	0.14	0.13
2.50	0.30	0.20	0.16	0.14	0.12	0.11	0.34	0.25	0.20	0.18	0.16	0.15
3.00	0.35	0.24	0.18	0.16	0.14	0.12	0.39	0.29	0.23	0.20	0.18	0.16
3.50	0.40	0.26	0.20	0.17	0.15	0.13	0.44	0.32	0.26	0.22	0.20	0.18
4.00	0.44	0.29	0.22	0.18	0.16	0.14	0.48	0.35	0.28	0.24	0.21	0.19

Nominal Pipe Diameter (in)	Bare Copper Piping			Bare Steel Piping	
	Domestic Hot Water	Hot Water Heat	Steam Heat	Hot Water Heat	Steam Heat
0.50	0.44	0.48	0.53	0.53	0.59
0.75	0.54	0.58	0.64	0.65	0.72
1.00	0.65	0.70	0.78	0.79	0.88
1.25	0.80	0.86	0.96	0.97	1.09
1.50	0.90	0.97	1.09	1.10	1.23
2.00	1.10	1.19	1.33	1.34	1.51
2.50	1.31	1.42	1.58	1.60	1.80
3.00	1.57	1.70	1.90	1.92	2.16
3.50	1.77	1.92	2.15	2.18	2.45
4.00	1.98	2.14	2.40	2.43	2.73

ECM 6 – Building Envelope Weatherization

Washington Township Public Schools ECM MATRIX ☒ ECM was evaluated ☒ ECM included in the project		Washington Township High School	Chestnut Ridge Middle School	Orchard Valley Middle School	Bunker Hill Middle School	Thomas Jefferson Elementary School	Hurffville Elementary School	Whitman Elementary School	Birches Elementary School	Bells Elementary School	Wedwood Elementary School	Grenloch Early Childhood Center	O'Brien Hall	Administration Building	Operations Building	Warehouse	Bus Garage
ECM #	ECM DESCRIPTION																
6	Building Envelope Weatherization	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒

An on-site survey of the existing air barrier continuity was conducted at the Washington Township School District's buildings. During the on-site inspection, several areas of the facilities were inspected for effective air barriers at the building envelope. Temperature, relative humidity, CO2 levels, smoke pencil testing and Infrared imaging was used to determine areas of uncontrolled air leakage into and out of the buildings.



Each of these facilities had varying degrees of uncontrolled air leakage into and out of the buildings. Typically, the exterior doors were found to have failed, missing or worn weather-seals and in some cases the exterior caulking had failed. Many of the facilities had insulation materials installed at the exterior roof/wall intersections. This can increase thermal values, however, the air leakage around the insulation and through the roof/wall joint was significant and results in increased energy costs.

Existing Conditions



Scope of Work

Building Envelope improvements to the district include:

- Door weather Stripping
- Roof-Wall Intersection Air Sealing
- Overhand Air Sealing
- Caulking
- Buck Frame Air Sealing
- Attic Insulation
- Attic Bypass Air Sealing
 - Weather strip and insulate the attic hatch to provide an airtight seal with permanently fixed insulation to prevent thermal heat gain and loss consistent with the surrounding attic recommendations.
- Garage Door Weather Stripping

ECM Calculations

Energy Savings from the installation of building envelope improvements are calculated using the methodology on the following pages: A summary of the savings is shown below, see saving calculations in Appendix G for more details.

Building Envelope Weatherization Savings		
BUILDING	kWh Savings	Therm Savings
Administration Building	470	171
Bells Elementary School	9285	2987
Birches Elementary School	8915	2875
Bunker Hill Middle School	11627	4451
Chestnut Ridge Middle School	7850	3020
Grenloch Early Childhood Center	1850	669
Hurffville Elementary School	7772	2790
Operations Building	270	0
Orchard Valley Middle School	9462	3650
Thomas Jefferson Elementary School	2491	0
Washington Township High School	33597	11809
Wedgwood Elementary School	8341	2766
Whitman Elementary School	9310	3064

Enthalpy

Based on Interior Relative Humidity of 40% and temperature of 72 degrees F = 24.55 btu/lb. Exterior Enthalpy based on outside relative humidity estimate of 75% and the below NOAA summer temperature data.

Heat Efficiency Factor

The derivation of the Efficiency Factor is based on sensible heat constant (1.08 * 24 Hours per Day) and an assumed efficiency percentage for the heating plant in the building. The efficiency of the heating plant is captured as a percentage of the total energy output of the heating system.

Calculation is = $1.08 * 24 \text{ hours per day} = 25.92$; in order to get the Efficiency Factor in the denominator and account for system efficiency = $1 / (25.92 / (1,000,000 \text{ Btus} * \text{Heating Plant Efficiency Percent}))$.

Infiltration Heating Savings (therm) = Infiltration Reduction (CFM) * Heating Degree Days (HDD) / Heat Efficiency Factor

Thermal Insulation Savings (therm) = Existing Heat Loss (therm) - Proposed Heat Loss (therm)

Existing Heat Loss (therm) = (Existing U-Value * (Hours/Day * Heating Degree Days (HDD)) * Surface Area (Sqft)) / Heating Efficiency (%) / 100,000 Btu/Therm

Proposed Heat Loss (therm) = (Proposed U-Value * (Hours/Day * Heating Degree Days (HDD)) * Surface Area (Sqft)) / Heating Efficiency (%) / 100,000 Btu/Therm

Infiltration Cooling Savings (kWh) = Tons * Efficiency (kW/ton)
* Cooling Degree Days (CDD) * 12000 btu/hr * 0.000293071

Tons = Infiltration Reduction (CFM) * Total Heat Constant * Enthalpy / 12,000 Btu/hr

Insulation Savings (kWh) = Existing Cooling Loss (kWh) - Proposed Cooling Loss (kWh)

Existing Cooling Loss (kWh) = (Existing U-Value) * (Hours/Day) * (Cooling Degree Days (CDD)) * (Surface Area (Sqft)) * (Cooling Efficiency (kWh/ton-hr)) * (1 Ton-hr/12,000 Btu)

Proposed Cooling Loss (kWh) = (Proposed U-Value) * (Hours/Day) * (Cooling Degree Days (CDD)) * (Surface Area (Sqft)) * (Cooling Efficiency (kWh/ton-hr)) * (1 Ton-hr/12,000 Btu)

ECM 7 – Plug Load Controls

Washington Township Public Schools ECM MATRIX		Washington Township High School	Chestnut Ridge Middle School	Orchard Valley Middle School	Bunker Hill Middle School	Thomas Jefferson Elementary School	Hurffville Elementary School	Whitman Elementary School	Birches Elementary School	Bells Elementary School	Wedgwood Elementary School	Grenloch Early Childhood Center	O'Brien Hall	Administration Building	Operations Building	Warehouse	Bus Garage
✓	ECM was evaluated																
✓	ECM included in the project																
ECM	ECM DESCRIPTION																
7	Plug Load Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	

Plug loads are often used for a small portion of the day. Left unmanaged, these loads can add significant usage and cost to a building's electric load. Plug load controls utilize specialty sockets that have software to track real-time usage of your appliances. The software also allows the user to use a web browser to view this usage and automatically turn on/off all appliances plugged into these outlets.

Scope of Work

Existing wall plugs within the facilities will be retrofitted with specialty controllable wall plugs.



ECM Calculations

Energy savings are calculated by multiplying the equipment Power Draw (W) by the number of hours the plug load will shut the equipment off completely:

Plug Load Controls Savings									
BUILDING	SQFT	DEVICE TYPE	QUANTITY	WATTS PER UNIT (PARASITIC LOAD)	HOURS PER YEAR PLUGGED IN	HOUR PER YEAR SCHEDULED "ON"	HOUR PER YEAR SCHEDULED "OFF"	ELECTRIC SAVINGS (kWh)	TOTAL ELECTRIC SAVINGS (kWh)
Washington Township High School	450,130	Projector	123	13	8,760	2,860	5,900	9,579	68,039
Washington Township High School		M Printer	68	22	8,760	2,860	5,900	8,666	
Washington Township High School		Charging Cart/Station	17	89	8,760	2,860	5,900	8,927	
Washington Township High School		Smartboard	36	10	8,760	2,860	5,900	2,018	
Washington Township High School		Proj/SmBrd Combo	1	13	8,760	2,860	5,900	78	
Washington Township High School		AC-110 15A	0	2	8,760	2,860	5,900	0	
Washington Township High School		AC-110 20A	0	2	8,760	2,860	5,900	0	
Washington Township High School		Copier- 110 15A	16	29	8,760	2,860	5,900	2,766	
Washington Township High School		Air Scrubber	22	112	8,760	2,860	5,900	14,538	
Washington Township High School		Soda Vend	6	398	8,760	2,860	5,900	14,082	
Washington Township High School		Snack Vend	4	160	8,760	2,860	5,900	3,776	
Washington Township High School		Lrg Coffee	1	255	8,760	2,860	5,900	1,505	
Washington Township High School		TV	71	4	8,760	2,860	5,900	1,634	
Washington Township High School		Water Fountain - Energy Star	8	10	8,760	2,860	5,900	472	
Chestnut Ridge Middle School	108,813	Projector	36	13	8,760	2,860	5,900	2,804	14,142
Chestnut Ridge Middle School		M Printer	9	22	8,760	2,860	5,900	1,147	
Chestnut Ridge Middle School		Charging Cart/Station	3	89	8,760	2,860	5,900	1,575	
Chestnut Ridge Middle School		Smartboard	16	10	8,760	2,860	5,900	897	
Chestnut Ridge Middle School		Proj/SmBrd Combo	0	13	8,760	2,860	5,900	0	
Chestnut Ridge Middle School		AC-110 15A	0	2	8,760	2,860	5,900	0	
Chestnut Ridge Middle School		AC-110 20A	0	2	8,760	2,860	5,900	0	
Chestnut Ridge Middle School		Copier- 110 15A	2	29	8,760	2,860	5,900	346	
Chestnut Ridge Middle School		Air Scrubber	11	112	8,760	2,860	5,900	7,269	
Chestnut Ridge Middle School		Soda Vend	0	398	8,760	2,860	5,900	0	
Chestnut Ridge Middle School		Snack Vend	0	160	8,760	2,860	5,900	0	
Chestnut Ridge Middle School		Lrg Coffee	0	255	8,760	2,860	5,900	0	
Chestnut Ridge Middle School		TV	2	4	8,760	2,860	5,900	46	
Chestnut Ridge Middle School		Water Fountain - Energy Star	1	10	8,760	2,860	5,900	59	
Orchard Valley Middle School	108,813	Projector	35	13	8,760	2,860	5,900	2,726	13,882
Orchard Valley Middle School		M Printer	13	22	8,760	2,860	5,900	1,657	
Orchard Valley Middle School		Charging Cart/Station	2	89	8,760	2,860	5,900	1,050	
Orchard Valley Middle School		Smartboard	14	10	8,760	2,860	5,900	785	
Orchard Valley Middle School		Proj/SmBrd Combo	0	13	8,760	2,860	5,900	0	
Orchard Valley Middle School		AC-110 15A	0	2	8,760	2,860	5,900	0	
Orchard Valley Middle School		AC-110 20A	0	2	8,760	2,860	5,900	0	
Orchard Valley Middle School		Copier- 110 15A	1	29	8,760	2,860	5,900	173	
Orchard Valley Middle School		Air Scrubber	11	112	8,760	2,860	5,900	7,269	
Orchard Valley Middle School		Soda Vend	0	398	8,760	2,860	5,900	0	
Orchard Valley Middle School		Snack Vend	0	160	8,760	2,860	5,900	0	
Orchard Valley Middle School		Lrg Coffee	0	255	8,760	2,860	5,900	0	
Orchard Valley Middle School		TV	2	4	8,760	2,860	5,900	46	
Orchard Valley Middle School		Water Fountain - Energy Star	3	10	8,760	2,860	5,900	177	

Plug Load Controls Savings

BUILDING	SQFT	DEVICE TYPE	QUANTITY	WATTS PER UNIT (PARASITIC LOAD)	HOURS PER YEAR PLUGGED IN	HOUR PER YEAR SCHEDULED "ON"	HOUR PER YEAR SCHEDULED "OFF"	ELECTRIC SAVINGS (kWh)	TOTAL ELECTRIC SAVINGS (kWh)
Bunker Hill Middle School	106,574	Projector	40	13	8,760	2,860	5,900	3,115	14,083
Bunker Hill Middle School		M Printer	16	22	8,760	2,860	5,900	2,039	
Bunker Hill Middle School		Charging Cart/Station	1	89	8,760	2,860	5,900	525	
Bunker Hill Middle School		Smartboard	13	10	8,760	2,860	5,900	729	
Bunker Hill Middle School		Proj/SmBrd Combo	0	13	8,760	2,860	5,900	0	
Bunker Hill Middle School		AC-110 15A	0	2	8,760	2,860	5,900	0	
Bunker Hill Middle School		AC-110 20A	0	2	8,760	2,860	5,900	0	
Bunker Hill Middle School		Copier- 110 15A	3	29	8,760	2,860	5,900	519	
Bunker Hill Middle School		Air Scrubber	2	112	8,760	2,860	5,900	1,322	
Bunker Hill Middle School		Soda Vend	2	398	8,760	2,860	5,900	4,694	
Bunker Hill Middle School		Snack Vend	1	160	8,760	2,860	5,900	944	
Bunker Hill Middle School		Lrg Coffee	0	255	8,760	2,860	5,900	0	
Bunker Hill Middle School		TV	6	4	8,760	2,860	5,900	138	
Bunker Hill Middle School		Water Fountain - Energy Star	1	10	8,760	2,860	5,900	59	
Thomas Jefferson Elementary School	72,396	Projector	36	13	8,760	2,860	5,900	2,804	15,007
Thomas Jefferson Elementary School		M Printer	10	22	8,760	2,860	5,900	1,274	
Thomas Jefferson Elementary School		Charging Cart/Station	5	89	8,760	2,860	5,900	2,626	
Thomas Jefferson Elementary School		Smartboard	2	10	8,760	2,860	5,900	112	
Thomas Jefferson Elementary School		Proj/SmBrd Combo	0	13	8,760	2,860	5,900	0	
Thomas Jefferson Elementary School		AC-110 15A	1	2	8,760	2,860	5,900	12	
Thomas Jefferson Elementary School		AC-110 20A	0	2	8,760	2,860	5,900	0	
Thomas Jefferson Elementary School		Copier- 110 15A	2	29	8,760	2,860	5,900	346	
Thomas Jefferson Elementary School		Air Scrubber	6	112	8,760	2,860	5,900	3,965	
Thomas Jefferson Elementary School		Soda Vend	1	398	8,760	2,860	5,900	2,347	
Thomas Jefferson Elementary School		Snack Vend	1	160	8,760	2,860	5,900	944	
Thomas Jefferson Elementary School		Lrg Coffee	0	255	8,760	2,860	5,900	0	
Thomas Jefferson Elementary School		TV	20	4	8,760	2,860	5,900	460	
Thomas Jefferson Elementary School		Water Fountain - Energy Star	2	10	8,760	2,860	5,900	118	
Hurffville Elementary School	65,655	Projector	29	13	8,760	2,860	5,900	2,259	4,807
Hurffville Elementary School		M Printer	4	22	8,760	2,860	5,900	510	
Hurffville Elementary School		Charging Cart/Station	0	89	8,760	2,860	5,900	0	
Hurffville Elementary School		Smartboard	1	10	8,760	2,860	5,900	56	
Hurffville Elementary School		Proj/SmBrd Combo	0	13	8,760	2,860	5,900	0	
Hurffville Elementary School		AC-110 15A	0	2	8,760	2,860	5,900	0	
Hurffville Elementary School		AC-110 20A	0	2	8,760	2,860	5,900	0	
Hurffville Elementary School		Copier- 110 15A	0	29	8,760	2,860	5,900	0	
Hurffville Elementary School		Air Scrubber	3	112	8,760	2,860	5,900	1,982	
Hurffville Elementary School		Soda Vend	0	398	8,760	2,860	5,900	0	
Hurffville Elementary School		Snack Vend	0	160	8,760	2,860	5,900	0	
Hurffville Elementary School		Lrg Coffee	0	255	8,760	2,860	5,900	0	
Hurffville Elementary School		TV	0	4	8,760	2,860	5,900	0	
Hurffville Elementary School		Water Fountain - Energy Star	0	10	8,760	2,860	5,900	0	

Plug Load Controls Savings									
BUILDING	SQFT	DEVICE TYPE	QUANTITY	WATTS PER UNIT (PARASITIC LOAD)	HOURS PER YEAR PLUGGED IN	HOUR PER YEAR SCHEDULED "ON"	HOUR PER YEAR SCHEDULED "OFF"	ELECTRIC SAVINGS (kWh)	TOTAL ELECTRIC SAVINGS (kWh)
Whitman Elementary School	64,411	Projector	36	13	8,760	2,860	5,900	2,804	7,074
Whitman Elementary School		M Printer	5	22	8,760	2,860	5,900	637	
Whitman Elementary School		Charging Cart/Station	4	89	8,760	2,860	5,900	2,100	
Whitman Elementary School		Smartboard	2	10	8,760	2,860	5,900	112	
Whitman Elementary School		Proj/SmBrd Combo	0	13	8,760	2,860	5,900	0	
Whitman Elementary School		AC-110 15A	0	2	8,760	2,860	5,900	0	
Whitman Elementary School		AC-110 20A	1	2	8,760	2,860	5,900	12	
Whitman Elementary School		Copier- 110 15A	1	29	8,760	2,860	5,900	173	
Whitman Elementary School		Air Scrubber	1	112	8,760	2,860	5,900	661	
Whitman Elementary School		Soda Vend	0	398	8,760	2,860	5,900	0	
Whitman Elementary School		Snack Vend	0	160	8,760	2,860	5,900	0	
Whitman Elementary School		Lrg Coffee	0	255	8,760	2,860	5,900	0	
Whitman Elementary School		TV	25	4	8,760	2,860	5,900	575	
Whitman Elementary School		Water Fountain - Energy Star	0	10	8,760	2,860	5,900	0	
Birches Elementary School	63,411	Projector	30	13	8,760	2,860	5,900	2,336	7,842
Birches Elementary School		M Printer	9	22	8,760	2,860	5,900	1,147	
Birches Elementary School		Charging Cart/Station	2	89	8,760	2,860	5,900	1,050	
Birches Elementary School		Smartboard	5	10	8,760	2,860	5,900	280	
Birches Elementary School		Proj/SmBrd Combo	0	13	8,760	2,860	5,900	0	
Birches Elementary School		AC-110 15A	6	2	8,760	2,860	5,900	71	
Birches Elementary School		AC-110 20A	0	2	8,760	2,860	5,900	0	
Birches Elementary School		Copier- 110 15A	1	29	8,760	2,860	5,900	173	
Birches Elementary School		Air Scrubber	4	112	8,760	2,860	5,900	2,643	
Birches Elementary School		Soda Vend	0	398	8,760	2,860	5,900	0	
Birches Elementary School		Snack Vend	0	160	8,760	2,860	5,900	0	
Birches Elementary School		Lrg Coffee	0	255	8,760	2,860	5,900	0	
Birches Elementary School		TV	1	4	8,760	2,860	5,900	23	
Birches Elementary School		Water Fountain - Energy Star	2	10	8,760	2,860	5,900	118	
Bells Elementary School	62,617	Projector	35	13	8,760	2,860	5,900	2,726	11,980
Bells Elementary School		M Printer	5	22	8,760	2,860	5,900	637	
Bells Elementary School		Charging Cart/Station	5	89	8,760	2,860	5,900	2,626	
Bells Elementary School		Smartboard	2	10	8,760	2,860	5,900	112	
Bells Elementary School		Proj/SmBrd Combo	0	13	8,760	2,860	5,900	0	
Bells Elementary School		AC-110 15A	0	2	8,760	2,860	5,900	0	
Bells Elementary School		AC-110 20A	0	2	8,760	2,860	5,900	0	
Bells Elementary School		Copier- 110 15A	1	29	8,760	2,860	5,900	173	
Bells Elementary School		Air Scrubber	4	112	8,760	2,860	5,900	2,643	
Bells Elementary School		Soda Vend	1	398	8,760	2,860	5,900	2,347	
Bells Elementary School		Snack Vend	0	160	8,760	2,860	5,900	0	
Bells Elementary School		Lrg Coffee	0	255	8,760	2,860	5,900	0	
Bells Elementary School		TV	26	4	8,760	2,860	5,900	598	
Bells Elementary School		Water Fountain - Energy Star	2	10	8,760	2,860	5,900	118	

Plug Load Controls Savings									
BUILDING	SQFT	DEVICE TYPE	QUANTITY	WATTS PER UNIT (PARASITIC LOAD)	HOURS PER YEAR PLUGGED IN	HOUR PER YEAR SCHEDULED "ON"	HOUR PER YEAR SCHEDULED "OFF"	ELECTRIC SAVINGS (kWh)	TOTAL ELECTRIC SAVINGS (kWh)
Wedgwood Elementary School	60,697	Projector	39	13	8,760	2,860	5,900	3,037	9,533
Wedgwood Elementary School		M Printer	4	22	8,760	2,860	5,900	510	
Wedgwood Elementary School		Charging Cart/Station	5	89	8,760	2,860	5,900	2,626	
Wedgwood Elementary School		Smartboard	1	10	8,760	2,860	5,900	56	
Wedgwood Elementary School		Proj/SmBrd Combo	1	13	8,760	2,860	5,900	78	
Wedgwood Elementary School		AC-110 15A	0	2	8,760	2,860	5,900	0	
Wedgwood Elementary School		AC-110 20A	0	2	8,760	2,860	5,900	0	
Wedgwood Elementary School		Copier- 110 15A	4	29	8,760	2,860	5,900	691	
Wedgwood Elementary School		Air Scrubber	3	112	8,760	2,860	5,900	1,982	
Wedgwood Elementary School		Soda Vend	0	398	8,760	2,860	5,900	0	
Wedgwood Elementary School		Snack Vend	0	160	8,760	2,860	5,900	0	
Wedgwood Elementary School		Lrg Coffee	0	255	8,760	2,860	5,900	0	
Wedgwood Elementary School		TV	24	4	8,760	2,860	5,900	552	
Wedgwood Elementary School		Water Fountain - Energy Star	0	10	8,760	2,860	5,900	0	
Grenloch Early Childhood Center	39,936	Projector	9	13	8,760	2,860	5,900	701	3,295
Grenloch Early Childhood Center		M Printer	5	22	8,760	2,860	5,900	637	
Grenloch Early Childhood Center		Charging Cart/Station	0	89	8,760	2,860	5,900	0	
Grenloch Early Childhood Center		Smartboard	7	10	8,760	2,860	5,900	392	
Grenloch Early Childhood Center		Proj/SmBrd Combo	3	13	8,760	2,860	5,900	234	
Grenloch Early Childhood Center		AC-110 15A	4	2	8,760	2,860	5,900	47	
Grenloch Early Childhood Center		AC-110 20A	1	2	8,760	2,860	5,900	12	
Grenloch Early Childhood Center		Copier- 110 15A	3	29	8,760	2,860	5,900	519	
Grenloch Early Childhood Center		Air Scrubber	1	112	8,760	2,860	5,900	661	
Grenloch Early Childhood Center		Soda Vend	0	398	8,760	2,860	5,900	0	
Grenloch Early Childhood Center		Snack Vend	0	160	8,760	2,860	5,900	0	
Grenloch Early Childhood Center		Lrg Coffee	0	255	8,760	2,860	5,900	0	
Grenloch Early Childhood Center		TV	4	4	8,760	2,860	5,900	92	
Grenloch Early Childhood Center		Water Fountain - Energy Star	0	10	8,760	2,860	5,900	0	
O'Brien Hall	22,900	Projector	0	13	8,760	2,860	5,900	0	2,950
O'Brien Hall		M Printer	0	22	8,760	2,860	5,900	0	
O'Brien Hall		Charging Cart/Station	0	89	8,760	2,860	5,900	0	
O'Brien Hall		Smartboard	0	10	8,760	2,860	5,900	0	
O'Brien Hall		Proj/SmBrd Combo	0	13	8,760	2,860	5,900	0	
O'Brien Hall		AC-110 15A	2	2	8,760	2,860	5,900	24	
O'Brien Hall		AC-110 20A	0	2	8,760	2,860	5,900	0	
O'Brien Hall		Copier- 110 15A	0	29	8,760	2,860	5,900	0	
O'Brien Hall		Air Scrubber	3	112	8,760	2,860	5,900	1,982	
O'Brien Hall		Soda Vend	0	398	8,760	2,860	5,900	0	
O'Brien Hall		Snack Vend	1	160	8,760	2,860	5,900	944	
O'Brien Hall		Lrg Coffee	0	255	8,760	2,860	5,900	0	
O'Brien Hall		TV	0	4	8,760	2,860	5,900	0	
O'Brien Hall		Water Fountain - Energy Star	0	10	8,760	2,860	5,900	0	

Plug Load Controls Savings									
BUILDING	SQFT	DEVICE TYPE	QUANTITY	WATTS PER UNIT (PARASITIC LOAD)	HOURS PER YEAR PLUGGED IN	HOUR PER YEAR SCHEDULED "ON"	HOUR PER YEAR SCHEDULED "OFF"	ELECTRIC SAVINGS (kWh)	TOTAL ELECTRIC SAVINGS (kWh)
Administration Building	20,000	Projector	1	13	8,760	2,860	5,900	78	15,707
Administration Building		M Printer	24	22	8,760	2,860	5,900	3,059	
Administration Building		Charging Cart/Station	0	89	8,760	2,860	5,900	0	
Administration Building		Smartboard	3	10	8,760	2,860	5,900	168	
Administration Building		Proj/SmBrd Combo	0	13	8,760	2,860	5,900	0	
Administration Building		AC-110 15A	0	2	8,760	2,860	5,900	0	
Administration Building		AC-110 20A	0	2	8,760	2,860	5,900	0	
Administration Building		Copier- 110 15A	1	29	8,760	2,860	5,900	173	
Administration Building		Air Scrubber	13	112	8,760	2,860	5,900	8,590	
Administration Building		Soda Vend	1	398	8,760	2,860	5,900	2,347	
Administration Building		Snack Vend	1	160	8,760	2,860	5,900	944	
Administration Building		Lrg Coffee	0	255	8,760	2,860	5,900	0	
Administration Building		TV	10	4	8,760	2,860	5,900	230	
Administration Building		Water Fountain - Energy Star	2	10	8,760	2,860	5,900	118	
Operations Building	5,625	Projector	0	13	8,760	2,860	5,900	0	5,840
Operations Building		M Printer	3	22	8,760	2,860	5,900	382	
Operations Building		Charging Cart/Station	0	89	8,760	2,860	5,900	0	
Operations Building		Smartboard	0	10	8,760	2,860	5,900	0	
Operations Building		Proj/SmBrd Combo	0	13	8,760	2,860	5,900	0	
Operations Building		AC-110 15A	0	2	8,760	2,860	5,900	0	
Operations Building		AC-110 20A	1	2	8,760	2,860	5,900	12	
Operations Building		Copier- 110 15A	1	29	8,760	2,860	5,900	173	
Operations Building		Air Scrubber	3	112	8,760	2,860	5,900	1,982	
Operations Building		Soda Vend	1	398	8,760	2,860	5,900	2,347	
Operations Building		Snack Vend	1	160	8,760	2,860	5,900	944	
Operations Building		Lrg Coffee	0	255	8,760	2,860	5,900	0	
Operations Building		TV	0	4	8,760	2,860	5,900	0	
Operations Building		Water Fountain - Energy Star	0	10	8,760	2,860	5,900	0	
Warehouse	5,400	Projector	0	13	8,760	2,860	5,900	0	661
Warehouse		M Printer	0	22	8,760	2,860	5,900	0	
Warehouse		Charging Cart/Station	0	89	8,760	2,860	5,900	0	
Warehouse		Smartboard	0	10	8,760	2,860	5,900	0	
Warehouse		Proj/SmBrd Combo	0	13	8,760	2,860	5,900	0	
Warehouse		AC-110 15A	0	2	8,760	2,860	5,900	0	
Warehouse		AC-110 20A	0	2	8,760	2,860	5,900	0	
Warehouse		Copier- 110 15A	0	29	8,760	2,860	5,900	0	
Warehouse		Air Scrubber	1	112	8,760	2,860	5,900	661	
Warehouse		Soda Vend	0	398	8,760	2,860	5,900	0	
Warehouse		Snack Vend	0	160	8,760	2,860	5,900	0	
Warehouse		Lrg Coffee	0	255	8,760	2,860	5,900	0	
Warehouse		TV	0	4	8,760	2,860	5,900	0	
Warehouse		Water Fountain - Energy Star	0	10	8,760	2,860	5,900	0	

ECM 8 – eTemp

Washington Township Public Schools ECM MATRIX ☒ ECM was evaluated ☒ ECM included in the project		Washington Township High School	Chestnut Ridge Middle School	Orchard Valley Middle School	Bunker Hill Middle School	Thomas Jefferson Elementary School	Hurffville Elementary School	Whitman Elementary School	Birches Elementary School	Bells Elementary School	Wedgwood Elementary School	Grenloch Early Childhood Center	O'Brien Hall	Administration Building	Operations Building	Warehouse	Bus Garage
ECM #	ECM DESCRIPTION																
8	eTemp	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒					

Commercial refrigerators waste 20% of their energy and run 50% or more cycles than necessary trying to keep temperature constant. This is because air temperature is measured instead of food temperature. eTemp is an energy saving device for commercial refrigerators (walk-in and reach-in coolers and freezers). It is a product temperature sensor that upgrades your existing cooler's air-temp thermostats into product-temp thermostats. Since a food product's temperature change is more gradual than the surrounding air temperature, conventional refrigeration units that control to maintain an air temperature at set point can waste energy and run more cycles than necessary by causing the compressor to overreact to air temperature changes. This product mimics actual food temp so the current thermostat is monitoring related food temperature rather than the surrounding air temperature.



This product covers a wide band of thermal properties, as specified by the National Sanitation Foundation, so no food and beverage products are excluded from the applicable lists of products that can use this device. In addition, NSF performed its own separate analysis which resulted in eTemp being Certified by the NSF for food safety as per their protocols.

Existing Conditions



ECM Calculations

Energy Savings from the installation of eTemp are shown below.

eTEMP Savings						
BUILDING NAME	Type	Qty Devices	Baseline Energy Use (kWh)	% Energy Reduction	Energy Savings (kWh)	Total Energy Savings (kWh)
Washington Township High School	Walk-in Cooler	3	21,000	20.7%	13,041	62,514
Washington Township High School	Walk-in Freezer	3	25,000	20.7%	15,525	
Washington Township High School	Reach-in Cooler - 1 door	8	7,500	20.7%	12,420	
Washington Township High School	Reach-in Cooler - 2 door	6	9,000	20.7%	11,178	
Washington Township High School	Reach-in Cooler - 3 door	3	10,000	20.7%	6,210	
Washington Township High School	Reach-in Cooler - 4 door	0	11,000	20.7%	0	
Washington Township High School	Reach-in Freezer - 1 door	2	10,000	20.7%	4,140	
Washington Township High School	Reach-in Freezer - 2 door	0	12,000	20.7%	0	
Washington Township High School	Reach-in Freezer - 3 door	0	14,000	20.7%	0	
Chestnut Ridge Middle School	Walk-in Cooler	1	21,000	20.7%	4,347	11,385
Chestnut Ridge Middle School	Walk-in Freezer	1	25,000	20.7%	5,175	
Chestnut Ridge Middle School	Reach-in Cooler - 1 door	0	7,500	20.7%	0	
Chestnut Ridge Middle School	Reach-in Cooler - 2 door	1	9,000	20.7%	1,863	
Chestnut Ridge Middle School	Reach-in Cooler - 3 door	0	10,000	20.7%	0	
Chestnut Ridge Middle School	Reach-in Cooler - 4 door	0	11,000	20.7%	0	
Chestnut Ridge Middle School	Reach-in Freezer - 1 door	0	10,000	20.7%	0	
Chestnut Ridge Middle School	Reach-in Freezer - 2 door	0	12,000	20.7%	0	
Chestnut Ridge Middle School	Reach-in Freezer - 3 door	0	14,000	20.7%	0	
Orchard Valley Middle School	Walk-in Cooler	1	21,000	20.7%	4,347	9,522
Orchard Valley Middle School	Walk-in Freezer	1	25,000	20.7%	5,175	
Orchard Valley Middle School	Reach-in Cooler - 1 door	0	7,500	20.7%	0	
Orchard Valley Middle School	Reach-in Cooler - 2 door	0	9,000	20.7%	0	
Orchard Valley Middle School	Reach-in Cooler - 3 door	0	10,000	20.7%	0	
Orchard Valley Middle School	Reach-in Cooler - 4 door	0	11,000	20.7%	0	
Orchard Valley Middle School	Reach-in Freezer - 1 door	0	10,000	20.7%	0	
Orchard Valley Middle School	Reach-in Freezer - 2 door	0	12,000	20.7%	0	
Orchard Valley Middle School	Reach-in Freezer - 3 door	0	14,000	20.7%	0	
Bunker Hill Middle School	Walk-in Cooler	1	21,000	20.7%	4,347	9,522
Bunker Hill Middle School	Walk-in Freezer	1	25,000	20.7%	5,175	
Bunker Hill Middle School	Reach-in Cooler - 1 door	0	7,500	20.7%	0	
Bunker Hill Middle School	Reach-in Cooler - 2 door	0	9,000	20.7%	0	
Bunker Hill Middle School	Reach-in Cooler - 3 door	0	10,000	20.7%	0	
Bunker Hill Middle School	Reach-in Cooler - 4 door	0	11,000	20.7%	0	
Bunker Hill Middle School	Reach-in Freezer - 1 door	0	10,000	20.7%	0	
Bunker Hill Middle School	Reach-in Freezer - 2 door	0	12,000	20.7%	0	
Bunker Hill Middle School	Reach-in Freezer - 3 door	0	14,000	20.7%	0	

eTEMP Savings						
BUILDING NAME	Type	Qty Devices	Baseline Energy Use (kWh)	% Energy Reduction	Energy Savings (kWh)	Total Energy Savings (kWh)
Thomas Jefferson Elementary School	Walk-in Cooler	1	21,000	20.7%	4,347	12,938
Thomas Jefferson Elementary School	Walk-in Freezer	1	25,000	20.7%	5,175	
Thomas Jefferson Elementary School	Reach-in Cooler - 1 door	1	7,500	20.7%	1,553	
Thomas Jefferson Elementary School	Reach-in Cooler - 2 door	1	9,000	20.7%	1,863	
Thomas Jefferson Elementary School	Reach-in Cooler - 3 door	0	10,000	20.7%	0	
Thomas Jefferson Elementary School	Reach-in Cooler - 4 door	0	11,000	20.7%	0	
Thomas Jefferson Elementary School	Reach-in Freezer - 1 door	0	10,000	20.7%	0	
Thomas Jefferson Elementary School	Reach-in Freezer - 2 door	0	12,000	20.7%	0	
Thomas Jefferson Elementary School	Reach-in Freezer - 3 door	0	14,000	20.7%	0	
Hurffville Elementary School	Walk-in Cooler	1	21,000	20.7%	4,347	11,385
Hurffville Elementary School	Walk-in Freezer	1	25,000	20.7%	5,175	
Hurffville Elementary School	Reach-in Cooler - 1 door	0	7,500	20.7%	0	
Hurffville Elementary School	Reach-in Cooler - 2 door	1	9,000	20.7%	1,863	
Hurffville Elementary School	Reach-in Cooler - 3 door	0	10,000	20.7%	0	
Hurffville Elementary School	Reach-in Cooler - 4 door	0	11,000	20.7%	0	
Hurffville Elementary School	Reach-in Freezer - 1 door	0	10,000	20.7%	0	
Hurffville Elementary School	Reach-in Freezer - 2 door	0	12,000	20.7%	0	
Hurffville Elementary School	Reach-in Freezer - 3 door	0	14,000	20.7%	0	
Whitman Elementary School	Walk-in Cooler	0	21,000	20.7%	0	9,315
Whitman Elementary School	Walk-in Freezer	0	25,000	20.7%	0	
Whitman Elementary School	Reach-in Cooler - 1 door	0	7,500	20.7%	0	
Whitman Elementary School	Reach-in Cooler - 2 door	1	9,000	20.7%	1,863	
Whitman Elementary School	Reach-in Cooler - 3 door	1	10,000	20.7%	2,070	
Whitman Elementary School	Reach-in Cooler - 4 door	0	11,000	20.7%	0	
Whitman Elementary School	Reach-in Freezer - 1 door	0	10,000	20.7%	0	
Whitman Elementary School	Reach-in Freezer - 2 door	1	12,000	20.7%	2,484	
Whitman Elementary School	Reach-in Freezer - 3 door	1	14,000	20.7%	2,898	
Birches Elementary School	Walk-in Cooler	0	21,000	20.7%	0	11,592
Birches Elementary School	Walk-in Freezer	1	25,000	20.7%	5,175	
Birches Elementary School	Reach-in Cooler - 1 door	0	7,500	20.7%	0	
Birches Elementary School	Reach-in Cooler - 2 door	1	9,000	20.7%	1,863	
Birches Elementary School	Reach-in Cooler - 3 door	1	10,000	20.7%	2,070	
Birches Elementary School	Reach-in Cooler - 4 door	0	11,000	20.7%	0	
Birches Elementary School	Reach-in Freezer - 1 door	0	10,000	20.7%	0	
Birches Elementary School	Reach-in Freezer - 2 door	1	12,000	20.7%	2,484	
Birches Elementary School	Reach-in Freezer - 3 door	0	14,000	20.7%	0	
Bells Elementary School	Walk-in Cooler	0	21,000	20.7%	0	11,592
Bells Elementary School	Walk-in Freezer	1	25,000	20.7%	5,175	
Bells Elementary School	Reach-in Cooler - 1 door	0	7,500	20.7%	0	
Bells Elementary School	Reach-in Cooler - 2 door	1	9,000	20.7%	1,863	
Bells Elementary School	Reach-in Cooler - 3 door	1	10,000	20.7%	2,070	
Bells Elementary School	Reach-in Cooler - 4 door	0	11,000	20.7%	0	
Bells Elementary School	Reach-in Freezer - 1 door	0	10,000	20.7%	0	
Bells Elementary School	Reach-in Freezer - 2 door	1	12,000	20.7%	2,484	
Bells Elementary School	Reach-in Freezer - 3 door	0	14,000	20.7%	0	
Wedgwood Elementary School	Walk-in Cooler	0	21,000	20.7%	0	11,592
Wedgwood Elementary School	Walk-in Freezer	1	25,000	20.7%	5,175	
Wedgwood Elementary School	Reach-in Cooler - 1 door	0	7,500	20.7%	0	
Wedgwood Elementary School	Reach-in Cooler - 2 door	1	9,000	20.7%	1,863	
Wedgwood Elementary School	Reach-in Cooler - 3 door	1	10,000	20.7%	2,070	
Wedgwood Elementary School	Reach-in Cooler - 4 door	0	11,000	20.7%	0	
Wedgwood Elementary School	Reach-in Freezer - 1 door	0	10,000	20.7%	0	
Wedgwood Elementary School	Reach-in Freezer - 2 door	1	12,000	20.7%	2,484	
Wedgwood Elementary School	Reach-in Freezer - 3 door	0	14,000	20.7%	0	
Grenloch Early Childhood Center	Walk-in Cooler	0	21,000	20.7%	0	2,070
Grenloch Early Childhood Center	Walk-in Freezer	0	25,000	20.7%	0	
Grenloch Early Childhood Center	Reach-in Cooler - 1 door	0	7,500	20.7%	0	
Grenloch Early Childhood Center	Reach-in Cooler - 2 door	0	9,000	20.7%	0	
Grenloch Early Childhood Center	Reach-in Cooler - 3 door	1	10,000	20.7%	2,070	
Grenloch Early Childhood Center	Reach-in Cooler - 4 door	0	11,000	20.7%	0	
Grenloch Early Childhood Center	Reach-in Freezer - 1 door	0	10,000	20.7%	0	
Grenloch Early Childhood Center	Reach-in Freezer - 2 door	0	12,000	20.7%	0	
Grenloch Early Childhood Center	Reach-in Freezer - 3 door	0	14,000	20.7%	0	

ECM 9 – Walk-In Refrigeration Controls

Washington Township Public Schools ECM MATRIX ☒ ECM was evaluated ☒ ECM included in the project		Washington Township High School	Chestnut Ridge Middle School	Orchard Valley Middle School	Bunker Hill Middle School	Thomas Jefferson Elementary School	Hurffville Elementary School	Whitman Elementary School	Birches Elementary School	Bells Elementary School	Wedwood Elementary School	Grenloch Early Childhood Center	O'Brien Hall	Administration Building	Operations Building	Warehouse	Bus Garage
ECM	ECM DESCRIPTION																
9	Walk-In Refrigeration Controls	✓	✓	✓	✓	✓	✓	✓								✓	

Artik Controls

The equipment in the walk-in coolers and freezers utilize a thermostat controlled Liquid Line Solenoid (LLS), a standard time clock for defrost, and up to ten (10) fractional horsepower 115/230 Volt A/C shaded pole fan motors. When the thermostat temperature rises above the setpoint it opens the LLS allowing refrigerant to enter the Evaporator. The Shaded Pole Fan Motors draw air across the evaporator coils allowing the heat in the air to transfer to the coil via conduction (Zeroth Law of Thermodynamics). The refrigerant removes the heat from the coil and transfers it to the condenser, releasing it into the open air. This cycle continues until the thermostat's low setpoint temperature is reached, which closes the LLS. The Standard Defrost Clock is set to place the Evaporator into defrost mode which is typically set for four defrost cycles per day each 34 minutes long to remove any build-up of ice which may occur from moisture in the air. During Defrost mode, the heater circuit energizes, allowing the heater probes to reach temperatures of up to 300°F, the fan motors are disabled, preventing the melted ice from blowing around the Walk-in. When the Standard Defrost Clock reaches the end of the 34 minutes it disables the heater probes. The systems are set to allow for a 10-minute drip time to enable the remaining moisture to be removed from the coils before the fan motors are turned back on. With temperature termination active, the ArtikControl™ WIF will disable the heating elements at the termination temperature of the coils, usually set around 90°F. The temperature is set high enough to defrost the coils and low enough to reduce energy consumption and prevent the ice from being turned into steam. The ability to properly manage the defrost temperature reduces the heat load in the walk-in freezer from prolonged defrost cycles. The reduction in heat load allows the compressor to bring down the box temperature quicker, reducing compressor run times.

