TOWNSHIP OF SOUTH BRUNSWICK
MONMOUTH JUNCTION
FIRE DISTRICT NO. 2, STATION 20
ENERGY ASSESSMENT

for

NEW JERSEY
BUREAU OF PUBLIC UTILITIES

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CHA PROJECT NO. 20998

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APPENDICES

1.0 INTRODUCTION & BACKGROUND

This report summarizes the energy audit performed at the Monmouth Junction, Fire District No. 2, Station 20, in the Township of South Brunswick located on Ridge Road in Monmouth Junction, NJ. Built in 1996, the building is a 16,000 square foot, single story structure. The building houses fire department equipment, offices, community meeting room, members room, members' workout room, command center and auxiliary spaces.

New Jersey's Clean Energy Program, funded by the New Jersey Board of Public Utilities, supports energy efficiency and sustainability for Municipal and Local Government Energy Audits. Through the support of a utility trust fund, New Jersey is able to assist state and local authorities in reducing energy consumption while increasing comfort.

This report covers the energy audit for Station 20.

2.0 EXECUTIVE SUMMARY

This report details the results of the Monmouth Junction, Fire District No. 2, Station 20, in the Township of South Brunswick. The 16,000 square foot, single story structure houses fire department equipment, offices, community meeting room, members room, members gym, command center and auxiliary spaces. The following areas were evaluated for energy conservation measures:

- Demand control ventilation
- Lighting upgrades with occupancy sensors
- HVAC occupancy load control
- Water use reduction
- Hot water recirculation demand

Various potential Energy Conservation Measures (ECMs) were identified for the above categories. Measures which are recommended for implementation have a payback of 10 years or less. This threshold is considered a viable return on investment. Potential annual savings of $4,538 for the recommended ECMs may be realized with a payback of 4.4 years.

The ECMs identified in this report will allow for the building to reduce its energy usage and if pursued has the opportunity to qualify for the New Jersey SmartStart Buildings Program. A summary of the costs, savings, and paybacks for the recommended ECMs follows:

ECM-4 Combined Demand Ventilation (AHU 2 & 3) & Supply Air Demand Modulation (AHU 2)

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
17,900	0	6,900	1,500	3,400	1.8	NA	5.3	NA

* There is no incentive available through the New Jersey Smart Start program for this ECM.

ECM-7 Combined Lighting Fixture and Control Modifications

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
2,500	-	4000	0	700	3.2	100	3.6	3.4

* Incentive shown is per the New Jersey Smart Start Program, 2010 Lighting Controls Application. Incentive is based on the use of five wall-mounted occupancy sensors.

ECM-8 Reduced Water Use

Budgetary Cost	Annual Utility Savings			ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Water	Natural Gas	Total				
$	Gallons	Therms	$		$	Years	Years
120	1,800	13	20	1.5	NA	6.1	NA

* There is no incentive available through the New Jersey Smart Start program for this ECM.

ECM-9 Hot Water Circulation with Timer

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
300	0	400	-	75	2.8	NA	4.0	NA

* There is no incentive available through the New Jersey Smart Start program for this ECM.

3.0 EXISTING CONDITIONS

3.1 Building General

The Monmouth Junction, Fire District No. 2, Station 20, in the Township of South Brunswick, constructed in 1996, is a 16,000 square foot, single story structure. The building houses fire department equipment, offices, community meeting room, members room, memberss workout room, command center and auxiliary spaces.

South Brunswick has a volunteer fire company. As such, this building houses one full time employee. The building is also used for various functions at different times of use. The following represents average use: General Office, 1.5 full time employee, 8 hours per day, Monday through Friday; Fire Department Office, 1 part time employee, 1 hour per month; Fire District Office, 1 part time employee, 6 hours per week; Communications Office, 1part time employee, 8 hours per week; Conference Room, 8 people, 8 hours per month; Community Meeting Room, 40 people, 20 hours per month; Members Room, 10 people 10 hours per week; Workout Room, 10 people, 20 hours per week; Engine Room, as required for approximately 500 call per year.

The building was constructed in 1998 and the building's exterior shell is in good condition except for the roof. The exterior wall materials vary. Part of the building walls consists of 4" split face block, 8" concrete masonry unit and 2" rigid board insulation. Other parts consist of 4" face brick, 8" concrete masonry unit and 2" rigid board insulation. The interior of the exterior walls are finished with ½" gypsum board in the public areas and painted block in the engine room and auxiliary spaces. The roof is a modified built up roof material with rigid insulation on metal deck. There are leaks in the low roof and flashing problems at the parapet walls and pitch pockets. The entrance lobby has a skylight with an area of approximately 144 square feet. All public areas have acoustical tile ceilings. The locker and shower room areas have moisture resistant acoustical tile. The engine room and auxiliary space are painted metal deck. Exterior windows are extruded aluminum frame with fixed double pane glass, and most have partial casements. Exterior doors are aluminum with tempered safety glass. The engine room overhead doors are insulated steel. All doors appeared to have good weather-stripping.

The building was designed with many energy savings considerations, such as, individual HVAC systems for differently functioning zones, economizer controls, multilevel light switching, energy saving lighting, and programmable thermostats. Due to the limited use of the building, hours of operation, and the management of building systems, the energy use within this facility is minimalized.

3.2 Utility Usage

Utilities include electricity, natural gas, and potable water. Electricity and natural gas are purchased from Public Service Electric & Gas Company (PSE&G); potable water from South Brunswick Water and Sewer Authority.

During the period of January 2009 to December 2009, electric usage was approximately 80,382 kWh at a total cost of about $14,666. Review of electricity bills during this period determined the building was charged a supply unit cost of $0.13 per kWh, demand unit cost of $14.51 per kW, and blended unit cost of $0.1824 per kWh. Electricity usage was highest is the summer months when cooling equipment is in use. During the same 2009 timeframe, the building heat and domestic hot water (DHW) produced by natural gas-fired equipment required approximately 4,550 therms. Based on the annual cost of $5,287, the blended price for natural gas was $1.16 per therm. Natural gas consumption is highest in the winter months to produce building heat. Water bills from November 2008 to August 2009 equaled a

consumption of 15,000 gallons at a total cost of $421. The base charge was $95.55 per quarter regardless of use. The average unit cost was $2.56/kgallons. Utility data can be found in Appendix A.

Electricity and natural gas commodity supply and delivery is presently purchased from PSE&G. The delivery component will always be the responsibility of the utility that connects the facility to the power grid or gas line; however, the supply can be purchased from a third party. The electricity or natural gas commodity supply entity will require submission of one to three years of past energy bills. Contract terms can vary among suppliers. A list of approved electrical and natural gas energy commodity suppliers can be found in Appendix A.

3.3 HVAC Systems

Ventilation and air conditioning is provided to various areas of the facility as follows: Lobby, meeting/training, and offices are served by two split systems utilizing Carrier air handling units with cooling coils, Reznor gas-fired duct furnaces, and Carrier roof top condensing units. The members' room and kitchen are served by a split system utilizing a Carrier air handing unit with cooling coil and a self-contained gas furnace, and Carrier rooftop condensing unit. The workout room is served by a split system Carrier air handling unit with cooling coil, a built-in electric heating coil, and Carrier rooftop condensing unit. The storage mezzanine is served by a Carrier heating and ventilating unit with gas fired furnace. The communications room is served by a Sanyo cooling only ductless split system in conjunction with the split system serving the office area.

In total, the four heating and cooling units supply 13,470 CFM air, including 2,700 CFM of outdoor air (OA). The one heating and ventilating unit supplies 2,000 CFM air.

The following is a summary of this equipment and areas served:

Equipment	Cooling Tons	Heating MBH Input/Output	Area Served
AHU-1 & DF-1	3	75 / 60	Member's Room and Kitchen
AHU-2 & DF-2	20	300 / 240	Lobby and Meeting/Training Room
AHU-3 & DF-3	15	150 / 120	Lobby and Office Spaces
AHU-4 & DF-4	6	51 / 51	Workout Room
AHU-5	1	-	Communications Room
HV-1	-	75 / 60	Storage Mezzanine
IRH-1 through 4	-	40 / x	Engine Deck
IRH-5 through 8	-	80 / x	Engine Deck

The engine room heat is generated by eight Robert Gordon Infrared, gas-fired, heaters. Six electric cabinet unit heaters are utilized at entrances and in other areas of the facility.

There are 7 exhaust fans located throughout the building serving the restrooms, engine deck, office area, meeting room, kitchen hood, and mezzanine. There are also two supply fans on the mezzanine that provide make-up combustion air and ventilation air for the engine deck and a supply fan that provides air at the kitchen hood.

The equipment is original to the building and installed in 1996 (14 years old). Service life is estimated at 15 years for split systems of this type. A list of HVAC equipment can be found in Appendix B.

3.4 Lighting/Electrical Systems

The majority of lighting fixtures throughout the facility utilize two or three energy efficient T-8 fluorescent lamps or compact fluorescent lamps. There are a combined 35 inefficient 150 watt incandescent bulbs in the meeting/training room and the members room and 12 inefficient 150 watt halogen lamps in the meeting room. All exit signs within the building use fluorescent lamps.

Exterior building lighting, located at exterior doors, includes 12 down light fixtures using 22 watt compact fluorescent lamps and 5 double head emergency fixtures using 16 watt halogen lamps. Site lighting consists of various pole mounted metal halide lamps in the parking areas.

Emergency power is provided by a 100 kW, gas-fired, Onan generator. The unit powers the entire building except for the air conditioning compressors. The unit is located within the facility in a generator room.

3.5 Control Systems

3.5.1 HVAC Controls

Each AHU and DF combination is controlled by a wall-mounted, programmable thermostat with occupied and unoccupied cycle. AHU-3 has zoned control in the office area through the use of a Carrier "VVT" variable volume, variable temperature system. AHU-2 and AHU-3 have economizer cycles. AHU-2 also has a minimum/maximum manual switch.

The infrared heaters are controlled by two thermostats in two stages by rows. The infrared heaters are interlocked with the combustion air supply fan.

Following are the existing occupied and unoccupied heating and cooling setpoints for each AHU and DF combination:

Equipment	Heating Occ/Unocc	Cooling* Occ/Unocc	Occupied Hours
AHU-1 & DF-1	70°F / 65°F	70°F / 80°F	520
AHU-2 & DF-2	70°F / 62°F	70°F / 80°F	240
AHU-3 & DF-3	70°F / 65°F	70°F / 80°F	2080
AHU-4 & DF-4	68°F / 62°F	70°F / 80°F	1040
AHU-5	-	70°F / 80°F	416
HV-1	60°F / 60°F	-	312
IRH-1 through 4	55°F / 55°F	-	312
IRH-5 through 8	55°F / 55°F	-	312

* The existing cooling temperature setpoint is not in line with current energy codes. It should be noted that for the energy conservation measure calculations, a cooling setpoint of 75 °F was used to calculate the energy savings.

Electric reheat coils and cabinet unit heaters are controlled by a dedicated, wall-mounted thermostat located in the corresponding spaces.

The toilet room fans are interlocked with their respective air handling units. The main men's and women's exhaust fan has a manual override switch with timer. EF-2 and SF-2 are interlocked for ventilation of the engine deck and are controlled by a manual switch with two hour timer. When the vehicle exhaust system is manually started a combustion air damper is opened for make up air.

3.5.2 Lighting Controls

Most lighting in the fire department building are controlled by manual wall switches. Lighting in the restrooms, locker area, line officer's office, and the communication room are controlled by motion sensors. Additional controls include multiple switching in the office area and public areas, dual switching of lamps within the office area fixtures, and a photocell with a manual override to operate most exterior lighting. The engine deck lighting has 5 levels of control plus a photocell for the operation of night lighting, one on each engine deck.

3.6 Plumbing Systems

Domestic hot water for the facility is produced by an 81 gallon, 140 MBh, gas-fired, A.O. Smith water heater. The heater is located on the storage mezzanine and vented through the roof. A hot water circulation pump returns hot water to the heater and is controlled via a drop in return water temperature via an Aquastat. Per interview with building users, the motor on the circulation pump has failed and water delivery time to restroom fixtures is too long. Plumbing fixtures include 1.6 gallon per flush water closets with flush valves; countertop restroom sinks; urinals; ADA compliant showers; kitchen sink; mop receptor; electric water cooler; service sink; laundry sink; and exterior non-freeze wall hydrants. All flush valves and faucets meet the maximum water flow requirements of the adopted plumbing codes.