The existing shaded pole motors in the evaporator will be replaced with 2-speed EC motors. ArtikControl FSC is a 2-Speed ecMotor Controller that utilizes state-of-the-art technology to control the fan speed of EC Motors inside evaporator boxes. When the evaporator coil is not being refrigerated, the ArtikControl™ FSC Controller turns the motors to low speed. This allows for significant energy savings, as the ECM driven fans use a fraction of the energy when operating at a lower speed. When the coil is cooling, the fans will automatically return to high speed (normal). Keeping the fan turning during non-refrigeration periods allows for consistent temperatures in the refrigerated area and eliminates air temperature stratification.

ECM Calculations

Energy Savings from the installation of Artik Controls are shown below.

Artik Defrost Controls Savings											
Line Item	Building	Cooler or Freezer	kW defrost	Hrs	DRF	EFF _{RS}	CF	kWh defrost savings	kWh heat savings	Peak Kw savings	Total kWh Savings
1.00	Warehouse	Walk in Freezer	0.90	487.00	35%	1.88	1	153.41	80.752	0.03	234.16
2.00	Warehouse	Walk in Freezer	0.90	487.00	35%	1.88	1	153.41	80.752	0.03	234.16
4.00	Bunker Hill Middle School	Walk in Freezer	0.90	487.00	35%	1.88	1	153.41	80.752	0.03	234.16
6.00	Chestnut Ridge Middle School	Walk in Freezer	0.90	487.00	35%	1.88	1	153.41	80.752	0.03	234.16
8.00	Washington Township High School	Walk in Freezer	0.90	487.00	35%	1.88	1	153.41	80.752	0.03	234.16
10.00	Washington Township High School	Walk in Freezer	0.90	487.00	35%	1.88	1	153.41	80.752	0.03	234.16
12.00	Hurffville Elementary School	Walk in Freezer	0.90	487.00	35%	1.88	1	153.41	80.752	0.03	234.16
14.00	Orchard Valley Middle School	Walk in Freezer	0.90	487.00	35%	1.88	1	153.41	80.752	0.03	234.16
16.00	Thomas Jefferson Elementary School	Walk in Freezer	0.90	487.00	35%	1.88	1	153.41	80.752	0.03	234.16
18.00	Whitman Elementary School	Walk in Freezer	0.90	487.00	35%	1.88	1	153.41	80.752	0.03	234.16

Artik Control Savings - Evaporator Motor and Controls											
Location	Cooler or Freezer	Control Propose	Motor Qty	Existing motor type	Existing motor	HP	Proposed Motor	Constant	Eff _B	Eff _Q	LF
Warehouse	Walk in Freezer	WIF	4.00	Shaded Pole	1/15 hp, 208V	1/15	EC2S	0.746	30%	70%	0.90
Warehouse	Walk in Freezer	WIF	4.00	Shaded Pole	1/15 hp, 208V	1/15	EC2S	0.746	30%	70%	0.90
Bunker Hill Middle School	Walk in Cooler	FSC	2.00	Shaded Pole	1/15 hp, 115V	1/15	EC2S	0.746	30%	70%	0.90
Bunker Hill Middle School	Walk in Freezer	WIF	2.00	Shaded Pole	1/15 hp, 208V	1/15	EC2S	0.746	30%	70%	0.90
Chestnut Ridge Middle School	Walk in Cooler	FSC	2.00	Shaded Pole	1/15 hp, 115V	1/15	EC2S	0.746	30%	70%	0.90
Chestnut Ridge Middle School	Walk in Freezer	WIF	2.00	Shaded Pole	1/15 hp, 208V	1/15	EC2S	0.746	30%	70%	0.90
Washington Township High School	Walk in Cooler	FSC	2.00	Shaded Pole	1/15 hp, 115V	1/15	EC2S	0.746	30%	70%	0.90
Washington Township High School	Walk in Freezer	WIF	2.00	Shaded Pole	1/15 hp, 208V	1/15	EC2S	0.746	30%	70%	0.90
Washington Township High School	Walk in Cooler	FSC	2.00	Shaded Pole	1/15 hp, 115V	1/15	EC2S	0.746	30%	70%	0.90
Washington Township High School	Walk in Freezer	WIF	2.00	Shaded Pole	1/15 hp, 208V	1/15	EC2S	0.746	30%	70%	0.90
Hurffville Elementary School	Walk in Cooler	FSC	1.00	Shaded Pole	1/15 hp, 115V	1/15	EC2S	0.746	30%	70%	0.90
Hurffville Elementary School	Walk in Freezer	WIF	2.00	Shaded Pole	1/15 hp, 208V	1/15	EC2S	0.746	30%	70%	0.90
Orchard Valley Middle School	Walk in Cooler	FSC	2.00	Shaded Pole	1/15 hp, 115V	1/15	EC2S	0.746	30%	70%	0.90
Orchard Valley Middle School	Walk in Freezer	WIF	2.00	Shaded Pole	1/15 hp, 208V	1/15	EC2S	0.746	30%	70%	0.90
Thomas Jefferson Elementary School	Walk in Cooler	FSC	2.00	Shaded Pole	1/15 hp, 115V	1/15	EC2S	0.746	30%	70%	0.90
Thomas Jefferson Elementary School	Walk in Freezer	WIF	2.00	Shaded Pole	1/15 hp, 208V	1/15	EC2S	0.746	30%	70%	0.90
Whitman Elementary School	Walk in Cooler	FSC	2.00	Shaded Pole	1/15 hp, 115V	1/15	EC2S	0.746	30%	70%	0.90
Whitman Elementary School	Walk in Freezer	WIF	2.00	Shaded Pole	1/15 hp, 208V	1/15	EC2S	0.746	30%	70%	0.90

Artik Control Savings - Evaporator Motor and Controls

Location	Equipment Type	IF _e	Pre-Retrofit kW _h	Post- Retrofit	%On _b	%On _q	kWh _b	kWh _q	kWh Savings	Kw Savings
Warehouse	SP Base, Freezer	1.76	0.597	0.256	0.978	0.692	8998.80	2728.82	6,269.98	0.07
Warehouse	SP Base, Freezer	1.76	0.60	0.26	0.978	0.692	8998.80	2728.82	6,269.98	0.07
Bunker Hill Middle School	SP Base, Cooler	1.38	0.30	0.13	0.978	0.692	3527.94	1069.82	2,458.12	0.03
Bunker Hill Middle School	SP Base, Freezer	1.76	0.30	0.13	0.978	0.692	4499.40	1364.41	3,134.99	0.03
Chestnut Ridge Middle School	SP Base, Cooler	1.38	0.30	0.13	0.978	0.692	3527.94	1069.82	2,458.12	0.03
Chestnut Ridge Middle School	SP Base, Freezer	1.76	0.30	0.13	0.978	0.692	4499.40	1364.41	3,134.99	0.03
Washington Township High School	SP Base, Cooler	1.38	0.30	0.13	0.978	0.692	3527.94	1069.82	2,458.12	0.03
Washington Township High School	SP Base, Freezer	1.76	0.30	0.13	0.978	0.692	4499.40	1364.41	3,134.99	0.03
Washington Township High School	SP Base, Cooler	1.38	0.30	0.13	0.978	0.692	3527.94	1069.82	2,458.12	0.03
Washington Township High School	SP Base, Freezer	1.76	0.30	0.13	0.978	0.692	4499.40	1364.41	3,134.99	0.03
Hurffville Elementary School	SP Base, Cooler	1.38	0.15	0.06	0.978	0.692	1763.97	534.91	1,229.06	0.01
Hurffville Elementary School	SP Base, Freezer	1.76	0.30	0.13	0.978	0.692	4499.40	1364.41	3,134.99	0.03
Orchard Valley Middle School	SP Base, Cooler	1.38	0.30	0.13	0.978	0.692	3527.94	1069.82	2,458.12	0.03
Orchard Valley Middle School	SP Base, Freezer	1.76	0.30	0.13	0.978	0.692	4499.40	1364.41	3,134.99	0.03
Thomas Jefferson Elementary School	SP Base, Cooler	1.38	0.30	0.13	0.978	0.692	3527.94	1069.82	2,458.12	0.03
Thomas Jefferson Elementary School	SP Base, Freezer	1.76	0.30	0.13	0.978	0.692	4499.40	1364.41	3,134.99	0.03
Whitman Elementary School	SP Base, Cooler	1.38	0.30	0.13	0.978	0.692	3527.94	1069.82	2,458.12	0.03
Whitman Elementary School	SP Base, Freezer	1.76	0.30	0.13	0.978	0.692	4499.40	1364.41	3,134.99	0.03

3.10.11 EVAPORATOR FAN CONTROLLER

Annual Energy Savings Algorithms

Annual Electric Energy Savings

$$\Delta kWh = kW \times (\%ON_b - \%ON_q) \times Hrs \times IF_e$$

Where,

$$kW = HP \times LF \times 0.746/\eta$$

Annual Fuel Savings

$$\Delta Therms = N/A$$

Peak Demand Savings

$$\Delta kW_{Peak} = \frac{\Delta kWh}{Hrs} \times CF$$

Daily Peak Fuel Savings

$$\Delta Therms_{Peak} = N/A$$

Lifetime Energy Savings Algorithms

Lifetime Electric Energy Savings

$$\Delta kWh_{Life} = \Delta kWh \times EUL$$

Lifetime Fuel Savings

$$\Delta Therms_{Life} = N/A$$

Dual:

Lifetime Electric Energy Savings

$$\Delta kWh_{Life} = \Delta kWh_{EREP} \times RUL + \Delta kWh_{NR} \times EUL$$

Lifetime Fuel Savings

$$\Delta Therms_{Life} = N/A$$

Calculation Parameters

Table 3-303 Calculation Parameters

Variable	Description	Value	Units	Ref
ΔkWh	Annual electric energy savings	Calculated	kWh/yr	
ΔkW_{Peak}	Peak Demand Savings	Calculated	kW	
ΔkWh_{Life}	Lifetime electric energy savings	Calculated	kWh	
kW	Input wattage of the SP, PSC or ECM motor	Site-specific, if unknown calculated	kW	
0.746	Conversion factor	0.746	kW/HP	[148]
LF	Load Factor - Ratio between the actual load and the rated load.	Site-specific, if unknown use 0.9	N/A	[148]
HP	Horsepower of SP, PSC or ECM motor	Site-specific	HP	

Variable	Description	Value	Units	Ref
η	Motor efficiency of the SP, PSC or ECM motor	SP: 30% PSC: 60% ECM: 70%		[149]
$\%ON_u$	Effective runtime of the uncontrolled motor	Site-specific, if unknown use 97.8%	N/A	[146]
$\%ON_c$	Effective runtime of the controlled motor	Site-specific, if unknown look up in Table 3-304	N/A	[146]
IF_e	Interactive effects factor for energy to account for cooling savings from offset refrigeration load	Look up in Table 3-305	N/A	[146]
CF	Electric coincidence factor	Look up in Table 3-306	N/A	[146]
Hrs	Hours of operation	8,760	Hrs	
EUL	Effective useful life	See Measure Life Section	Years	

Table 3-304 Effective run time of controlled motors

Control Type	Value	Ref
ON/OFF style controls	63.6%	[146]
Multi-speed style controls	69.2%	[146]

Table 3-305 Interactive Effects Factor for Energy¹³⁵

System Type	IF_e Value	Ref
Cooler or Refrigerator	1.38	[146]
Freezer	1.76	[146]

Coincidence Factor

Table 3-306 Coincidence Factors¹³⁶

Control Type	CF Value	Ref
ON/OFF control style	0.087	[146]
Micropulse control style	0.102	[146]
Unknown control style	0.094	[146]

3.10.7 DEFROST CONTROLS

Annual Energy Savings Algorithms

Annual Electric Energy Savings

$$\Delta kWh = \Delta kWh_{Defrost} + \Delta kWh_{Heat}$$

Where,

$$\Delta kWh_{Defrost} = kW_{Defrost} \times \text{Hours} \times DRF$$

$$\Delta kWh_{Heat} = \Delta kWh_{Defrost} \times 0.28 \times Eff_{RS}$$

Annual Fuel Savings

$$\Delta \text{Therms} = N/A$$

Peak Demand Savings

$$\Delta kW_{Peak} = \frac{\Delta kWh}{8760} \times CF$$

Daily Peak Fuel Savings

$$\Delta \text{Therms}_{Peak} = N/A$$

Lifetime Energy Savings Algorithms

Lifetime Electric Energy Savings

$$\Delta kWh_{Life} = \Delta kWh \times EUL$$

Lifetime Fuel Savings

$$\Delta \text{Therms}_{Life} = N/A$$

Dual:

Lifetime Electric Energy Savings

$$\Delta kWh_{Life} = \Delta kWh_{REF} \times RUL + \Delta kWh_{NR} \times EUL$$

Lifetime Fuel Savings

$$\Delta \text{Therms}_{Life} = N/A$$

Calculation Parameters

Table 3-289 Calculation Parameters

Variable	Description	Value	Units	Ref
ΔkWh	Annual electric energy savings	Calculated	kWh/yr	
ΔkW_{Peak}	Peak Demand Savings	Calculated	kW	
ΔkWh_{Life}	Lifetime electric energy savings	Calculated	kWh	
$\Delta kWh_{Defrost}$	Energy savings resulting from an increase in operating efficiency due to the addition of electronic defrost controls.	Calculated	kWh	
ΔkWh_{Heat}	Energy savings due to reduced heat from reduced number of defrost cycles	Calculated	kWh	
$kW_{Defrost}$	Load of electric defrost	Site-specific, if unknown use 0.9 kW	kW	
Hours	Number of hours defrost occurs over a year without the defrost controls	From Application, if unknown use 487 ¹³³	Hrs/yr	[131]
DRF	Defrost reduction factor- percent reduction in defrosts required per year	35%		[129]

Variable	Description	Value	Units	Ref
Eff _{RS}	Efficiency of typical refrigeration system	From Application, if unknown 3.35 (cooler), 1.88 (freezer)	kW/ton	[132]
0.28	Conversion constant	0.28	ton/kW	
CF	Electric coincidence factor	Look up in Table 3-290	N/A	
PDF	Gas peak demand factor	Look up in Table 3-290	N/A	
EUL	Effective useful life	See Measure Life Section	Years	
RUL	Remaining useful life of existing unit	See Measure Life Section	Years	

Peak Factors

Table 3-290 Peak Factors

Peak Factor	Value	Ref
Electric coincidence factor (CF)	1	
Natural gas peak day factor (PDF)	N/A	

Measure Life

The remaining useful life (RUL) for existing equipment is limited to 1/3 of the effective useful life (EUL) of the equipment.

Table 3-291 Measure Life

Equipment	EUL	RUL	Ref
Defrost Controls	10	3.33	[130]

ECM 10 – Retro-commissioning

Washington Township Public Schools ECM MATRIX ☒ ECM was evaluated ☒ ECM included in the project		Washington Township High School	Chestnut Ridge Middle School	Orchard Valley Middle School	Bunker Hill Middle School	Thomas Jefferson Elementary School	Hurffville Elementary School	Whitman Elementary School	Birches Elementary School	Bells Elementary School	Wedwood Elementary School	Grenloch Early Childhood Center	O'Brien Hall	Administration Building	Operations Building	Warehouse	Bus Garage
		ECM #	ECM DESCRIPTION														
10	Retro-Commissioning		<	<	<	<	<	<	<	<	<	<					

Due to the complexity of today's HVAC systems and controls, it is likely for systems to be operating incorrectly or not as efficiently as they could be. Retro-commissioning studies reveal hidden deficiencies and highlight operational & maintenance (O&M) issues that could have been avoided as well as expose hidden control system problems. There are valuable benefits to retro-commissioning in existing buildings. It is a detailed and specialized process that reviews how an HVAC system is controlled and designed to operate. Applying retro-commissioning to existing facilities includes planning, discovering root causes of inefficiencies, development of cost-effective project delivery and a focus on optimizing value to the building owner. The study includes functional system testing under various modes, such as heating or cooling loads, occupied and unoccupied modes, varying outside air temperature and space temperatures.

This is a systematic process to ensure that the building energy systems perform interactively according to the original design intent and the current operational needs of the facility. Retro-commissioning is a common practice recommended by the American Society of Heating Refrigeration and Energy (ASHRAE) to be revisited every couple of years. We recommend that an engineering firm who specializes in energy control systems and retro-commissioning be contacted for a detailed evaluation and implementation costs. Facility operations personnel would work with the engineers to develop goals and objectives. During on-site testing, the qualified personnel conducting the study would immediately make any no/low-cost improvements as identified. Furthermore, if there are any suggested corrective actions which require the purchase of material, a contractor who specializes in that scope of work would be contacted to implement the remaining improvements. DCO Energy is budgeting \$191,100 for on-site testing and to resolve district building system deficiencies.

Energy Savings Calculations

According to a Lawrence Berkeley National Laboratory study, *The Cost-Effectiveness of Commercial Buildings Commissioning*, “For existing buildings... whole-building energy savings of 15 percent, and payback times of 0.7 years.” Savings are conservatively estimated to be 2% of post-ESIP site electric and 2% of the existing natural gas consumption:

Retro-Commissioning Savings			
BUILDING	SQFT	kWh SAVINGS	THERMS SAVINGS
Washington Township High School	450,130	82,920	2,711
Chestnut Ridge Middle School	108,813	18,787	897
Orchard Valley Middle School	108,813	18,976	698
Bunker Hill Middle School	106,574	13,838	788
Thomas Jefferson Elementary School	72,396	11,535	0
Hurffville Elementary School	65,655	8,352	200
Whitman Elementary School	64,411	5,676	341
Birches Elementary School	63,411	5,843	310
Bells Elementary School	62,617	5,686	304
Wedgwood Elementary School	60,697	8,120	310
Grenloch Early Childhood Center	39,936	3,220	179
O'Brien Hall	22,900	1,626	94
Administration Building	20,000	1,843	80
Operations Building	5,625	776	0
Warehouse	5,400	1,071	47
Bus Garage	4,500	636	66

% SAVINGS
2.0%

ECM 11 – Combined Heat & Power

Washington Township Public Schools ECM MATRIX ☒ ECM was evaluated ☒ ECM included in the project		Washington Township High School	Chestnut Ridge Middle School	Orchard Valley Middle School	Bunker Hill Middle School	Thomas Jefferson Elementary School	Hurffville Elementary School	Whitman Elementary School	Birches Elementary School	Bells Elementary School	Wedgwood Elementary School	Grenloch Early Childhood Center	O'Brien Hall	Administration Building	Operations Building	Warehouse	Bus Garage
ECM #	ECM DESCRIPTION																
11	Combined Heating & Power	☒															

CHP offers energy and environmental benefits over electric-only and thermal-only systems in both central and distributed power generation applications. CHP systems have the potential for a wide range of applications and the higher efficiencies result in lower emissions than separate heat and power generation.

The simultaneous production of useful thermal and electrical energy in CHP systems leads to increased fuel efficiency. CHP units can be strategically located at the point of energy use. Such onsite generation avoids the transmission and distribution losses associated with electricity purchased via the grid from central stations. CHP is versatile and can be coupled with existing and planned technologies for many different applications in the industrial, commercial, and residential sectors.



4.4kW Axiom CHP

Scope of Work

- Location: Washington Township High School
- Coordinate sequence of installation with DCO Project Manager & Construction Manager
- Obtain all necessary permits required by local authorities.
- Ensure the installation plan complies with local building codes, fire codes, and safety standards.
- Apply for the Interconnection application (if required).
- Furnish and install a new 4.4 KW CHP and 120-gallon glass lined buffer tank. CHP and buffer tank shall be installed on new 4"high concrete pad
- Furnish and install HW supply piping, HW return piping, mixing valve, and circulation pump per manufacturer's installation manual.
- Furnish and install new 7.5kVA isolation transformer (provided by CHP manufacturer), new 30A fused disconnect and new 30A/2P breaker in nearest electrical panel for interconnect.
- Connect CHP 1" HWR line to existing building domestic HWR.
- Connect CHP 1" HWS line to existing building domestic HWR.
- Furnish and install gas piping to the new CHP.
- Furnish and install exhaust venting pipe to exterior of building and terminate with a gooseneck.
- Furnish and install combustion air intake pipe and terminate with galvanized wire mesh screen.
- Insulate newly installed piping where applicable.
- Furnish and install all electrical power and control wiring.
- Perform system start-up and testing
- Remove all debris and old equipment from the site.
- Support system commissioning and testing.
- Provide DCO Energy with all manuals, warranty information, and a detailed report on the installation process, including any modifications made to existing systems.
- Provide Owner training for new equipment and systems.

ECM Calculations

The CHP will act as the first stage of heating for the domestic water heating re-circulation loop. The CHP is estimated to run at full load for over 3,844 hours per year. The installed CHP will be available year-round and will operate when adequate hot water heating load exists. If necessary, heat can be rejected through a radiator when the full heating load is not required.

CHP Input Data		
Number of units	1	
Thermal output	42,000	BTU/hr
Gas input (HHV)	65,000	Btu/hr
Overall efficiency	87.7%	

Runtime Analysis	
Run hours	3,844

		Fuel Usage Without CHP				4.4 kW Cogen Plant Thermal Operation							
Month	Days	Total Building Gas Natural Use	Existing DHW Efficiency	Displaceable Gas Therms	Displaceable Heat Therms	Combined Cogen Run Hours	% Heat Load Displaced by CHP	Total Cogen Hours	Utilized Cogen Heat Therms	Max Cogen Heat Therms	Avoided DHW Gas Therms	Full Load Run Hours	System Operating Efficiency
Jan	31	26,527	80.0%	26,527	21,222	365	1%	365	153	153	192	365	88%
Feb	28	27,966	80.0%	27,966	22,373	330	1%	330	138	138	173	330	88%
Mar	31	20,825	80.0%	20,825	16,660	365	1%	365	153	153	192	365	88%
Apr	30	16,556	80.0%	16,556	13,245	353	1%	353	148	148	185	353	88%
May	31	7,303	80.0%	7,303	5,843	312	2%	312	131	131	164	312	88%
Jun	30	792	80.0%	792	634	246	15%	220	92	92	116	246	88%
Jul	31	525	80.0%	525	420	258	26%	258	108	108	136	258	88%
Aug	31	412	80.0%	412	329	258	33%	258	108	108	136	258	88%
Sep	30	7,543	80.0%	7,543	6,034	299	2%	299	126	126	157	299	88%
Oct	31	8,450	80.0%	8,450	6,760	365	2%	365	153	153	192	365	88%
Nov	30	12,430	80.0%	12,430	9,944	353	1%	353	148	148	185	353	88%
Dec	31	27,616	80.0%	27,616	22,093	365	1%	365	153	153	192	365	88%
Total:	365	156,947		156,947	125,557	3,870	1.3%	3,844	1,615	1,615	2,018	3,870	88%

		Fuel Usage With CHP			Electric Savings With CHP			
Month	Days	Supplemental DHW Gas Therms	Cogen Gas Therms	Total Gas	Run Hours	Avg Cogen Plant kW Output	kW Demand Savings	Cogen Electric Generation kWh
Jan	31	26,336	237	26,573	365	4	4	1,607
Feb	28	27,793	214	28,007	330	4	4	1,450
Mar	31	20,634	237	20,871	365	4	4	1,607
Apr	30	16,371	229	16,600	353	4	4	1,553
May	31	7,140	203	7,342	312	4	4	1,372
Jun	30	677	143	820	220	4	4	968
Jul	31	389	168	557	258	4	4	1,136
Aug	31	276	168	444	258	4	4	1,136
Sep	30	7,385	195	7,580	299	4	4	1,317
Oct	31	8,258	237	8,496	365	4	4	1,607
Nov	30	12,245	229	12,474	353	4	4	1,553
Dec	31	27,425	237	27,662	365	4	4	1,607
Total:	365	154,929	2,499	157,427	3,844		4	16,914

Combined Heat & Power Emission Reduction

BUILDING	SQFT	kW	Equivalent Full Load Electric Hours	NET GENERATION MWh	FUEL INPUT MMBTU	ELECTRIC SAVINGS FROM HEAT RECOVERY	FOSSIL FUEL SAVINGS FROM HEAT RECOVERY	CO2 EF ELECTRIC	CO2 EF CHP	CO2 EF GAS	CO2 EMISSION REDUCTION LBS
Washington Township High School	450,130	4.4	3,844	16.9	249.9	0	201.8	1,292.0	1,728.4	117.0	16,231.3

Combined Heat & Power Emission Reduction

BUILDING	SQFT	kW	NOx EF ELECTRIC	NOx EF CHP	NOx EF GAS	NOx EMISSION REDUCTION LBS	SO2 EF ELECTRIC	SO2 EF CHP	SO2 EMISSION REDUCTION LBS	Hg EF ELECTRIC	Hg EMISSION REDUCTION LBS
Washington Township High School	450,130	4.4	0.83	1.36	0.092	9.6	0.67	0.00	11.3	0.67	0.0

Combined Heat & Power Emission Reduction

BUILDING	SQFT	kW	CHP Gas Input (therms)	Pre-CHP DWH Gas Use (therms)	Post CHP DWH Gas Use (therms)	DWH Gas Savings (therms)	Net Building Gas Savings (therms)	DWH Efficiency	CHP Heat Recovered (MMBTU)	CHP Overall Efficiency
Washington Township High School	450,130	4.4	2,499	156,947	154,929	2,018	-481	80%	161	88%

The NJ Protocol is to follow the National Renewable Energy Laboratory's Combined Heat and Power, The Uniform Methods Project: Methods for Determining Energy-Efficiency Savings for Specific Measures [1]. The product should be all of the below outputs, as applicable:

- a. Annual energy input to the generator, HHV basis (MMBtu/yr)
- b. Annual electricity generated, net of all parasitic loads (kWh/yr)
- c. Annual fossil fuel energy savings from heat recovery (MMBtu/yr)
- d. Annual electric energy savings from heat recovery, including absorption chiller sourced savings if chiller installation is included as part of the system installation (kWh/yr)
- e. Annual overall CHP fuel conversion efficiency, HHV basis (%)
- f. Annual electric conversion efficiency, net of parasitics, HHV basis (%)

CHP Emissions Reduction Associated with PJM Grid

(Assuming that the useful thermal output will displace natural gas)

Algorithms

$$\text{CO}_2 \text{ ER (lbs)} = (\text{CO}_2 \text{ EF}_{\text{elec}} - \text{CO}_2 \text{ EF}_{\text{CHP}}) * \text{Net Electricity Generation (MWh)} + \text{CO}_2 \text{ EF}_{\text{elec}} * \text{Electric Energy Savings (MWh)} + \text{CO}_2 \text{ EF}_{\text{NG}} * \text{Gas Energy Savings (MMBtu)} * 10$$

$$\text{NO}_x \text{ ER (tons)} = (\text{NO}_x \text{ EF}_{\text{elec}} - \text{NO}_x \text{ EF}_{\text{CHP}}) * \text{Net Electricity Generation (MWh)} + \text{NO}_x \text{ EF}_{\text{elec}} * \text{Electric Energy Savings (MWh)} + \text{NO}_x \text{ EF}_{\text{NG}} * \text{Gas Energy Savings (MMBtu)} * 10$$

$$\text{SO}_2 \text{ ER (lbs)} = (\text{SO}_2 \text{ EF}_{\text{elec}} - \text{SO}_2 \text{ EF}_{\text{CHP}}) * \text{Net Electricity Generation (MWh)} + \text{SO}_2 \text{ EF}_{\text{elec}} * \text{Electric Energy Savings (MWh)}$$

$$\text{Hg (grams)} = (\text{Electric Energy Savings (MWh)} * \text{Hg EF}_{\text{elec}}) / 1,000$$

Definition of Variables

$\text{CO}_2 \text{ EF}_{\text{elec}}$ = CO_2 Electric Emissions Factor – see emissions tables summarized in Introduction section of Protocols

$\text{NO}_x \text{ EF}_{\text{elec}}$ = NO_x Electric Emissions Factor – see emissions tables summarized in Introduction section of Protocols

$\text{SO}_2 \text{ EF}_{\text{elec}}$ = SO_2 Electric Emissions Factor – see emissions tables summarized in Introduction section of Protocols

$\text{Hg EF}_{\text{elec}}$ = Hg Electric Emissions Factor – see emissions tables summarized in Introduction section of Protocols

$\text{CO}_2 \text{ EF}_{\text{CHP}}$ = CO_2 Emissions Factor of the CHP system (in lbs/MWh), which will vary with different projects based on the types of prime movers and emission control devices used

$\text{NO}_x \text{ EF}_{\text{CHP}}$ = NO_x Emissions Factor of the CHP system (in lbs/MWh), which will vary with different projects based on the types of prime movers and emission control devices used

$\text{SO}_2 \text{ EF}_{\text{CHP}}$ = SO_2 Emissions Factor of the CHP system (in lbs/MWh), which will vary with different projects based on the types of prime movers and emission control devices used

$\text{CO}_2 \text{ EF}_{\text{NG}}$ = CO_2 Natural Gas Emissions Factor associated with boiler fuel displacement – see emissions tables summarized in Introduction section of Protocols

$\text{NO}_x \text{ EF}_{\text{NG}}$ = NO_x Natural Gas Emissions Factor associated with boiler fuel displacement – see emissions tables summarized in Introduction section of Protocols

10 = Conversion from MMBtu to therms (1 MMBtu = 10 therms)

Calculation of Clean Air Impacts

The amount of air emission reductions resulting from the energy savings is calculated using the energy savings at the system level and multiplying them by factors provided by the New Jersey Department of Environmental Protection, Office of Air and Energy Advisor, on June 25, 2019.

Using Weighted Average of 2018 PJM On-Peak and Off-Peak annual data:

Electric Emission Factors

Emissions Product	Pounds per MWh ⁷
CO ₂	1,292
NO _x	0.83
SO ₂	0.67
Hg	1.1 mg/MWh ⁸

Natural Gas Emission Factors

Emissions Product	Current
CO ₂	11.7 lbs per therm saved
NO _x	0.0092 lbs per therm saved

Note: CHP emission factors for CO₂ and NO_x were calculated using nameplate electric generation and natural gas input capacity as seen in the ECM calculation. Per BPU Protocols, natural gas does not require SO₂ or Hg emission factors.

ECM 12 – Hot Water Boiler Plant Replacement

Washington Township Public Schools ECM MATRIX		Washington Township High School	Chestnut Ridge Middle School	Orchard Valley Middle School	Bunker Hill Middle School	Thomas Jefferson Elementary School	Hurffville Elementary School	Whitman Elementary School	Birches Elementary School	Bells Elementary School	Wedgwood Elementary School	Grenloch Early Childhood Center	O'Brien Hall	Administration Building	Operations Building	Warehouse	Bus Garage
ECM #	ECM DESCRIPTION	✓	✓	✓	✓		✓										
12	Hot Water Boiler Plant Replacement	ECM was evaluated	ECM included in the project														

***Note:** Hot Water Boiler Plant Replacements were evaluated at Washington Township High School, Bunker Hill Middle School, and Hurffville Elementary School. Due to poor payback and WTPS priorities, the Hot Water Boiler Plant Replacements at Chestnut Ridge and Orchard Valley Middle Schools are the only locations included in the ESIP Project.

Old, oversized boiler systems have efficiencies in the range of 56%–75%. A condensing boiler hot water heating system can achieve efficiencies as high as 97%, converting nearly all the fuel to useful heat. The efficiency of the boiler increases at lower return water temperature. Lower return water temperatures allow more water vapor from the exiting flue gas to condense, allowing its latent heat of vaporization to be recovered.



Chestnut Ridge Middle School

Existing Conditions



EQUIPMENT INVENTORY AND SYSTEM DESCRIPTION	
UNIT TAG	B-1, B-2, & B-3
QUANTITY	3
MANUFACTURER	H.B. Smith
TYPE	Hot Water Boiler
OUTPUT CAPACITY	3,101 MBH
AGE	20+ Years
LOCATION	Boiler Room
SERVES	Whole Building

Scope of Work

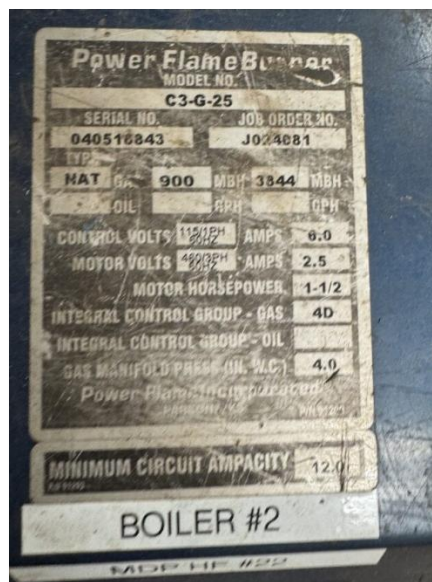
- Location: Chestnut Ridge Middle School Mechanical Room
- Coordinate sequence of installation with DCO Project Manager & Construction Manager
- Obtain all necessary permits required by local authorities for the installation of a natural gas-fired appliance.
- Ensure the installation plan complies with local building codes, fire codes, and safety standards
- Perform combustion testing on existing boilers and coordinate requirements with DCO M&V Analyst before demolition can take place.
- Disconnect existing electrical wiring, natural gas piping, hot water supply and return piping, and flue piping required for each location
- Demolition and removal of (3) 3,101 MBH hot water boilers and associated expansion tanks.
- Pumps, motors, and VFDs to remain.
- Demolition and removal of existing electrical wiring, natural gas piping, hot water supply and return piping, and flue piping required for each location
- Electrical wiring and conduit shall be removed back to source. Natural gas piping to be demolished back to nearest isolation valve. Hot water supply and return piping shall be removed as required to facilitate installation of new boilers. Flue shall be demolished entirely.
- Furnish and install the following:
 - (3) new Hydrotherm KN30 Series condensing hot water boilers
 - Connect new natural gas piping to existing piping. Provide new NG regulators for each boiler.
 - Connect new hot water supply and return piping to existing piping.
 - Furnish and install new primary hot water supply and return piping including header sensors, valves and meters/gauges required by the boiler manufacturer.
 - Furnish and install a new air separator on the suction side of the existing pumps. Furnish and install one (1) new bladder type expansion tank.
 - Provide new emergency stops at each boiler room door as required by code. Existing e-stops may be re-used if present and functional.
- Install new power wiring and conduit for new boilers from existing power panel(s). If adequate spare capacity is not available, provide new sub-panel for electrical service to new equipment.
- Furnish and install new hot water piping with insulation from new boilers to point of connection to existing system. New piping materials and fittings shall match existing.
- Furnish and install all valves, fittings, temperature/pressure sensors, meters and gauges required to complete the installation in accordance with the manufacturer's requirements

and final design. Install all interlock or daisy chain wiring between boilers as well as manufacturer provided header sensors, isolation control valves and outdoor air sensor wired back to boiler integral control panel. Integration of boiler system to the BAS will be by others.