4.0 ENERGY CONSERVATION MEASURES

4.1 ECM-1 Demand Ventilation (AHU 2 & 3)

The meeting/training room and office spaces are served by two air-handling units AHU-2 and AHU-3, with a combined supply air rate of 10,120 CFM, including 2,000 CFM of outside air (OA). Each AHU draws fresh air in through an OA intake and blends it with return air prior to being treated and discharged into the room. The existing system constantly ventilates the space for maximum occupancy. If the space is occupied at less than the design level, the space is still ventilated at the maximum level. Because there is no control on the fresh air intake, the same amount of OA is treated regardless of the ventilation demand determined by space occupancy. Utilizing a demand control ventilation (DCV) system would regulate the amount of OA induced into the space based on the CO_2 levels detected within the room or return air duct. A DCV system is based on the principle that the number of people within the space is proportional to the concentration of CO_2. Controlling the outdoor air amount based on CO_2, the DCV system offers the possibility of reducing the energy consumption by reducing the over-ventilation periods during low occupancy. This ECM evaluates providing only the required fresh air to the space, decreasing the amount of OA to be treated, and reducing the annual heating and cooling loads.

According to the International Mechanical Code, the office areas require 20 CFM/person of OA and the meeting room requires 15 CFM of OA. Based on the occupancy schedule for the space and capabilities of the AHUs, it was determined that the typical required amount of OA needed to serve the office spaces is approximately 800 CFM and the meeting space requires approximately 1200 CFM. Utilizing a DCV system, the required OA in the Office spaces can be reduced to 265 CFM during occupied operating time in lieu of 800 CFM, yielding an annual savings of 261 therms and 678 kWh. Utilizing a DCV system for the Meeting Room, the required OA can be reduced to 400 CFM during occupied operating time in lieu of 1200 CFM, yielding an annual savings of 359 therms and 814 kWh.

Implementation of this measure requires installation of OA controls on the two AHUs serving the office space and the meeting room. This includes installing a CO_2 sensor within the return air duct, wiring and connections between the sensors and the unit, and reprogramming the unit's logic controller so that the unit can control the OA damper positions based on the CO_2 readings. The existing dampers are considered to be in good condition and will be retrofitted with a modulating motor for more precise damper control.

The DCV equipment has an expected life of 15 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 9,239 therms, 22,380 kWh, and $14,863.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-1 Demand Ventilation (AHU 2 & 3)

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
4,000	-	800	400	1,000	2.8	NA	4.0	NA

* There is no incentive available through the New Jersey Smart Start program for this ECM.

This measure is recommended when combined with ECM-2; see ECM-4.

4.2 ECM-2 Meeting Room Supply Air Demand Modulation (AHU 2)

Based on existing building drawings and our site survey, it is determined that air-handling unit AHU-2 is a constant volume unit. A constant volume system delivers a constant amount of airflow to a space from the air-handling unit. A room thermostat modulates the heating & cooling sections to cool & heat the airflow in response to falling or rising room temperatures. The amount of energy required to heat & cool the maximum airflow in addition to the fan energy required to constantly supply the same volume of air, regardless of space temperature, is a disadvantage of this system.

A variable air volume system delivers varying amount of airflow at a constant air temperature to distinct zones from the air-handling unit. Individual terminal air boxes serve each designated zone. To vary the amount of airflow between pre-determined maximum and minimum quantity to meet the space cooling and heating loads based on the room thermostat setting. Because the terminal air boxes can reduce the air volume based on room temperature, the total airflow at the air-handling unit is reduce thereby saving fan energy. In addition, reduced airflow will result in saving heating & cooling energy. By incorporating the Supply Air Demand modulation, it is anticipated the overall air volume delivered by the air-handling unit can be reduce to 2700 CFM during occupied hours as compared to 6000 CFM constantly during occupied hours. The expected annual savings will be 1163 therms and 6028 kWh.

The reduction in heating load is due to reduction of total air volume. The cooling load is not reduced due to balance of load based on enthalpy changes and reduced air volume. The derated CFM value was determined by load calculations and utilization of common ventilation calculation as allowed by the International Mechanical Code – 2006 to correct the outdoor air fraction. The minimum supply air volume is modulated from maximum constant volume supply to a pre-determined minimum airflow volume when space temperatures are satisfied.

Implementation of this measure requires installation of two variable air terminal boxes and associated thermostats, one variable frequency drive for the air-handling supply air fan with a static pressure sensor in the supply duct to monitor the static pressure. Also required is modification of the unit's controls programming to utilize static pressure reading to modulate airflow volume by controlling the variable frequency drive.

The supply air modulation equipment has a life expectancy of 15 years according to ASHRAE and total energy savings over the life of the project are estimated at 17,445 therms, 90,420 kWh, and $36,730.

The implementation cost and savings related to this ECM are presented in Appendix D and summarized below:

ECM-2 Meeting Room Supply Air Demand Modulation (AHU 2)

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
13,900	-	6,000	1,200	2,400	1.6	NA	5.8	NA

* There is no incentive available through the New Jersey Smart Start program for this ECM.

This measure is recommended when combined with ECM-1; see ECM-4.

4.3 ECM-3 Modify Meeting Room (AHU 2) Demand Ventilation & Supply Air Demand Modulation

By implementing Demand Control Ventilation and Supply Air Demand Modulation for AHU 2, cumulative energy and cost saving can be achieved. This measure is a combination of part of ECM-1 associated with AHU 2 and ECM-2 to allow for maximum energy consumption reduction for the Meeting Room air-handling unit.

DCV & Supply Air Demand Modulation equipment have an expected life of 15 years, according to the ASHRAE, and total energy savings over the life of the project are estimated at 23,830 therms and 102,630 kWh, which will result in $45,200 cost savings.

The implementation cost and savings related to this ECM are presented in Appendix E and summarized below:

ECM-3 Modify Meeting Room (AHU 2) Demand Ventilation & Supply Air Demand Modulation

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
15,900	0	8,200	1,546	3,300	2.1	NA	4.8	NA

* There is no incentive available through the New Jersey Smart Start program for this ECM.

This measure is recommended when demand ventilation is also provided at AHU 3. See ECM-4.

4.4 ECM-4 Combined Demand Ventilation (AHU 2 & 3) & Supply Air Demand Modulation (AHU 2)

By implementing both Demand Control Ventilation and Supply Air Demand Modulation for both air-handling units (AHU 2 & AHU 3), cumulative energy and cost saving can be achieved. This measure is a combination of ECM-1 and ECM-2 to allow for maximum energy consumption reduction for both air-handling units.

DCV & Supply Air Demand Modulation equipment have an expected life of 15 years, according to the ASHRAE, and total energy savings over the life of the project are estimated at 112, 800 kWh and 26,685 therms, which will result in $51,600 cost savings.

The implementation cost and savings related to this ECM are presented in Appendix F and summarized below:

ECM-4 Combined Demand Ventilation (AHU 2 & 3) & Supply Air Demand Modulation (AHU 2)

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
17,900	0	6,900	1,500	3,400	1.8	NA	5.3	NA

* There is no incentive available through the New Jersey Smart Start program for this ECM.

This measure is recommended.

4.5 ECM-5 Lighting Fixture Modifications

The facility has 35 fixtures which utilize 150 watt incandescent bulbs and 12 fixtures which utilize 150 watt halogen bulbs; 28 are in the meeting/raining room and 17 in the member's room. Overall energy consumption can be reduced by utilizing more efficient, 45 watt and 36 watt compact fluorescent lamps. The building also has 15 exit signs that currently have 16 watt fluorescent bulbs. Exit sign energy consumption can be greatly reduced by replacing these lamps with energy efficient LED lamps.

Energy savings for this measure were calculated by applying the existing and proposed fixture wattages to the estimated time of operation. The difference resulted in an annual savings of 3,604 kWh per year, or $657.45 per year. Supporting calculations, including all assumptions for lighting hours, and the annual energy usage for each fixture can be found in Appendix G.

Lighting has an expected life of 15 years, according to the manufacturer, and total energy savings over the life of the project are estimated at 54,060 kWh and $9,862.

The implementation cost and savings related to this ECM are presented in Appendix G and summarized as follows:

ECM-5 Lighting Fixture Modifications

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
2,000	-	3,600	0	700	4.3	NA	2.9	NA

* There is no incentive available through the New Jersey Smart Start program's Prescriptive Lighting Application for this ECM.

This measure is recommended when combined with ECM-6; see ECM-7.

4.6 ECM-6 Lighting Control Modifications

Lighting in several rooms within the fire department building are currently equipped with occupancy sensors that are very effective in reducing unoccupied energy use. This ECM proposes the addition of five wall-mounted occupancy sensors in rooms that are not continuously occupied throughout the day.

The weekly occupied times for each space was determined by taking into account typical traffic patterns for selected offices and the kitchen. Applying the existing and proposed operating times to the combined wattage requirements for each room's lighting fixtures, it was determined that about 402 kWh per year, or $73.37 per year, can be saved through implementation of this ECM.

Occupancy sensors have an expected life of 15 years, according to the manufacturer, and total energy savings over the life of the project are estimated at 6,030 kWh and $1,101.

Supporting calculations, including the proposed rooms to install occupancy sensors; assumptions for lighting hours in each space; annual energy usage for each fixture; and the type of occupancy sensor recommended is included in Appendix H. The implementation cost and savings related to this ECM are summarized as follows:

ECM-6 Lighting Control Modifications

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
566	0	402	0	73	0.9	100	7.7	6.3

* Incentive shown is per the New Jersey Smart Start Program, 2010 Lighting Controls Application. Incentive is based on the use of five wall-mounted occupancy sensors.

This measure is recommended when combined with ECM-5; see ECM-7.

4.7 ECM-7 Combined Lighting Fixture & Control Modifications

Due to the use of occupancy sensors in areas other than those suggested for lamp replacement, the energy and cost savings for occupancy sensors and lighting upgrades are cumulative. This measure is a combination of ECM-5 and ECM-6 to allow for maximum energy and demand reduction.

Lighting and occupancy sensors have an expected life of 15 years, according to the manufacturer, and total energy savings over the life of the project are estimated at 60,090 kWh and $10,963.

The implementation cost and savings related to this ECM are presented in Appendix I and summarized below:

ECM-7 Combined Lighting Fixture and Control Modifications

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
2,500	-	4000	0	700	3.2	100	3.6	3.4

* Incentive shown is per the New Jersey Smart Start Program, 2010 Lighting Controls Application. Incentive is based on the use of five wall-mounted occupancy sensors.

This measure is recommended.

4.8 ECM-8 Reduced Water Use

The facility's locker areas have three showerheads with a flow rate of 2.5 gallons per minute each. Overall water consumption can be reduced by replacing these showerheads with fixtures that have a flow rate of 1.6 gallons per minute. The average annual operation of the showers was determined by taking into account typical traffic patterns of the lockers and workout rooms.

Shower heads have an expected life of 10 years, according to the manufacturer, and the total energy saving over the life of the project are estimated at 27,000 gallons and $295.

The implementation and savings related to this ECM are presented in Appendix J and summarized as follows:

ECM-8 Reduced Water Use

Budgetary Cost	Annual Utility Savings			ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Water	Natural Gas	Total				
$	Gallons	Therms	$		$	Years	Years
120	1,800	13	20	1.5	NA	6.1	NA

* There is no incentive available through the New Jersey Smart Start program for this ECM.

This measure is recommended.

4.9 ECM-9 Hot Water Circulation with Timer

The facility currently has a hot water return system controlled by water temperature, measured by an Aquastat, but it does not operate because the circulation pump has failed. Because the return system is a code requirement based on the time of hot water delivery to a fixture, it is assumed that a replacement pump will be installed. Therefore, the water flow wasted while waiting for hot water delivery is not taken into account of this ECM. To further reduce the power consumed by a working pump, it is proposed that a timer be used in conjunction with the Aquastat so that the pump only operates when the building is occupied.

The implementation and savings related to this ECM are presented in Appendix K and summarized below:

ECM-9 Hot Water Circulation with Timer

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
300	0	400	-	75	2.8	NA	4.0	NA

* There is no incentive available through the New Jersey Smart Start program for this ECM.