- Provide new double wall, stainless steel flue and PVC combustion air intake piping. New flue to be run to existing chimney. Provide new single wall liner in existing chimney. Intake piping can be piped to existing combustion air intake louver. Removed existing damper and provide sheet metal plenum.
- Furnish and install new condensate drains from each boiler and flue with condensate neutralizers (one per boiler). Extend condensate piping to nearest floor drain.
- Perform system start-up and testing
- Perform combustion testing on new boilers and coordinate requirements with DCO M&V Analyst after installation is complete.
- Remove all debris and old equipment from the site.
- Start up the new pumps and check for any leaks or abnormal noises.
- Support system commissioning and testing.
- Provide DCO Energy with all manuals, warranty information, and a detailed report on the installation process, including any modifications made to existing systems
- Provide Owner training for new equipment and systems.

Orchard Valley Middle School

Existing Conditions



EQUIPMENT INVENTORY AND SYSTEM DESCRIPTION	
UNIT TAG	B-1, B-2, & B-3
QUANTITY	3
MANUFACTURER	H.B. Smith
TYPE	Hot Water Boiler
OUTPUT CAPACITY	3,101 MBH
AGE	20+ Years
LOCATION	Boiler Room
SERVES	Whole Building

Scope of Work

- Location: Orchard Valley MS Mechanical Room
- Coordinate sequence of installation with DCO Project Manager & Construction Manager
- Obtain all necessary permits required by local authorities for the installation of a natural gas-fired appliance.
- Ensure the installation plan complies with local building codes, fire codes, and safety standards
- Perform combustion testing on existing boilers and coordinate requirements with DCO M&V Analyst before demolition can take place.
- Disconnect existing electrical wiring, natural gas piping, hot water supply and return piping, and flue piping required for each location
- Demolition and removal of (3) 3,101 MBH hot water boilers and associated expansion tanks.
- Pumps, motors, and VFDs to remain.
- Demolition and removal of existing electrical wiring, natural gas piping, hot water supply and return piping, and flue piping required for each location
- Electrical wiring and conduit shall be removed back to source. Natural gas piping to be demolished back to nearest isolation valve. Hot water supply and return piping shall be removed as required to facilitate installation of new boilers. Flue shall be demolished entirely.
- Furnish and install the following:
 - (3) new Hydrotherm KN30 Series condensing hot water boilers
 - Connect new natural gas piping to existing piping. Provide new NG regulators for each boiler.
 - Connect new hot water supply and return piping to existing piping.
 - Furnish and install new hot water supply and return piping including, header sensors, valves and meters/gauges required by the boiler manufacturer.
 - Furnish and install a new air separator on the suction side of the existing pumps. Furnish and install one (1) new bladder type expansion tank.
 - Provide new emergency stops at each boiler room door as required by code. Existing e-stops may be re-used if present and functional.
- Install new power wiring and conduit for new boilers from existing power panel(s). If adequate spare capacity is not available, provide new sub-panel for electrical service to new equipment.
- Furnish and install new hot water piping with insulation from new boilers to point of connection to existing system. New piping material and fittings shall be match existing.

- Furnish and install all valves, fittings, temperature/pressure sensors, meters and gauges required to complete the installation in accordance with the manufacturer's requirements and final design. Install all interlock or daisy chain wiring between boilers as well as manufacturer provided header sensors, isolation control valves and outdoor air sensor wired back to boiler integral control panel. Integration of boiler system to the BAS will be by others.
- Provide new double wall, stainless steel flue and PVC combustion air intake piping. New flue to be run to existing chimney. Provide new single wall liner in existing chimney. Intake piping can be piped to existing combustion air intake louver. Removed existing damper and provide sheet metal plenum.
- Furnish and install new condensate drains from each boiler and flue with condensate neutralizers (one per boiler). Extend condensate piping to nearest floor drain.
- Perform system start-up and testing
- Perform combustion testing on new boilers and coordinate requirements with DCO M&V Analyst after installation is complete.
- Remove all debris and old equipment from the site.
- Start up the new pumps and check for any leaks or abnormal noises.
- Support system commissioning and testing.
- Provide DCO Energy with all manuals, warranty information, and a detailed report on the installation process, including any modifications made to existing systems
- Provide Owner training for new equipment and systems.

ECM Calculations

**Note: Hot Water Boiler Plant Replacements were evaluated at Washington Township High School, Bunker Hill Middle School, and Hurffville Elementary School. Due to poor payback and WTPS priorities, the Hot Water Boiler Plant Replacements at Chestnut Ridge and Orchard Valley Middle Schools are the only locations included in the ESIP Project.*

Hot Water Boiler Replacement Savings											
BUILDING	SYSTEM AND SERVICE	Existing Qty	Existing Qty Used	Input Capacity (mbh) [CAPin]	Equivalent Full Load Hours [EFLHh]	Derated Boiler Baseline Efficiency [EFFb]	Baseline Plant Rated Output MBH	Proposed Qty	Proposed Qty Used	Boiler Proposed Combustion Efficiency [EFFq]	Calculated Annual Fuel Savings (Th)
Chestnut Ridge Middle School	Whole Building - Hot Water	3	1.0	3,844.00	850	80.7%	3,101	1	1.0	87.0%	2,944
Orchard Valley Middle School	Whole Building - Hot Water	3	1.0	3,844.00	850	80.7%	3,101	1	1.0	87.0%	2,944

Annual Fuel Savings

$$\Delta Therms = Therms_b - Therms_q$$

Where,

$$Therms_b = \frac{Cap_h}{Eff_{AF} \times Eff_b \times 100,000} \times EFLH_h \text{ (Gas Equipment Baseline)}$$

$$Therms_b = 0 \text{ (Electric Baseline)}$$

$$Therms_q = \frac{Cap_h}{Eff_q \times 100,000} \times EFLH_h$$

Variable	Description	Value	Units	Ref
ΔkWh	Annual electric energy savings	Calculated	kWh/yr	
$\Delta Therms$	Annual fuel savings	Calculated	Therms/yr	
$\Delta Therms_{Peak}$	Daily peak fuel savings	Calculated	Therms/day	
ΔkWh_{Life}	Lifetime electric energy savings	Calculated	kWh	
$\Delta Therms_{Lifetime}$	Lifetime fuel savings	Calculated	Therms	
Cap_{in}	Input capacity of qualifying unit	Site-specific	Btu/hr	
Eff_q	Equipment Proposed Efficiency	Site-specific	Varies	
$HSPF_b$	Heating seasonal performance factor of baseline electric unit	Site-specific or look up in Appendix E: Code-Compliant Efficiencies		
$EFLH_h$	Equivalent Full Load Hours of operation for the average unit during the heating season	Look up in Appendix C: Heating and Cooling EFLH	Hrs/yr	[456]
Eff_b	Gas equipment baseline efficiency	Look up in Table 3-116	Varies	[457][458]
Eff_{AF}	Equipment baseline efficiency ISP adjustment Factor	1.15 (New Construction furnaces only) 1.0 (all others)	N/A	[459]
1,000	Conversion factor	1,000	Watts/kW	
100,000	Conversion factor	100,000	Btu/Therm	
CF	Electric coincidence factor	Look up in Table 3-117 Peak Factors	N/A	
PDF	Gas peak day factor	Look up in Table 3-117 Peak Factors	N/A	
EUL	Effective useful life	See Measure Life Section	Years	
RUL	Remaining useful life of existing unit	See Measure Life Section	Years	

ECM 16 – Solar PPA

Washington Township Public Schools ECM MATRIX ☒ ECM was evaluated ☒ ECM included in the project		Washington Township High School	Chestnut Ridge Middle School	Orchard Valley Middle School	Bunker Hill Middle School	Thomas Jefferson Elementary School	Hurffville Elementary School	Whitman Elementary School	Birches Elementary School	Bells Elementary School	Wedgwood Elementary School	Grenloch Early Childhood Center	O'Brien Hall	Administration Building	Operations Building	Warehouse	Bus Garage
ECM	ECM DESCRIPTION																
16	Solar PPA	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒

The renewable energy industry is one of the fastest growing and evolving components to modern building system design. The ability to capture solar energy will provide long term economic and environmental benefits. Technology improvements are rapidly evolving as well, and the market is flooded with new products with new features that have only been available within the last few years, with promising new technologies and updates on the verge of becoming available to the market.



Photovoltaic (PV) solar array

Clients have the opportunity to purchase power through a Power Purchase Agreement, predetermining fixed low rates for the duration of the agreement, without having to manage any part of the process. This allows the solar provider to manage compliance reporting, filings, and maintenance of the equipment for the entire length of the contract.

A solar PPA makes going green easy. Work takes place around the client's schedule, and a safe and functional environment is maintained throughout installation of the system.

Assessment

A preliminary assessment of your facilities will allow for the design of a system that meets your energy needs and environmental goals.

Agreement

Power Purchase Agreements allow for the sale of the energy produced on a per kWh basis, while a lease agreement allows the solar provider to access the system, they own so that they may monitor and maintain the system for you.

Installation

A turnkey system includes the design, construction, commissioning, and interconnection with local utilities.

Monitoring

The solar provider monitors the PV installation to ensure performance and for ease of billing. The client has the capability to track output and environmental benefits online.

Management

The solar provider handles all compliance and reporting requirements for the client. They will file documentation with federal and state agencies and participate in state and utility REC markets.

Scope of Work

- Savings estimates are calculated from proposals received during Washington Township Public Schools' Solar PPA RFP process.
- Installation of the Solar PV System shall be in accordance with NFPA 70. NEC 2011. ARTICLE 690.Solar Photovoltaic (PV) Systems
- The PPA Firm will receive any incentives available.

Solar Photovoltaic Arrays

Washington Township Public Schools' roof mounted solar opportunities are show below:

Washington Township High School



Chestnut Ridge Middle School



Orchard Valley Middle School



Thomas Jefferson Elementary School



Hurffville Elementary School



Whitman Elementary School



Birches Elementary School



Bells Elementary School



Wedgwood Elementary School



ECM Calculations

The energy savings shown below are a result of the reduced electrical cost from the PPA for the kWh generated by the solar panels. Actual rates and solar generation estimates were taken from the proposals received during the Washington Township Public Schools' PPA RFP process. A comparison was done to ensure the generated kWh did not exceed the post-project estimated energy consumption. In cases where the generated kWh exceeded the post-project electrical consumption, the generation numbers were reduced to ensure the site would not generate more electricity than it consumes. The PPA term is 15 years.

**Note: Solar PPA was also evaluated at Bunker Hill Middle School and Grenloch Early Childhood Center but is not included in the ESIP. Bunker Hill Middle School was removed due to a denied interconnection application, and Grenloch ECC was removed due to structural roof limitations.*

PPA Rate	ESCALATION RATE	ANNUAL PANEL DERATING	CONTRACT TERM (YRS)
\$0.0290	1.00%	0.50%	15

Solar PPA Rates & Savings	
BUILDING	Solar PPA Generation (kWh)
Washington Township High School	2,801,383
Chestnut Ridge Middle School	252,854
Orchard Valley Middle School	239,648
Thomas Jefferson Elementary School	458,829
Hurffville Elementary School	337,990
Whitman Elementary School	278,148
Birches Elementary School	286,323
Bells Elementary School	278,592
Wedgwood Elementary School	374,996

YEAR	15 YEAR SOLAR PPA kWh SAVINGS	15 YEAR SOLAR PPA COST SAVINGS
1	5,308,763	543,587
2	5,282,219	554,607
3	5,255,808	565,822
4	5,229,529	577,235
5	5,203,381	588,850
6	5,177,365	600,670
7	5,151,478	612,700
8	5,125,720	624,942
9	5,100,092	637,400
10	5,074,591	650,078
11	5,049,218	662,980
12	5,023,972	676,108
13	4,998,852	689,469
14	4,973,858	703,064
15	4,948,989	716,899

Washington Township High School				
YEAR	\$/kWh RATES		SOLAR kWh	SAVINGS
	UTILITY	SOLAR PPA		
1	\$0.137	\$0.0290	2,801,383	\$303,658
2	\$0.140	\$0.0293	2,787,376	\$309,757
3	\$0.144	\$0.0296	2,773,439	\$315,963
4	\$0.147	\$0.0299	2,759,572	\$322,280
5	\$0.150	\$0.0302	2,745,774	\$328,707
6	\$0.153	\$0.0305	2,732,045	\$335,249
7	\$0.157	\$0.0308	2,718,385	\$341,905
8	\$0.160	\$0.0311	2,704,793	\$348,679
9	\$0.164	\$0.0314	2,691,269	\$355,573
10	\$0.167	\$0.0317	2,677,813	\$362,587
11	\$0.171	\$0.0320	2,664,424	\$369,725
12	\$0.175	\$0.0324	2,651,102	\$376,989
13	\$0.178	\$0.0327	2,637,846	\$384,381
14	\$0.182	\$0.0330	2,624,657	\$391,902
15	\$0.186	\$0.0333	2,611,534	\$399,556

Chestnut Ridge Middle School				
YEAR	\$/kWh RATES		SOLAR kWh	SAVINGS
	UTILITY	SOLAR PPA		
1	\$0.135	\$0.0290	252,854	\$26,762
2	\$0.138	\$0.0293	251,590	\$27,301
3	\$0.141	\$0.0296	250,332	\$27,851
4	\$0.144	\$0.0299	249,080	\$28,409
5	\$0.147	\$0.0302	247,835	\$28,978
6	\$0.150	\$0.0305	246,596	\$29,557
7	\$0.154	\$0.0308	245,363	\$30,146
8	\$0.157	\$0.0311	244,136	\$30,745
9	\$0.160	\$0.0314	242,915	\$31,355
10	\$0.164	\$0.0317	241,701	\$31,976
11	\$0.168	\$0.0320	240,492	\$32,607
12	\$0.171	\$0.0324	239,290	\$33,250
13	\$0.175	\$0.0327	238,093	\$33,904
14	\$0.179	\$0.0330	236,903	\$34,570
15	\$0.183	\$0.0333	235,718	\$35,247

Orchard Valley Middle School				
YEAR	\$/kWh RATES		SOLAR kWh	SAVINGS
	UTILITY	SOLAR PPA		
1	\$0.144	\$0.0290	239,648	\$27,609
2	\$0.147	\$0.0293	238,450	\$28,158
3	\$0.151	\$0.0296	237,258	\$28,717
4	\$0.154	\$0.0299	236,071	\$29,286
5	\$0.157	\$0.0302	234,891	\$29,865
6	\$0.161	\$0.0305	233,716	\$30,454
7	\$0.164	\$0.0308	232,548	\$31,054
8	\$0.168	\$0.0311	231,385	\$31,664
9	\$0.172	\$0.0314	230,228	\$32,284
10	\$0.175	\$0.0317	229,077	\$32,916
11	\$0.179	\$0.0320	227,932	\$33,559
12	\$0.183	\$0.0324	226,792	\$34,212
13	\$0.187	\$0.0327	225,658	\$34,878
14	\$0.191	\$0.0330	224,530	\$35,555
15	\$0.196	\$0.0333	223,407	\$36,244

Thomas Jefferson Elementary School				
YEAR	\$/kWh RATES		SOLAR kWh	SAVINGS
	UTILITY	SOLAR PPA		
1	\$0.117	\$0.0290	458,829	\$40,215
2	\$0.119	\$0.0293	456,535	\$41,053
3	\$0.122	\$0.0296	454,252	\$41,906
4	\$0.125	\$0.0299	451,981	\$42,774
5	\$0.127	\$0.0302	449,721	\$43,658
6	\$0.130	\$0.0305	447,472	\$44,557
7	\$0.133	\$0.0308	445,235	\$45,473
8	\$0.136	\$0.0311	443,009	\$46,404
9	\$0.139	\$0.0314	440,794	\$47,353
10	\$0.142	\$0.0317	438,590	\$48,318
11	\$0.145	\$0.0320	436,397	\$49,300
12	\$0.148	\$0.0324	434,215	\$50,299
13	\$0.151	\$0.0327	432,044	\$51,317
14	\$0.155	\$0.0330	429,884	\$52,352
15	\$0.158	\$0.0333	427,734	\$53,406

Hurffville Elementary School				
YEAR	\$/kWh RATES		SOLAR kWh	SAVINGS
	UTILITY	SOLAR PPA		
1	\$0.127	\$0.0290	337,990	\$33,032
2	\$0.130	\$0.0293	336,300	\$33,707
3	\$0.132	\$0.0296	334,619	\$34,394
4	\$0.135	\$0.0299	332,945	\$35,093
5	\$0.138	\$0.0302	331,281	\$35,804
6	\$0.141	\$0.0305	329,624	\$36,528
7	\$0.144	\$0.0308	327,976	\$37,265
8	\$0.148	\$0.0311	326,336	\$38,015
9	\$0.151	\$0.0314	324,705	\$38,779
10	\$0.154	\$0.0317	323,081	\$39,555
11	\$0.158	\$0.0320	321,466	\$40,346
12	\$0.161	\$0.0324	319,858	\$41,150
13	\$0.165	\$0.0327	318,259	\$41,969
14	\$0.168	\$0.0330	316,668	\$42,802
15	\$0.172	\$0.0333	315,084	\$43,649

Whitman Elementary School				
YEAR	\$/kWh RATES		SOLAR kWh	SAVINGS
	UTILITY	SOLAR PPA		
1	\$0.121	\$0.0290	278,148	\$25,483
2	\$0.123	\$0.0293	276,757	\$26,009
3	\$0.126	\$0.0296	275,373	\$26,546
4	\$0.129	\$0.0299	273,997	\$27,091
5	\$0.132	\$0.0302	272,627	\$27,646
6	\$0.134	\$0.0305	271,263	\$28,212
7	\$0.137	\$0.0308	269,907	\$28,787
8	\$0.140	\$0.0311	268,558	\$29,372
9	\$0.144	\$0.0314	267,215	\$29,968
10	\$0.147	\$0.0317	265,879	\$30,574
11	\$0.150	\$0.0320	264,549	\$31,192
12	\$0.153	\$0.0324	263,227	\$31,820
13	\$0.157	\$0.0327	261,910	\$32,459
14	\$0.160	\$0.0330	260,601	\$33,109
15	\$0.164	\$0.0333	259,298	\$33,771

Birches Elementary School				
YEAR	\$/kWh RATES		SOLAR kWh	SAVINGS
	UTILITY	SOLAR PPA		
1	\$0.119	\$0.0290	286,323	\$25,663
2	\$0.121	\$0.0293	284,892	\$26,195
3	\$0.124	\$0.0296	283,467	\$26,737
4	\$0.127	\$0.0299	282,050	\$27,289
5	\$0.129	\$0.0302	280,640	\$27,850
6	\$0.132	\$0.0305	279,237	\$28,422
7	\$0.135	\$0.0308	277,840	\$29,004
8	\$0.138	\$0.0311	276,451	\$29,596
9	\$0.141	\$0.0314	275,069	\$30,198
10	\$0.144	\$0.0317	273,694	\$30,811
11	\$0.147	\$0.0320	272,325	\$31,435
12	\$0.151	\$0.0324	270,963	\$32,071
13	\$0.154	\$0.0327	269,609	\$32,717
14	\$0.157	\$0.0330	268,261	\$33,375
15	\$0.161	\$0.0333	266,919	\$34,044

Bells Elementary School				
YEAR	\$/kWh RATES		SOLAR kWh	SAVINGS
	UTILITY	SOLAR PPA		
1	\$0.120	\$0.0290	278,592	\$25,461
2	\$0.123	\$0.0293	277,199	\$25,988
3	\$0.126	\$0.0296	275,813	\$26,524
4	\$0.129	\$0.0299	274,434	\$27,069
5	\$0.131	\$0.0302	273,061	\$27,624
6	\$0.134	\$0.0305	271,696	\$28,189
7	\$0.137	\$0.0308	270,338	\$28,764
8	\$0.140	\$0.0311	268,986	\$29,349
9	\$0.143	\$0.0314	267,641	\$29,945
10	\$0.146	\$0.0317	266,303	\$30,551
11	\$0.150	\$0.0320	264,971	\$31,168
12	\$0.153	\$0.0324	263,647	\$31,796
13	\$0.156	\$0.0327	262,328	\$32,434
14	\$0.160	\$0.0330	261,017	\$33,085
15	\$0.163	\$0.0333	259,712	\$33,746

Wedgwood Elementary School				
YEAR	\$/kWh RATES		SOLAR kWh	SAVINGS
	UTILITY	SOLAR PPA		
1	\$0.124	\$0.0290	374,996	\$35,705
2	\$0.127	\$0.0293	373,121	\$36,438
3	\$0.130	\$0.0296	371,255	\$37,184
4	\$0.133	\$0.0299	369,399	\$37,944
5	\$0.136	\$0.0302	367,552	\$38,716
6	\$0.138	\$0.0305	365,714	\$39,503
7	\$0.142	\$0.0308	363,886	\$40,303
8	\$0.145	\$0.0311	362,066	\$41,117
9	\$0.148	\$0.0314	360,256	\$41,946
10	\$0.151	\$0.0317	358,455	\$42,790
11	\$0.154	\$0.0320	356,662	\$43,648
12	\$0.158	\$0.0324	354,879	\$44,522
13	\$0.161	\$0.0327	353,105	\$45,411
14	\$0.165	\$0.0330	351,339	\$46,316
15	\$0.168	\$0.0333	349,583	\$47,236

ECM 17 – Stadium Lighting

Washington Township Public Schools ECM MATRIX																	
		Washington Township High School	Chestnut Ridge Middle School	Orchard Valley Middle School	Bunker Hill Middle School	Thomas Jefferson Elementary School	Hurffville Elementary School	Whitman Elementary School	Birches Elementary School	Bells Elementary School	Wedgwood Elementary School	Grenloch Early Childhood Center	O'Brien Hall	Administration Building	Operations Building	Warehouse	Bus Garage
ECM	ECM DESCRIPTION																
17	Stadium Lighting																

Outdoor field lighting are types of site light fixtures that are commonly used to illuminate large areas for sporting events or other large outdoor events and activities, such as concerts. Sports light fixtures are typically mounted on poles 40 to 100 feet tall, with between 1-12 fixtures mounted on each pole. This type of outdoor lighting is often used by schools, colleges and universities, municipalities, amateur sports clubs, and professional sports franchises. Common (HID) lamp wattages used for conventional sports lighting fixtures range from 400 watts to 2,000 watts. The higher the wattage, the higher the light output. The function of the area being illuminated, combined with the quantity, spacing, and mounting height of the field light fixtures plays a role in the existing wattages utilized. A few 1000w or 2000w metal halide sports light lamps (very common wattages for existing outdoor sports lighting) can cost up to \$6,300 to \$12,500 to operate per year, in electricity costs alone.



LED Field Lighting

ECM Calculations

Stadium Lighting Replacement Savings					
BUILDING	kW _b	kW _q	ΔkW	Hours per Year	Replacement Energy Savings (kWh)
Washington Township High School	67.5	52.6	14.9	325	4842.5

Lighting Retrofit

Annual Energy Savings

Replacement/Midstream Interior Lighting:

$$\Delta kWh = \frac{Qty_b \times W_b - Qty_q \times W_q}{1,000} \times Hrs \times (1 + HVAC_e)$$

Replacement/Midstream Exterior Lighting:

$$\Delta kWh = \frac{Qty_b \times W_b - Qty_q \times W_q}{1,000} \times Hrs$$

Annual Fuel Savings

Replacement/Midstream Interior Lighting:

$$\Delta Therms = (Qty_b \times W_b - Qty_q \times W_q) \times Hrs \times HVAC_g \times 10$$

Note: No fuel impacts are claimed in exterior lighting installation.

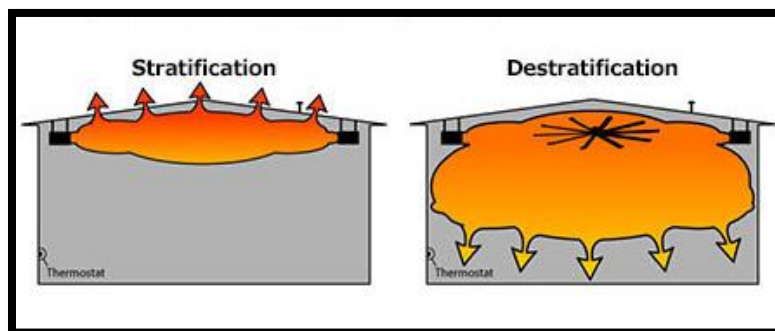
Definitions of Variables

Variable	Description	Value	Units	Ref
W_q	Wattage of Energy Efficient Fixture	Site-specific	W	
LPD_q	Installed lighting power density	Site-specific	W/Sq Ft	
LPD_b	Baseline lighting power density	Site-specific, if unknown look up in Table 3-193, Table 3-194, Table 3-196	W/Sq Ft	
LPA_b	Baseline lighting power allowance	Site-specific, if unknown look up in Table 3-196	W/Sq Ft or W/Linear Ft	[39]
LPA_q	Installed lighting power allowance	Site-specific, if unknown look up in Table 3-196	W/Sq Ft or W/Linear Ft	[39]
AL	If LPA unit is W/Sq Ft: AL is Area If LPA Unit is W/linear ft: AL is linear ft	Site-specific	Sq Ft or Linear Ft	
A	Area in Square Feet	Site-Specific	Square Foot	
Hrs	Annual Hours of Operation	Site-specific, if unknown use Table 3-197	Hrs/yr	[30]
LPD_{adj} (interior)	Interior Lighting LPD adjustment factor (25% better)	0.75	N/A	[44]
LPA_{adj} (exterior)	Exterior Lighting LPA adjustment factor (35% better)	0.65	N/A	[44]
$HVAC_e$	HVAC Interactive Factor for Annual Energy Savings	Look up in Table 3-198	N/A	[58][60]
$HVAC_f$	HVAC Interactive Factor for Annual Fuel Savings	Look up in Table 1 -8	N/A	[61]
$HVAC_d$	HVAC Interactive Factor for Peak Demand Savings	Look up in Table 3-198	N/A	[58][60]
CF	Coincidence Factor	Look up in Table 3-197	N/A	[30]
SVG_b	Savings control factor	Look up in Table 3-200		[47]
PDF	Gas peak day factor	Look up in Table 3-201		
RUL	Remaining useful life of existing equipment	Site-specific, if unknown use EUL/3	Years	
EUL	Effective useful life of new measure	See	Years	
1,000	Conversion from watts to kW	1,000	W/kW	
10	Conversion from MMBtu to therms	10	Therms/MMBtu	

ECM 19 – Destratification Fans

Washington Township Public Schools ECM MATRIX ☒ ECM was evaluated ☒ ECM included in the project		Washington Township High School	Chestnut Ridge Middle School	Orchard Valley Middle School	Bunker Hill Middle School	Thomas Jefferson Elementary School	Hurffville Elementary School	Whitman Elementary School	Birches Elementary School	Bells Elementary School	Wedgwood Elementary School	Grenloch Early Childhood Center	O'Brien Hall	Administration Building	Operations Building	Warehouse	Bus Garage
ECM #	ECM DESCRIPTION																
19	Destratification Fans	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒						

Large indoor spaces with high ceilings such as a gymnasium are prone to a condition called stratification. Stratification is a common property of air to separate due to temperature difference. Typically, a layer of warm air will sit on top of a layer of cold air. The lower cold air causes discomfort for occupants of the space as well as increased energy usage of air handling systems to overcome this condition. A destratification fan can efficiently heat large spaces by slowly moving large volumes of warm air off the ceiling without creating a draft. The steady mixing of air creates a uniform temperature throughout the space which helps the HVAC maintain the same thermostat setpoint with less effort, resulting in energy savings.



ECM Calculations

Destrat Fan Savings												
Building	Area in Building	Ceiling Height (ft.)	Area (sq.ft.)	Gas Usage (therms)	Temp Differential (°F)	Savings Percentage (%)	Savings in therms	Yearly Fan Operating Hours	Fan Type	QTY	Power Draw	Annual kWh
Washington Township High School	Gym 1	27	12,480	14,976	12	21%	3,115	4000	E-ONYX-P4-STD-120-X	7	0.076	-2,128
Washington Township High School	Gym 2	23	8,000	9,600	11	18%	1,680	4000	E-ONYX-P4-STD-120-X	4	0.076	-1,216
Washington Township High School	Gym 3	23	6,600	7,920	11	18%	1,386	4000	E-ONYX-P4-STD-120-X	4	0.076	-1,216
Thomas Jefferson Elementary School	Gym	22	5,198	6,237	10	16%	1,010	4000	E-ONYX-P4-STD-120-X	3	0.076	-912
Chestnut Ridge Middle School	Gym	25	6,900	8,280	11	18%	1,449	4000	E-ONYX-P4-STD-120-X	4	0.076	-1,216
Hurffville Elementary School	Gym	24	3,540	4,248	11	18%	743	4000	E-ONYX-P4-STD-120-X	2	0.076	-608
Bells Elementary School	Gym	21	4,680	5,616	10	16%	910	4000	E-ONYX-P4-STD-120-X	3	0.076	-912
Wedgwood Elementary School	Gym	21	4,680	5,616	10	16%	910	4000	E-ONYX-P4-STD-120-X	3	0.076	-912
Bunker Hill Middle School	Gym	27	7,154	8,585	12	21%	1,786	4000	E-ONYX-P4-STD-120-X	4	0.076	-1,216
Whitman Elementary School	Gym	21	4,680	5,616	10	16%	910	4000	E-ONYX-P4-STD-120-X	3	0.076	-912
Birches Elementary School	Gym	21	4,680	5,616	10	16%	910	4000	E-ONYX-P4-STD-120-X	3	0.076	-912
Orchard Valley Middle School	Gym	25	7,286	8,743	11	18%	1,530	4000	E-ONYX-P4-STD-120-X	4	0.076	-1,216

Savings Table

Ceiling Height (ft.)	Temp Differential (°F)						
	5.4	7.2	9	10.8	16.2	18	19.8
	20	12.7	14.7	16.2	17.5	21	22
	26	15.8	17.6	19	20.8	24.4	26
	33	18	20	21.8	23.2	27.6	28.8
	40	20	22	23.6	25.6	30	31.8

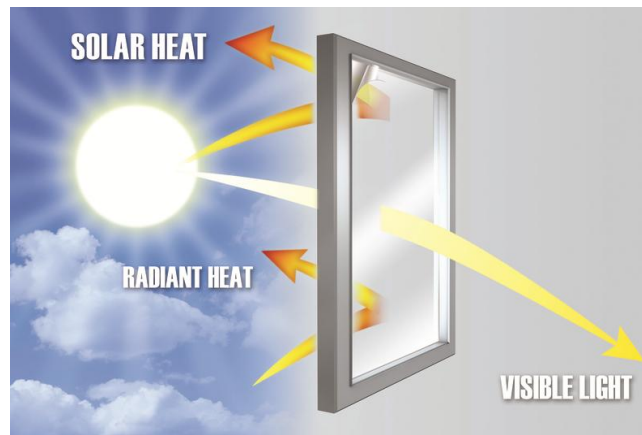
% savings

Source: Building Scientific Research Information Association, UK, 1997. Computational Fluid Dynamics for a 100' x 165' x 26' building with a 100kW gas heater at 3,600cfm. Insulation and lighting remain constant.

ECM 20 – Window Film

Washington Township Public Schools ECM MATRIX ☒ ECM was evaluated ☒ ECM included in the project		Washington Township High School	Chestnut Ridge Middle School	Orchard Valley Middle School	Bunker Hill Middle School	Thomas Jefferson Elementary School	Hurffville Elementary School	Whitman Elementary School	Birches Elementary School	Bells Elementary School	Wedgwood Elementary School	Grenloch Early Childhood Center	O'Brien Hall	Administration Building	Operations Building	Warehouse	Bus Garage
ECM #	ECM DESCRIPTION																
20	Window Film	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒					

Window film adheres to existing windows to reflect radiant infrared energy, thus tending to keep radiant heat on the side of the glass where it originated. This results in more efficient windows because radiant heat originating from indoors in winter is reflected back inside, while infrared heat radiation from the sun during summer is reflected away, keeping it cooler inside. Window film stills allow the natural light to shine through but reduces the window glare to allow occupants to see clearly without straining their eyes.



Scope of Work

The buildings listed below were evaluated to have low efficiency glazing. Due to poor payback on the solar reduction film, Hurffville will only have security film installed,

Window Film Savings	
BUILDING	Film Model
Washington Township High School	Sentinel 35 / Security
Chestnut Ridge Middle School	Sentinel 35 / Security
Orchard Valley Middle School	Sentinel 35 / Security
Thomas Jefferson Elementary School	Sentinel 35 / Security
Whitman Elementary School	Sentinel 35 / Security
Birches Elementary School	Sentinel 35 / Security
Bells Elementary School	Sentinel 35 / Security
Wedgwood Elementary School	Sentinel 35 / Security
Grenloch Early Childhood Center	Sentinel 35 / Security
Bunker Hill Middle School	Sentinel 35 / Security
Hurffville Elementary School	Security Only

Specification	Sentinel Plus 4mil Clear	Sentinel Plus DX 15	Sentinel Plus DX 5	Sentinel Plus Silver 20	Sentinel Plus Silver 35	Sentinel Plus Stainless Steel 15	Sentinel Plus Stainless Steel 25	Sentinel Plus Stainless Steel 40	Sentinel Plus SX50 OSW	Sentinel Plus SX80 OSW
Visible light transmittance %	88%	14%	5%	16%	33%	13%	23%	38%	47%	77%
Visible light reflectance (exterior) %	9%	42%	60%	61%	41%	40%	28%	18%	27%	8%
Visible light reflectance (interior) %	9%	17%	15%	56%	36%	35%	25%	15%	24%	8%
Solar heat gain coefficient	.79	.25	.14	.18	.33	.28	.37	.49	.44	.57
Total solar energy rejected %	21%	75%	86%	82%	67%	72%	63%	51%	56%	43%
UV Tdw-ISO @ 300 to 700 nm %	60%	11%	4%	13%	26%	9%	16%	26%	36%	54%
UV light blocked (300 to 380 nm) %	>99%	>99%	>99%	>99%	>99%	>99%	>99%	>99%	>99%	>99%
Fade Reduction %	27%	87%	95%	84%	68%	89%	80%	68%	56%	34%

Performance Notes:

- Performance results are calculated using NFRC methodology and LBNL Window software, applied to 1/4" (6mm) clear glass and are subject to variations within industry standards and only intended for estimating purposes. This data is provided for informational purposes only and subject to normal manufacturing variances.
- Performance results for glare and fade reduction are calculated by comparing filmed glass to that of untreated glazing.

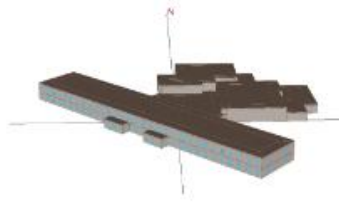
ECM Calculations

Energy Savings from the installation of Window Film was modeled in eQuest and the summary is shown below.

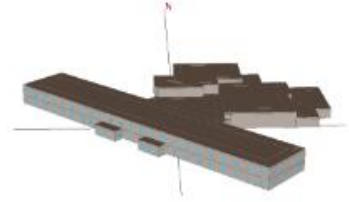
Window Film Savings				
BUILDING	Film Model	kWh Savings	kW Savings	THERM Savings
Washington Township High School	Sentinel 35 / Security	164,500.2	77	3,461
Chestnut Ridge Middle School	Sentinel 35 / Security	48,726.0	14	1,428
Orchard Valley Middle School	Sentinel 35 / Security	40,496.4	12	1,202
Thomas Jefferson Elementary School	Sentinel 35 / Security	19,942.2	14	(530)
Whitman Elementary School	Sentinel 35 / Security	33,270.3	14	(108)
Birches Elementary School	Sentinel 35 / Security	23,995.8	11	(515)
Bells Elementary School	Sentinel 35 / Security	22,692.6	10	(436)
Wedgwood Elementary School	Sentinel 35 / Security	27,973.8	(5)	(287)
Grenloch Early Childhood Center	Sentinel 35 / Security	35,595.9	20	(1,395)
Bunker Hill Middle School	Sentinel 35 / Security	32,099.4	17	(734)
Hurffville Elementary School	Security Only	-	-	-



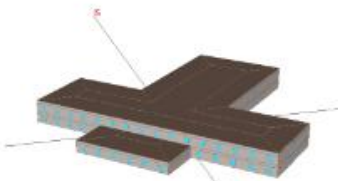
**Washington Township
High School**



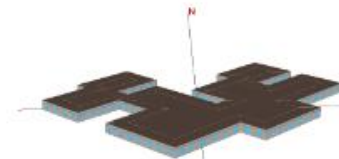
**Chestnut Ridge
Middle School**



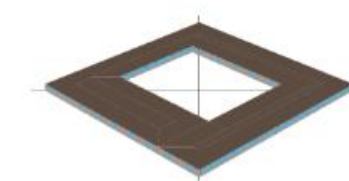
**Orchard Valley
Middle School**



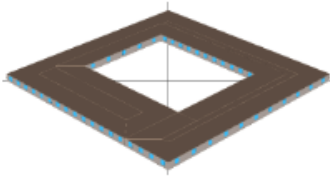
**Thomas Jefferson
Elementary School**



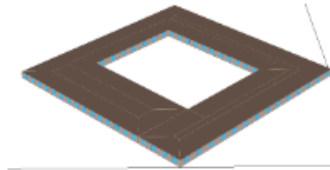
**Hurffville
Elementary School**



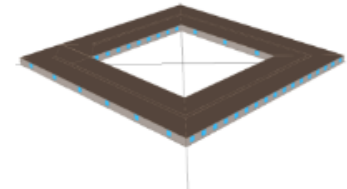
**Whitman Elementary
School**



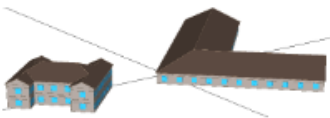
**Birches Elementary
School**



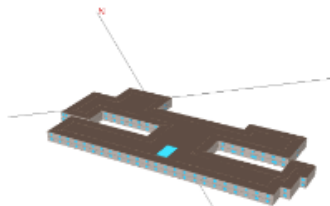
**Belts Elementary
School**



**Wedgwood
Elementary School**



**Grenloch Early Childhood
Center**



Bunker Hill

ECM 21 – HVAC Armor

Washington Township Public Schools ECM MATRIX ☒ ECM was evaluated ☒ ECM included in the project		Washington Township High School	Chestnut Ridge Middle School	Orchard Valley Middle School	Bunker Hill Middle School	Thomas Jefferson Elementary School	Hurffville Elementary School	Whitman Elementary School	Birches Elementary School	Bells Elementary School	Wedgwood Elementary School	Grenloch Early Childhood Center	O'Brien Hall	Administration Building	Operations Building	Warehouse	Bus Garage
		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓		
ECM #	ECM DESCRIPTION																
21	HVAC Armor																

Over time, condenser coils accumulate contaminants such as dust, dirt, and grime. These deposits act as thermal insulators, obstructing the heat exchange process and forcing the system to operate at higher pressures and temperatures to achieve the desired cooling output. This increased workload leads to higher energy consumption. By employing a thorough cleaning process, these contaminants are removed, restoring the coils to their optimal thermal conductivity. Following the cleaning, the application of a specialized coating further enhances efficiency by improving the surface's thermal properties. The combined effect of cleaning and coating ensures that the air conditioner operates at peak efficiency, lowering the required energy by 10-15%.



Scope of Work

HVAC Armor DX (coil rejuvenation)

- General clean up of overall unit and wash-down of coils
- Deep clean condenser coils to remove final materials in coils, and corrosion
- Disassemble equipment to perform deep clean of condenser coils, removing final materials in coils and corrosion
- Straighten aluminum fins
- Spray each condenser coil with HVAC Armor from both outside-in and inside-out, applying an even coverage.
- Assemble and ensure equipment is operating.



ECM Calculations

HVAC ARMOR - SAVINGS																											
Building	Manufacturer	Model	Serial	Type	Nominal Tons	EFLH	Avg ECAT °F	Baseline										HVAC Armor									
								Avg Cond Temp °F	Derated Cooling Capacity [ton]	Condenser Fan [kW]	Evap Fan [kW]	Compressor [kW]	Derated Avg EER BTU/W	Annual Usage [kWh]	Avg Cond Temp °F	Net Cooling Capacity [ton]	Condenser Fan [kW]	Evap Fan [kW]	Compressor [kW]	Net Avg EER	Runtime Adjust	Annual Usage [kWh]	Savings				
																							[kWh]	[kWh]	[kWh]		
Washington Township High School	Lennox	LSA120C-1g	5697C 01347	Package Unit	10	388	79.0	132.1	8.58	0.50	1.50	10.87	8.00	4,995	122.3	9.36	0.50	1.50	9.65	9.64	106.9%	4,832	163	1.22			
Washington Township High School	Trane	YCH30B4PN6B2E370B0D	C17G04613	Package Unit	27.5	388	79.0	127.3	28.06	1.38	4.13	28.56	9.89	13,217	117.5	30.59	1.38	4.13	24.75	12.13	89.9%	10,553	2,663	3.81			
Washington Township High School	Trane	YCH30B4PN6B2E370B0D	C17G04614	Package Unit	27.5	388	79.0	127.3	28.06	1.38	4.13	28.56	9.89	13,217	117.5	30.59	1.38	4.13	24.75	12.13	89.9%	10,553	2,663	3.81			
Washington Township High School	Daikin	R2R24PVJU	E001482	Package Unit	3.5	388	79.0	127.3	3.50	0.18	0.53	3.64	9.68	1,682	117.5	3.81	0.18	0.53	3.15	11.88	91.9%	1,372	310	0.48			
Washington Township High School	Carrier	MA360GLC300	E11180948	Package Unit	3	388	79.0	129.2	3.14	0.15	0.45	3.20	9.90	1,475	119.3	3.42	0.15	0.45	2.78	12.15	87.8%	1,149	326	0.43			
Washington Township High School	EM	SCC24D0000AA0A	1-0-P-8100-25	Split-System	2	388	79.0	129.2	1.79	0.10	0.30	2.10	8.60	970	119.3	1.95	0.10	0.30	1.86	10.36	102.4%	899	71	0.24			
Washington Township High School	York	H1RA060S46A	WKLM042003	Package Unit	5	388	79.0	131.7	4.21	0.25	0.75	5.41	7.87	2,488	121.9	4.58	0.25	0.75	4.80	9.48	109.1%	2,456	32	0.61			
Washington Township High School	York	H1RA042S46G	WOF6421428	Package Unit	3.5	388	79.0	132.1	3.21	0.18	0.53	3.81	8.55	1,748	122.3	3.50	0.18	0.53	3.38	10.30	100.0%	1,582	166	0.43			
Washington Township High School	York	DR120C00S4TZ230001D	N0F6542956	Package Unit	10	388	79.0	131.4	10.34	0.50	1.50	10.78	9.71	4,958	121.5	11.27	0.50	1.50	9.57	11.69	88.8%	3,983	976	1.21			
Washington Township High School	EM	S1HA9000D10	1-06-D-2685-15	Split-System	7.5	388	79.0	131.4	6.45	0.38	1.13	8.08	8.08	3,719	121.5	7.03	0.38	1.13	7.17	9.73	106.7%	3,589	129	0.91			
Washington Township High School	AAON	RM-015-3-0BA02-E3N	200606-AMWL01685	Package Unit	15	388	79.0	131.4	16.63	0.75	2.25	16.52	10.23	7,573	121.5	18.13	0.75	2.25	14.33	12.56	82.7%	5,562	2,011	2.19			
Washington Township High School	Carrier	38AU080A0A0A0A0A0A	2613C90835	Package Unit	8	388	79.0	128.5	8.73	0.40	1.20	8.45	10.42	3,901	118.7	9.51	0.40	1.20	7.33	12.78	84.1%	2,914	988	1.13			
Washington Township High School	York	H1RA042S46G	WOF6421434	Package Unit	3.5	388	79.0	132.1	3.21	0.18	0.53	3.81	8.55	1,748	122.3	3.50	0.18	0.53	3.38	10.30	100.0%	1,582	166	0.43			
Washington Township High School	York	H1RA042S46G	WOF6421418	Package Unit	3.5	388	79.0	132.1	3.21	0.18	0.53	3.81	8.55	1,748	122.3	3.50	0.18	0.53	3.38	10.30	100.0%	1,582	166	0.43			
Washington Township High School	York	H1RA036S46G	WOF6501092	Package Unit	3	388	79.0	132.1	3.01	0.15	0.45	3.26	9.34	1,499	122.3	3.28	0.15	0.45	2.90	11.26	91.5%	1,241	258	0.37			
Washington Township High School	York	H1RA042S46G	WOF6421423	Package Unit	3.5	388	79.0	132.1	3.21	0.18	0.53	3.81	8.55	1,748	122.3	3.50	0.18	0.53	3.38	10.30	100.0%	1,582	166	0.43			
Washington Township High School	York	H1RA042S46G	WOF6421424	Package Unit	3.5	388	79.0	132.1	3.21	0.18	0.53	3.81	8.55	1,748	122.3	3.50	0.18	0.53	3.38	10.30	100.0%	1,582	166	0.43			
Washington Township High School	York	H1RA042S46G	WOF6421435	Package Unit	3.5	388	79.0	132.1	3.21	0.18	0.53	3.81	8.55	1,748	122.3	3.50	0.18	0.53	3.38	10.30	100.0%	1,582	166	0.43			
Washington Township High School	York	DR090C00S4TZ230001D	N0F6541399	Package Unit	7.5	388	79.0	131.4	7.75	0.38	1.13	8.08	9.71	3,719	121.5	8.45	0.38	1.13	7.17	11.69	88.8%	2,987	732	0.91			
Washington Township High School	York	DR060C00P4TZ230001A	N0F6499410	Package Unit	5	388	79.0	131.4	5.17	0.25	0.75	5.39	9.71	2,479	121.5	5.63	0.25	0.75	4.78	11.69	88.8%	1,991	488	0.61			
Washington Township High School	York	H1RA042S46G	1	Package Unit	3.5	388	79.0	132.1	3.21	0.18	0.53	3.81	8.55	1,748	122.3	3.50	0.18	0.53	3.38	10.30	100.0%	1,582	166	0.43			
Washington Township High School	Thermal Zone	TZAA-336-DC757	WS21413148	Package Unit	3	388	79.0	127.9	2.86	0.15	0.45	3.10	9.27	1,435	118.0	3.12	0.15	0.45	2.75	11.16	96.2%	1,251	194	0.35			
Washington Township High School	Sanyo	SAP183C	2973	Split-System	1.5	388	79.0	129.2	1.30	0.08	0.23	1.57	8.30	727	119.3	1.41	0.08	0.23	1.40	9.99	106.2%	699	28	0.18			
Washington Township High School	York	DR090C00S4TZ230001D	N0F6541400	Package Unit	7.5	388	79.0	131.4	7.75	0.38	1.13	8.08	9.71	3,719	121.5	8.45	0.38	1.13	7.17	11.69	88.8%	2,987	732	0.91			
Washington Township High School	York	H1RA036S46G	2	Package Unit	3	388	79.0	132.1	3.01	0.15	0.45	3.26	9.34	1,499	122.3	3.28	0.15	0.45	2.90	11.26	91.5%	1,241	258	0.37			
Washington Township High School	Daikin	DBC03630000001SA	211E+09	Package Unit	3	388	79.0	131.5	3.63	0.15	0.45	3.31	11.16	1,516	121.6	3.96	0.15	0.45	2.87	13.70	75.7%	1,019	497	0.44			
Washington Township High School	Daikin	DBC03630000001SA	2105199845	Package Unit	3	388	79.0	131.5	3.63	0.15	0.45	3.31	11.16	1,516	121.6	3.96	0.15	0.45	2.87	13.70	75.7%	1,019	497	0.44			
Washington Township High School	AAON	UNREADABLE	3	Package Unit	30	388	79.0	129.2	34.37	1.50	4.50	31.49	11.00	14,547	119.3	37.46	1.50	4.50	27.95	13.24	80.1%	10,548	4,000	3.55			
Washington Township High School	York	H1RA036S46G	WOF6501084	Package Unit	3	388	79.0	132.1	3.01	0.15	0.45	3.26	9.34	1,499	122.3	3.28	0.15	0.45	2.90	11.26	91.5%	1,241	258	0.37			
Washington Township High School	York	H1RA036S46G	WOF6501087	Package Unit	3	388	79.0	132.1	3.01	0.15	0.45	3.26	9.34	1,499	122.3	3.28	0.15	0.45	2.90	11.26	91.5%	1,241	258	0.37			
Washington Township High School	York	H1RA042S46G	WOF6421438	Package Unit	3.5	388	79.0	132.1	3.21	0.18	0.53	3.81	8.55	1,748	122.3	3.50	0.18	0.53	3.38	10.30	100.0%	1,582	166	0.43			
Washington Township High School	York	H1RA042S46G	WOF6421425	Package Unit	3.5	388	79.0	132.1	3.21	0.18	0.53	3.81	8.55	1,748	122.3	3.50	0.18	0.53	3.38	10.30	100.0%	1,582	166	0.43			
Washington Township High School	York	H1RA036S46G	WOF6501089	Package Unit	3	388	79.0	132.1	3.01	0.15	0.45	3.26	9.34	1,499	122.3	3.28	0.15	0.45	2.90	11.26	91.5%	1,241	258	0.37			
Washington Township High School	York	H1RA042S46G	WOF6421427	Package Unit	3.5	388	79.0	132.1	3.21	0.18	0.53	3.81	8.55	1,748	122.3	3.50	0.18	0.53	3.38	10.30	100.0%	1,582	166	0.43			
Washington Township High School	York	H1RA042S46G	WOF6501933	Package Unit	3.5	388	79.0	132.1	3.21	0.18	0.53	3.81	8.55	1,748	122.3	3.50	0.18	0.53	3.38	10.30	100.0%	1,582	166	0.43			
Washington Township High School	York	H1RA042S46G	WOF6421417	Package Unit	3.5	388	79.0	132.1	3.21	0.18	0.53	3.81	8.55	1,748	122.3	3.50	0.18	0.53	3.38	10.30	100.0%	1,582	166	0.43			
Washington Township High School	York	DR090C00S4TZ230001D	N0F6542952	Package Unit	7.5	388	79.0	131.4	7.75	0.38	1.13	8.08	9.71	3,719	121.5	8.45	0.38	1.13	7.17	11.69	88.8%	2,987	732	0.91			
Washington Township High School	York	H1RA036S46G	WOF6501104	Package Unit	3	388	79.0	132.1	3.01	0.15	0.45	3.26	9.34	1,499	122.3	3.28	0.15	0.45	2.90	11.26	91.5%	1,241	258	0.37			
Washington Township High School	York	H1RA036S46G	WOF6501091	Package Unit	3	388	79.0	132.1	3.01	0.15	0.45	3.26	9.34	1,499	122.3	3.28	0.15	0.45	2.90	11.26	91.5%	1,241	258	0.37			
Washington Township High School	York	H1RA042S46G	WOF6421421	Package Unit	3.5	388	79.0	132.1	3.21	0.18	0.53	3.81	8.55	1,748	122.3	3.50	0.18	0.53	3.38	10.30	100.0%	1,582	166	0.43			
Washington Township High School	York	H1RA036S46G	WOF6501083	Package Unit	3	388	79.0	132.1	3.01	0.15	0.45	3.26	9.34	1,499	122.3	3.28	0.15	0.45	2.90	11.26	91.5%	1,241	258	0.37			
Washington Township High School	York	H1RA042S46G	WOF6421436	Package Unit	3.5	388	79.0	132.1	3.21	0.18	0.53	3.81	8.55	1,748	122.3	3.50	0.18	0.53	3.38	10.30	100.0%	1,582	166	0.43			
Washington Township High School	York	H1RA036S46G	WOF6501088	Package Unit	3	388	79.0	132.1	3.01	0.15	0.45	3.26	9.34	1,499	122.3	3.28	0.15	0.45	2.90	11.26	91.5%	1,241	258	0.37			
Washington Township High School	York	H1RA036S46G	WOF6501086	Package Unit	3	388	79.0	132.1	3.01	0.15	0.45	3.26	9.34	1,499	122.3	3.28	0.15	0.45	2.90	11.26	91.5%	1,241	258	0.37			
Washington Township High School	York	H1RA042S46G	WOF6421437	Package Unit	3.5	388	79.0	132.1	3.21	0.18																	



HVAC ARMOR - SAVINGS																									
Building	Manufacturer	Model	Serial	Type	Nominal Tons	EFLH	Avg ECAT °F	Baseline								HVAC Armor									
								Avg Cond Temp °F	Derated Cooling Capacity [ton]	Condenser Fan [kW]	Evap Fan [kW]	Compressor [kW]	Derated Avg EER BTU/W	Annual Usage [kWh]	Avg Cond Temp °F	Net Cooling Capacity [ton]	Condenser Fan [kW]	Evap Fan [kW]	Compressor [kW]	Net Avg EER	Runtime Adjust	Annual Usage [kWh]	Savings		
																							[kWh]	[kW]	
Washington Township High School	York	H1RA042S46G	W0F6501928	Package Unit	3.5	388	79.0	132.1	3.21	0.18	0.53	3.81	8.55	1,748	122.3	3.50	0.18	0.53	3.38	10.30	100.0%	1,582	166	0.43	
Washington Township High School	York	H1RA042S46G	W0F6501925	Package Unit	3.5	388	79.0	132.1	3.21	0.18	0.53	3.81	8.55	1,748	122.3	3.50	0.18	0.53	3.38	10.30	100.0%	1,582	166	0.43	
Washington Township High School	York	H1RA036S46G	W0F6501100	Package Unit	3	388	79.0	132.1	3.01	0.15	0.45	3.26	9.34	1,499	122.3	3.28	0.15	0.45	2.90	11.26	91.5%	1,241	258	0.37	
Washington Township High School	York	H1RA042S46G	W0F6501940	Package Unit	3.5	388	79.0	132.1	3.21	0.18	0.53	3.81	8.55	1,748	122.3	3.50	0.18	0.53	3.38	10.30	100.0%	1,582	166	0.43	
Washington Township High School	York	H1RA042S46G	W0F6421441	Package Unit	3.5	388	79.0	132.1	3.21	0.18	0.53	3.81	8.55	1,748	122.3	3.50	0.18	0.53	3.38	10.30	100.0%	1,582	166	0.43	
Washington Township High School	York	H1RA042S46G	4	Package Unit	3.5	388	79.0	132.1	3.21	0.18	0.53	3.81	8.55	1,748	122.3	3.50	0.18	0.53	3.38	10.30	100.0%	1,582	166	0.43	
Washington Township High School	York	RA4418GKB100	X183969451	Package Unit	1.5	388	79.0	127.0	1.64	0.08	0.23	1.55	10.63	718	117.2	1.79	0.08	0.23	1.34	13.04	83.9%	536	183	0.21	
Washington Township High School	York	H1RA036S46G	W0F6501081	Package Unit	3	388	79.0	132.1	3.01	0.15	0.45	3.26	9.34	1,499	122.3	3.28	0.15	0.45	2.90	11.26	91.5%	1,241	258	0.37	
Washington Township High School	York	DR036C00P4TZ22001A	N0F6499755	Package Unit	3	388	79.0	131.4	3.18	0.15	0.45	3.23	9.97	1,487	121.5	3.47	0.15	0.45	2.87	12.00	86.4%	1,164	324	0.36	
Washington Township High School	York	DR060C00P4TZ22001A	N0F6541531	Package Unit	5	388	79.0	131.4	5.17	0.25	0.75	5.39	9.71	2,479	121.5	5.63	0.25	0.75	4.78	11.69	88.8%	1,991	488	0.61	
Washington Township High School	UNREADABLE	TZAA-336-DC757	W281421298	Package Unit	3	388	79.0	128.2	2.87	0.15	0.45	3.11	9.27	1,440	118.3	3.13	0.15	0.45	2.76	11.16	96.0%	1,251	189	0.35	
Washington Township High School	York	DR090C00S4TZ22001D	N0F6541402	Package Unit	7.5	388	79.0	131.4	7.75	0.38	1.13	8.08	9.71	3,719	121.5	8.45	0.38	1.13	7.17	11.69	88.8%	2,987	732	0.91	
Washington Township High School	York	H1RA042S46G	W0F6501916	Package Unit	3.5	388	79.0	132.1	3.21	0.18	0.53	3.81	8.55	1,748	122.3	3.50	0.18	0.53	3.38	10.30	100.0%	1,582	166	0.43	
Washington Township High School	York	H1RA042S46G	W0F6501918	Package Unit	3.5	388	79.0	132.1	3.21	0.18	0.53	3.81	8.55	1,748	122.3	3.50	0.18	0.53	3.38	10.30	100.0%	1,582	166	0.43	
Washington Township High School	York	H1RA042S46G	W0F6501917	Package Unit	3.5	388	79.0	132.1	3.21	0.18	0.53	3.81	8.55	1,748	122.3	3.50	0.18	0.53	3.38	10.30	100.0%	1,582	166	0.43	
Washington Township High School	York	H1RA042S46G	W0F6501921	Package Unit	3.5	388	79.0	132.1	3.21	0.18	0.53	3.81	8.55	1,748	122.3	3.50	0.18	0.53	3.38	10.30	100.0%	1,582	166	0.43	
Washington Township High School	York	DR090C00S4TZ22001D	N0F6541403	Package Unit	7.5	388	79.0	131.4	7.75	0.38	1.13	8.08	9.71	3,719	121.5	8.45	0.38	1.13	7.17	11.69	88.8%	2,987	732	0.91	
Washington Township High School	York	H1RA042S46G	W0F6421440	Package Unit	3.5	388	79.0	132.1	3.21	0.18	0.53	3.81	8.55	1,748	122.3	3.50	0.18	0.53	3.38	10.30	100.0%	1,582	166	0.43	
Washington Township High School	York	DR120C00Q4TZ22001D	N0F6541415	Package Unit	10	388	79.0	131.4	10.34	0.50	1.50	10.78	9.71	4,958	121.5	11.27	0.50	1.50	9.57	11.69	88.8%	3,983	976	1.21	
Washington Township High School	York	DR090C00S4TZ22001D	N0F6542953	Package Unit	7.5	388	79.0	131.4	7.75	0.38	1.13	8.08	9.71	3,719	121.5	8.45	0.38	1.13	7.17	11.69	88.8%	2,987	732	0.91	
Washington Township High School	York	DR090C00S4TZ22001D	N0F6542955	Package Unit	7.5	388	79.0	131.4	7.75	0.38	1.13	8.08	9.71	3,719	121.5	8.45	0.38	1.13	7.17	11.69	88.8%	2,987	732	0.91	
Washington Township High School	York	LULJ367HV	5	Split-System	3	388	79.0	127.0	3.60	0.15	0.45	3.10	11.65	1,437	117.2	3.92	0.15	0.45	2.69	14.30	76.5%	977	460	0.41	
Washington Township High School	ICP	RAS11940CA0AAA	P214489054	Package Unit	10	388	79.0	126.2	11.07	0.50	1.50	10.22	10.87	4,741	116.3	12.06	0.50	1.50	8.85	13.33	82.9%	3,492	1,249	1.36	
Washington Township High School	Carrier	50TFF012-501GA	1401G34201	Package Unit	4	388	79.0	128.2	3.72	0.20	0.60	4.15	9.02	1,920	118.3	4.05	0.20	0.60	3.68	10.86	98.7%	1,715	205	0.47	
Washington Township High School	York	DR048C00P4TZ22001A	N0F498285	Package Unit	4	388	79.0	131.4	4.17	0.20	0.60	4.31	9.79	1,983	121.5	4.55	0.20	0.60	3.83	11.80	88.0%	1,579	404	0.49	
Washington Township High School	York	DR060C00P4TZ22001A	N0F499409	Package Unit	5	388	79.0	131.4	5.17	0.25	0.75	5.39	9.71	2,479	121.5	5.63	0.25	0.75	4.78	11.69	88.8%	1,991	488	0.61	
Washington Township High School	York	DR120C00Q4TZ22001D	N0F6541414	Package Unit	10	388	79.0	131.4	10.34	0.50	1.50	10.78	9.71	4,958	121.5	11.27	0.50	1.50	9.57	11.69	88.8%	3,983	976	1.21	
Washington Township High School	York	DR036C00P4TZ22001A	N0F6494104	Package Unit	3	388	79.0	131.4	3.18	0.15	0.45	3.23	9.97	1,487	121.5	3.47	0.15	0.45	2.87	12.00	86.4%	1,164	324	0.36	
Washington Township High School	York	YC180C00AAA2A	N1F2898674	Package Unit	15	388	79.0	125.9	16.61	0.75	2.25	15.12	11.00	7,031	116.0	18.11	0.75	2.25	13.42	13.23	82.8%	5,278	1,753	1.70	
Washington Township High School	York	DR090C00Q4TZ22001D	N0F6542951	Package Unit	7.5	388	79.0	131.4	7.75	0.38	1.13	8.08	9.71	3,719	121.5	8.45	0.38	1.13	7.17	11.69	88.8%	2,987	732	0.91	
Washington Township High School	York	H1RA036S46G	W0F6501097	Package Unit	5	388	79.0	131.4	4.98	0.25	0.75	5.39	9.34	2,479	121.5	5.42	0.25	0.75	4.78	11.25	92.2%	2,068	411	0.61	
Washington Township High School	York	H1RA036S46G	W0F6501093	Package Unit	5	388	79.0	131.4	4.98	0.25	0.75	5.39	9.34	2,479	121.5	5.42	0.25	0.75	4.78	11.25	92.2%	2,068	411	0.61	
Washington Township High School	York	DR120C00S4TZ22001D	N0F6542957	Package Unit	10	388	79.0	131.4	10.34	0.50	1.50	10.78	9.71	4,958	121.5	11.27	0.50	1.50	9.57	11.69	88.8%	3,983	976	1.21	
Washington Township High School	AOON	RM-015-3-0BA02-E3N	260606-AMVLO1684	Package Unit	15	388	79.0	131.4	16.34	0.75	2.25	16.17	10.23	7,437	115.5	17.81	0.75	2.25	14.35	13.23	84.2%	5,670	1,767	1.82	
Washington Township High School	York	DR090C00S4TZ22001D	N0F6541401	Package Unit	7.5	388	79.0	131.4	7.75	0.38	1.13	8.08	9.71	3,719	121.5	8.45	0.38	1.13	7.17	11.69	88.8%	2,987	732	0.91	
Washington Township High School	AOON	BM-013-3-0BB02-EJN	260606-AMVKK01862	Package Unit	12.5	388	79.0	131.4	13.15	0.63	1.88	13.47	9.88	6,198	121.5	14.34	0.63	1.88	11.96	11.90	87.2%	4,891	1,307	1.52	
Washington Township High School	York	DR300C00C4TZ22001B	N0F6539031	Package Unit	25	388	79.0	131.4	25.61	1.25	3.75	26.95	9.62	12,395	121.5	27.92	1.25	3.75	23.91	11.59	89.6%	10,046	2,349	3.03	
Chestnut Ridge Middle School	AOON	62690	200507-BNVN01112	Package Unit	18	388	79.0	131.5	18.82	0.90	2.70	19.42	9.81	8,933	121.6	20.51	0.90	2.70	17.24	11.81	87.8%	7,096	1,837	2.19	
Chestnut Ridge Middle School	AOON	65694	200507-BNVU00188	Package Unit	31	388	79.0	131.5	29.53	1.55	4.65	34.18	8.77	15,669	121.6	32.19	1.55	4.65	29.65	10.77	96.3%	13,398	2,271	4.53	
Chestnut Ridge Middle School	Trane	OAGD180B4-C1A5A0BC	OA264249-2-1	Package Unit	15	388	79.0	127.3	16.70	0.75	2.25	15.58	10.79	7,209	117.5	18.20	0.75	2.25	13.50	13.24	82.4%	5,276	1,933	2.08	
Chestnut Ridge Middle School	AOON	65694	6	Package Unit	31	388	79.0	131.5	29.53	1.55	4.65	34.18	8.77	15,669	121.6	32.19	1.55	4.65	29.65	10.77	96.3%	13,398	2,271	4.53	
Chestnut Ridge Middle School	AOON	65694	7	Package Unit	31	388	79.0	131.5	29.53	1.55	4.65	34.18	8.77	15,669	121.6	32.19	1.55	4.65	29.65	10.77	96.3%	13,398	2,271	4.53	
Chestnut Ridge Middle School	AOON	32696	200508-AMV001108	Package Unit	13	388	79.0	131.5	8.52	0.40															



HVAC ARMOR - SAVINGS																									
Building	Manufacturer	Model	Serial	Type	Nominal Tons	EFLH	Avg ECAAT °F	Baseline							HVAC ARMOR										
								Avg Cond Temp °F	Derated Cooling Capacity [ton]	Condenser Fan [kW]	Evap Fan [kW]	Compressor [kW]	Derated Avg EER BTU/W	Annual Usage [kWh]	Avg Cond Temp °F	Net Cooling Capacity [ton]	Condenser Fan [kW]	Evap Fan [kW]	Compressor [kW]	Net Avg EER	Runtime Adjust	Annual Usage [kWh]	Savings		
Hurffville Elementary School	Carrier	24ABB342A0060010	0112E04686	Package Unit	2	388	79.0	128.8	2.21	0.10	0.30	2.12	10.51	979	119.0	2.41	0.10	0.30	1.84	12.90	83.0%	722	257	0.28	
Hurffville Elementary School	Carrier	24ABB342A0060010	0112E04689	Package Unit	2	388	79.0	128.8	2.21	0.10	0.30	2.12	10.51	979	119.0	2.41	0.10	0.30	1.84	12.90	83.0%	722	257	0.28	
Hurffville Elementary School	Carrier	24ABB342A0N31011	3416E21367	Package Unit	2	388	79.0	127.6	2.23	0.10	0.30	2.09	10.75	965	117.7	2.43	0.10	0.30	1.81	13.19	82.4%	706	259	0.28	
Hurffville Elementary School	Carrier	24ABB342A0060010	0112E04688	Package Unit	2	388	79.0	128.8	2.21	0.10	0.30	2.12	10.51	979	119.0	2.41	0.10	0.30	1.84	12.90	83.0%	722	257	0.28	
Hurffville Elementary School	Carrier	24ABB342A0060010	2608E13274	Package Unit	2	388	79.0	130.4	2.25	0.10	0.30	2.17	10.51	998	120.6	2.45	0.10	0.30	1.88	12.90	81.5%	722	276	0.29	
Hurffville Elementary School	Carrier	24ABB342A0060010	2608E13260	Package Unit	2	388	79.0	130.4	2.25	0.10	0.30	2.17	10.51	998	120.6	2.45	0.10	0.30	1.88	12.90	81.5%	722	276	0.29	
Hurffville Elementary School	Carrier	24ABB342A0060010	3910E07390	Package Unit	2	388	79.0	129.6	2.23	0.10	0.30	2.15	10.51	988	119.7	2.43	0.10	0.30	1.86	12.90	82.3%	722	266	0.29	
Hurffville Elementary School	Carrier	24ABB342A0060010	3809E06998	Package Unit	2	388	79.0	130.0	2.24	0.10	0.30	2.16	10.51	993	120.1	2.44	0.10	0.30	1.87	12.90	81.9%	722	271	0.29	
Hurffville Elementary School	Carrier	24ABB342A0060010	1315E16033	Package Unit	2	388	79.0	127.9	2.18	0.10	0.30	2.09	10.51	968	118.0	2.38	0.10	0.30	1.82	12.90	84.0%	722	246	0.28	
Hurffville Elementary School	Carrier	24ABB342A0060010	1214E12762	Package Unit	2	388	79.0	128.2	2.19	0.10	0.30	2.10	10.51	972	118.3	2.39	0.10	0.30	1.82	12.90	83.7%	722	249	0.28	
Hurffville Elementary School	Carrier	24ABB342A0060010	1214E12739	Package Unit	2	388	79.0	128.2	2.19	0.10	0.30	2.10	10.51	972	118.3	2.39	0.10	0.30	1.82	12.90	83.7%	722	249	0.28	
Hurffville Elementary School	Carrier	24ABB342A0060010	1315E16051	Package Unit	2	388	79.0	128.2	2.19	0.10	0.30	2.10	10.51	972	118.3	2.39	0.10	0.30	1.82	12.90	83.7%	722	249	0.28	
Hurffville Elementary School	Carrier	24ABB342A0060010	3314E20895	Package Unit	2	388	79.0	128.2	2.19	0.10	0.30	2.10	10.51	972	118.3	2.39	0.10	0.30	1.82	12.90	83.7%	722	249	0.28	
Hurffville Elementary School	Carrier	24ABB342A0060010	3112E00630	Package Unit	2	388	79.0	128.2	2.19	0.10	0.30	2.10	10.51	972	118.3	2.39	0.10	0.30	1.82	12.90	83.7%	722	249	0.28	
Hurffville Elementary School	Carrier	24ABB342A0060010	3809E06987	Package Unit	2	388	79.0	130.0	2.24	0.10	0.30	2.16	10.51	993	120.1	2.44	0.10	0.30	1.87	12.90	81.9%	722	271	0.29	
Hurffville Elementary School	Carrier	24ABB342A0060010	2608E13250	Package Unit	2	388	79.0	130.4	2.25	0.10	0.30	2.17	10.51	998	120.6	2.45	0.10	0.30	1.88	12.90	81.5%	722	276	0.29	
Hurffville Elementary School	Carrier	24ABB342A0060010	3910E07378	Package Unit	2	388	79.0	129.6	2.23	0.10	0.30	2.15	10.51	988	119.7	2.43	0.10	0.30	1.86	12.90	82.3%	722	266	0.29	
Hurffville Elementary School	Carrier	24ABB342A0060010	3910E07384	Package Unit	2	388	79.0	129.6	2.23	0.10	0.30	2.15	10.51	988	119.7	2.43	0.10	0.30	1.86	12.90	82.3%	722	266	0.29	
Hurffville Elementary School	Carrier	24ABB342A0060010	3316E24032	Package Unit	2	388	79.0	127.6	2.18	0.10	0.30	2.09	10.51	965	117.7	2.37	0.10	0.30	1.81	12.89	84.3%	722	242	0.28	
Hurffville Elementary School	Carrier	24ABB342A0060010	3316E24756	Package Unit	2	388	79.0	127.6	2.18	0.10	0.30	2.09	10.51	965	117.7	2.37	0.10	0.30	1.81	12.89	84.3%	722	242	0.28	
Hurffville Elementary School	Carrier	24ABB342A0060010	3314E20091	Package Unit	2	388	79.0	128.2	2.19	0.10	0.30	2.10	10.51	972	118.3	2.39	0.10	0.30	1.82	12.90	83.7%	722	249	0.28	
Hurffville Elementary School	Carrier	24ABB342A0060010	3516E24742	Package Unit	2	388	79.0	128.2	2.19	0.10	0.30	2.10	10.51	972	118.3	2.39	0.10	0.30	1.82	12.90	83.7%	722	249	0.28	
Hurffville Elementary School	Carrier	24ABB342A0060010	1909E00424	Package Unit	2	388	79.0	128.2	2.19	0.10	0.30	2.10	10.51	972	118.3	2.39	0.10	0.30	1.82	12.90	83.7%	722	249	0.28	
Hurffville Elementary School	Carrier	24ABS342A0060010	2608E13262	Package Unit	2	388	79.0	130.4	2.07	0.10	0.30	2.17	9.68	998	120.6	2.26	0.10	0.30	1.88	11.88	88.5%	784	214	0.29	
Hurffville Elementary School	Carrier	24ABB342A0N31011	3512E14431	Package Unit	2	388	79.0	128.8	2.26	0.10	0.30	2.12	10.75	979	119.0	2.46	0.10	0.30	1.84	13.19	81.2%	706	273	0.28	
Whitman Elementary School	York	HSC090A25A	NFAM133464	Package Unit	7.5	388	79.0	128.5	8.65	0.38	1.13	7.81	11.15	3,611	118.7	9.42	0.38	1.13	6.93	13.42	79.6%	2,603	1,009	0.88	
Whitman Elementary School	York	ZE036C00B2A1ABA1A1	N1M8385146	Package Unit	3	388	79.0	127.0	3.19	0.15	0.45	3.10	10.35	1,437	117.2	3.48	0.15	0.45	2.69	12.70	86.2%	1,100	337	0.41	
Whitman Elementary School	York	H1RA036S46G	W0F6421404	Split-System	3	388	79.0	131.4	2.99	0.15	0.45	3.23	9.34	1,487	121.5	3.25	0.15	0.45	2.87	11.25	92.2%	1,241	246	0.36	
Whitman Elementary School	York	H1RA036S46G	16	Split-System	3	388	79.0	131.4	2.99	0.15	0.45	3.23	9.34	1,487	121.5	3.25	0.15	0.45	2.87	11.25	92.2%	1,241	246	0.36	
Whitman Elementary School	Trane	TC048C30ABC	L33104177D	Package Unit	4	388	79.0	132.2	4.33	0.20	0.60	4.35	10.08	2,000	122.3	4.72	0.20	0.60	3.86	12.14	84.8%	1,534	466	0.49	
Whitman Elementary School	York	ZE036C00B2A1ABA1A1	N1M7794883	Package Unit	3	388	79.0	127.3	3.20	0.15	0.45	3.12	10.35	1,442	117.5	3.49	0.15	0.45	2.70	12.70	85.9%	1,100	342	0.42	
Whitman Elementary School	Trane	TC048C30ABC	L33104178D	Package Unit	4	388	79.0	132.2	4.33	0.20	0.60	4.35	10.08	2,000	122.3	4.72	0.20	0.60	3.86	12.14	84.8%	1,534	466	0.49	
Whitman Elementary School	Trane	TC048C30ABC	L34104114D	Package Unit	4	388	79.0	132.2	4.33	0.20	0.60	4.35	10.08	2,000	122.3	4.72	0.20	0.60	3.86	12.14	84.8%	1,534	466	0.49	
Whitman Elementary School	Trane	TC060C30ABC	L33104187D	Package Unit	5	388	79.0	132.2	5.27	0.25	0.75	5.44	9.83	2,499	122.3	5.75	0.25	0.75	4.83	11.83	87.0%	1,967	532	0.61	
Whitman Elementary School	Trane	THC120F3R0AQJG6E1A1B6B	192814885L	Package Unit	10	388	79.0	126.7	10.78	0.50	1.50	10.50	10.51	4,774	116.9	11.75	0.50	1.50	8.93	12.90	85.1%	3,609	1,165	1.37	
Whitman Elementary School	Trane	THC120F3R0AQJG6E1A1B6B	192910715D	Package Unit	20	388	79.0	126.7	21.56	1.00	3.00	20.61	10.51	9,547	116.9	23.50	1.00	3.00	17.86	12.90	85.1%	7,217	2,330	2.75	
Whitman Elementary School	Trane	TC060C30ABC	L33104186D	Package Unit	5	388	79.0	132.2	5.27	0.25	0.75	5.44	9.83	2,499	122.3	5.75	0.25	0.75	4.83	11.83	87.0%	1,967	532	0.61	
Whitman Elementary School	York	ZF102C00D2A1AAA1A1	N1E7701558	Package Unit	8.5	388	79.0	127.3	8.05	0.43	1.28	8.83	9.18	4,085	117.5	8.78	0.43	1.28	7.65	11.27	96.8%	3,513	572	1.18	
Whitman Elementary School	Trane	THD150G3R0B0UHE1A1B6	192910717D	Package Unit	12.5	388	79.0	126.7	13.23	0.63	1.88	12.88	10.32	5,967	116.9	14.42	0.63	1.88	11.16	12.67	86.7%	4,594	1,373	1.72	
Whitman Elementary School	Trane	TC048C30ABC	19	Package Unit	4	388	79.0	132.2	4.33	0.20	0.60	4.35	10.08	2,000	122.3	4.72	0.20	0.60	3.86	12.14	84.8%	1,534	466	0.49	
Whitman Elementary School	Trane	TC048C30ABC	L33104181D	Package Unit	4	388	79.0	132.2	4.33	0.20	0.60	4.35	10.08	2,000	122.3	4.72	0.20	0.60	3.86	12.14	84.8%	1,534	466	0.49	
Whitman Elementary School	York	H1RA036S46G	20	Split-System	3	388	79.0	131.4	2.99	0.15	0.45	3.23	9.34	1,487	121.5	3.25	0.15	0.45	2.87	11.25	92.2%	1,241	246	0.36	
Whitman Elementary School	York	H1RA036S46G	21	Split-System	3	388	79.0	131.4	2.99	0.15	0.45	3.23	9.34	1,487	121.5	3.25	0.15	0.45							