This measure is recommended.

5.0 PROJECT INCENTIVES

5.1 Incentives Overview

5.1.1 New Jersey Pay For Performance Program

The building will be eligible for incentives from the New Jersey Office of Clean Energy. The most significant incentives will be from the New Jersey Pay for Performance (P4P) Program. The P4P program is designed for qualified energy conservation projects in facilities whose demand in any of the preceding 12 months exceeds 200 kW. However, the 200 kW/month average minimum has been waived for buildings owned by local governments or municipalities and non-profit organizations. Facilities that meet this criterion must also achieve a minimum performance target of 15% energy reduction by using the EPA Portfolio Manager benchmarking tool before and after implementation of the measure(s). If the participant is a municipal electric company customer, and a customer of a regulated gas New Jersey Utility, only gas measures will be eligible under the Program. American Recovery and Reinvestment Act (ARRA) funding, when available, may allow oil, propane and municipal electric customers to be eligible for the P4P Program. Available incentives are as follows:

Incentive #1: Energy Reduction Plan – This incentive is designed to offset the cost of services associated with the development of the Energy Reduction Plan (ERP). The standard incentive pays $0.10 per square foot, up to a maximum of $50,000, not to exceed 50% of facility annual energy cost, paid after approval of application. For building audits funded by the New Jersey Board of Public Utilities, which receive an initial 75% incentive toward performance of the energy audit, facilities are only eligible for an additional $0.05 per square foot, up to a maximum of $25,000, rather than the standard incentive noted above.

Incentive #2: Installation of Recommended Measures – This incentive is based on projected energy saving and designed to pay approximately 60% of the total performance-based incentive. Base incentives deliver $0.11/kWh and $1.10/therm not to exceed 30% of total project cost.

Incentive #3: Post-Construction Benchmarking Report – This incentive is paid after acceptance of a report proving energy savings over one year utilizing the Environmental Protection Agency (EPA) Portfolio Manager benchmarking tool. Incentive #3 base incentives deliver $0.07/kWh and $0.70/therm not to exceed 20% of total project cost.

Combining incentives #2 and #3 will provide a total of $0.18/ kWh and $1.8/therm not to exceed 50% of total project cost. Additional incentives for #2 and #3 are increased by $0.005/kWh and $0.05/therm for each percentage increase above the 15% minimum target to 20%, calculated with the EPA Portfolio Manager benchmarking tool, not to exceed 50% of total project cost.

5.1.2 New Jersey Smart Start Program

For this program, specific incentives for energy conservation measures are calculated on an individual basis utilizing the 2010 New Jersey Smart Start incentive program. This program provides incentives dependent upon mechanical and electrical equipment. If applicable, incentives from this program are reflected in the ECM summaries and attached appendices.

If the building qualifies and enters into the New Jersey Pay for Performance Program, all energy savings will be included in the total building energy reduction, and savings will be applied towards the Pay for Performance incentive. A project is not applicable for both New Jersey incentive programs.

5.1.3 Energy Efficient and Conservation Block Grant

Following is a brief summary of the Energy Efficient and Conservation Block Grant (EECBG) program. The Energy Efficiency and Conservation Block Grant Complete Program Application Package should be consulted for rules and regulations.

Additional funding is available to local government entities through the EECBG, a part of New Jersey's Clean Energy program (NJCEP). The grant is for local government entities only, and can offset the cost of energy reduction implementation to a maximum of $20,000 per building.

This program is provided in conjunction with NJCEP funding and any utility incentive programs; the total amount of the three incentives combined cannot exceed 100% of project cost. Funds shall first be provided by NJCEP, followed by the EECBG and any utility incentives available to the customer. The total amount of the incentive shall be determined TRC Solutions, a third party technical consulting firm for the NJCEP.

In order to receive EECBG incentives, local governments must not have received a Direct Block Grant from the US Department of Energy. A list of the 512 qualifying municipalities and counties is provided on the NJCEP website. Qualifying municipalities must participate in at least one eligible Commercial & Industrial component of the NJCEP, utility incentive programs, or install building shell measures recommended by the Local Government Energy Audit Program. Eligible conservation programs through NJCEP include:

- Direct Install
- Pay for Performance
- NJ SmartStart Buildings for measures recommended by a Local Government Energy Audit (LGEA) or an equivalent audit completed within the last 12 months
- Applicants may propose to independently install building shell measures recommended by a LGEA or an equivalent audit. The audit must have been completed within the past 12 months.
- Any eligible utility energy efficiency incentive program

Most facilities owned or leased by an eligible local government within the State of New Jersey are eligible for this grant. Ineligible facilities include casinos or other gambling establishments, aquariums, zoos, golf courses, swimming pools, and any building owned or leased by the United States Federal Government. New construction is also ineligible.

5.1.4 ARRA Initiative "Energy Efficiency Programs through the Clean Energy Program"

The American Recovery and Reinvestment Act (ARRA) Initiative is available to New Jersey oil, propane, cooperative and municipal electric customers who do not pay the Societal Benefits Charge. This charge can be seen on any electric bill as the line item "SBC Charge." Applicants can participate in this program in conjunction with other New Jersey Clean Energy Program initiatives including Pay for Performance, Local Government Energy Audits, and Direct Install programs.

Funding for this program is dispersed on a first come, first serve basis until all funds are exhausted. The program does not limit the municipality to a minimum or maximum incentive, and the availability of funding cannot be determined prior to application. If the municipality meets all qualifications, the application must be submitted to TRC Energy Solutions for review. TRC will then determine the amount

of the incentive based on projected energy savings of the project. It is important to note that all applications for this incentive must be submitted before implementation of energy conservation measures.

Additional information is available on New Jersey's Clean Energy Program website.

5.2 Building Incentives

5.2.1 New Jersey Pay For Performance Program

The building is eligible for all three incentives available from the New Jersey P4P program. Incentive #1 is for the development of an energy reduction plan and will pay $.05/ square foot of the building footprint, which equates to about $800. Implementation of the energy conservation measures discussed in this report is expected to reduce the building's energy usage by over 15% which qualifies it for both incentives #2 and #3. Combining incentives #2 and #3 will provide maximum savings of $0.18/ kWh and $1.80/ therm not to exceed 50% of the total project cost. The building is projected to save about 11,260 kWh which amounts to about $2,000 in incentives. The building is also projected to save about 1,540 therms of natural gas. With New Jersey's current incentive structure, this would qualify for about $2,800 in incentive money. Combining all incentives in the P4P program would amount to approximately $4,800, reducing the overall payback of the project from 4.8 years to 3.6 years.