HVAC ARMOR - SAVINGS																								
Building	Manufacturer	Model	Serial	Type	Nominal Tons	EFLH	Avg ECAT °F	Baseline						HVAC Armor										
								Avg Cond Temp °F	Derated Cooling Capacity [ton]	Condenser Fan [kW]	Evap Fan [kW]	Compressor [kW]	Derated Avg EER BTU/W	Annual Usage [kWh]	Avg Cond Temp °F	Net Cooling Capacity [ton]	Condenser Fan [kW]	Evap Fan [kW]	Compressor [kW]	Net Avg EER	Runtime Adjust	Annual Usage [kWh]	Savings	
																							[kWh]	[kWh]
Birches Elementary School	YORK	H1RA042S46G	W0D6205235	Split-System	3.5	388	79.0	131.4	3.19	0.18	0.53	3.77	8.55	1,735	121.5	3.47	0.18	0.53	3.35	10.30	100.8%	1,582	153	0.42
Birches Elementary School	YORK	H1RA036S46G	W0F6421398	Package Unit	3	388	79.0	131.4	2.99	0.15	0.45	3.23	9.34	1,487	121.5	3.25	0.15	0.45	2.87	11.25	92.2%	1,241	246	0.36
Birches Elementary School	Trane	TC060C30ABC	28	Package Unit	5	388	79.0	132.2	5.27	0.25	0.75	5.44	9.83	2,499	122.3	5.75	0.25	0.75	4.83	11.83	87.0%	1,967	532	0.61
Birches Elementary School	Trane	TC060C30ABC	29	Package Unit	5	388	79.0	132.2	5.27	0.25	0.75	5.44	9.83	2,499	122.3	5.75	0.25	0.75	4.83	11.83	87.0%	1,967	532	0.61
Birches Elementary School	Trane	THD240G3R0B0UHE1A1B6B	192910714D	Package Unit	20	388	79.0	126.7	20.58	1.00	3.00	20.61	10.04	9,547	116.9	22.43	1.00	3.00	17.86	12.32	89.2%	7,561	1,986	2.75
Birches Elementary School	Trane	TC060C30ABC	L31100943D	Package Unit	5	388	79.0	132.2	5.27	0.25	0.75	5.44	9.83	2,499	122.3	5.75	0.25	0.75	4.83	11.83	87.0%	1,967	532	0.61
Birches Elementary School	Trane	TC060C30ABC	L31100944D	Package Unit	5	388	79.0	132.2	5.41	0.25	0.75	5.44	10.08	2,499	122.3	5.90	0.25	0.75	4.83	12.14	84.8%	1,917	582	0.61
Birches Elementary School	Trane	THD150G3R0B0UHE1A1B6	192910716D	Package Unit	12.5	388	79.0	126.7	13.23	0.63	1.88	12.88	10.32	5,967	116.9	14.42	0.63	1.88	11.16	12.67	86.7%	4,594	1,373	1.72
Birches Elementary School	Trane	TC048C30ABC	L31100396D	Package Unit	4	388	79.0	132.2	4.33	0.20	0.60	4.35	10.08	2,000	122.3	4.72	0.20	0.60	3.86	12.14	84.8%	1,534	466	0.49
Birches Elementary School	Trane	TZAA-336-DC757	W041518653	Package Unit	3	388	79.0	127.9	2.75	0.15	0.45	3.10	9.27	1,435	118.0	3.12	0.15	0.45	2.75	11.16	96.2%	1,251	184	0.35
Birches Elementary School	YORK	H1RA042S46G	W0D6459677	Split-System	3.5	388	79.0	131.4	3.19	0.18	0.53	3.77	8.55	1,735	121.5	3.47	0.18	0.53	3.35	10.30	100.8%	1,582	153	0.42
Birches Elementary School	YORK	H1RA036S46G	W0F6205151	Package Unit	3	388	79.0	131.4	2.99	0.15	0.45	3.23	9.34	1,487	121.5	3.25	0.15	0.45	2.87	11.25	92.2%	1,241	246	0.36
Birches Elementary School	YORK	H1RA042S46G	W0D6205197	Split-System	3.5	388	79.0	131.4	3.19	0.18	0.53	3.77	8.55	1,735	121.5	3.47	0.18	0.53	3.35	10.30	100.8%	1,582	153	0.42
Birches Elementary School	YORK	H1RA042S46G	30	Split-System	3.5	388	79.0	131.4	3.19	0.18	0.53	3.77	8.55	1,735	121.5	3.47	0.18	0.53	3.35	10.30	100.8%	1,582	153	0.42
Birches Elementary School	YORK	H1RA042S46G	W0D6205214	Split-System	3.5	388	79.0	131.4	3.19	0.18	0.53	3.77	8.55	1,735	121.5	3.47	0.18	0.53	3.35	10.30	100.8%	1,582	153	0.42
Birches Elementary School	YORK	H1RA042S46G	W0D6205194	Split-System	3.5	388	79.0	131.4	3.19	0.18	0.53	3.77	8.55	1,735	121.5	3.47	0.18	0.53	3.35	10.30	100.8%	1,582	153	0.42
Birches Elementary School	YORK	H1RA042S46G	W0D6205198	Split-System	3.5	388	79.0	131.4	3.19	0.18	0.53	3.77	8.55	1,735	121.5	3.47	0.18	0.53	3.35	10.30	100.8%	1,582	153	0.42
Birches Elementary School	YORK	DR048C00P4TZ220001A	31	Package Unit	4	388	79.0	131.4	4.17	0.20	0.60	4.31	9.79	1,983	121.5	4.55	0.20	0.60	3.83	11.80	88.0%	1,579	404	0.49
Birches Elementary School	YORK	H1RA042S46G	W0D6205201	Split-System	3.5	388	79.0	131.4	3.19	0.18	0.53	3.77	8.55	1,735	121.5	3.47	0.18	0.53	3.35	10.30	100.8%	1,582	153	0.42
Birches Elementary School	YORK	H1RA042S46G	W0D6205200	Split-System	3.5	388	79.0	131.4	3.19	0.18	0.53	3.77	8.55	1,735	121.5	3.47	0.18	0.53	3.35	10.30	100.8%	1,582	153	0.42
Birches Elementary School	YORK	H1RA042S46G	W0D6205218	Split-System	3.5	388	79.0	131.4	3.19	0.18	0.53	3.77	8.55	1,735	121.5	3.47	0.18	0.53	3.35	10.30	100.8%	1,582	153	0.42
Birches Elementary School	YORK	H1RA042S46G	W0D6205234	Split-System	3.5	388	79.0	131.4	3.19	0.18	0.53	3.77	8.55	1,735	121.5	3.47	0.18	0.53	3.35	10.30	100.8%	1,582	153	0.42
Birches Elementary School	YORK	H1RA042S46G	W0D6205195	Split-System	3.5	388	79.0	131.4	3.19	0.18	0.53	3.77	8.55	1,735	121.5	3.47	0.18	0.53	3.35	10.30	100.8%	1,582	153	0.42
Birches Elementary School	YORK	H1RA042S46G	W0D6205213	Split-System	3.5	388	79.0	131.4	3.19	0.18	0.53	3.77	8.55	1,735	121.5	3.47	0.18	0.53	3.35	10.30	100.8%	1,582	153	0.42
Birches Elementary School	YORK	H1RA042S46G	W0D6459676	Split-System	3.5	388	79.0	131.4	3.19	0.18	0.53	3.77	8.55	1,735	121.5	3.47	0.18	0.53	3.35	10.30	100.8%	1,582	153	0.42
Birches Elementary School	YORK	H1RA042S46G	W0D6206191	Split-System	3.5	388	79.0	131.4	3.19	0.18	0.53	3.77	8.55	1,735	121.5	3.47	0.18	0.53	3.35	10.30	100.8%	1,582	153	0.42
Birches Elementary School	YORK	H1RA042S46G	W0D6205231	Split-System	3.5	388	79.0	131.4	3.19	0.18	0.53	3.77	8.55	1,735	121.5	3.47	0.18	0.53	3.35	10.30	100.8%	1,582	153	0.42
Birches Elementary School	YORK	H1RA042S46G	W0D6205212	Split-System	3.5	388	79.0	131.4	3.19	0.18	0.53	3.77	8.55	1,735	121.5	3.47	0.18	0.53	3.35	10.30	100.8%	1,582	153	0.42
Birches Elementary School	YORK	H1RA042S46G	W0D6205192	Split-System	3.5	388	79.0	131.4	3.19	0.18	0.53	3.77	8.55	1,735	121.5	3.47	0.18	0.53	3.35	10.30	100.8%	1,582	153	0.42
Birches Elementary School	YORK	DR048C00P4TZ220001A	N0F6541626	Package Unit	4	388	79.0	131.4	4.17	0.20	0.60	4.31	9.79	1,983	121.5	4.55	0.20	0.60	3.83	11.80	88.0%	1,579	404	0.49
Birches Elementary School	Arcoaire	PAMA060H1	B93268533	Package Unit	5	388	79.0	132.4	4.77	0.25	0.75	5.45	8.87	2,504	122.5	5.20	0.25	0.75	4.84	10.68	96.2%	2,180	324	0.61
Birches Elementary School	Sanyo	C3622	52634	Package Unit	3	388	79.0	129.2	0.92	0.15	0.45	3.15	2.93	1,455	119.3	1.00	0.15	0.45	2.79	3.53	300.3%	3,955	-2,011	0.35
Birches Elementary School	YORK	DR072S00P4TZ220001A	N0F6508836	Package Unit	6	388	79.0	131.4	6.20	0.30	0.90	6.47	9.71	2,975	121.5	6.76	0.30	0.90	5.74	11.69	88.8%	2,390	585	0.73
Birches Elementary School	YORK	ZF090C00D2A1AAA1A1	N1L6068699	Package Unit	7.5	388	79.0	127.6	7.34	0.38	1.13	7.82	9.45	3,617	117.7	8.00	0.38	1.13	6.78	11.60	93.7%	3,011	606	1.04
Birches Elementary School	YORK	DR036C00P4TZ220001A	N0F6541525	Package Unit	4	388	79.0	131.4	4.25	0.20	0.60	4.31	9.97	1,983	121.5	4.63	0.20	0.60	3.83	12.00	86.4%	1,551	432	0.49
Birches Elementary School	YORK	ZF090C00D2A1AAA1A1	N1L6068852	Package Unit	7.5	388	79.0	127.6	7.34	0.38	1.13	7.82	9.45	3,617	117.7	8.00	0.38	1.13	6.78	11.60	93.7%	3,011	606	1.04
Birches Elementary School	YORK	H1RA042S46G	32	Split-System	3.5	388	79.0	131.4	3.19	0.18	0.53	3.77	8.55	1,735	121.5	3.47	0.18	0.53	3.35	10.30	100.8%	1,582	153	0.42
Birches Elementary School	YORK	DR036C00P4TZ220001A	N0F6541524	Package Unit	4	388	79.0	131.4	4.25	0.20	0.60	4.31	9.97	1,983	121.5	4.63	0.20	0.60	3.83	12.00	86.4%	1,551	432	0.49
Birches Elementary School	YORK	H1RA036S46G	W0F6205164	Package Unit	3	388	79.0	131.4	2.99	0.15	0.45	3.23	9.34	1,487	121.5	3.25	0.15	0.45	2.87	11.25	92.2%	1,241	246	0.36
Bells Elementary School	Carrier	H3CE090A25A	NFAM133462	Package Unit	7.5	388	79.0	132.4	9.00	0.38	1.13	8.19	11.15	3,759	122.6	9.81	0.38	1.13	7.27	13.43	76.5%	2,601	1,158	0.92
Bells Elementary School	YORK	H1RA042S46G	W0D6205189	Split-System	3.5	388	79.0	131.4	3.19	0.18	0.53	3.77	8.55	1,735	121.5	3.47	0.18	0.53	3.35	10.30	100.8%	1,582	153	0.42
Bells Elementary School	YORK	H1RA042S46G	W0D6205188	Split-System	3.5	388	79.0	131.4	3.19	0.18	0.53	3.77	8.55	1,735	121.5	3.47	0.18	0.53	3.35	10.30	100.8%	1,582	153	0.42
Bells Elementary School	Trane	TC048C30ABC	L31100934D	Package Unit	4	388	79.0	132.2	4.33	0.20	0.60	4.35	10.08	2,000	122.3	4.72	0.20	0.60	3.86	12.14	84.8%	1,534	466	0.49
Bells Elementary School	Trane	TC048C30ABC	33	Package Unit	4	388	79.0	132.2	4.33	0.20	0.60	4.3												

HVAC ARMOR - SAVINGS

Building	Manufacturer	Model	Serial	Type	Nominal Tons	EFLH	Avg EACAT °F	Baseline										HVAC Armor										Savings		
								Avg Cond Temp °F	Derated Cooling Capacity [ton]	Condenser Fan [kW]	Evap Fan [kW]	Compressor [kW]	Derated Avg EER BTU/Wh	Annual Usage [kWh]	Avg Cond Temp °F	Net Cooling Capacity [ton]	Condenser Fan [kW]	Evap Fan [kW]	Compressor [kW]	Net Avg EER	Runtime Adjust	Annual Usage [kWh]	Savings							
																							[kWh]	[kWh]						
Bells Elementary School	York	H1RA018S06	W0C6061116	Split-System	1.5	388	79.0	131.4	1.37	0.08	0.23	1.62	8.55	744	121.5	1.49	0.08	0.23	1.43	10.30	100.8%	678	66	0.18						
Bells Elementary School	Fujitsu	AQUH42LMAS1	MPQ001852	Split-System	2	388	79.0	131.9	2.71	0.10	0.30	2.22	12.41	1,016	122.0	2.95	0.10	0.30	1.92	15.23	67.8%	611	405	0.29						
Bells Elementary School	Carrier	50TJQ00B-501AL	4397G30414	Package Unit	4	388	79.0	132.1	3.40	0.20	0.60	4.35	7.91	1,998	122.3	3.70	0.20	0.60	3.86	9.53	108.0%	1,954	44	0.49						
Bells Elementary School	Trane	DR072S00P4TZ220001A	N0F6508856	Package Unit	6	388	79.0	131.4	6.20	0.30	0.90	6.47	9.71	2,975	121.5	6.76	0.30	0.90	5.74	11.69	88.8%	2,390	585	0.73						
Bells Elementary School	York	ZF090C00D2A1AAA1A1	N1L6047627	Package Unit	7.5	388	79.0	127.6	7.34	0.38	1.13	7.82	9.45	3,617	117.7	8.00	0.38	1.13	6.78	11.60	93.7%	3,011	606	1.04						
Bells Elementary School	York	ZF090C00D2A1AAA1A1	N1L606178	Package Unit	7.5	388	79.0	127.6	7.34	0.38	1.13	7.82	9.45	3,617	117.7	8.00	0.38	1.13	6.78	11.60	93.7%	3,011	606	1.04						
Bells Elementary School	York	DR036C00P4TZ220001A	N0F6535846	Package Unit	3	388	79.0	131.4	3.18	0.15	0.45	3.23	9.97	1,487	121.5	3.47	0.15	0.45	2.87	12.00	86.4%	1,164	324	0.36						
Bells Elementary School	York	H1RA042S46G	38	Split-System	3.5	388	79.0	131.4	3.19	0.18	0.53	3.77	8.55	1,735	121.5	3.47	0.18	0.53	3.35	10.30	100.8%	1,582	153	0.42						
Bells Elementary School	York	H1RA042S46G	W0D6205202	Split-System	3.5	388	79.0	131.4	3.19	0.18	0.53	3.77	8.55	1,735	121.5	3.47	0.18	0.53	3.35	10.30	100.8%	1,582	153	0.42						
Wedgwood Elementary School	York	H1RA042S46G	W0C6087798	Split-System	3.5	388	79.0	131.4	3.19	0.18	0.53	3.77	8.55	1,735	121.5	3.47	0.18	0.53	3.35	10.30	100.8%	1,582	153	0.42						
Wedgwood Elementary School	York	H1RA042S46G	W0C6087796	Split-System	3.5	388	79.0	131.4	3.19	0.18	0.53	3.77	8.55	1,735	121.5	3.47	0.18	0.53	3.35	10.30	100.8%	1,582	153	0.42						
Wedgwood Elementary School	York	DR060C00P4TZ220001A	N0F6541529	Package Unit	5	388	79.0	131.4	5.17	0.25	0.75	5.39	9.71	2,479	121.5	5.63	0.25	0.75	4.78	11.69	88.8%	1,991	488	0.61						
Wedgwood Elementary School	York	ZE036C00B2A1ABA1A1	N1M8385147	Package Unit	3	388	79.0	127.0	3.19	0.15	0.45	3.10	10.35	1,437	117.2	3.48	0.15	0.45	2.69	12.70	86.2%	1,100	337	0.41						
Wedgwood Elementary School	York	ZF090C00D2A1AAA1A1	N1L6066179	Package Unit	7.5	388	79.0	127.6	7.34	0.38	1.13	7.82	9.45	3,617	117.7	8.00	0.38	1.13	6.78	11.60	93.7%	3,011	606	1.04						
Wedgwood Elementary School	York	ZF090C00R2A1AAA1A2	N1B9637085	Package Unit	7.5	388	79.0	126.7	7.27	0.38	1.13	7.73	9.45	3,580	116.9	7.92	0.38	1.13	6.70	11.60	94.7%	3,011	569	1.03						
Wedgwood Elementary School	YORK	ZF090C00D2A1AAA1A1	N1L6047626	Package Unit	7.5	388	79.0	127.6	7.34	0.38	1.13	7.82	9.45	3,617	117.7	8.00	0.38	1.13	6.78	11.60	93.7%	3,011	606	1.04						
Wedgwood Elementary School	York	DR060C00P4TZ220001A	N0F6541530	Package Unit	5	388	79.0	131.4	5.17	0.25	0.75	5.39	9.71	2,479	121.5	5.63	0.25	0.75	4.78	11.69	88.8%	1,991	488	0.61						
Wedgwood Elementary School	York	ZF090C00R2A1AAA1A2	N1M8383586	Package Unit	7.5	388	79.0	127.0	7.29	0.38	1.13	7.76	9.45	3,592	117.2	7.95	0.38	1.13	6.72	11.60	94.4%	3,011	581	1.04						
Wedgwood Elementary School	York	ZF090C00R2A1AAA1A2	39	Package Unit	7.5	388	79.0	127.0	7.29	0.38	1.13	7.76	9.45	3,592	117.2	7.95	0.38	1.13	6.72	11.60	94.4%	3,011	581	1.04						
Wedgwood Elementary School	York	H1RA042S46G	W0C6087793	Split-System	3.5	388	79.0	131.4	3.19	0.18	0.53	3.77	8.55	1,735	121.5	3.47	0.18	0.53	3.35	10.30	100.8%	1,582	153	0.42						
Wedgwood Elementary School	York	H1RA042S46G	W0C6087601	Split-System	3.5	388	79.0	131.4	3.19	0.18	0.53	3.77	8.55	1,735	121.5	3.47	0.18	0.53	3.35	10.30	100.8%	1,582	153	0.42						
Wedgwood Elementary School	York	H1RA042S46G	W0C6087791	Split-System	3.5	388	79.0	131.4	3.19	0.18	0.53	3.77	8.55	1,735	121.5	3.47	0.18	0.53	3.35	10.30	100.8%	1,582	153	0.42						
Wedgwood Elementary School	York	H1RA042S46G	W0F6421429	Split-System	3.5	388	79.0	131.4	3.19	0.18	0.53	3.77	8.55	1,735	121.5	3.47	0.18	0.53	3.35	10.30	100.8%	1,582	153	0.42						
Wedgwood Elementary School	York	H1RA042S46G	W0F6501931	Split-System	3.5	388	79.0	131.4	3.19	0.18	0.53	3.77	8.55	1,735	121.5	3.47	0.18	0.53	3.35	10.30	100.8%	1,582	153	0.42						
Wedgwood Elementary School	Trane	THD240G3R0B0U0H6E1A1B6B	192910541D	Package Unit	20	388	79.0	126.7	20.58	1.00	3.00	20.61	10.04	9,547	116.9	22.43	1.00	3.00	17.86	12.32	89.2%	7,561	1,986	2.75						
Wedgwood Elementary School	Trane	THC120F3R0A0JG6E1A1B6B	192814891L	Package Unit	10	388	79.0	126.7	10.78	0.50	1.50	10.30	10.51	4,774	116.9	11.75	0.50	1.50	8.93	12.90	85.1%	3,609	1,165	1.37						
Wedgwood Elementary School	York	ZE060C00B2A1ABA1A1	N1E8834105	Package Unit	5	388	79.0	127.0	5.46	0.25	0.75	5.17	10.62	2,395	117.2	5.95	0.25	0.75	4.48	13.03	84.0%	1,786	609	0.89						
Wedgwood Elementary School	York	ZE036F05A2A1ABA1A1	N1A9527433	Package Unit	3	388	79.0	126.7	3.18	0.15	0.45	3.09	10.35	1,432	116.9	3.47	0.15	0.45	2.68	12.70	86.5%	1,100	332	0.41						
Wedgwood Elementary School	Trane	TC0048C30ABC	40	Package Unit	4	388	79.0	132.2	4.33	0.20	0.60	4.35	10.08	2,000	122.3	4.72	0.20	0.60	3.86	12.14	84.8%	1,534	466	0.49						
Wedgwood Elementary School	Trane	TC0048C30ABC	41	Package Unit	4	388	79.0	132.2	4.33	0.20	0.60	4.35	10.08	2,000	122.3	4.72	0.20	0.60	3.86	12.14	84.8%	1,534	466	0.49						
Wedgwood Elementary School	Trane	TC0048C30ABC	42	Package Unit	4	388	79.0	132.2	4.33	0.20	0.60	4.35	10.08	2,000	122.3	4.72	0.20	0.60	3.86	12.14	84.8%	1,534	466	0.49						
Wedgwood Elementary School	Trane	TC0048C30ABC	43	Package Unit	4	388	79.0	132.2	4.33	0.20	0.60	4.35	10.08	2,000	122.3	4.72	0.20	0.60	3.86	12.14	84.8%	1,534	466	0.49						
Wedgwood Elementary School	Trane	TC0048C30ABC	44	Package Unit	4	388	79.0	132.2	4.33	0.20	0.60	4.35	10.08	2,000	122.3	4.72	0.20	0.60	3.86	12.14	84.8%	1,534	466	0.49						
Wedgwood Elementary School	Trane	TC0048C30ABC	45	Package Unit	4	388	79.0	132.2	4.33	0.20	0.60	4.35	10.08	2,000	122.3	4.72	0.20	0.60	3.86	12.14	84.8%	1,534	466	0.49						
Wedgwood Elementary School	Trane	TC0048C30ABC	46	Package Unit	4	388	79.0	132.2	4.33	0.20	0.60	4.35	10.08	2,000	122.3	4.72	0.20	0.60	3.86	12.14	84.8%	1,534	466	0.49						
Wedgwood Elementary School	Trane	TC0048C30ABC	143191438	Package Unit	4	388	79.0	132.2	4.33	0.20	0.60	4.35	10.08	2,000	122.3	4.72	0.20	0.60	3.86	12.14	84.8%	1,534	466	0.49						
Wedgwood Elementary School	Trane	THC047E3R0A0MG6E1A1B6	192814082L	Package Unit	4	388	79.0	126.7	4.39	0.20	0.60	4.12	10.71	1,909	116.9	4.79	0.20	0.60	3.57	12.14	83.6%	1,418	432	0.55						
Wedgwood Elementary School	York	H1RA042S46G	W0F6087780	Split-System	3.5	388	79.0	131.4	3.19	0.18	0.53	3.77	8.55	1,735	121.5	3.47	0.18	0.53	3.35	10.30	100.8%	1,582	153	0.42						
Wedgwood Elementary School	York	H1RA042S46G	W0F6087781	Split-System	3.5	388	79.0	131.4	3.19	0.18	0.53	3.77	8.55	1,735	121.5	3.47	0.18	0.53	3.35	10.30	100.8%	1,582	153	0.42						
Wedgwood Elementary School	York	H1RA042S46G	W0F6087806	Split-System	3.5	388	79.0	131.4	3.19	0.18	0.53	3.77	8.55	1,735	121.5	3.47	0.18	0.53	3.35	10.30	100.8%	1,582	153	0.42						
Wedgwood Elementary School	York	H1RA036S46G	W0E6421802	Split-System	3	388	79.0	131.4	2.99	0.15	0.45	3.23	9.94	1,487	121.5	3.25	0.15	0.45	2.87	11.25	92.2%	1,241	246	0.36						
Wedgwood Elementary School	York	DR060C00P4TZ220001A	N0F64941322	Package Unit	5	388	79.0	131.4	5.17	0.25	0.75	5.39	9.71	2,479	121.5	5.63	0.25	0.75	4.78	11.69	88.8%	1,991	488	0.61						
Wedgwood Elementary School	York	H1RA042S46G	W0C6087794	Split-System	3.5	388	79.0	131.4	3.19	0.18	0.53	3.77	8.55	1,735	121.5	3.47	0.18	0.53	3.35	10.30	100.8%	1,582	153	0.42						
Wedgwood Elementary School	York	H1RA042S46G	W0C6087797	Split-System																										

ECMs Evaluated but Not Included

The energy conservation measures highlighted in this section were each evaluated during the investment grade audit. Due to high capital costs compared to annual energy savings and district priorities, these measures have not been included in the Energy Savings Plan.

ECM 1 – LED Lighting Tube Retrofit

Due to poor payback and WTPS priorities, this ECM is not included in the ESIP Project

Washington Township Public Schools ECM MATRIX		Washington Township High School	Chestnut Ridge Middle School	Orchard Valley Middle School	Bunker Hill Middle School	Thomas Jefferson Elementary School	Hurffville Elementary School	Whitman Elementary School	Birches Elementary School	Bells Elementary School	Wedgwood Elementary School	Grenloch Early Childhood Center	O'Brien Hall	Administration Building	Operations Building	Warehouse	Bus Garage
✓	ECM was evaluated																
✓	ECM included in the project																
ECM #	ECM DESCRIPTION																
1	LED Lighting Tube Retrofit	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Background, Scope of Work, and ECM Calculations not provided. Cost and savings can be reviewed on Form II in Section 4 of the Energy Savings Plan.

ECM 13 – Steam Boiler Plant Replacement

Due to poor payback and WTPS priorities, this ECM is not included in the ESIP Project

Washington Township Public Schools ECM MATRIX ☒ ECM was evaluated ☒ ECM included in the project		Washington Township High School	Chestnut Ridge Middle School	Orchard Valley Middle School	Bunker Hill Middle School	Thomas Jefferson Elementary School	Hurffville Elementary School	Whitman Elementary School	Birches Elementary School	Bells Elementary School	Wedgwood Elementary School	Grenloch Early Childhood Center	O'Brien Hall	Administration Building	Operations Building	Warehouse	Bus Garage	Washington Township High School Stadium
ECM	ECM DESCRIPTION																	
13	Steam Boiler Replacements											✓						

Background, Scope of Work, and ECM Calculations not provided. Cost and savings can be reviewed on Form II in Section 4 of the Energy Savings Plan.

ECM 14 – Chiller Replacements

Due to poor payback and WTPS priorities, this ECM is not included in the ESIP Project

Washington Township Public Schools ECM MATRIX ECM was evaluated ECM included in the project		Washington Township High School	Chestnut Ridge Middle School	Orchard Valley Middle School	Bunker Hill Middle School	Thomas Jefferson Elementary School	Hurffville Elementary School	Whitman Elementary School	Birches Elementary School	Bells Elementary School	Wedgwood Elementary School	Grenloch Early Childhood Center	O'Brien Hall	Administration Building	Operations Building	Warehouse	Bus Garage
ECM #	ECM DESCRIPTION																
14	Chiller Replacements																

Background, Scope of Work, and ECM Calculations not provided. Cost and savings can be reviewed on Form II in Section 4 of the Energy Savings Plan.

ECM 15 – Unit Ventilator Replacements

Due to poor payback and WTPS priorities, this ECM is not included in the ESIP Project

Washington Township Public Schools ECM MATRIX		Washington Township High School	Chestnut Ridge Middle School	Orchard Valley Middle School	Bunker Hill Middle School	Thomas Jefferson Elementary School	Hurffville Elementary School	Whitman Elementary School	Birches Elementary School	Bells Elementary School	Wedgwood Elementary School	Grenloch Early Childhood Center	O'Brien Hall	Administration Building	Operations Building	Warehouse	Bus Garage
✓	ECM was evaluated																
✓	ECM included in the project																
ECM #	ECM DESCRIPTION																
15	Unit Ventilator Replacements	✓				✓											

Background, Scope of Work, and ECM Calculations not provided. Cost and savings can be reviewed on Form II in Section 4 of the Energy Savings Plan.

Due to poor payback and WTPS priorities, this ECM is not included in the ESIP Project

Background, Scope of Work, and ECM Calculations not provided. Cost and savings can be reviewed on Form II in Section 4 of the Energy Savings Plan.

ECM 22 – Theatre Electrical Upgrades

Due to poor payback and WTPS priorities, this ECM is not included in the ESIP Project

Washington Township Public Schools ECM MATRIX		Washington Township High School	Chestnut Ridge Middle School	Orchard Valley Middle School	Bunker Hill Middle School	Thomas Jefferson Elementary School	Hurffville Elementary School	Whitman Elementary School	Birches Elementary School	Bells Elementary School	Wedgwood Elementary School	Grenloch Early Childhood Center	O'Brien Hall	Administration Building	Operations Building	Warehouse	Bus Garage
✓	ECM was evaluated																
✓	ECM included in the project																
ECM	ECM DESCRIPTION																
22	Theatre Electrical Upgrades	✓															

Background, Scope of Work, and ECM Calculations not provided. Cost and savings can be reviewed on Form II in Section 4 of the Energy Savings Plan.



ENERGY SAVINGS PLAN

SECTION 4 – FINANCIAL ANALYSIS

Form II – Energy Conservation Measures Summary Form

FORM II					
ESCO's PRELIMINARY ENERGY SAVINGS PLAN (ESP): ENERGY CONSERVATION MEASURES (ECMs) SUMMARY FORM Washington Township Public Schools ENERGY SAVINGS IMPROVEMENT PROGRAM					
ESCO Name: <u>DCO Energy</u>					
Proposed Preliminary Energy Savings Plan (Base Project)		Estimated Installed Hard Costs ⁽¹⁾ \$	Estimated Annual Savings \$	Est. Simple Payback (Years)	
ECM Number	Energy Conservation Measure				
2	LED Lighting Volumetric Kit Retrofit	\$3,582,387	\$455,395	7.9	
3	Lighting Controls	\$448,725	\$53,396	8.4	
4	Roof Renovations	\$4,334,650	\$1,631	2657.3	
5	Pipe and Valve Insulation	\$100,442	\$7,663	13.1	
6	Building Envelope Weatherization	\$882,246	\$66,815	13.2	
7	Plug Load Controls	\$259,517	\$25,138	10.3	
8	Etemp	\$82,936	\$20,329	4.1	
9	Walk-In Refrigeration Controls	\$107,648	\$8,028	13.4	
10	Retro-Commissioning	\$361,036	\$32,298	11.2	
11	Combined Heating & Power	\$205,101	\$2,382	86.1	
12	Hot Water Boiler Plant Replacement	\$1,912,880	\$8,902	214.9	
16	Solar PPA	\$0	\$543,587	0.0	
17	Stadium Lighting	\$346,000	\$823	420.6	
19	Destratification Fans	\$212,050	\$20,581	10.3	
20	Window Film	\$792,004	\$86,691	9.1	
21	HVAC Armor	\$858,225	\$60,191	14.3	
Add additional lines as needed*		Project Summary:	\$14,485,847	\$1,393,850	10.4
Optional ECMs Considered, but not included with base project at this time		Estimated Installed Hard Costs ⁽¹⁾ \$	Estimated Annual Savings \$	Est. Simple Payback (Years)	
ECM Number	Energy Conservation Measure				
1	LED Lighting Tube Retrofit	\$3,277,013	\$529,981	6.2	
4	Roof Renovations	\$540,575	\$215	2513.0	
12	Hot Water Boiler Plant Replacement	\$3,012,021	\$13,240	227.5	
13	Steam Boiler Replacements	\$629,359	\$1,770	355.5	
14	Chiller Replacements	\$1,534,951	\$8,525	180.0	
15	Unit Ventilator Replacements	\$7,695,075	\$5,731	1342.7	
18	Practice Field Lighting	\$118,500	\$0	-	
22	Theatre Electrical Upgrades	\$630,833	\$0	-	
Add additional lines as needed*		Optional ECMs Summary:	\$17,438,327	\$559,463	31.2
Proposed Facility Alterations needed to Implement Energy Conservation Measures		Supporting ECM	Estimated Cost	Percentage of Total Project Cost (Not to Exceed 15%)	
ECM Number	Energy Conservation Measure				
Add additional lines as needed*		Optional ECMs Summary:		-	
Proposed Energy Related Capital Improvements (that do not reduce energy usage)			Estimated Cost	Alternate Funding Source (may not be funded through ESCO)	
ECM Number	Energy Conservation Measure				
Add additional lines as needed*		Optional ECMs Summary:		-	

Form V – ESCO Construction and Service Fees

FORM V		
ESCO's PRELIMINARY ENERGY SAVINGS PLAN (ESP):		
ESCOs PROPOSED FINAL PROJECT COST FORM		
Washington Township Public Schools		
ENERGY SAVING IMPROVEMENT PROGRAM		
ESCO Name: <u>DCO Energy</u>		
PROPOSED CONSTRUCTION FEES:		
Fee Category	Fees ⁽¹⁾ Dollar (\$) Value	Percentage of Hard Costs
Estimated Value of Hard Costs ⁽²⁾	\$ 14,485,847	N/A
Project Contingency	\$ 3,259,315.49	
Estimated Value of Hard Costs ⁽²⁾	\$ 17,745,162	
Project Service Fees		
Investment Grade Energy Audit	\$ 354,903	2.00%
Design Engineering Fees	\$ 266,177	1.50%
Construction Management & Project Administration	\$ 1,330,887	7.50%
System Commissioning	\$ 266,177	1.50%
Equipment Initial Training Fees	\$ 266,177	1.50%
ESCO Overhead	\$ 709,806	4.00%
ESCO Profit	\$ 709,806	4.00%
Project Service Fees Sub Total	\$ 2,484,323	14.00%
TOTAL FINANCED PROJECT COSTS:	\$ 21,649,098	22.00%
PROPOSED ANNUAL SERVICE FEES		
First Year Annual Service Fees	Fees ⁽¹⁾ Dollar (\$) Value	Percentage of Hard Costs
SAVINGS GUARANTEE (OPTION)	\$159,706	0.90%
Measurement & Verification (Associated w/ Savings Guarantee Option)	Included with Savings Guarantee Option	
ENERGY STAR Services (optional)	\$79,853	0.45%
Post Construction Services (if applicable)	\$266,177	1.50%
Performance Monitoring	w/ M&V	0.90%
On-going Training Services	w/ M&V	0.55%
Verification Reports	w/ M&V	0.20%
TOTAL FIRST YEAR ANNUAL SERVICES	\$0	4.50%

Form VI – Project Cash Flow Analysis

FORM VI - 20 Years									
ESCO's PRELIMINARY ENERGY SAVINGS PLAN (ESP): ESCO's PRELIMINARY ANNUAL CASH FLOW ANALYSIS FORM Washington Township Public Schools - ENERGY SAVING IMPROVEMENT PROGRAM									
ESCO Name: <u>DCO Energy</u>						Miscellaneous Costs Financed:			
Note: Respondents must use the following assumptions in all financial calculations: (a) The cost of all types of energy should be assumed to inflate at 2.4% gas, 2.2% electric per year and 1. Term of Agreement: 20 years 2. Construction Period ⁽²⁾ (months): 24 Months 3. Cash Flow Analysis Format: Project Cost(1): \$21,649,098 Misc Costs Financed: \$1,935,790 Financed Amount: \$23,584,888 Interest Rate: 4.00%						Cost of Issuance		\$250,000	
						Design Fees		\$1,242,161	
						CM Fees		\$354,903	
						Commissioning		\$88,726	
						Total		\$1,935,790	
Year	Annual Energy Savings	Annual Operational Savings	Energy Rebates / Incentives		Total Annual Savings	Annual Project Costs	Solar Savings	Net Cash-Flow to Client	Cumulative Cash Flow
			Value	Utility					
Installation	\$694,537				\$ 694,537	\$ (655,659.89)			\$ -
Year 1	\$908,236	\$51,730	\$329,063	ACE/SJG	\$1,289,028	\$ (1,868,934.76)	\$543,587	\$2,558	\$2,558
Year 2	\$928,426	\$51,730	\$329,063	ACE/SJG	\$1,309,219	\$ (1,861,267.49)	\$554,607	\$2,558	\$5,116
Year 3	\$949,066	\$51,730			\$1,000,795	\$ (1,564,058.71)	\$565,822	\$2,558	\$7,674
Year 4	\$970,165	\$18,180			\$988,344	\$ (1,563,020.87)	\$577,235	\$2,558	\$10,232
Year 5	\$991,733	\$18,180			\$1,009,913	\$ (1,596,204.34)	\$588,850	\$2,558	\$12,790
Year 6	\$1,013,781				\$1,013,781	\$ (1,611,893.47)	\$600,670	\$2,558	\$15,348
Year 7	\$1,036,320				\$1,036,320	\$ (1,646,461.77)	\$612,700	\$2,558	\$17,906
Year 8	\$1,059,360				\$1,059,360	\$ (1,681,744.07)	\$624,942	\$2,558	\$20,464
Year 9	\$1,082,913				\$1,082,913	\$ (1,717,755.20)	\$637,400	\$2,558	\$23,022
Year 10	\$1,106,990				\$1,106,990	\$ (1,754,510.26)	\$650,078	\$2,558	\$25,580
Year 11	\$1,131,603				\$1,131,603	\$ (1,792,024.68)	\$662,980	\$2,558	\$28,138
Year 12	\$1,156,764				\$1,156,764	\$ (1,830,314.23)	\$676,108	\$2,558	\$30,696
Year 13	\$1,182,484				\$1,182,484	\$ (1,869,394.98)	\$689,469	\$2,558	\$33,254
Year 14	\$1,208,777				\$1,208,777	\$ (1,909,283.36)	\$703,064	\$2,558	\$35,812
Year 15	\$1,235,655				\$1,235,655	\$ (1,949,996.15)	\$716,899	\$2,558	\$38,370
Year 16	\$1,263,131				\$1,263,131	\$ (1,260,573.09)		\$2,558	\$40,928
Year 17	\$1,291,219				\$1,291,219	\$ (1,288,660.66)		\$2,558	\$43,487
Year 18	\$1,319,931				\$1,319,931	\$ (1,317,373.33)		\$2,558	\$46,045
Year 19	\$1,349,283				\$1,349,283	\$ (1,346,725.03)		\$2,558	\$48,603
Year 20	\$1,379,288				\$1,379,288	\$ (1,376,729.97)		\$2,558	\$51,161
Totals	\$ 23,259,662	\$ 191,548	\$ 658,126		\$ 24,109,336	\$ (33,462,586)	\$ 9,404,411	\$ 51,161	

Utility Inflation Details

Per Form VI, the annual inflation rate is 2.2% for electric and 2.4% for natural gas.

Utility Inflation Worksheet			
Year	ANNUAL ELECTRIC COST SAVINGS	ANNUAL NATURAL GAS COST SAVINGS	Total
1	\$803,596.32	\$104,639.22	\$908,235.54
2	\$821,275.44	\$107,150.56	\$928,426.00
3	\$839,343.50	\$109,722.17	\$949,065.67
4	\$857,809.06	\$112,355.50	\$970,164.56
5	\$876,680.86	\$115,052.04	\$991,732.90
6	\$895,967.84	\$117,813.29	\$1,013,781.12
7	\$915,679.13	\$120,640.80	\$1,036,319.93
8	\$935,824.07	\$123,536.18	\$1,059,360.25
9	\$956,412.20	\$126,501.05	\$1,082,913.25
10	\$977,453.27	\$129,537.08	\$1,106,990.35
11	\$998,957.24	\$132,645.97	\$1,131,603.21
12	\$1,020,934.30	\$135,829.47	\$1,156,763.77
13	\$1,043,394.85	\$139,089.38	\$1,182,484.23
14	\$1,066,349.54	\$142,427.52	\$1,208,777.06
15	\$1,089,809.23	\$145,845.78	\$1,235,655.01
16	\$1,113,785.03	\$149,346.08	\$1,263,131.12
17	\$1,138,288.31	\$152,930.39	\$1,291,218.69
18	\$1,163,330.65	\$156,600.72	\$1,319,931.37
19	\$1,188,923.92	\$160,359.13	\$1,349,283.06
20	\$1,215,080.25	\$164,207.75	\$1,379,288.00



ENERGY SAVINGS PLAN

SECTION 5 – RISK, DESIGN, & COMPLIANCE

Assessment of Risks, Design & Compliance Issues

Moving from a conceptual design to engineered documents, DCO has identified areas of the project that could change during the detailed design. The table below represents potential conceptual areas of concern that will need to be investigated further with a corresponding party responsible for the compliance of each item.

Issue	Category	Responsible Party
Alteration of expected Maintenance and Operational Savings	Risk	Washington Township School District
Disposition of Abandoned Equipment (Steam Piping, Condensate Piping, Oil Tanks, etc.)	Risk	Washington Township School District
New Natural Gas Distribution	Risk	Washington Township School District
Integrity of re-used Infrastructure	Risk	Washington Township School District
Life Safety System Coordination	Risk	Washington Township School District
Coordination with Washington Township School District Information Technology Department	Risk	Washington Township School District
Ventilation Compliance with Code	Compliance	Consulting Engineer
Temperature, Humidity and Air Change Compliance with Code	Compliance	Consulting Engineer
Boiler Capacity and Turndown	Design	Consulting Engineer
Natural Gas Regulator Compliance with Code	Compliance	Consulting Engineer
Undocumented Underground Utilities	Risk	Consulting Engineer
Code Compliance of Existing Electrical Infrastructure	Compliance	Consulting Engineer
Lighting Levels	Compliance	Consulting Engineer
Design Light Consortium rating for bulbs	Compliance	Consulting Engineer

Underwriters Laboratory Testing for retrofitted LED Lighting Systems	Compliance	Consulting Engineer
Lighting Retrofits within hard ceilings for fixtures and occupancy sensors	Risk	Consulting Engineer
Street/Parking Lot Pole Structural Integrity	Risk	Consulting Engineer
Unrealized Energy Savings 1. Energy Modeling 2. Performance Monitoring 3. Capacity of Equipment 4. Efficiency of Equipment 5. Run Hours of Equipment	Risk	DCO/ Consulting Engineer 1. DCO 2. DCO 3. Consulting Engineer / Basis of Design Vendor 4. Consulting Engineer / Basis of Design Vendor 5. Washington Township School District
Existing Plumbing Infrastructure with New Low Flow Devices	Design	Consulting Engineer
Adaptation to New RTUs (Curb, Electric, Ductwork, Condensate)	Design	Consulting Engineer / Basis of Design Manufacture
Structural Loads for Rooftop Equipment Replacement	Design	Consulting Engineer
Transformer Loading	Risk	Consulting Engineer
Site Work for Equipment	Design	Consulting Engineer
Condition of Roof Under Units	Risk	Consulting Engineer
Adequate Crane Lifts & Clearances	Design	Consulting Engineer / Rigger
Physical Space Constraints and Clearance for Equipment Replacement	Design	Consulting Engineer
Refrigerant Reclaim / Refrigerant Disposal	Compliance	Contractor
Existing Tie in Locations	Design	Consulting Engineer

Schedule Oversight	Risk	DCO Energy
Impact of Boiler Flue	Design	Consulting Engineer
Impact of Space Usage During Construction	Risk	Consulting Engineer & Washington Township School District
Scope changes relating to requests by Authorities Having Jurisdiction.	Risk	Washington Township School District (via contingency)
Department of Environmental Protection Permitting	Risk	Consulting Engineer
Modifications of Energy Saving Control Sequences and Setpoints impacting Energy Savings and Incentives	Risk	Washington Township School District
Post Construction Calibration of Sensors, Meters, & Safety Devices	Risk	Washington Township School District
Adequate time and access for bidding contractor site surveys	Risk	Washington Township School District
Utility Interconnection approval for the CHP Unit	Risk	Contractor

Measurement & Verification (M&V) Plan

Our approach to M&V of energy savings aligns with the International Performance Measurement & Verification Protocol. More detailed information may be found below. It's most cost-effective to perform M&V using the least costly option that still adequately documents system performance and permits analysis of savings. This approach lowers the total cost of the program, leaving more dollars available to perform more facility improvements. Depending upon which ECMs are implemented by Washington Township School District, the M&V plan proposed by DCO would incorporate one or more of the following options which outlines the four most common approaches for M&V:

Option A – Retrofit Isolation with Key Parameter Measurement	This option is based on a combination of measured and estimated factors when variations in factors are not expected. Measurements are spot or short-term and are taken at the component or system level, both in the baseline and post-installation cases. Measurements should include the key performance parameter(s) which define the energy use of the ECM. Estimated factors are supported by historical or manufacturer's data. Savings are determined by means of engineering calculations of baseline and post-installation energy use based on measured and estimated values.	Direct measurements and estimated values, engineering calculations and/or component or system models often developed through regression analysis. Adjustments to models are not typically required.
Option B – Retrofit Isolation with Parameter Measurement	This option is based on periodic or continuous measurements of energy use taken at the component or system level when variations in factors are expected. Energy or proxies of energy use are measured continuously. Periodic spot or short-term measurements may suffice when variations in factors are not expected. Savings are determined from analysis of baseline and reporting period energy use of proxies of energy use.	Direct measurements, engineering calculations, and/or component or system models often developed through regression analysis. Adjustments to models may be required.
Option C – Utility Data Analysis	This option is based on long-term, continuous, whole-building utility meter, facility level, or sub-meter energy (or water) data. Savings are determined from analysis of baseline and reporting period energy data. Typically, regression analysis is conducted to correlate with and adjust energy use to independent variables such as weather, but simple comparisons may also be used.	Based on regression analysis of utility meter data to account for factors that drive energy use. Adjustments to models are typically required.
Option D – Calibrated Computer Simulation	Computer simulation software is used to model energy performance of a whole facility (or sub-facility). Models must be calibrated with actual hourly or monthly billing data from the facility. Implementation of simulation modeling requires engineering expertise. Inputs to the model include facility characteristics; performance specifications of new and existing	Based on computer simulation model calibrated with whole-building or end-use metered data or both.

equipment or systems; engineering estimates, spot-, short-term, or long-term measurements of system components; and long-term whole-building utility meter data. After the model has been calibrated, savings are determined by comparing a simulation of the baseline with either a simulation of the performance period or actual utility data

Adjustments to models are required.

Each of the options can be used for a wide array of energy efficiency upgrades and each has different costs and complexities associated with it. When selecting an M&V approach, the following general rule of thumb can be applied:

OPTION A

- ❖ When magnitude of savings is low for the entire project or a portion of the project
- ❖ The risk of not achieving savings is low.

OPTION B

- ❖ For simple equipment replacement projects
- ❖ When energy savings values per individual measure are desired
- ❖ When interactive effects are to be ignored or are estimated using estimating methods that do not involve long term measurements
- ❖ When sub-meters already exist that record the energy use of subsystems under consideration

OPTION C

- ❖ For complex equipment replacement and controls projects
- ❖ When predicted energy savings are in excess of 10 to 20 percent as compared with the record energy use
- ❖ When energy savings per individual measure are not desired
- ❖ When interactive effects are to be included
- ❖ When the independent variables that affect energy, use are complex and excessively difficult or expensive.

OPTION D

- ❖ When new construction projects are involved
- ❖ When energy savings values per measure are desired
- ❖ When Option C tools cannot cost effectively evaluate particular measures or their interactions with the building when complex baseline adjustments are anticipated

DCO will perform measurement and verification of the energy unit's savings at the conclusion of each month in the first year of the energy units guarantee. After the first year, M&V will be performed and presented within 30 days of the year end. Washington Township School District will work with DCO to provide necessary information and provide access to any buildings to allow DCO to properly verify and measure energy savings. DCO's energy guarantee will be based on units of energy saved as determined from the baseline provided in the RFP, or adjusted baseline if original baseline is determined by both parties to be inaccurate.

Adjustments to the baseline and associated savings will be taken for weather, hours of operation, building usage, utility rate increases, code or statute changes, requirements listed in Table 1, and any other actions that adversely affect the savings beyond the control of DCO. Any savings discrepancies will be resolved to the satisfaction of both Washington Township School District and DCO in a timely manner.

As part of the optional energy guarantee, DCO uses weather normalization procedures to correct the effect of weather variance on energy savings in subsequent years. Baseline energy and weather data are used to establish an algorithm to predict how the baseline building uses energy as a function of weather. The algorithm is then applied to subsequent years to correct for the impact weather may have on future building energy use. The weather normalization procedure and algorithms will be covered in detail as part of the optional energy guarantee contract provided to Washington Township School District.

Maintenance Plan

Owner Tasks and Responsibilities:

As a general statement, Washington Township School District or its 3rd party service providers shall be responsible for providing ongoing maintenance through the duration of the M&V period. DCO will review operational procedures and schedules associated with such things as the building automation/control upgrades as well as the manufacturers' published requirements for all installed equipment be it: quarterly, semi-annually or annually. In most cases, Washington Township School District is already aware of or self-implementing similar maintenance practices on campus or has contracted a 3rd party for such services. Failure to properly maintain the equipment may cause energy savings goals to fall short.

Specific Areas of Consideration:

In order to sustain energy savings Washington Township School District's Staff will be required to implement new maintenance tasks and even modify existing policies and practices. Outlined are two examples of specific instances.

Example 1. Advanced Building Operations Programming:

Washington Township School District will be given specific training on the changes and advancements in environmental operations and energy savings strategies. Washington Township School District will be responsible for following the agreed upon guidelines associated with programmed schedules and any use of override functions.

Example 2. Verification of Proper Operations: Mechanical Equipment

Washington Township School District will be required to assure that proper mechanical maintenance continues to be implemented on their mechanical equipment. Example: outside air dampers will require proper operation with the appropriate seals in order to maintain ECM(s) such as demand ventilation. DCO will periodically spot check system operations to verify the Owner or its 3rd party representative is implementing proper maintenance. Any deficiencies that may be identified will be brought to Washington Township School District's attention for correction.



ENERGY SAVINGS PLAN

SECTION 6 – OPERATION & MAINTENANCE

It is critical to the success of achieving continued energy savings that Washington Township School District develop and implement an Operation and Maintenance Plan. In this section are some recommendations for Washington Township School District and/or 3rd party maintenance contractors.

Air Handling Units

Comprehensive Annual Inspection

1. Record and report abnormal conditions, measurements taken, etc.
2. Review logs for operational problems and trends.
3. General Assembly
 - a) Inspect the unit for cleanliness.
 - b) Inspect the fan wheel and shaft for wear and clearance.
 - c) Check the sheaves and pulleys for wear and alignment.
 - d) Check the belts for tension, wear, cracks, and glazing.
 - e) Verify tight bolts, set screws, and locking collars.
 - f) Check dampers for wear, security and linkage adjustment.
 - g) Verify clean condensate pan.
 - h) Verify proper operation of the condensate drain.
 - i) Verify clean air filters.
 - j) Verify clean coils.
 - k) Verify proper operation of the spray pump, if applicable.
 - l) Verify smooth fan operation.
 - m) Log operating conditions after system has stabilized.
 - n) Provide a written report of completed work, operating log, and indicate any uncorrected deficiencies detected.
4. Lubrication
 - a) Lubricate the fan shaft bearings, if applicable.
 - b) Lubricate the motor bearings, if applicable.
5. Controls and Safeties
 - a) Test the operation of the low temperature safety device, if applicable.
 - b) Test the operation of the high static pressure safety device, if applicable.
 - c) Test the operation of the low static pressure safety device, if applicable.
 - d) Check the thermal cutout on electric heaters, if applicable.
 - e) Check the step controller, if applicable.
 - f) Check and record supply air and control air pressure, if applicable.

- g) Verify the operation of the control system and dampers while the fan is operating.
- 6. Motor and Starter
 - a) Clean the starter and cabinet.
 - b) Inspect the wiring and connections for tightness and signs of overheating and discoloration. This includes wiring to the electric heat, if applicable.
 - c) Check the condition of the contacts for wear and pitting.
 - d) Check the contactors for free and smooth operation.
 - e) Meg the motor and record readings.

Heating Inspection

- 1. Gas Heat Option
 - a) Visually inspect the heat exchanger.
 - b) Inspect the combustion air blower fan, and clean, if required.
 - c) Lubricate the combustion air blower fan motor, if applicable.
 - d) Verify the operation of the combustion air flow-proving device.
 - e) Test the operation of the high gas pressure safety device, if applicable. Calibrate, if necessary.
 - f) Test the operation of the low gas pressure safety device, if applicable. Calibrate, if necessary.
 - g) Verify the operation of the flame detection device.
 - h) Test the operation of the high temperature limit switch.
 - i) Verify the integrity of the flue system.
 - j) Verify the operation of the operating controls.
 - k) Verify the burner sequence of operation.
 - l) Verify proper gas pressure to the unit and/or at the manifold, if applicable.
 - m) Perform combustion test. Make adjustments as necessary.
- 2. Electric Heat Option
 - a) Inspect wiring and connections for tightness and signs of overheating and discoloration.
 - b) Check and calibrate operating and safety controls, if applicable.
 - c) Verify the operation of the heating elements.
 - d) Check voltage and amperage and compare readings with the watt rating on the heater.
- 3. Hot Water / Steam Heat Option
 - a) Inspect control valves and traps.
 - b) Check and calibrate all operating and safety controls.
 - c) Verify the operation of the heating coils.
 - d) Verify the operation of the unit low temperature safety device.

Scheduled Running Inspection

- 1. Check the general condition of the fan.

2. Verify smooth fan operation.
3. Check and record supply and control air pressure, if applicable.
4. Verify the operation of the control system.
5. Log the operating conditions after the system has stabilized.
6. Review operating procedures with operating personnel.
7. Provide a written report of completed work, operating log, and indicate uncorrected deficiencies detected.

Oil Sample/Spectrographic Analysis

1. Pull oil sample for spectrographic analysis.

Refrigerant Sample/Analysis

1. Pull refrigerant sample for spectrographic analysis for contaminants (oil, water, and acid), using approved containers

Boilers

Comprehensive Annual Inspection

1. Record and report abnormal conditions, measurements taken, etc.
2. Review logs for operational problems and trends.
3. General Assembly
 - a) Secure and drain the boiler.
 - b) Open the fire and water side for cleaning and inspection.
 - c) Check heating surfaces and water side for corrosion, pitting, scale, blisters, bulges, and soot.
 - d) Inspect refractory.
 - e) Clean fire inspection glass.
 - f) Check blow-down valve packing, and lubricate.
 - g) Check and test boiler blow-down valve.
 - h) Perform hydrostatic test, if required.
 - i) Verify proper operation of the level float.
 - j) Gas Train Burner Assembly
 1. Check the gas train isolation valves for leaks.

2. Check the gas supply piping for leaks.
 3. Check the gas pilot solenoid valve for wear and leaks.
 4. Check the main gas and the pilot gas regulators for wear and leaks.
 5. Test the low gas pressure switch. Calibrate and record setting.
 6. Test the high gas pressure switch. Calibrate and record setting.
 7. Verify the operation of the burner fan air flow switch.
 8. Inspect and clean the burner assembly.
 9. Inspect and clean the pilot igniter assembly.
 10. Inspect and clean the burner fan.
 11. Run the fan and check for vibration.
 12. Inspect the flue and flue damper.
 13. Burner Control Panel:
 - a) Inspect the panel for cleanliness.
 - b) Inspect wiring and connections for tightness and signs of overheating and discoloration.
 - k) Clean burner fan wheel and air dampers. Check fan for vibration.
 - l) Verify tightness on linkage set screws.
 - m) Check gas valves for leakage (where test cocks are provided).
 - n) Verify proper operation of the feed water pump.
 - o) Verify proper operation of the feed water treating equipment.
4. Controls and Safeties
- a) Disassemble and inspect low water cutoff safety device.
 - b) Reassemble boiler low water cutoff safety device with new gaskets.
 - c) Clean contacts in program timer, if applicable.
 - d) Check the operation of the low water cutoff safety device and feed controls.
 - e) Verify the setting and test the operation of the operating and limit controls.
 - f) Verify the operation of the water level control.

Startup/Checkout Procedure

1. Verify proper water level in the boiler
2. Test the safety/relief valve after startup (full pressure test).
3. Clean or replace fuel filters.
4. Clean fuel nozzles.
5. Inspect clean, and functionally test the flame scanner and flame safeguard relay.
6. Clean and adjust the ignition electrode.
7. Replace the vacuum tube in the flame safeguard control, if applicable.
8. Perform pilot turn down test.

9. Verify proper steam pressure.
10. Perform combustion test and adjust the burner for maximum efficiency.
11. Test the following items:
 - a) Firing rate
 - b) Fuel/air ratio
 - c) CO₂
 - d) CO
 - e) NOX
 - f) Perform smoke test.
12. Review operating procedures
13. Provide a written report of completed work, operating log, and indicate any uncorrected deficiencies detected.

Mid-Season Running Inspection

1. Check the general condition of the unit.
2. Inspect the burner.
3. Adjust the burner controls to obtain proper combustion.
4. Check the operation of the pressure relief valve.
5. Check the operation of the low water cutoff and feed controls.
6. Check the setting and test the operation of the operating and limit controls.
7. Check the operation of the modulating motor.
8. Lift the safety/relief valves with at least 70% of rated pressure.
9. Blow down and try gauge cocks to confirm glass water level.
10. Check and test boiler blow down valve.
11. Log operating conditions after the system has stabilized.
12. Review operating procedures
13. Provide a written report of completed work, operating log, and indicate uncorrected deficiencies detected.

Seasonal Shut-down Procedure

1. Shut down boiler at boiler controls.
2. Shut off fuel lines at main valves.
3. Review operating procedures
4. Provide a written report of completed work, operating log, and indicate any uncorrected deficiencies detected.

Burners

Gas Train

1. Check the gas train isolation valves for leaks.
2. Check the gas supply piping for leaks.
3. Check the gas pilot solenoid valve for wear and leaks.
4. Check the main gas and the pilot gas regulators for wear and leaks.
5. Test the low gas pressure switch. Calibrate and record setting.
6. Test the high gas pressure switch. Calibrate and record setting.
7. Verify the operation of the burner fan air flow switch.
8. Inspect and clean the burner assembly.
9. Inspect and clean the pilot ignitor assembly.
10. Inspect and clean the burner fan.
11. Run the fan and check for vibration.
12. Inspect the flue and flue damper.
13. Burner Control Panel:
 - a) Inspect the panel for cleanliness.
 - b) Inspect wiring and connections for tightness and signs of overheating.
14. Clean burner fan wheel and air dampers. Check the fan for vibration.
15. Verify tightness of the linkage set screws.
16. Check the gas valves against leakage (where test cocks are provided)

Oil Train

1. Check the gas train isolation valves for leaks.
2. Check the gas supply piping for leaks.
3. Check the gas pilot solenoid valve for wear and leaks.
4. Check the main gas and the pilot gas regulators for wear and leaks.
5. Test the low gas pressure switch. Calibrate and record setting.
6. Test the high gas pressure switch. Calibrate and record setting.
7. Verify the operation of the burner fan air flow switch.
8. Inspect and clean the burner assembly.
9. Inspect and clean the pilot ignitor assembly.
10. Inspect and clean the burner fan.
11. Run the fan and check for vibration.
12. Inspect the flue and flue damper.
13. Burner Control Panel:

- a) Inspect the panel for cleanliness.
- b) Inspect wiring and connections for tightness and signs of overheating.
- 14. Clean burner fan wheel and air dampers. Check the fan for vibration.
- 15. Verify tightness of the linkage set screws.
- 16. Check the gas valves against leakage (where test cocks are provided).

Dual Fuel Train

- 1. Check the gas train isolation valves for leaks.
- 2. Check the gas supply piping for leaks.
- 3. Check the gas pilot solenoid valve for wear and leaks.
- 4. Check the main gas and the pilot gas regulators for wear and leaks.
- 5. Test the low gas pressure switch. Calibrate and record setting.
- 6. Test the high gas pressure switch. Calibrate and record setting.
- 7. Verify the operation of the burner fan air flow switch.
- 8. Inspect and clean the burner assembly.
- 9. Inspect and clean the pilot ignitor assembly.
- 10. Inspect and clean the burner fan.
- 11. Run the fan and check for vibration.
- 12. Inspect the flue and flue damper.
- 13. Burner Control Panel:
 - a) Inspect the panel for cleanliness.
 - b) Inspect wiring and connections for tightness and signs of overheating.
- 14. Clean burner fan wheel and air dampers. Check the fan for vibration.
- 15. Verify tightness of the linkage set screws.
- 16. Check the gas valves against leakage (where test cocks are provided)

Cooling Towers

Startup/Checkout Procedure

- 1. Fill the basin and verify the float level.
- 2. Verify the operation of the basin heaters
- 3. Verify the operation, setpoint, and sensitivity of the basin heater temperature control device.
- 4. Start the condenser water pumps.

5. Verify the balance of the return water through the distribution boxes.
6. Verify proper operation of the bypass valve(s), if applicable.
7. Operate fan and verify smooth operation.
8. Log operation after system has stabilized.
9. Review operating procedures
10. Provide a written report of completed work, operating log, and indicate uncorrected deficiencies detected.

Comprehensive Bi-Annual Inspection

1. Perform following inspection and cleaning before starting the tower for the cooling season and during shutdown at end of season.
2. Record and report abnormal conditions, measurements taken, etc.
3. Review logs for operational problems and trends.
4. General Assembly
 - a) Structure
 1. Disassemble all screens and access panels for inspection.
 2. Inspect the conditions of the slats, if applicable.
 3. Inspect the condition of the tower fill.
 4. Inspect the condition of the support structure.
 5. Inspect the condition of the basins (upper and lower) and/or spray nozzles.
 6. Verify clean basins and strainer(s).
 7. Verify the condition and operation of the basin fill valve system.
 - b) Mechanical
 1. Inspect belts for wear, cracks, and glazing.
 2. Verify correct belt tension. Adjust the tension as necessary.
 3. Inspect sheaves and pulleys for wear, condition, and alignment.
 4. Inspect fan shaft and bearings for condition.
 5. Inspect fan assembly for condition, security, and clearances. (e.g. blade tip clearance).
4. Lubrication System
 - a) Lubricate motor bearings.
 - b) Lubricate fan shaft bearings.
5. Motor And Starter
 - a) Clean the starter and cabinet.
 - b) Inspect wiring and connections for tightness and signs of overheating and discoloration.
 - c) Check the condition of the contacts for wear and pitting.
 - d) Check the contactor(s) for free and smooth operation.

- e) Meg the motor(s) and record readings.
- f) Check disconnect terminal block for wear, tightness and signs of overheating and discoloration.
- g) Check the condition and operation of the basin heater contactor(s).

Shut-Down Procedure

1. Check the general condition of the tower.
2. Turn off electrical power to basin heaters, tower fans, and pipe heaters as necessary.
3. Drain tower and condenser water piping.
4. Review operating procedures
5. Provide a written report of completed work, operating log, and indicate any uncorrected deficiencies detected.

Energy Management System

Maintenance Inspection

1. Review reports for operational problems and trends.
2. Make a back-up copy of the BAS program.
3. Check for loose or damaged parts or wiring.
4. Check for any accumulation of dirt or moisture. Clean if required.
5. Verify proper electrical grounding.
6. Verify control panel power supplies for proper output voltages.
7. Inspect interconnecting cables and electrical connections.
8. Verify that manual override switches are in the desired positions.
9. Check the operation of all binary and analog outputs, if applicable.
10. Calibrate control devices, if applicable.
11. Verify the correct time and date.
12. Check and update the holiday schedules and daylight savings time.
13. Via terminal mode, view the event log and input/output points for any unusual status or override conditions.
14. Clean the external surfaces of the panel enclosure.
15. Review operating program and parameters.
16. Check cable connections for security.

17. Review operating procedures
18. Provide a written report of completed work, and indicate any uncorrected deficiencies detected.

Maintenance Inspection (Control Panels)

1. Control Panel
 - a) Verify secure connections on all internal wiring, LAN, and communication links.
 - b) Check for loose or damaged parts or wiring.
 - c) Check for any accumulation of dirt or moisture. Clean if required.
 - d) Remove excessive dust from heat sink surfaces
 - e) Verify proper system electrical grounding.
 - f) Verify proper output voltages on control panel power supplies.
 - g) Check LED Indications to verify proper operation
 - h) Verify LAN communications
 - i) Verify that cards are seated and secured.
 - j) Check wiring trunks and check for possible Error Code Indications
 - k) Check voltage level of
 - l) Verify the proper operation of critical control processes and points associated with this unit and make adjustments if necessary.
 - m) Check Volatile memory available
 - n) Check Non volatile memory available
 - o) Check Processor idle time
 - p) Clean external surfaces of the panel enclosure.
 - q) Check modem operation, if applicable.
 - r) View the event log and input/output points for any unusual status or override conditions.
 - s) Verify correct time and date.
 - t) Check and update holiday schedules, if applicable, and daylight savings time.
 - u) Review operating procedures with operating personnel.
 - v) Provide a written report of completed work, and indicate any uncorrected deficiencies detected.

Maintenance Inspection (EMS - Sequence of Operations)

Central Plant

In order to assure effective environmental conditioning while minimizing the cost to operate the equipment, technicians will review operating sequences and practices for the chiller plant. An

initial survey of current equipment operating parameters will be conducted within the first 60 days of the contract term during cooling season. This survey will include:

1. Chiller(s) operation
2. Cooling tower(s) operation
3. Pump(s) operation
4. Economizer operation (where applicable)
5. Environmental safety

A detailed report of findings and recommendations for changes, if any, will be made. Agreed upon operational changes which require only adjustment of controls or programming will be made during regularly scheduled maintenance visits as part of this agreement at no additional cost. Any recommended alterations that require addition of devices or equipment will be accompanied by a guaranteed cost proposal reflecting the applicable discounts determined by this agreement.

Building Systems

In order to assure effective environmental conditioning while minimizing the cost to operate the equipment, technicians will review operating sequences and practices for covered airside systems. An initial survey of current systems operating parameters will be conducted within the first 60 days of the contract term, except seasonally operated systems, which will be surveyed during the appropriate operating season. This survey will include:

1. Time schedule(s)
2. Reset schedule(s)
3. Economizer changeover (where applicable)
4. Setpoints
5. Energy Management routines

A detailed report of findings and recommendations for changes, if any, will be made. Agreed upon operational changes which require only adjustment of controls or programming will be made during regularly scheduled maintenance visits as part of this agreement at no additional cost. Any recommended alterations that require addition of devices or equipment will be accompanied by a guaranteed cost proposal reflecting the applicable discounts determined by this agreement.

Fans

Maintenance Procedure

1. Record and report abnormal conditions, measurements taken, etc.
2. Review logs for operational problems and trends.
3. General Assembly
 - a) Check the general condition of the unit.
 - b) Verify tightness of the fan, fan guards, louvers, etc.
 - c) Verify clean burner assembly.
 - d) Check sheaves and pulleys for wear and alignment, if applicable.
 - e) Check belts for tension, wear, cracks, and/or glazing.
4. Lubrication
 - a) Lubricate the fan motor, if applicable.
 - b) Lubricate the fan bearings as necessary.
5. Controls and Safeties
 - a) Verify proper operation of the temperature control device.
 - b) Verify proper operation of the high temperature control device.
 - c) Verify proper operation of the fan switch.
 - d) Verify proper operation of the pilot safety device, if applicable.
6. Electrical
 - a) Inspect wiring and connections for tightness and signs of overheating and discoloration.
7. Startup and Checkout
 - a) Start the unit.
 - b) Verify proper combustion air to the burner.
 - c) Verify proper gas pressure to the burner.
 - d) Check the flame for proper combustion.

Comprehensive Annual Inspection

1. Record and report abnormal conditions, measurements taken, etc.
2. Review logs for operational problems and trends.
3. General Assembly
 - a) Disassemble all screens and panels necessary to gain access to the fan mechanism.
 - b) Disassemble the control mechanism (AVPB only).
 - c) Clean all accessible rotor components to include control pitch mechanism (AVPB only).
 - d) Inspect blades for wear.
 - e) Inspect blade arms for wear (AVPB only).

- f) Check blade tip clearance.
- g) Check for oil leak on the blade bearing housing (AVPB only).
- h) Clean motor and fan housing.
- i) Reassemble all removed screens and plates.
- 4. Lubrication
 - a) Lubricate the motor bearings.
 - b) Lubricate the shaft bearings (AVPA only).
- 5. Controls and Safeties
 - a) Test the operation of the high static safety device. Calibrate and record setting.
 - b) Test the operation of the low static safety device. Calibrate and record setting.
 - c) Test the operation of the vibration safety device. Calibrate and record setting.
 - d) Verify the operation of the phase monitor, if applicable.
 - e) Inspect pneumatic and electrical controls for condition and calibration.
 - f) Verify proper operation.
- 6. Motor and Starter
 - a) Clean the starter and cabinet.
 - b) Clean the disconnect switch and cabinet at the fan, if applicable.
 - c) Inspect the wiring and connections for tightness and signs of overheating and discoloration.
 - d) Check the condition of the contacts for wear and pitting.
 - e) Check the contactors for free and smooth operation.
 - f) Meg the motor and record readings.
- 7. Startup / Checkout Procedure
 - a) Start the fan.
 - b) Verify the operation of the starter.
 - c) Check and record supply and control air pressure.
 - d) Verify the operation of the control system while the fan is operating.
 - e) Log the operating conditions after the system has stabilized.
 - f) Review operating procedures with operating personnel.
 - g) Provide a written report of completed work, operating log, and indicate any uncorrected deficiencies detected.

Scheduled Running Inspection (fans)

- 1. Check the general operation of the fan.
- 2. Check and record supply and control air pressure.
- 3. Verify the operation of the control system.
- 4. Log the operating conditions after the system has stabilized.
- 5. Review operating procedures with operating personnel.

6. Provide a written report of completed work, operating log, and indicate any uncorrected deficiencies detected.

Comprehensive Annual Inspection (fans)

1. Record and report abnormal conditions, measurements taken, etc.
2. Review logs for operational problems and trends.
3. General Assembly
 - a) Verify tight bolts, set screws, and locking collars.
 - b) Inspect sheaves and pulleys for wear and alignment.
 - c) Inspect belts for tension, wear, cracks, and glazing.
 - d) Inspect dampers for wear, security, and clearances, if applicable.
 - e) Verify clean air filters.
 - f) Provide a written report of completed work, operating log, and indicate any uncorrected deficiencies detected.
4. Lubrication
 - a) Lubricate fan bearings.
 - b) Lubricate motor bearings, if applicable.
5. Controls and Safeties
 - a) Verify the operation of the control system while the fan is operating.
 - b) Verify the setting of the low temperature safety device, if applicable.
 - c) Verify the operation of the pre-heat control device, if applicable.
 - d) Verify the operation of the cooling control device, if applicable.
 - e) Verify the operation of the re-heat control device, if applicable.
 - f) Verify the operation of the humidity control device, if applicable.
6. Motor and Starter
 - a) Clean the starter and cabinet.
 - b) Inspect the wiring and connections for tightness and signs of overheating and discoloration.
 - c) Check the condition of the contacts for wear and pitting.
 - d) Check the contactors for free and smooth operation.
 - e) Meg the motor and record readings.
 - f) Check volts and amps of the motor.

Lubricate/Grease Bearings

1. Lubricate and/or grease bearings according to manufacturer's specifications

MEG Motor

1. Check the integrity of the insulation on the motor windings and the motor leads, using a megohm meter.

Coils

Maintenance Procedure

1. Record and report abnormal conditions.
2. Visually inspect the coil for leaks.
3. Inspect the coil for cleanliness.

Pumps

Annual Inspection

1. Record and report abnormal conditions, measurements taken, etc.
2. Review logs for operational problems and trends.
3. General Assembly
 - a) Check motor shaft and pump shaft for alignment, if applicable.
 - b) Inspect the coupling for wear.
 - c) Verify that the shaft guard is in place and tight, if applicable.
 - d) Verify water flow through the pump.
 - e) Check for leaks on the mechanical pump seals, if applicable.
 - f) Verify proper drip rate on the pump seal packing, if applicable.
 - g) Verify smooth operation of the pump.
 - h) Provide a written report of completed work, operating log, and indicate any uncorrected deficiencies detected.
4. Lubrication
 - a) Lubricate the motor bearings as necessary.
 - b) Lubricate the pump bearings as necessary.
5. Motor and Starter

- a) Clean the starter and cabinet.
- b) Inspect wiring and connections for tightness and signs of overheating and discoloration.
- c) Meg the motor.
- d) Verify tight connections on the motor terminals.
- e) Check the condition of the contacts for wear and pitting, if applicable.
- f) Check the contactors for free and smooth operation.
- g) Verify proper volts and amps.