5.2.2 New Jersey Smart Start Program

The South Brunswick Fire District No. 2, Station 20 building is eligible for incentives from the New Jersey Smart Start Program.

The lighting control modifications ECM is eligible for about $100 in incentive money for the addition of five motion sensor lighting controls.

5.2.3 Energy Efficient and Conservation Block Grant

The South Brunswick Station 20 building is owned by local government which makes it eligible for this incentive. The incentive amount is determined by TRC Solutions and is not calculable at this time. Further information about this incentive, including the application, can be found at:
http://www.njcleanenergy.com/commercial-industrial/programs/energy-efficiency-and-conservation-block-grants

5.2.4 ARRA Initiative "Energy Efficiency Programs through the Clean Energy Program"

Based on the utility information that was provided by the township for the facility, it was determined that the facility is paying the societal benefits charge. This facility is not eligible for additional funding through this program.

6.0 ALTERNATIVE ENERGY SCREENING EVALUATION

6.1 Geothermal

Geothermal heat pumps (GHP) transfer heat between the constant temperature of the earth and the building to maintain the building's interior space conditions. Below the surface of the earth throughout New Jersey the temperature remains in the low 50°F range throughout the year. This stable temperature provides a source for heat in the winter and a means to reject excess heat in the summer. With GHP systems, water is circulated between the building and the piping buried in the ground. The ground heat exchanger in a GHP system is made up of a closed or open loop pipe system. Most common is the closed loop in which high density polyethylene pipe is buried horizontally at 4-6 feet deep or vertically at 100 to 400 feet deep. These pipes are filled with an environmentally friendly antifreeze/water solution that acts as a heat exchanger. In the summer, the water picks up heat from the building and moves it to the ground. In the winter the system reverses and fluid picks up heat from the ground and moves it to the building. Heat pumps make collection and transfer of this heat to and from the building possible.

The building primarily uses split system, cooling only air handling units with gas-fired duct furnaces. This existing equipment is not compatible with a geothermal energy source. Therefore, to take advantage of a GHP system, the existing mechanical equipment would have to be completely removed and a low temperature closed loop water source heat pump system would have to be installed to realize the benefit of the consistent temperature of the ground. Significant site work is also required for the installation of the geothermal pipe loop.

This measure is not recommended due to the extent of HVAC system renovation needed for implementation and the additional site work.

6.2 Solar

6.2.1 Photovoltaic Rooftop Solar Power Generation

The facility was evaluated for the potential to install rooftop photovoltaic (PV) solar panels for power generation. Present technology incorporates the use of solar cell arrays that produce direct current (DC) electricity. This DC current is converted to alternating current (AC) with the use of an electrical device known as an inverter. The building's roof has sufficient room to install a large solar cell array. A structural analysis would be required to determine if the roof framing could support a cell array.

The PVWATTS solar power generation model was utilized to calculate PV power generation. The New Jersey Clean Energy Program recommends the use of the PVWATTS program to determine solar grid tied system production. Version 2 of the program was used, allowing the zip code of the fire department building to be analyzed. A fixed tilt array type was utilized to calculate energy production. The PVWATTS solar power generation model is provided in Appendix L. Additionally, further financial analysis was provided by www.solar-estimate.org. The result of this analysis is also located in Appendix L.

The State of New Jersey incentives for non-residential PV applications is $1.00/watt up to 50 kW of installed PV array. Federal tax credits are also available for renewable energy projects up to 30% of installation cost. Municipalities do not pay federal taxes; therefore, would not be able to utilize the federal tax credit incentive.

Installation of (PV) arrays in the State of New Jersey will allow the owner to participate in the New Jersey solar renewable energy certificates program (SREC). This is a program that has been set up to allow entities with large amounts of environmentally unfriendly emissions to purchase credits from zero emission (PV) solar-producers. An alternative compliance penalty (ACP) is paid for by the high emission producers and is set each year on a declining scale of 3% per year. One SREC credit is equivalent to 1000 kilowatt hours of PV electrical production; these credits can be traded for period of 15 years from the date of installation. The cost of the ACP penalty for 2009 is $689; this is the amount that must be paid per SERC by the high emission producers. The expected dollar amount that will be paid to the PV producer for 2009 is expected to be $600/SREC credit. Payments that will be received from the PV producer will change from year to year dependent upon supply and demand. Renewable Energy Consultants is a third party SREC broker that has been approved by the New Jersey Clean Energy Program. As stated above there is no definitive way to calculate an exact price that will be received by the PV producer per SREC over the next 15 years. Renewable Energy Consultants estimated an average of $487/ SERC per year and this number was utilized in the cash flow for this report.

The building had a maximum kW demand of 42.6 kW and a minimum of 10.3 kW over the previous 12 months. The monthly average over the observed 12 month period was 25.5 kW. The existing load justifies the use of the maximum incentive cap of 50 kW of installed PV solar array; but, because the most frequent monthly demand is approximately 24 kW, a 24 kW system size was selected for the calculations. The system costs for PV installations were derived from average installation costs for this area. It should be noted that the cost of installation is currently $8 per watt or $8,000 per kW of installed system. Other cost considerations will also need to be considered. PV panels have an approximate 20 year life span; however, the inverter device that converts DC electricity to AC has a life span of 10 to 12 years and will need to be replaced multiple times during the useful life of the PV system.

The implementation cost and savings related to this ECM are presented in Appendix L and summarized below:

Photovoltaic (PV) Rooftop Solar Power Generation – 24 kW System

Budgetary Cost	Annual Utility Savings				Total Savings	New Jersey Renewable Energy Incentive*	New Jersey Renewable SREC**	Payback (without incentive)	Payback (with incentives)
	Electricity		Natural Gas	Total					
$	kW	kWh	Therms	$	$	$	$/yr	Years	Years
192,000	0	28,139	0	5,132	5,132	24,000	13,800	>25	~4

*Incentive based on New Jersey Renewable Energy Program for non-residential applications of $1.00 per Watt of installed capacity
** Estimated Solar Renewable Energy Certificate Program (SREC) for 15 years at $487/1000 kWh

Based on the above, it is recommended that a third party power purchase agreement (PPA) be considered to take advantage of the ITC, reduce the cost of the system to the township, and provide a guaranteed reduced cost of power.

6.2.2 Solar Thermal Hot Water Plant

Active solar water-heating systems for buildings use solar collectors to absorb the sun's energy to heat a fluid, either a liquid or air. The collector would then circulate the heated liquid to the normal system. If the liquid is water it may be circulated to the domestic water heater to increase the temperature further prior to entering the hot water supply system. There are also collectors that heat air which is then passed through an air to liquid heat exchanger to increase the temperature of another fluid. Applications for

active solar thermal energy include providing hot water, heating swimming pools, space heating, and preheating air in residential and commercial buildings.

A standard solar hot water system is typically composed of solar collectors, heat storage vessel, piping, circulators, and controls. Systems are typically integrated to work alongside a conventional heating system that provides heat when solar resources are not sufficient. The solar collectors are usually placed on the roof of the building, oriented south, and tilted around the site's latitude, to maximize the amount of radiation collected on a yearly basis.

Several options exist for using active solar thermal systems for space heating. The most common method involves using glazed collectors to heat a liquid held in a storage tank (similar to an active solar hot water system). The most practical system for the fire department building would utilize a solar circulation, domestic hot water system that pre-heats incoming water prior to entering the domestic water heater. Although this system is the both the simplest and least expensive to implement, the small amount of hot water used at the facility on an annual basis results in a payback period that greatly exceeds the useful life of the system itself. DHW is presently produced by a natural gas fired water heater and, therefore, this measure would not save site electricity.

Currently, an incentive is not available for installation of thermal solar systems. A Federal tax credit of 30% of installation cost for the thermal applications is available; however, the Township of South Brunswick does not pay Federal taxes and, therefore, would not benefit from this program.

The implementation cost and savings related to this ECM are presented in Appendix M and summarized as follows:

Solar Thermal Domestic Hot Water Plant

Budgetary Cost	Annual Utility Savings				Total Savings	New Jersey Renewable Energy Incentive	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$	$	$	Years	Years
9,305	0	0	150	200	200	NA	>25	NA

* No incentive is available in New Jersey at this time.

This measure is not recommended.

6.3 Wind

Wind turbines are part of a renewable energy system that converts the kinetic energy of wind into usable mechanical and electrical energy. Small wind turbines comprise the group of turbines utilized for residential and small business applications.

The most common design for small wind turbines utilize a horizontal axis propeller which converts kinetic energy of the wind into rotary motion to drive a generator which usually is designed specifically for the wind turbine. The rotor consists of two or three blades, usually made from wood or fiberglass. These materials give the turbine the needed strength and flexibility, and have the added advantage of not interfering with television signals. The structural backbone of the wind turbine is the mainframe, and includes the slip-rings that connect the wind turbine, which rotates as it points into changing wind directions, and the fixed tower wiring. The tail aligns the rotor into the wind.

To avoid turbulence and capture greater wind energy, turbines are mounted on towers. Turbines should be mounted at least 30 feet above any structure or natural feature within 300 feet of the installation. Smaller turbines can utilize shorter towers. For example, a 250-watt turbine may be mounted on a 30-50 foot tower, while a 10 kW turbine will usually need a tower of 80-120 feet. Tower designs include tubular or latticed, guyed or self-supporting. Wind turbine manufacturers also provide towers.

The New Jersey Clean Energy Program for small wind installations has designated numerous pre-approved wind turbines for installation in the State of New Jersey. Incentives for wind turbine installations are based on kilowatt hours saved in the first year. Systems sized under 16,000 kWh per year of production will receive a $3.20 per kWh incentive. Systems producing over 16,000 kWh will receive $51,200 for the first 16,000 kWh of production with an additional $0.50 per kWh up to a maximum cap of 750,000 kWh per year. Federal tax credits are also available for renewable energy projects up to 30% of installation cost for systems less than 100 kW. However, as noted previously, municipalities do not pay federal taxes and is, therefore, not eligible for the tax credit incentive.

The most important part of any small wind generation project is the mean annual wind speed at the height of which the turbine will be installed. In the Monmouth Junction area, the map indicates a mean annual wind speed of less than 4.5 meters per second, approximately 14 miles per hour. Most small wind turbines are not financially viable at such wind speeds. Therefore, the model indicates that a wind turbine installation may not be applicable at this location. The model was designed to provide a good indication of wind speeds at applicable locations throughout the state. Before moving forward with a small wind production project at the facility's location, a wind test tower will need to be installed at the 30 meter tower height and monitored for a year. Consideration must also be given to the effects of the turbine location on the neighbors and local ordinances.

A wind speed map is included in Appendix N.

This measure is not recommended due to the low mean annual wind speed at the proposed location.

6.4 Combined Heat and Power Generation (CHP)

Combined heat and power, cogeneration, is self-production of electricity on-site with beneficial recovery of the heat byproduct from the electrical generator. Common CHP equipment includes reciprocating engine-driven, micro turbines, steam turbines, and fuel cells. Typical CHP customers include industrial, commercial, institutional, educational institutions, and multifamily residential facilities. CHP systems that are commercially viable at the present time are sized approximately 50 kW and above, with numerous options in blocks grouped around 300 kW, 800 kW, 1,200 kW and larger. Typically, CHP systems are used to produce a portion of the electricity needed by a facility some or all of the time, with the balance of electric needs satisfied by purchase from the grid.

Any proposed CHP project will need to consider many factors, such as existing system load, use of thermal energy produced, system size, natural gas fuel availability, and proposed plant location. The facility does not have sufficient need for electrical generation or the ability to use most of the thermal byproduct during the winter or summer months. Thermal energy produced by the CHP plant in the warmer months will be wasted. An absorption chiller could be installed to utilize the heat to produce chilled water; however, there is no chilled water distribution system in the building. The most viable selection for a CHP plant at this location would be a reciprocating engine natural gas-fired unit. Purchasing this system and performing modifications to the existing HVAC and electrical systems would greatly outweigh the savings over the life of the equipment.