Pump Run Inspection

1. Verify smooth operation of the pump.
2. Check for leaks on the mechanical pump seals, if applicable.
3. Verify proper drip rate on the pump seal packing, if applicable.
4. Provide a written report of completed work, operating log, and indicate any uncorrected deficiencies detected.

Mechanical Starters with Electronic Controls

Comprehensive Annual Maintenance

1. Clean the starter and cabinet.
2. Inspect wiring and connections for tightness and signs of overheating and discoloration.
3. Check condition of the contacts for wear and pitting.
4. Check contactors for free and smooth operation.
5. Check the mechanical linkages for wear, security, and clearances.
6. Verify the overload settings.

VFD Starters

Comprehensive Annual Maintenance

1. Clean the starter and cabinet.
2. Inspect wiring and connections for tightness and signs of overheating and discoloration.
3. Check the tightness of the motor terminal connections.

4. Verify the operation of the cooling loop.
5. Verify proper operation of the frequency drive.

Rooftop Units

Comprehensive Annual Maintenance

1. Record and report abnormal conditions, measurements taken, etc.
2. Review logs for operational problems and trends.
3. General Assembly
 - a) Inspect for leaks and report results.
 - b) Calculate refrigerant loss rate and report to the customer.
 - c) Repair minor leaks as required (e.g. valve packing, flare nuts).
 - d) Visually inspect condenser tubes for cleanliness.
4. Controls and Safeties
 - a) Inspect the control panel for cleanliness.
 - b) Inspect wiring and connections for tightness and signs of overheating and discoloration.
 - c) Verify the working condition of all indicator/alarm lights, if applicable.
 - d) Test the low water temperature control device. Calibrate and record setting.
 - e) Test the low evaporator pressure safety device. Calibrate and record setting.
 - f) Test the oil pressure safety device. Calibrate and record setting, if applicable.
 - g) Check programmed parameters of RCM control, if applicable.
5. Lubrication System
 - a) Check oil level in the compressor.
 - b) Test oil for acid content and discoloration. Make recommendations to the customer based on the results of the test.
 - c) Verify the operation of the oil heater. Measure amps and compare reading with the watt rating of the heater.
6. Motor and Starter
 - a) Clean the starter and cabinet.
 - b) Inspect wiring and connections for tightness and signs of overheating and discoloration.
 - c) Check condition of the contacts for wear and pitting.
 - d) Check the contactors for free and smooth operation.
 - e) Check the tightness of the motor terminal connections.
 - f) Meg the motor and record readings.

- g) Verify the operation of the electrical interlocks.
- h) Measure voltage and record. Voltage should be nominal voltage $\pm 10\%$.

Comprehensive Maintenance Inspection (RTU Heating Cycle)

1. Perform heating inspection/maintenance applicable to the unit (steam/hot water, gas, electric).
2. Verify smooth operation of the fans.
3. Check the belts for tension, wear, cracks, and glazing.
4. Verify clean air filters.
5. Gas Heat Option
 - a) Visually inspect the heat exchanger.
 - b) Inspect the combustion air blower fan, and clean, if required.
 - c) Lubricate the combustion air blower fan motor, if applicable.
 - d) Verify the operation of the combustion air flow-proving device.
 - e) Test the operation of the high gas pressure safety device, if applicable. Calibrate, if necessary.
 - f) Test the operation of the low gas pressure safety device, if applicable. Calibrate, if necessary.
 - g) Verify the operation of the flame detection device.
 - h) Test the operation of the high temperature limit switch. i.e. Verify the integrity of the flue system.
 - i) Verify the operation of the operating controls.
 - j) Verify the burner sequence of operation.
 - k) Verify proper gas pressure to the unit and/or at the manifold, if applicable.
 - l) Perform combustion test. Make adjustments as necessary.
6. Electric Heat Option
 - a) Inspect wiring and connections for tightness and signs of overheating and discoloration.
 - b) Check and calibrate operating and safety controls, if applicable.
 - c) Verify the operation of the heating elements.
 - d) Check voltage and amperage and compare readings with the watt rating on the heater.
7. Hot Water / Steam Heat Option
 - a) Inspect control valves and traps.
 - b) Check and calibrate all operating and safety controls.
 - c) Verify the operation of the heating coils.
 - d) Verify the operation of the unit low temperature safety device.

Mid-Season Cooling Inspection (RTU)

1. Check the general condition of the unit.
2. Log the operating condition after system has stabilized.
3. Verify the operation of the control circuits.
4. Analyze the recorded data. Compare the data to the original design conditions.
5. Review operating procedures with operating personnel.
6. Provide a written report of completed work, operating log, and indicate any uncorrected deficiencies detected.

Comprehensive Maintenance Inspection (RTU - Cooling Cycle)

1. Record and report abnormal conditions, measurements taken, etc.
2. Review logs for operational problems and trends.
3. General Assembly
 - a) Inspect for leaks and report results.
 - b) Calculate refrigerant loss rate and report to the customer.
 - c) Repair minor leaks as required (e.g. valve packing, flare nuts).
 - d) Check pulleys and sheaves for wear and alignment.
 - e) Check belts for tension, wear, cracks, and glazing.
 - f) Verify clean evaporator coil, blower wheel, and condensate pan.
 - g) Verify clean air filters.
 - h) Verify proper operation of the condensate drain.
 - i) Verify proper operation of the dampers and/or inlet guide vanes, if applicable.
4. Controls and Safeties
 - a) Inspect the control panel for cleanliness.
 - b) Inspect wiring and connections for tightness and signs of overheating and discoloration.
 - c) Verify the working condition of all indicator/alarm lights, if applicable.
 - d) Test the low evaporator pressure safety device. Calibrate and record setting, if applicable.
 - e) Test the high condenser pressure safety device. Calibrate and record setting, applicable.
 - f) Test the oil pressure safety device, if applicable. Calibrate and record setting.
 - g) Test the high static pressure safety device, if applicable. Calibrate and record setting.
 - h) Verify the operation of the static pressure control device, if applicable.
5. Lubrication
 - a) Verify the operation of the oil heater, if applicable.
 - b) Lubricate the fan bearings as required.
 - c) Lubricate the fan motor bearings as required.

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- d) Lubricate the damper bearings, if applicable.
 - 6. Motor and Starter
 - a) Clean the starter and cabinet.
 - b) Inspect wiring and connections for tightness and signs of overheating and discoloration.
 - c) Check the condition of the contacts for wear and pitting.
 - d) Check the contactors for free and smooth operation.
 - 7. Startup /Checkout Procedure
 - a) Verify the operation of the oil heater.
 - b) Verify full water system, including the cooling tower and the condenser.
 - c) Verify clean cooling tower and strainers.
 - d) Test all flow-proving devices on the condenser water circuit.
 - e) Start the condenser water pump and the cooling tower fan(s).
 - f) Verify flow rate through the condenser.
 - g) Start the unit.
 - h) Verify smooth operation of the compressor(s) and fan(s).
 - i) Check the setpoint and sensitivity of the temperature control device.
 - j) Verify the operation of the condenser water temperature control device.
 - k) Verify clean condenser using pressure and temperature.
 - l) Check operation and setup of the Unit Control Module.
 - m) Check the superheat and subcooling on the refrigeration circuit(s).
 - n) Log the operating conditions after the system has stabilized.
 - o) Review operating procedures with operating personnel.
 - p) Provide a written report of completed work, operating log, and indicate any uncorrected deficiencies detected.



ENERGY SAVINGS PLAN

SECTION 7 – OPTIONAL ENERGY GUARANTEE

OPTIONAL ENERGY GUARANTEE OVERVIEW

FORM II				
ESCO's PRELIMINARY ENERGY SAVINGS PLAN (ESP): ENERGY CONSERVATION MEASURES (ECMs) SUMMARY FORM Washington Township Public Schools ENERGY SAVINGS IMPROVEMENT PROGRAM				
ESCO Name: <u>DCO Energy</u>				
Proposed Preliminary Energy Savings Plan (Base Project)		Estimated Installed Hard Costs ⁽¹⁾ \$	Estimated Annual Savings \$	Est. Simple Payback (Years)
ECM Number	Energy Conservation Measure			
2	LED Lighting Volumetric Kit Retrofit	\$3,582,387	\$455,395	7.9
3	Lighting Controls	\$448,725	\$53,396	8.4
4	Roof Renovations	\$4,334,650	\$1,631	2657.3
5	Pipe and Valve Insulation	\$100,442	\$7,663	13.1
6	Building Envelope Weatherization	\$882,246	\$66,815	13.2
7	Plug Load Controls	\$259,517	\$25,138	10.3
8	Eltemp	\$82,936	\$20,329	4.1
9	Walk-In Refrigeration Controls	\$107,648	\$8,028	13.4
10	Retro-Commissioning	\$361,036	\$32,298	11.2
11	Combined Heating & Power	\$205,101	\$2,382	86.1
12	Hot Water Boiler Plant Replacement	\$1,912,880	\$8,902	214.9
16	Solar PPA	\$0	\$543,587	0.0
17	Stadium Lighting	\$346,000	\$823	420.6
19	De-stratification Fans	\$212,050	\$20,581	10.3
20	Window Film	\$792,004	\$86,691	9.1
21	HVAC Armor	\$858,225	\$60,191	14.3
Add additional lines as needed* Project Summary:		\$14,485,847	\$1,393,850	10.4

PROPOSED ANNUAL SERVICE FEES		
First Year Annual Service Fees	Fees ⁽¹⁾ Dollar (\$) Value	Percentage of Hard Costs
SAVINGS GUARANTEE (OPTION)	\$159,706	0.90%
Measurement & Verification (Associated w/ Savings Guarantee Option)	Included with Savings Guarantee Option	
ENERGY STAR Services (optional)	\$79,853	0.45%
Post Construction Services (if applicable)	\$266,177	1.50%
Performance Monitoring	w/ M&V	0.90%
On-going Training Services	w/ M&V	0.55%
Verification Reports	w/ M&V	0.20%
TOTAL FIRST YEAR ANNUAL SERVICES	\$0	4.50%

NOTE: The following is meant only to serve as a description of an optional energy guarantee and does not constitute any contractual obligations between the Washington Township School District and DCO. If Washington Township School District chooses to implement an energy guarantee contract, a separate document will be used based on mutual agreement and acceptance of all parties of its terms and conditions.

A successful energy project consists of a partnership between an ESCO and Owner. Both parties have defined roles and accept their individual responsibilities as well as support any joint initiatives of the program as defined in this document. Both DCO and the Washington Township School District will have a role in ongoing maintenance and operations as defined in the agreed-upon energy guarantee contractual documents. Both parties will be required to meet their obligations for the guaranteed energy units savings (referred to as “guarantee or savings”) to be achieved and to ensure the guarantee stays intact.

DCO will guarantee Washington Township School District will achieve the energy unit savings per the provisions of the agreed-upon energy guarantee contractual documents based on the final selection of ECMs and their associated energy savings as measured and verified by the Owner’s third-party, independent firm. The energy savings will be in energy units, not dollars as DCO has no control over the costs of utilities. The energy units guarantee contract shall commence thirty (30) days after the start-up and commissioning of the last Energy Conservation Measure (ECM) and be enforced for a period of one (1) year or until terminated by Washington Township School District.

SAVINGS VERIFICATION

There are events that cause energy savings to change. Washington Township School District and DCO will agree to baseline energy consumption that represents the facility’s energy use and cost prior to the date of any Agreement (the “Base Year”) and parameters, which affect the energy usage and cost of the facility, including but not limited to, utility rates, local weather profile, facility square footage, environmental conditions, schedules (e.g., lighting, HVAC) and an inventory of equipment in the facility. Energy savings are determined by comparing measured energy use or demand before and after implementation of an energy savings program.

ECM ENERGY SAVINGS = BASELINE ENERGY USE – POST INSTALLATION ENERGY USE +/- ADJUSTMENTS

Changes in estimated energy savings fall into two categories. These categories are Routine Adjustments and Non-Routine Adjustments. Routine Adjustments are expected changes during the savings reporting period to energy governing factors (e.g. weather). DCO uses IPMVP approved mathematical techniques to determine adjustments. Non-Routine

Adjustments include energy-governing factors which are not usually expected to change, such as the facility size, the design and operation of installed equipment, occupancy and the type of occupants or any physical changes to the building or equipment that impact the facilities' utility use. These factors will be monitored for change throughout the reporting period.

DCO will perform monthly utility bill analysis and audit reports which compare the current year with base year energy consumption and costs. DCO will perform periodic on-site analysis to determine whether mechanical and electrical systems are operating at optimal efficiency and to assess the occupancy and operational schedules of the buildings.

As part of the optional energy guarantee, DCO uses weather normalization procedures to correct the effect of weather variance on energy savings in subsequent years. Baseline energy and weather data are used to establish an algorithm to predict how the baseline building uses energy as a function of weather. The algorithm is then applied to subsequent years to correct for the impact weather may have on future building energy use. The weather normalization procedure and algorithms will be covered in detail as part of the optional energy guarantee contract provided to Washington Township School District.



ENERGY SAVINGS PLAN

APPENDICIES

APPENDIX LIST

APPENDIX A	Construction Contingency Allowance
APPENDIX B	Design Bid Build Procedures
APPENDIX C	Operations & Maintenance Savings
APPENDIX D	Project Changes in Financing
APPENDIX E	Incentives in Debt Service
APPENDIX F	ECM Breakdown by Building
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APPENDIX H	Local Government Energy Audits



ENERGY SAVINGS PLAN

APPENDIX A – CONSTRUCTION CONTINGENCY ALLOWANCE

Appendix A – Construction Contingency Allowance

Experience shows that during the construction phase there are four major categories of potential change of scope issues that benefit from having an appropriate Construction Contingency Allowance (CCA).

- Unknown conditions
- Building inspector's modifications
- Project owner requested changes.
- Design clarifications or modifications

Unknown Conditions

Renovations to older facilities have greater potential for revealing the unknown. Missing or inaccurate Blueprints, deviations from the original blueprints by the original builder and unknown or undocumented modifications during the life of the facility.

Areas such as behind a wall/roof/equipment or under the slab can bring unforeseen conditions which can delay the new construction and change the anticipated scope of the work. Therefore, it is advisable to dedicate a CCA that is higher than that for new construction.

Building Inspection Modifications

A plan review for the local building jurisdiction reviews the construction documents prior to issuing a building permit. However, there remains the likelihood that the building inspector will request modifications to the plans based upon experience and their interpretation of the applicable building code.

While we can ask for code review and documentation, if you hope to get a Certificate of Occupancy under a tight schedule from this same inspector requested modifications will need to be implemented as successfully appeals take time.

Whether it is adding an extra exit sign, smoke detector or fire extinguisher, or whether it is something more significant, it may require more work from the contractor, thus adding expense. The CCA is intended to be the source of funds necessary for these requested modifications.

Project Owner Requested Changes

It is nearly impossible to express your every desire during the design phase. You will always see something during construction that you would like to change.

There is nothing necessarily wrong with that.

The CCA is intended to be the source of funds necessary for these requested changes.

Design Clarifications or Modifications

No designer has ever developed the perfect set of construction documents.

There are always items that can be detailed better or more clearly. The design intent should be adequately reflected in the drawings and specifications so that the contractor can bid and build the ECM to meet the design intent.

However, there will be times during construction when the builder will not be readily able to identify the exact intent of particular details or systems. At that time the builder will submit a Request for Information (RFI) to the designer for clarification or more information. The designer will issue clarifications or directives so that the builder can continue to meet the design intent.

On occasion, the RFI will reveal that something more than was shown in the construction documents is necessary to fulfill the design intent. The clarification or modification may impact the scope of the work to a degree that additional construction costs become necessary.

As long as the design omission is not negligent, the CCA is intended to be the source of funds necessary for these design clarifications or modifications.

Allowance Method

Detailed plans, schematics and specifications for Washington Township School District were not available to deliver a cost estimate for each ECM. The budgetary costs carried out in the project are based on good faith estimates, contractor supplied budgets for similar ECMs on other recent projects and a database of actual installed costs for various ECMs.

a. Allowance Amount (22.5% of Hard Costs)

BID PACKAGE ALLOWANCE		
ENERGY CONSERVATION MEASURE	ESTIMATED INSTALLED HARD COSTS \$	CONTINGENCY AMOUNT (22.5%)
LED Lighting Volumetric Kit Retrofit	\$3,582,387	\$806,037
Lighting Controls	\$448,725	\$100,963
Roof Renovations	\$4,334,650	\$975,296
Pipe and Valve Insulation	\$100,442	\$22,600
Building Envelope Weatherization	\$882,246	\$198,505
Plug Load Controls	\$259,517	\$58,391
Etemp	\$82,936	\$18,661
Walk-In Refrigeration Controls	\$107,648	\$24,221
Retro-Commissioning	\$361,036	\$81,233
Combined Heating & Power	\$205,101	\$46,148
Hot Water Boiler Plant Replacement	\$1,912,880	\$430,398
Steam Boiler Replacements	\$0	\$0
Chiller Replacements	\$0	\$0
Unit Ventilator Replacements	\$0	\$0
Solar PPA	\$0	\$0
Stadium Lighting	\$346,000	\$77,850
Practice Field Lighting	\$0	\$0
De-stratification Fans	\$212,050	\$47,711
Window Film	\$792,004	\$178,201
HVAC Armor	\$858,225	\$193,101
TOTALS	\$14,485,847	\$3,259,315



ENERGY SAVINGS PLAN

APPENDIX B – DESIGN BID BUILD

Appendix B – Design Bid Build Procedures

Design–bid–build (or **design/bid/build**, and abbreviated **D–B–B** or **D/B/B** accordingly), also known as **Design–tender** (or "design/tender") **traditional method** or **hard bid** is the method of delivery for this project.

Design–bid–build is the traditional method for project delivery and differs in several substantial aspects from design–build.

There are three main sequential phases to the design–bid–build delivery method:

- The design phase.
- The bidding (or tender) phase
- The construction phase.

Design Phase

In this phase DCO will design and produce bid documents, including construction drawings and technical specifications, on which various contractors will in turn bid to construct the project.

The Energy Savings Plan (ESP) is intended to document the owner's project requirements and provide a conceptual and/or schematic design and good faith estimates.

With the ESP DCO will bring in other design professionals including mechanical, electrical, and plumbing engineers (MEP specifications engineers), a fire protection engineer, structural engineer, sometimes a civil engineer and a landscape architect to help complete the construction drawings and technical.

The design document should reflect the intent of the energy savings plan for scope, price, savings, operations & maintenance savings, incentive and schedule.

The finished bid documents are coordinated by the DCO and owner for issuance to contractors during the bid phase.

Bid (or tender) phase

Bidding is according to NJ Public Bid Law and is "open", in which any qualified bidder may participate.

The various contractors bidding obtains bid documents, and then put them out to multiple subcontractors for bids on sub-components of the project.

Questions may arise during the bid period, and DCO will issue clarifications or corrections to the bid documents in the form of addenda.

From these elements, the contractor compiles a complete bid for submission by the established closing date and time bid date.

Bids are to be based on a base bid lump sum plus alternates, bid requirements and alternates are elucidated within the bid documents.

Once bids are received, DCO reviews the bids, seeks any clarifications required of the bidders, investigates contractor qualifications, ensures all documentation is in order (including bonding if required), and advises the owner as to the ranking of the bids.

If the bids fall in a range acceptable to the owner, the project is awarded to the contractor with the lowest reasonable bid.

In the event that all of the bids do not satisfy the needs of the owner the following options become available to DCO:

- Rebid the construction of the project in the future when monies become available and/or construction costs go down.
- Revise the design of that ECM (at no cost to the client) so as to make the project smaller or reduce features or elements of the project to bring the cost down. The revised bid documents can then be issued again for bid.
 - DCO will provide guidance on energy savings, operation and maintenance savings and incentives to ensure the project is self-funding.
- Revise the design of future ECM(s) (at no cost to the client) so as to make the project smaller or reduce features or elements of the project to bring the cost down. The current bid package can then be contracted.
 - DCO will provide guidance on energy savings, operation and maintenance savings and incentives to ensure the project is self-funding.

Construction phase

Once the construction of the project has been awarded to the contractor, the bid documents (e.g., approved construction drawings and technical specifications) may not be altered.

The necessary permits (for example, a building permit) must be achieved from all jurisdictional authorities in order for the construction process to begin.

Should design changes be necessary during construction, whether initiated by the contractor, owner, or as discovered by the architect, DCO will issue sketches or written clarifications and handle the project through allowance (See Appendix A).

The contractor may be required to document "as built" conditions to the owner.

Bidding Method

- To achieve energy savings and fund debt service payments as rapidly as possible the bid packages will be bid in the following order:

BID METHOD SCHEDULE		
ENERGY CONSERVATION MEASURE	Cost + Allowance	SAVINGS
LED Lighting Volumetric Kit Retrofit	\$4,388,424	\$455,395
Lighting Controls	\$549,688	\$53,396
Pipe and Valve Insulation	\$123,042	\$7,663
Building Envelope Weatherization	\$1,080,751	\$66,815
Plug Load Controls	\$317,908	\$25,138
Etemp	\$101,597	\$20,329
Walk-In Refrigeration Controls	\$131,869	\$8,028
Retro-Commissioning	\$442,269	\$32,298
Solar PPA	\$0	\$543,587
Roof Renovations	\$5,309,946	\$1,631
Combined Heating & Power	\$251,249	\$2,382
Destratification Fans	\$259,761	\$20,581
Window Film	\$970,205	\$86,691
HVAC Armor	\$1,051,326	\$60,191
Hot Water Boiler Plant Replacement	\$2,343,278	\$8,902
Stadium Lighting	\$423,850	\$823
TOTALS	\$17,745,162	\$1,393,850

- Bids in group 1 (Green) are within 15% of the budget value they will be awarded.
- Bids in group 2 (Yellow) may be value engineered from the project to meet budget.
 - DCO will provide the impact of ECMs value engineered:
 - Energy Savings
 - Operations and Maintenance Savings
 - Incentive
- Bids in group 3 (Red) may be value engineered **or removed** from the project to meet budget.
 - DCO will provide the impact of ECMs value engineered or removed:
 - Energy Savings
 - Operations and Maintenance Savings
 - Incentive
- As per ESIP law DCO fee will be applied to the ECM hard cost.
 - DCO will receive no compensation for bids that are under budget.
 - DCO will receive no penalty for bids that are over budget.
- If the budget overruns make savings unachievable at the current budget, DCO will provide additional ECMs above the budget to meet the required energy savings.



ENERGY SAVINGS PLAN

APPENDIX C – OPERATIONS AND MAINTENANCE SAVINGS

Appendix C – Operation & Maintenance Savings

Operations and Maintenance and other non-energy-related cost savings are allowable in NJ ESIPs, and are defined as reduction in expenses (other than energy cost savings) related to energy and water consuming equipment:

Energy-related cost savings can result from avoided expenditures for operations, maintenance, equipment repair, or equipment replacement due to the ESIP project.

Sources of O&M savings include:

- Termination of service personnel
- Lower maintenance service contract costs
- Decrease in repair costs.
 - Avoided repair and replacement costs as a result of replacing old and unreliable equipment.
 - Material savings due to new equipment warranties
 - Material savings due to the longer life items not needing replacement.
 - In particular, reduction in florescent bulbs due to LED

Termination of service personnel

As a result of the ESIP, a number of the client's maintenance staff members may no longer be required. If there is a reduction in the government's maintenance staff, O&M savings can be claimed.

A problem could arise if the maintenance staff is not reduced. Then it would be necessary to determine what new O&M responsibilities the facility has taken on, or savings should not be claimed. For example, it could be that a new building was constructed. During the performance period, it is important to establish that any increased maintenance was not due to the equipment installed under the ESIP.

Lower maintenance service contract costs

Prior to the implementation of the ESIP mechanical and electrical equipment was maintained by a third party under a maintenance contract. The ESIP replaces the aging equipment with newer, more efficient equipment, which can reduce the service costs to the client.

Decrease in repair costs.

The client is responsible for maintenance both before and after the equipment installation. Although there is no reduction in staff for which to claim labor savings, there will be cost savings on replacement materials.

Material-related savings frequently result from lighting and lighting controls projects.

For this project, lighting maintenance savings will result from the following:

1. Reduced material requirements (e.g., lamps)
2. Reduced operating time — Control measures increase equipment life by reducing the burn time of lamps and ballasts.
3. Warranty-related savings — newly installed lamps, and fixtures come with a manufacturer warranty of 10 years.

Year 1 O&M Savings

Washington Township Public Schools		ANNUAL O&M COST SAVINGS
ECM #	ENERGY CONSERVATION MEASURE	\$
2	LED Lighting Volumetric Kit Retrofit	\$ 18,180
10	Retro-Commissioning	\$ 35,232
12	Hot Water Boiler Plant Replacement	\$ 16,455
21	HVAC Armor	\$ 43
TOTALS		\$ 69,909



ENERGY SAVINGS PLAN

APPENDIX D – PROJECT CHANGES IN FINANCING

Appendix D – Project Changes in Financing

The Energy savings plan has been approved using:

Interest rate of 4.00%
Term: 20 Years
Construction Term 24 Months
Construction Interest Only Payment of TBD
Annual Surplus of no less than \$2,400

During financing DCO will provide assistance but does not guarantee the timing of savings or incentives.

While beneficial to the client financing changes are the responsibility of the client, bond counsel and/or financial advisor. DCO represents in no way advice on these financial items

Financial items may include but are not limited to:

- Timing of payments
- Splitting payments into bi-annual, tri-annual, etc.
- Coordination with the client's fiscal year
- Local finance board material, forms and presentations
- Multiple tiered interest rates



ENERGY SAVINGS PLAN

APPENDIX E – INCENTIVES IN DEBT SERVICE

Appendix E – Incentives in Debt Service



As part of the Energy Savings Plan for Washington Township School District, prescriptive & custom rebates through Atlantic City Electric and South Jersey Gas were investigated. The estimated incentive amount is listed below. Upon final selection of the project scope and award of subcontractor bids, the incentive applications will be filed.

Incentive Calculations

Washington Township Public Schools			Estimated Incentive
ECM #	BUILDING/FACILITY	ENERGY CONSERVATION MEASURE	\$
2	Washington Township High School	LED Lighting Volumetric Kit Retrofit	183,827.70
5	Washington Township High School	Pipe and Valve Insulation	5,809.69
6	Washington Township High School	Building Envelope Weatherization	46,706.88
9	Washington Township High School	Walk-In Refrigeration Controls	300.00
2	Chestnut Ridge Middle School	LED Lighting Volumetric Kit Retrofit	42,253.20
5	Chestnut Ridge Middle School	Pipe and Valve Insulation	1,878.27
6	Chestnut Ridge Middle School	Building Envelope Weatherization	11,827.18
9	Chestnut Ridge Middle School	Walk-In Refrigeration Controls	150.00
12	Chestnut Ridge Middle School	Hot Water Boiler Plant Replacement	10,304.24
2	Orchard Valley Middle School	LED Lighting Volumetric Kit Retrofit	44,595.00
5	Orchard Valley Middle School	Pipe and Valve Insulation	2,961.90
6	Orchard Valley Middle School	Building Envelope Weatherization	14,290.09
9	Orchard Valley Middle School	Walk-In Refrigeration Controls	150.00
12	Orchard Valley Middle School	Hot Water Boiler Plant Replacement	10,304.24
2	Bunker Hill Middle School	LED Lighting Volumetric Kit Retrofit	49,620.60
5	Bunker Hill Middle School	Pipe and Valve Insulation	1,444.48
6	Bunker Hill Middle School	Building Envelope Weatherization	17,437.40
9	Bunker Hill Middle School	Walk-In Refrigeration Controls	150.00
2	Thomas Jefferson Elementary School	LED Lighting Volumetric Kit Retrofit	20,071.80
6	Thomas Jefferson Elementary School	Building Envelope Weatherization	398.54
9	Thomas Jefferson Elementary School	Walk-In Refrigeration Controls	150.00
2	Hurffville Elementary School	LED Lighting Volumetric Kit Retrofit	19,314.90
5	Hurffville Elementary School	Pipe and Valve Insulation	2,922.16
6	Hurffville Elementary School	Building Envelope Weatherization	11,009.39
9	Hurffville Elementary School	Walk-In Refrigeration Controls	150.00

Washington Township Public Schools			Estimated Incentive
ECM #	BUILDING/FACILITY	ENERGY CONSERVATION MEASURE	\$
2	Whitman Elementary School	LED Lighting Volumetric Kit Retrofit	21,357.90
5	Whitman Elementary School	Pipe and Valve Insulation	765.29
6	Whitman Elementary School	Building Envelope Weatherization	12,214.46
9	Whitman Elementary School	Walk-In Refrigeration Controls	150.00
2	Birches Elementary School	LED Lighting Volumetric Kit Retrofit	21,187.80
5	Birches Elementary School	Pipe and Valve Insulation	1,291.29
6	Birches Elementary School	Building Envelope Weatherization	11,488.23
2	Bells Elementary School	LED Lighting Volumetric Kit Retrofit	17,290.80
5	Bells Elementary School	Pipe and Valve Insulation	746.62
6	Bells Elementary School	Building Envelope Weatherization	11,941.29
2	Wedgwood Elementary School	LED Lighting Volumetric Kit Retrofit	16,792.20
5	Wedgwood Elementary School	Pipe and Valve Insulation	1,061.28
6	Wedgwood Elementary School	Building Envelope Weatherization	11,016.46
2	Grenloch Early Childhood Center	LED Lighting Volumetric Kit Retrofit	12,177.90
5	Grenloch Early Childhood Center	Pipe and Valve Insulation	365.61
6	Grenloch Early Childhood Center	Building Envelope Weatherization	2,637.52
2	O'Brien Hall	LED Lighting Volumetric Kit Retrofit	2,052.00
2	Administration Building	LED Lighting Volumetric Kit Retrofit	10,453.50
6	Administration Building	Building Envelope Weatherization	675.22
2	Operations Building	LED Lighting Volumetric Kit Retrofit	1,980.00
6	Operations Building	Building Envelope Weatherization	43.23
2	Warehouse	LED Lighting Volumetric Kit Retrofit	1,470.60
9	Warehouse	Walk-In Refrigeration Controls	150.00
2	Bus Garage	LED Lighting Volumetric Kit Retrofit	789.30

Estimated incentive values for the Washington Township School District ESIP project were calculated using prescriptive & custom rebates through Atlantic City Electric and South Jersey Gas. The total incentive amount was calculated to be \$658,126.

No implied and/or written guarantee is made regarding the receipt of incentives. All incentives estimates carry inherent risks that may jeopardize the receipt of them. Therefore, Washington Township School District acknowledges and accepts that any project proposed should not rely on the receipt of incentives as a reason to implement it.



ENERGY SAVINGS PLAN

APPENDIX F – ECM BREAKDOWN BY BUILDING

Washington Township Public Schools % SAVINGS BY BUILDING (T.O.R.)

Washington Township Public Schools BUILDINGS/FACILITIES		ELECTRIC DEMAND SAVINGS	ONSITE ELECTRIC SAVINGS	NATURAL GAS SAVINGS
BUILDING/FACILITY NAME	SQFT	kW	kWh	Therms
Washington Township High School	450,130	20.4%	29.8%	15.4%
Chestnut Ridge Middle School	108,813	18.3%	29.9%	18.4%
Orchard Valley Middle School	108,813	20.6%	30.5%	23.4%
Bunker Hill Middle School	106,574	22.6%	41.2%	13.7%
Thomas Jefferson Elementary School	72,396	12.1%	26.2%	13.6%
Hurffville Elementary School	65,655	18.7%	32.5%	31.0%
Whitman Elementary School	64,411	28.1%	44.3%	20.7%
Birches Elementary School	63,411	22.8%	45.4%	19.6%
Bells Elementary School	62,617	23.2%	44.7%	20.2%
Wedgwood Elementary School	60,697	12.9%	34.1%	20.5%
Grenloch Early Childhood Center	39,936	19.9%	42.1%	-6.0%
O'Brien Hall	22,900	4.0%	21.1%	-0.8%
Administration Building	20,000	12.2%	41.0%	2.8%
Operations Building	5,625	11.8%	30.0%	-
Warehouse	5,400	9.8%	28.4%	-0.4%
Bus Garage	4,500	1.0%	11.4%	0.0%
Washington Township High School Stadium	-	0.0%	26.6%	-
TOTALS	1,261,878	20.4%	32.9%	16.9%

Washington Township Public Schools SAVINGS BY BUILDING BY UTILITY FROM SMART SELECT

Washington Township Public Schools BUILDINGS/FACILITIES		ELECTRIC CONSUMPTION SAVINGS	ELECTRIC DEMAND SAVINGS	ONSITE ELECTRIC SAVINGS	NATURAL GAS SAVINGS
BUILDING/FACILITY NAME	SQFT	kWh	kW	kWh	Therms
Washington Township High School	450,130	1,726,457	428	1,726,457	24,118
Chestnut Ridge Middle School	108,813	392,738	98	392,738	9,899
Orchard Valley Middle School	108,813	406,544	96	406,544	10,460
Bunker Hill Middle School	106,574	475,605	98	475,605	6,115
Thomas Jefferson Elementary School	72,396	198,790	50	198,790	480
Hurffville Elementary School	65,655	195,914	51	195,914	4,395
Whitman Elementary School	64,411	221,043	71	221,043	4,351
Birches Elementary School	63,411	237,637	70	237,637	3,711
Bells Elementary School	62,617	225,312	65	225,312	3,762
Wedgwood Elementary School	60,697	205,929	51	205,929	3,904
Grenloch Early Childhood Center	39,936	114,742	40	114,742	(495)
O'Brien Hall	22,900	21,786	5	21,786	(39)
Administration Building	20,000	64,143	9	64,143	113
Operations Building	5,625	16,486	4	16,486	0
Warehouse	5,400	21,263	2	21,263	(10)
Bus Garage	4,500	4,087	0	4,087	(1)
Washington Township High School Stadium	-	4,843	0	4,843	0
TOTALS	1,261,878	4,533,320	428	4,533,320	70,762

ECMs evaluated and included in the ESIP

Washington Township Public Schools			INCLUDED IN PROJECT	INSTALLED COST	ANNUAL ELECTRIC COST SAVINGS	ANNUAL NATURAL GAS COST SAVINGS	ANNUAL ENERGY COST SAVINGS	SIMPLE PAYBACK WITHOUT INCENTIVES	ELECTRIC CONSUMPTION SAVINGS	ELECTRIC DEMAND SAVINGS	NATURAL GAS SAVINGS	TOTAL SITE ENERGY SAVINGS	TOTAL SOURCE ENERGY SAVINGS	Reduction of CO ₂	Reduction of NO _x	Reduction of SO ₂	Reduction of Hg
ECM #	BUILDING/FACILITY	ENERGY CONSERVATION MEASURE	"Y" OR "N"	\$	\$	\$	\$	YEARS	kWh	kW	THERMS	MMBTU	MMBTU	LBS	LBS	LBS	LBS
2	Washington Township High School	LED Lighting Volumetric Kit Retrofit	Y	\$1,294,905	\$186,717	(\$2,298)	\$184,419	7.0	1,121,334	244	(2,004)	3,626	12,569	1,680,976.02	3,121.29	7,288.67	0.40
3	Washington Township High School	Lighting Controls	Y	\$156,843	\$20,697	\$0	\$20,697	7.6	120,017	31	0	409	1,368	182,426.34	336.05	780.11	0.04
4	Washington Township High School	Roof Renovations	Y	\$2,388,825	\$2	\$896	\$898	2659.8	14	0	782	78	82	9,168.22	7.23	0.09	0.00
5	Washington Township High School	Pipe and Valve Insulation	Y	\$29,915	\$0	\$1,903	\$1,903	15.7	0	0	1,660	166	174	19,420.95	15.27	0.00	0.00
6	Washington Township High School	Building Envelope Weatherization	Y	\$292,344	\$4,419	\$13,538	\$17,957	16.3	33,597	0	11,809	1,296	1,619	189,232.01	202.71	218.38	0.01
7	Washington Township High School	Plug Load Controls	Y	\$83,979	\$8,950	\$0	\$8,950	9.4	68,039	0	0	232	775	103,419.87	190.51	442.26	0.02
8	Washington Township High School	Eltemp	Y	\$37,025	\$8,223	\$0	\$8,223	4.5	62,514	0	0	213	712	95,021.28	175.04	406.34	0.02
9	Washington Township High School	Walk-In Refrigeration Controls	Y	\$22,499	\$1,542	\$0	\$1,542	14.6	11,655	0	0	40	133	17,714.88	32.63	75.75	0.00
10	Washington Township High School	Retro-Commissioning	Y	\$135,039	\$10,893	\$3,108	\$14,000	9.6	82,805	0	2,711	554	1,227	157,580.45	256.79	538.24	0.03
11	Washington Township High School	Combined Heating & Power	Y	\$205,101	\$2,933	(\$551)	\$2,382	86.1	16,914	4	(481)	10	142	16,231.27	9.62	11.33	0.00
16	Washington Township High School	Solar PPA	Y	\$0	\$303,658	\$0	\$303,658	0.0	0	0	0	0	31,925	4,258,102.16	7,843.87	18,208.99	1.00
19	Washington Township High School	Deaerification Fans	Y	\$72,375	(\$600)	\$7,086	\$6,486	11.2	(4,560)	0	6,181	603	595	65,386.59	44.10	-29.64	0.00
20	Washington Township High School	Window Film	Y	\$204,269	\$33,949	\$3,967	\$37,916	5.4	164,500	77	3,461	907	2,237	290,528.15	492.44	1,969.25	0.06
21	Washington Township High School	HVAC Armor	Y	\$46,975	\$18,200	\$0	\$18,200	13.6	49,628	73	0	169	566	75,434.11	138.96	322.58	0.02
2	Chestnut Ridge Middle School	LED Lighting Volumetric Kit Retrofit	Y	\$334,973	\$39,900	(\$641)	\$39,258	8.5	244,867	52	(430)	792	2,745	367,164.98	681.67	1,591.64	0.09
3	Chestnut Ridge Middle School	Lighting Controls	Y	\$19,048	\$4,971	\$0	\$4,971	3.8	23,350	7	0	100	334	44,612.55	82.18	190.78	0.01
4	Chestnut Ridge Middle School	Roof Renovations	Y	\$170,750	\$0	\$80	\$80	2136.7	1	0	54	5	6	627.55	0.49	0.01	0.00
5	Chestnut Ridge Middle School	Pipe and Valve Insulation	Y	\$7,357	\$0	\$800	\$800	9.2	0	0	537	54	56	6,278.79	4.94	0.00	0.00
6	Chestnut Ridge Middle School	Building Envelope Weatherization	Y	\$63,878	\$1,013	\$4,503	\$5,517	11.6	7,850	0	3,020	329	406	47,269.61	49.77	51.02	0.00
7	Chestnut Ridge Middle School	Plug Load Controls	Y	\$18,012	\$1,826	\$0	\$1,826	9.9	14,142	0	0	48	161	21,496.30	39.60	91.92	0.01
8	Chestnut Ridge Middle School	Eltemp	Y	\$4,443	\$1,470	\$0	\$1,470	3.0	11,385	0	0	39	130	17,305.20	31.88	74.00	0.00
9	Chestnut Ridge Middle School	Walk-In Refrigeration Controls	Y	\$11,250	\$766	\$0	\$766	14.7	5,827	0	0	20	66	8,857.44	16.32	37.88	0.00
10	Chestnut Ridge Middle School	Retro-Commissioning	Y	\$32,644	\$2,425	\$1,338	\$3,763	8.7	18,787	0	897	154	308	39,054.27	60.86	122.11	0.01
12	Chestnut Ridge Middle School	Hot Water Boiler Plant Replacement	Y	\$971,650	\$0	\$4,390	\$4,390	221.4	0	0	2,944	294	308	34,445.60	27.09	0.00	0.00
16	Chestnut Ridge Middle School	Solar PPA	Y	\$0	\$26,762	\$0	\$26,762	0.0	0	0	0	0	2,882	384,338.08	707.99	1,643.55	0.09
19	Chestnut Ridge Middle School	Deaerification Fans	Y	\$19,275	(\$157)	\$2,160	\$2,003	9.6	(1,216)	0	1,449	141	138	15,104.37	9.93	-7.90	0.00
20	Chestnut Ridge Middle School	Window Film	Y	\$63,854	\$8,573	\$2,130	\$10,702	6.0	48,726	14	1,428	309	705	90,774.63	149.57	316.72	0.02
21	Chestnut Ridge Middle School	HVAC Armor	Y	\$30,815	\$5,397	\$0	\$5,397	5.7	13,019	23	0	44	148	19,789.27	36.45	84.63	0.00
2	Orchard Valley Middle School	LED Lighting Volumetric Kit Retrofit	Y	\$346,925	\$44,999	(\$711)	\$44,288	7.8	261,302	56	(454)	845	2,929	391,752.63	727.38	1,698.46	0.09
3	Orchard Valley Middle School	Lighting Controls	Y	\$10,174	\$5,390	\$0	\$5,390	1.9	30,233	8	0	103	345	45,953.77	84.65	196.51	0.01
4	Orchard Valley Middle School	Roof Renovations	Y	\$168,500	\$0	\$81	\$81	2081.3	1	0	53	5	6	618.43	0.49	0.01	0.00
5	Orchard Valley Middle School	Pipe and Valve Insulation	Y	\$12,074	\$0	\$1,297	\$1,297	9.3	0	0	846	85	89	9,901.22	7.79	0.00	0.00
6	Orchard Valley Middle School	Building Envelope Weatherization	Y	\$77,383	\$1,306	\$5,595	\$6,901	11.2	9,462	0	3,650	397	490	57,091.18	60.08	61.50	0.00
7	Orchard Valley Middle School	Plug Load Controls	Y	\$18,237	\$1,917	\$0	\$1,917	9.5	13,882	0	0	47	158	21,100.81	38.87	90.23	0.00
8	Orchard Valley Middle School	Eltemp	Y	\$2,962	\$1,315	\$0	\$1,315	2.3	9,522	0	0	32	109	14,473.44	26.66	61.89	0.00
9	Orchard Valley Middle School	Walk-In Refrigeration Controls	Y	\$10,521	\$809	\$0	\$809	13.0	5,827	0	0	20	66	8,857.44	16.32	37.88	0.00
10	Orchard Valley Middle School	Retro-Commissioning	Y	\$32,644	\$2,610	\$1,070	\$3,680	8.9	18,901	0	698	134	289	36,901.44	59.35	122.86	0.01
12	Orchard Valley Middle School	Hot Water Boiler Plant Replacement	Y	\$941,230	\$0	\$4,512	\$4,512	208.6	0	0	2,944	294	308	34,445.60	27.09	0.00	0.00
16	Orchard Valley Middle School	Solar PPA	Y	\$0	\$27,609	\$0	\$27,609	0.0	0	0	0	0	2,731	364,264.96	671.01	1,557.71	0.09
19	Orchard Valley Middle School	Deaerification Fans	Y	\$19,325	(\$168)	\$2,345	\$2,177	8.9	(1,216)	0	1,530	149	146	16,052.77	10.67	-7.90	0.00
20	Orchard Valley Middle School	Window Film	Y	\$60,036	\$7,443	\$1,842	\$9,284	6.5	40,496	12	1,202	258	587	75,612.08	124.44	263.23	0.01
21	Orchard Valley Middle School	HVAC Armor	Y	\$32,985	\$5,673	\$0	\$5,673	5.8	18,133	20	0	62	207	27,562.21	50.77	117.86	0.01

ECMs evaluated and included in the ESIP

Washington Township Public Schools			INCLUDED IN PROJECT	INSTALLED COST	ANNUAL ELECTRIC COST SAVINGS	ANNUAL NATURAL GAS COST SAVINGS	ANNUAL ENERGY COST SAVINGS	SIMPLE PAYBACK WITHOUT INCENTIVES	ELECTRIC CONSUMPTION SAVINGS	ELECTRIC DEMAND SAVINGS	NATURAL GAS SAVINGS	TOTAL SITE ENERGY SAVINGS	TOTAL SOURCE ENERGY SAVINGS	Reduction of CO ₂	Reduction of NO _x	Reduction of SO ₂	Reduction of Hg
ECM #	BUILDING/FACILITY	ENERGY CONSERVATION MEASURE	"Y" OR "N"	\$	\$	\$	\$	YEARS	kWh	kW	THERMS	MMBTU	MMBTU	LBS	LBS	LBS	LBS
2	Bunker Hill Middle School	LED Lighting Volumetric Kit Retrofit	Y	\$381,253	\$53,925	(\$830)	\$53,095	7.2	356,155	72	(\$89)	1,156	3,997	534,464.25	991.82	2,315.01	0.13
3	Bunker Hill Middle School	Lighting Controls	Y	\$25,095	\$5,245	\$0	\$5,245	4.8	32,781	8	0	112	374	49,827.60	91.79	213.08	0.01
5	Bunker Hill Middle School	Pipe and Valve Insulation	Y	\$10,250	\$0	\$582	\$582	17.6	0	0	413	41	43	4,828.70	3.80	0.00	0.00
6	Bunker Hill Middle School	Building Envelope Weatherization	Y	\$100,311	\$1,382	\$6,272	\$7,654	13.1	11,627	0	4,451	485	598	69,745.41	73.50	75.58	0.00
7	Bunker Hill Middle School	Plug Load Controls	Y	\$19,137	\$1,674	\$0	\$1,674	11.4	14,083	0	0	48	160	21,406.62	39.43	91.54	0.01
8	Bunker Hill Middle School	Ettemp	Y	\$2,962	\$1,132	\$0	\$1,132	2.6	9,522	0	0	32	109	14,473.44	26.66	61.89	0.00
9	Bunker Hill Middle School	Walk-In Refrigeration Controls	Y	\$11,250	\$707	\$0	\$707	15.9	5,827	0	0	20	66	8,857.44	16.32	37.88	0.00
10	Bunker Hill Middle School	Retro-Commissioning	Y	\$31,972	\$1,645	\$1,111	\$2,756	11.6	13,838	0	788	126	240	30,257.17	46.00	89.94	0.00
19	Bunker Hill Middle School	Deaerification Fans	Y	\$19,300	(\$145)	\$2,516	\$2,372	8.1	(1,216)	0	1,786	174	173	19,043.65	13.02	-7.90	0.00
20	Bunker Hill Middle School	Window Film	Y	\$87,695	\$6,583	(\$1,034)	\$5,549	15.8	32,099	17	(734)	36	289	40,209.14	83.13	208.65	0.01
21	Bunker Hill Middle School	HVAC Armor	Y	\$5,570	\$247	\$0	\$247	22.6	888	1	0	3	10	1,349.12	2.49	5.77	0.00
2	Thomas Jefferson Elementary School	LED Lighting Volumetric Kit Retrofit	Y	\$161,614	\$17,146	\$0	\$17,146	9.4	114,348	28	0	390	1,303	173,809.65	320.18	743.26	0.04
3	Thomas Jefferson Elementary School	Lighting Controls	Y	\$12,131	\$2,116	\$0	\$2,116	5.7	13,417	4	0	46	153	20,393.88	37.57	87.21	0.00
4	Thomas Jefferson Elementary School	Roof Renovations	Y	\$322,425	\$1	\$0	\$1	297983.2	10	0	0	0	0	14.73	0.03	0.06	0.00
6	Thomas Jefferson Elementary School	Building Envelope Weatherization	Y	\$17,418	\$278	\$0	\$278	62.6	2,491	0	0	8	28	3,786.17	6.97	16.19	0.00
7	Thomas Jefferson Elementary School	Plug Load Controls	Y	\$19,362	\$1,676	\$0	\$1,676	11.6	15,007	0	0	51	171	22,811.00	42.02	97.55	0.01
8	Thomas Jefferson Elementary School	Ettemp	Y	\$5,924	\$1,445	\$0	\$1,445	4.1	12,938	0	0	44	147	19,665.00	36.23	84.09	0.00
9	Thomas Jefferson Elementary School	Walk-In Refrigeration Controls	Y	\$11,250	\$655	\$0	\$655	17.2	5,827	0	0	20	66	8,857.44	16.32	37.88	0.00
10	Thomas Jefferson Elementary School	Retro-Commissioning	Y	\$21,719	\$1,279	\$0	\$1,279	17.0	11,452	0	0	39	131	17,406.40	32.06	74.44	0.00
16	Thomas Jefferson Elementary School	Solar PPA	Y	\$0	\$40,215	\$0	\$40,215	0.0	0	0	0	0	5,229	697,420.08	1,284.72	2,982.39	0.16
19	Thomas Jefferson Elementary School	Deaerification Fans	Y	\$14,475	(\$102)	\$1,543	\$1,441	10.0	(912)	0	1,010	98	95	10,435.37	6.74	-5.93	0.00
20	Thomas Jefferson Elementary School	Window Film	Y	\$39,821	\$4,504	(\$810)	\$3,695	10.8	19,942	14	(530)	15	172	24,109.97	50.96	129.62	0.01
21	Thomas Jefferson Elementary School	HVAC Armor	Y	\$11,920	\$1,178	\$0	\$1,178	10.1	4,270	4	0	15	49	6,490.09	11.96	27.75	0.00
2	Hurffville Elementary School	LED Lighting Volumetric Kit Retrofit	Y	\$183,963	\$21,171	(\$420)	\$20,751	8.9	132,840	34	(278)	425	1,485	198,667.05	369.40	863.46	0.05
3	Hurffville Elementary School	Lighting Controls	Y	\$30,918	\$2,391	\$0	\$2,391	12.9	15,004	4	0	51	171	22,805.36	42.01	97.52	0.01
4	Hurffville Elementary School	Roof Renovations	Y	\$334,500	\$0	\$158	\$158	2107.9	2	0	105	10	11	1,227.70	0.97	0.01	0.00
5	Hurffville Elementary School	Pipe and Valve Insulation	Y	\$17,711	\$0	\$1,264	\$1,264	14.0	0	0	835	83	87	9,768.37	7.68	0.00	0.00
6	Hurffville Elementary School	Building Envelope Weatherization	Y	\$57,965	\$943	\$4,223	\$5,166	11.2	7,772	0	2,790	306	381	44,459.55	47.43	50.52	0.00
7	Hurffville Elementary School	Plug Load Controls	Y	\$8,330	\$583	\$0	\$583	14.3	4,807	0	0	16	55	7,306.23	13.46	31.24	0.00
8	Hurffville Elementary School	Ettemp	Y	\$4,443	\$1,381	\$0	\$1,381	3.2	11,385	0	0	39	130	17,305.20	31.88	74.00	0.00
9	Hurffville Elementary School	Walk-In Refrigeration Controls	Y	\$10,521	\$562	\$0	\$562	18.7	4,598	0	0	16	52	6,989.27	12.87	29.89	0.00
10	Hurffville Elementary School	Retro-Commissioning	Y	\$19,697	\$1,009	\$302	\$1,311	15.0	8,315	0	200	48	116	14,975.47	25.12	54.05	0.00
16	Hurffville Elementary School	Solar PPA	Y	\$0	\$33,032	\$0	\$33,032	0.0	0	0	0	0	3,852	513,744.80	946.37	2,196.94	0.12
19	Hurffville Elementary School	Deaerification Fans	Y	\$9,700	(\$74)	\$1,125	\$1,051	9.2	(608)	0	743	72	71	7,773.62	5.14	-3.95	0.00
20	Hurffville Elementary School	Window Film	Y	\$17,864	\$0	\$0	\$0	0.0	0	0	0	0	0	0.00	0.00	0.00	0.00
21	Hurffville Elementary School	HVAC Armor	Y	\$69,155	\$3,393	\$0	\$3,393	20.4	11,799	13	0	40	134	17,934.40	33.04	76.69	0.00

ECMs evaluated and included in the ESIP

Washington Township Public Schools			INCLUDED IN PROJECT	INSTALLED COST	ANNUAL ELECTRIC COST SAVINGS	ANNUAL NATURAL GAS COST SAVINGS	ANNUAL ENERGY COST SAVINGS	SIMPLE PAYBACK WITHOUT INCENTIVES	ELECTRIC CONSUMPTION SAVINGS	ELECTRIC DEMAND SAVINGS	NATURAL GAS SAVINGS	TOTAL SITE ENERGY SAVINGS	TOTAL SOURCE ENERGY SAVINGS	Reduction of CO ₂	Reduction of NO ₂	Reduction of SO ₂	Reduction of Hg
ECM #	BUILDING/FACILITY	ENERGY CONSERVATION MEASURE	"Y" OR "N"	\$	\$	\$	\$	YEARS	kWh	kW	THERMS	MMBTU	MMBTU	LBS	LBS	LBS	LBS
2	Whitman Elementary School	LED Lighting Volumetric Kit Retrofit	Y	\$188,714	\$17,569	(\$324)	\$17,246	10.9	115,838	26	(215)	374	1,298	173,553.55	322.36	752.95	0.04
3	Whitman Elementary School	Lighting Controls	Y	\$44,356	\$2,825	\$0	\$2,825	15.7	18,091	5	0	62	206	27,498.59	50.66	117.59	0.01
4	Whitman Elementary School	Roof Renovations	Y	\$487,025	\$0	\$213	\$213	2287.3	3	0	141	14	15	1,659.26	1.31	0.02	0.00
5	Whitman Elementary School	Pipe and Valve Insulation	Y	\$4,786	\$0	\$329	\$329	14.6	0	0	219	22	23	2,558.24	2.01	0.00	0.00
6	Whitman Elementary School	Building Envelope Weatherization	Y	\$64,489	\$1,075	\$4,606	\$5,681	11.4	9,310	0	3,064	338	427	50,002.56	54.26	60.51	0.00
7	Whitman Elementary School	Plug Load Controls	Y	\$17,161	\$817	\$0	\$817	21.0	7,074	0	0	24	81	10,752.63	19.81	45.98	0.00
8	Whitman Elementary School	Eltemp	Y	\$5,924	\$1,076	\$0	\$1,076	5.5	9,315	0	0	32	106	14,158.80	26.08	60.55	0.00
9	Whitman Elementary School	Walk-In Refrigeration Controls	Y	\$11,250	\$677	\$0	\$677	16.6	5,827	0	0	20	66	8,857.44	16.32	37.88	0.00
10	Whitman Elementary School	Retro-Commissioning	Y	\$19,323	\$656	\$512	\$1,167	16.6	5,676	0	341	53	100	12,613.31	19.03	36.90	0.00
16	Whitman Elementary School	Solar PPA	Y	\$0	\$25,483	\$0	\$25,483	0.0	0	0	0	0	3,170	422,784.92	778.81	1,807.96	0.10
19	Whitman Elementary School	De-stratification Fans	Y	\$14,400	(\$105)	\$1,367	\$1,262	11.4	(912)	0	910	88	85	9,258.33	5.82	-5.93	0.00
20	Whitman Elementary School	Window Film	Y	\$76,215	\$6,148	(\$162)	\$5,985	12.7	33,270	14	(108)	103	368	49,307.26	92.16	216.26	0.01
21	Whitman Elementary School	HVAC Armor	Y	\$100,205	\$6,229	\$0	\$6,229	16.1	17,550	26	0	60	200	26,676.54	49.14	114.08	0.01
2	Birches Elementary School	LED Lighting Volumetric Kit Retrofit	Y	\$164,818	\$21,795	(\$363)	\$21,432	7.7	150,726	29	(236)	490	1,693	226,315.17	419.84	979.72	0.05
3	Birches Elementary School	Lighting Controls	Y	\$21,723	\$2,352	\$0	\$2,352	9.2	15,215	4	0	52	173	23,127.23	42.60	98.90	0.01
5	Birches Elementary School	Pipe and Valve Insulation	Y	\$6,915	\$0	\$561	\$561	12.3	0	0	369	37	39	4,316.61	3.39	0.00	0.00
6	Birches Elementary School	Building Envelope Weatherization	Y	\$60,001	\$1,013	\$4,374	\$5,387	11.1	8,915	0	2,875	318	403	47,186.30	51.41	57.95	0.00
7	Birches Elementary School	Plug Load Controls	Y	\$13,509	\$891	\$0	\$891	15.2	7,842	0	0	27	89	11,919.37	21.96	50.97	0.00
8	Birches Elementary School	Eltemp	Y	\$5,924	\$1,317	\$0	\$1,317	4.5	11,592	0	0	40	132	17,619.84	32.46	75.35	0.00
10	Birches Elementary School	Retro-Commissioning	Y	\$19,023	\$664	\$472	\$1,136	16.7	5,843	0	310	51	99	12,512.25	19.22	37.98	0.00
16	Birches Elementary School	Solar PPA	Y	\$0	\$25,663	\$0	\$25,663	0.0	0	0	0	0	3,263	435,211.52	801.71	1,861.10	0.10
19	Birches Elementary School	De-stratification Fans	Y	\$14,400	(\$104)	\$1,384	\$1,281	11.2	(912)	0	910	88	85	9,258.33	5.82	-5.93	0.00
20	Birches Elementary School	Window Film	Y	\$49,876	\$4,468	(\$783)	\$3,685	13.5	23,996	11	(515)	30	220	30,450.46	62.45	155.97	0.01
21	Birches Elementary School	HVAC Armor	Y	\$102,555	\$5,841	\$0	\$5,841	17.6	14,419	26	0	49	164	21,917.02	40.37	93.72	0.01
2	Bells Elementary School	LED Lighting Volumetric Kit Retrofit	Y	\$148,539	\$19,873	(\$327)	\$19,546	7.6	135,674	26	(216)	441	1,524	203,694.69	377.90	881.88	0.05
3	Bells Elementary School	Lighting Controls	Y	\$50,269	\$2,161	\$0	\$2,161	23.3	13,835	4	0	47	158	21,029.64	38.74	89.93	0.00
5	Bells Elementary School	Pipe and Valve Insulation	Y	\$4,786	\$0	\$323	\$323	14.8	0	0	213	21	22	2,495.85	1.96	0.00	0.00
6	Bells Elementary School	Building Envelope Weatherization	Y	\$67,368	\$1,070	\$4,523	\$5,593	12.0	9,285	0	2,987	330	419	49,064.72	53.48	60.35	0.00
7	Bells Elementary School	Plug Load Controls	Y	\$18,237	\$1,381	\$0	\$1,381	13.2	11,980	0	0	41	137	18,209.52	33.54	77.87	0.00
8	Bells Elementary School	Eltemp	Y	\$5,924	\$1,336	\$0	\$1,336	4.4	11,592	0	0	40	132	17,619.84	32.46	75.35	0.00
10	Bells Elementary School	Retro-Commissioning	Y	\$18,785	\$655	\$460	\$1,115	16.8	5,686	0	304	50	97	12,194.85	18.71	36.96	0.00
16	Bells Elementary School	Solar PPA	Y	\$0	\$25,461	\$0	\$25,461	0.0	0	0	0	0	3,175	423,459.36	780.06	1,810.85	0.10
19	Bells Elementary School	De-stratification Fans	Y	\$14,400	(\$105)	\$1,378	\$1,272	11.3	(912)	0	910	88	85	9,258.33	5.82	-5.93	0.00
20	Bells Elementary School	Window Film	Y	\$50,727	\$4,210	(\$660)	\$3,551	14.3	22,693	10	(436)	34	213	29,396.23	59.53	147.50	0.01
21	Bells Elementary School	HVAC Armor	Y	\$100,955	\$5,839	\$0	\$5,839	17.3	15,480	25	0	53	176	23,529.57	43.34	100.62	0.01

ECMs evaluated and included in the ESIP

Washington Township Public Schools			INCLUDED IN PROJECT	INSTALLED COST	ANNUAL ELECTRIC COST SAVINGS	ANNUAL NATURAL GAS COST SAVINGS	ANNUAL ENERGY COST SAVINGS	SIMPLE PAYBACK WITHOUT INCENTIVES	ELECTRIC CONSUMPTION SAVINGS	ELECTRIC DEMAND SAVINGS	NATURAL GAS SAVINGS	TOTAL SITE ENERGY SAVINGS	TOTAL SOURCE ENERGY SAVINGS	Reduction of CO ₂	Reduction of NO _x	Reduction of SO _x	Reduction of Hg
ECM #	BUILDING/FACILITY	ENERGY CONSERVATION MEASURE	"Y" OR "N"	\$	\$	\$	\$	YEARS	kWh	kW	THERMS	MMBTU	MMBTU	LBS	LBS	LBS	LBS
2	Wedgwood Elementary School	LED Lighting Volumetric Kit Retrofit	Y	\$140,266	\$17,808	(\$344)	\$17,464	8.0	111,391	28	(233)	357	1,245	166,589.13	309.75	724.04	0.04
3	Wedgwood Elementary School	Lighting Controls	Y	\$28,508	\$2,207	\$0	\$2,207	12.9	13,804	4	0	47	157	20,982.11	38.65	89.73	0.00
4	Wedgwood Elementary School	Roof Renovations	Y	\$462,625	\$0	\$199	\$200	2318.2	3	0	135	14	14	1,582.74	1.25	0.02	0.00
5	Wedgwood Elementary School	Pipe and Valve Insulation	Y	\$5,653	\$0	\$448	\$448	12.6	0	0	303	30	32	3,547.69	2.79	0.00	0.00
6	Wedgwood Elementary School	Building Envelope Weatherization	Y	\$59,299	\$992	\$4,085	\$5,077	11.7	8,341	0	2,766	305	385	45,043.74	48.80	54.22	0.00
7	Wedgwood Elementary School	Plug Load Controls	Y	\$18,237	\$1,134	\$0	\$1,134	16.1	9,533	0	0	33	109	14,489.60	26.69	61.96	0.00
8	Wedgwood Elementary School	Eltemp	Y	\$5,924	\$1,379	\$0	\$1,379	4.3	11,592	0	0	40	132	17,619.84	32.46	75.35	0.00
10	Wedgwood Elementary School	Retro-Commissioning	Y	\$18,209	\$966	\$458	\$1,423	12.8	8,120	0	310	59	125	15,967.23	25.59	52.78	0.00
16	Wedgwood Elementary School	Solar PPA	Y	\$0	\$35,705	\$0	\$35,705	0.0	0	0	0	0	4,273	569,993.92	1,049.99	2,437.47	0.13
19	Wedgwood Elementary School	De-stratification Fans	Y	\$14,400	(\$108)	\$1,343	\$1,235	11.7	(912)	0	910	88	85	9,258.33	5.82	-5.93	0.00
20	Wedgwood Elementary School	Window Film	Y	\$60,605	\$2,457	(\$424)	\$2,033	29.8	27,974	(5)	(287)	67	289	39,161.11	75.69	181.83	0.01
21	Wedgwood Elementary School	HVAC Armor	Y	\$92,225	\$5,872	\$0	\$5,872	15.7	16,084	25	0	55	183	24,448.24	45.04	104.55	0.01
2	Grenloch Early Childhood Center	LED Lighting Volumetric Kit Retrofit	Y	\$110,930	\$6,949	(\$78)	\$6,872	16.1	51,091	6	(52)	169	577	77,051.11	142.58	332.09	0.02
3	Grenloch Early Childhood Center	Lighting Controls	Y	\$27,271	\$1,377	\$0	\$1,377	19.8	9,235	2	0	32	105	14,036.81	25.86	60.03	0.00
5	Grenloch Early Childhood Center	Pipe and Valve Insulation	Y	\$994	\$0	\$157	\$157	6.3	0	0	104	10	11	1,222.17	0.96	0.00	0.00
6	Grenloch Early Childhood Center	Building Envelope Weatherization	Y	\$15,941	\$229	\$1,005	\$1,233	12.9	1,850	0	669	73	91	10,639.08	11.33	12.02	0.00
7	Grenloch Early Childhood Center	Plug Load Controls	Y	\$8,605	\$407	\$0	\$407	21.1	3,295	0	0	11	38	5,007.73	9.22	21.41	0.00
8	Grenloch Early Childhood Center	Eltemp	Y	\$1,481	\$256	\$0	\$256	5.8	2,070	0	0	7	24	3,146.40	5.80	13.46	0.00
10	Grenloch Early Childhood Center	Retro-Commissioning	Y	\$11,981	\$398	\$269	\$667	18.0	3,220	0	179	29	55	6,987.26	10.66	20.93	0.00
20	Grenloch Early Childhood Center	Window Film	Y	\$81,042	\$6,385	(\$2,095)	\$4,290	18.9	35,596	20	(1,395)	(18)	260	37,784.27	86.83	231.37	0.01
21	Grenloch Early Childhood Center	HVAC Armor	Y	\$57,660	\$2,155	\$0	\$2,155	26.8	8,386	11	0	29	96	12,746.59	23.48	54.51	0.00
2	O'Brien Hall	LED Lighting Volumetric Kit Retrofit	Y	\$21,993	\$3,879	(\$46)	\$3,834	5.7	18,836	5	(39)	60	211	28,170.11	52.38	122.43	0.01
7	O'Brien Hall	Plug Load Controls	Y	\$1,351	\$575	\$0	\$575	2.3	2,950	0	0	10	34	4,484.00	8.26	19.18	0.00
2	Administration Building	LED Lighting Volumetric Kit Retrofit	Y	\$78,108	\$6,600	(\$88)	\$6,512	12.0	41,260	7	(59)	135	464	62,029.19	114.99	268.19	0.01
3	Administration Building	Lighting Controls	Y	\$16,251	\$1,159	\$0	\$1,159	14.0	6,706	2	0	23	76	10,193.47	18.78	43.59	0.00
6	Administration Building	Building Envelope Weatherization	Y	\$3,967	\$62	\$257	\$319	12.5	470	0	171	19	23	2,720.23	2.89	3.96	0.00
7	Administration Building	Plug Load Controls	Y	\$12,608	\$2,082	\$0	\$2,082	6.1	15,707	0	0	54	179	23,874.61	43.98	102.10	0.01
2	Operations Building	LED Lighting Volumetric Kit Retrofit	Y	\$14,103	\$1,768	\$0	\$1,768	8.0	8,732	3	0	30	100	13,273.16	24.45	56.76	0.00
3	Operations Building	Lighting Controls	Y	\$4,070	\$205	\$0	\$205	19.9	1,012	0	0	3	12	1,537.54	2.83	6.58	0.00
6	Operations Building	Building Envelope Weatherization	Y	\$1,862	\$51	\$0	\$51	36.3	270	0	0	1	3	410.66	0.76	1.76	0.00
7	Operations Building	Plug Load Controls	Y	\$2,526	\$1,109	\$0	\$1,109	2.3	5,840	0	0	20	67	8,877.42	16.35	37.96	0.00
21	Operations Building	HVAC Armor	Y	\$7,205	\$167	\$0	\$167	43.1	632	1	0	2	7	960.58	1.77	4.11	0.00
2	Warehouse	LED Lighting Volumetric Kit Retrofit	Y	\$8,426	\$1,175	(\$16)	\$1,159	7.3	6,332	1	(10)	21	71	9,502.46	17.63	41.16	0.00
3	Warehouse	Lighting Controls	Y	\$925	\$237	\$0	\$237	3.9	1,262	0	0	4	14	1,918.83	3.53	8.21	0.00
7	Warehouse	Plug Load Controls	Y	\$225	\$117	\$0	\$117	1.9	661	0	0	2	8	1,004.42	1.85	4.30	0.00
9	Warehouse	Walk-In Refrigeration Controls	Y	\$19,107	\$2,310	\$0	\$2,310	8.3	13,008	0	0	44	148	19,772.57	36.42	84.55	0.00
2	Bus Garage	LED Lighting Volumetric Kit Retrofit	Y	\$2,859	\$608	(\$2)	\$606	4.7	3,737	0	(1)	13	42	5,663.68	10.45	24.29	0.00
3	Bus Garage	Lighting Controls	Y	\$1,143	\$60	\$0	\$60	19.0	351	0	0	1	4	533.18	0.98	2.28	0.00
17	Washington Township High School Stadium	Stadium Lighting	Y	\$346,000	\$823	\$0	\$823	420.6	4,843	0	0	17	55	7,360.60	13.56	31.48	0.00

ECMs evaluated but NOT included in the ESIP

Washington Township Public Schools			INSTALLED COST	ANNUAL ELECTRIC COST SAVINGS	ANNUAL NATURAL GAS COST SAVINGS	ANNUAL ENERGY COST SAVINGS	SIMPLE PAYBACK WITHOUT INCENTIVES	ELECTRIC CONSUMPTION SAVINGS	ELECTRIC DEMAND SAVINGS	NATURAL GAS SAVINGS	TOTAL SITE ENERGY SAVINGS	TOTAL SOURCE ENERGY SAVINGS	Reduction of CO ₂	Reduction of NO _x	Reduction of SO ₂	Reduction of Hg
ECM #	BUILDING/FACILITY	ENERGY CONSERVATION MEASURE	\$	\$	\$	\$	YEARS	kWh	kW	THERMS	MMBTU	MMBTU	LBS	LBS	LBS	LBS
1	Washington Township High School	LED Lighting Tube Retrofit	\$1,212,471	\$185,486	(\$2,762)	\$182,724	6.6	1,331,239	64	(2,409)	4,301	14,919	1,995,294.29	3,705.30	8,653.05	0.47
12	Washington Township High School	Hot Water Boiler Plant Replacement	\$996,798	\$0	\$5,023	\$5,023	198.5	0	0	4,381	438	459	51,261.05	40.31	0.00	0.00
14	Washington Township High School	Chiller Replacements	\$1,534,951	\$8,525	\$0	\$8,525	180.0	23,032	34	0	79	262	35,008.26	64.49	149.71	0.01
15	Washington Township High School	Unit Ventilator Replacements	\$4,824,219	\$3,744	\$0	\$3,744	1288.5	15,264	11	0	52	174	23,201.92	42.74	99.22	0.01
22	Washington Township High School	Threatre Electrical Upgrades	\$630,833	\$0	\$0	\$0	0.0	0	0	0	0	0	0.00	0.00	0.00	0.00
1	Chestnut Ridge Middle School	LED Lighting Tube Retrofit	\$295,380	\$50,159	(\$821)	\$49,338	6.0	306,367	67	(551)	990	3,434	459,236.38	852.76	1,991.39	0.11
1	Orchard Valley Middle School	LED Lighting Tube Retrofit	\$290,106	\$56,492	(\$908)	\$55,584	5.2	326,653	72	(592)	1,055	3,661	489,583.99	909.18	2,123.24	0.12
1	Bunker Hill Middle School	LED Lighting Tube Retrofit	\$341,039	\$65,452	(\$1,026)	\$64,426	5.3	430,114	89	(728)	1,395	4,825	645,254.00	1,197.62	2,795.74	0.15
4	Bunker Hill Middle School	Roof Renovations	\$540,575	\$0	\$215	\$215	2513.0	3	0	152	15	16	1,787.43	1.41	0.02	0.00
12	Bunker Hill Middle School	Hot Water Boiler Plant Replacement	\$895,271	\$0	\$4,566	\$4,566	196.1	0	0	3,240	324	339	37,911.32	29.81	0.00	0.00
16	Bunker Hill Middle School	Solar PPA	\$0	\$0	\$0	\$0	0.0	0	0	0	0	0	0.00	0.00	0.00	0.00
1	Thomas Jefferson Elementary School	LED Lighting Tube Retrofit	\$111,772	\$23,549	(\$445)	\$23,103	4.8	160,683	35	(291)	519	1,801	240,828.42	447.23	1,044.44	0.06
15	Thomas Jefferson Elementary School	Unit Ventilator Replacements	\$2,870,856	\$1,987	\$0	\$1,987	1444.8	9,660	6	0	33	110	14,682.83	27.05	62.79	0.00
1	Hurffville Elementary School	LED Lighting Tube Retrofit	\$180,991	\$24,991	(\$496)	\$24,495	7.4	156,811	40	(328)	502	1,753	234,517.22	436.06	1,019.27	0.06
12	Hurffville Elementary School	Hot Water Boiler Plant Replacement	\$1,119,952	\$0	\$3,651	\$3,651	306.7	0	0	2,412	241	253	28,224.10	22.19	0.00	0.00
1	Whitman Elementary School	LED Lighting Tube Retrofit	\$183,920	\$29,013	(\$551)	\$28,462	6.5	189,444	45	(367)	610	2,121	283,665.13	527.07	1,231.38	0.07
1	Birches Elementary School	LED Lighting Tube Retrofit	\$158,321	\$25,710	(\$2,031)	\$23,679	6.7	177,029	35	(1,335)	471	1,878	253,462.13	483.40	1,150.69	0.06
1	Bells Elementary School	LED Lighting Tube Retrofit	\$143,287	\$24,225	(\$1,907)	\$22,317	6.4	164,377	33	(1,260)	435	1,741	235,113.98	448.67	1,068.45	0.06
1	Wedgwood Elementary School	LED Lighting Tube Retrofit	\$133,058	\$22,486	(\$2,030)	\$20,456	6.5	140,651	36	(1,375)	342	1,459	197,706.82	381.18	914.23	0.05
1	Grenloch Early Childhood Center	LED Lighting Tube Retrofit	\$105,686	\$14,098	(\$1,036)	\$13,062	8.1	99,478	18	(690)	270	1,061	143,136.94	272.19	646.61	0.04
13	Grenloch Early Childhood Center	Steam Boiler Replacements	\$629,359	\$0	\$1,770	\$1,770	355.5	0	0	1,179	118	123	13,791.71	10.84	0.00	0.00
16	Grenloch Early Childhood Center	Solar PPA	\$0	\$0	\$0	\$0	0.0	0	0	0	0	0	0.00	0.00	0.00	0.00
1	O'Brien Hall	LED Lighting Tube Retrofit	\$19,569	\$3,879	(\$213)	\$3,666	5.3	18,836	5	(184)	46	195	26,477.17	51.05	122.43	0.01
1	Administration Building	LED Lighting Tube Retrofit	\$77,300	\$14,530	(\$1,024)	\$13,506	5.7	88,353	18	(683)	233	935	126,306.78	241.11	574.29	0.03
1	Operations Building	LED Lighting Tube Retrofit	\$13,864	\$3,087	\$0	\$3,087	4.5	15,366	4	(150)	37	159	21,599.80	41.64	99.88	0.01
1	Warehouse	LED Lighting Tube Retrofit	\$7,990	\$1,476	(\$97)	\$1,379	5.8	7,940	2	(63)	21	84	11,332.20	21.65	51.61	0.00
1	Bus Garage	LED Lighting Tube Retrofit	\$2,261	\$710	(\$14)	\$695	3.3	4,350	0	(9)	14	49	6,502.75	12.09	28.27	0.00
18	Washington Township High School Stadium	Practice Field Lighting	\$118,500	\$0	\$0	\$0	0.0	0	0	0	0	0	0.00	0.00	0.00	0.00

Note:

- **Factors used to calculate Greenhouse Gas Reductions are as follows:**
 - $CO_2 = (1.52 * kWh \text{ Savings}) + (11.7 * Therm \text{ Savings})$
 - $NO_x = (0.0028 * kWh \text{ Savings}) + (0.0092 * Therm \text{ Savings})$
 - $SO_2 = (0.0065 * kWh \text{ Savings})$
 - $Hg = (0.000000356 * kWh \text{ Savings})$



ENERGY SAVINGS PLAN

APPENDIX G – ENERGY SAVINGS SUPPLEMENTAL INFORMATION

*Refer to submission folder



ENERGY SAVINGS PLAN

APPENDIX H – LOCAL GOVERNMENT ENERGY AUDITS

*Refer to submission folder