This measure is not recommended.

6.5 Biomass Power Generation

Biomass power generation is a process in which waste organic materials are used to produce electricity or thermal energy. These materials would otherwise be sent to the landfill or expelled to the atmosphere. To participate in NJCEP's Customer On-Site Renewable Energy program, participants must install an on-site sustainable biomass or fuel cell energy generation system. Incentives for bio-power installations are available to support up to 1MW-dc of rated capacity.

*Class I organic residues are eligible for funding through the NJCEP CORE program. Class I wastes include the following renewable supply of organic material:

- Wood wastes not adulterated with chemicals, glues or adhesives
- Agricultural residues (corn stover, rice hulls or nut shells, manures, poultry litter, horse manure, etc) and/or methane gases from landfills
- Food wastes
- Municipal tree trimming and grass clipping wastes
- Paper and cardboard wastes
- Non adulterated construction wood wastes, pallets

The NJDEP evaluates biomass resources not identified in the RPS.

Examples of eligible facilities for a CORE incentive include:

- Digestion of sewage sludge
- Landfill gas facilities
- Combustion of wood wastes to steam turbine
- Gasification of wood wastes to reciprocating engine
- Gasification or pyrolysis of bio-solid wastes to generation equipment

* from NJOCE Website

This measure is not recommended because of noise issues, potential zoning issues, and the lack of a reliable waste stream that can be utilized.

6.6 Demand Response Curtailment

Presently, electricity is delivered by PSE&G, which receives the electricity from regional power grid RFC. PJM is the regional transmission organization (RTO) that coordinates the movement of wholesale electricity in all or parts of 13 states and the District of Columbia including the State of New Jersey.

Utility Curtailment, also known as Economic Load Response, is an agreement with the PJM regional transmission organization and an approved Curtailment Service Provider (CSP) to reduce electrical demand by either turning major equipment off or energizing all or part of a facility utilizing an emergency generator; therefore, reducing the electrical demand on the utility grid. This program is to benefit the utility company during high demand periods and PJM offers incentives to the CSP to participate in this program. Enrolling in the program will require program participants to drop electrical load or turn on emergency generators during high electrical demand conditions or during emergencies. Part of the program also will require that program participants reduce their required load or run emergency generators with notice to test the system.

A PJM pre-approved CSP will require a minimum of 100 kW of load reduction to participate in any curtailment program. The fire department building had a monthly average kW demand of 25.5 kW and a maximum demand of 42.6 kW over the previous 12 months.

This measure is not recommended because the facility does not have adequate load to meet the required minimum load reduction.

7.0 EPA PORTFOLIO MANAGER

The United State Energy Protection Agency (EPA) is a federal agency in charge of regulating environment waste and policy in the United States. The EPA has released the EPA Portfolio Manager for public use. The program is designed to allow property owners and managers to share, compare and improve upon their facility's energy consumption. Inputting such parameters as electricity, heating fuel, building characteristics and location into the website based program generates a naturalized energy rating score out of 100. Once an account is registered, monthly utility data can be entered to track the savings progress and retrieve an updated energy rating score on a monthly basis.

The fire department building is considered a moderate energy consumer per the Portfolio Manager with a Site Energy Usage Index (EUI) of 46 kBTU/ft^2/year. In comparison, a site with an energy performance rating of 75 (the minimum to be eligible for ENERGY STAR) has a site EUI of 36 kBTU/ft^2/year and the national average site EUI is 90 kBTU/ft^2/year. The building's EUI is much lower than the national average because spaces such as the meeting/training and the member's rooms are used rarely when compared to a building that operates 40 hours per week. In addition, the national average includes a large variety of buildings that are classified as "Other." Before the additional measures discussed in this report are implemented, there is already a large lighting load reduction because of the rates of occupancy throughout the building.

If the recommended measures are implemented, ECM-4, ECM-7, ECM-8, and ECM-9, the facility's EUI will be reduced from 46 kBTU/ft^2/year to 34. kBTU/ft^2/year, making it a similar energy consumer to a building with an ENERGY STAR rating of 75.

The EPA Portfolio Manager was not able to calculate an energy performance rating for this building because more than 50% of the floor area is defined as "Other" within the program. Although the Portfolio Manager does not calculate a rating for this building, we are still able to compare the building's performance with a building rated 75 and the national average for all buildings designated "Other" as follows:

Energy Performance Comparison

	Evaluation Period	Comparisons	
Performance Metrics	Baseline (Ending date 12/31/2009)	Rating of 75	National Average
Energy Intensity			
Site (kBtu/ft^2)	46	36	90
Source (kBtu/ft^2)	87	69	189
Energy Cost			
$/year	$19,951.01	$15,718.31	$39,394.27
$/$ft^2$/year	$1.25	$0.98	$2.47
Greenhouse Gas Emissions			
MtCO_2e/year	66	52	130
kgCO_2e/ft^2/year	44	3	8

A full EPA Energy Star Portfolio Manager Report is located in Appendix O.

The user name and password for the facility's EPA Portfolio Manager Account has been provided to Douglas A. Wolfe, Fire Service Coordinator for Monmouth Junction.

8.0 CONCLUSIONS & RECOMMENDATIONS

The energy audit conducted by CHA at the Monmouth Junction, Fire District No. 2, Station 20, in the Township of South Brunswick, New Jersey identified potential ECMs for demand ventilation control, supply air demand modulation, lighting fixture upgrades, lighting fixture control modifications, water use reduction, and domestic hot water flow reduction. Potential annual savings of $4,267 may be realized for the recommended ECMs, with a summary of the costs, savings, and paybacks as follows:

ECM-4 Combined Demand Ventilation (AHU 2 & 3) & Supply Air Demand Modulation (AHU 2)

Budgetary Cost	Annual Utility Savings					Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total	ROI			
$	kW	kWh	Therms	$		$	Years	Years
17,900	0	6,900	1,500	3,400	1.8	NA	5.3	NA

* There is no incentive available through the New Jersey Smart Start program for this ECM.

ECM-7 Combined Lighting Fixture and Control Modifications

Budgetary Cost	Annual Utility Savings					Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total	ROI			
$	kW	kWh	Therms	$		$	Years	Years
2,500	-	4000	0	700	3.2	100	3.6	3.4

* Incentive shown is per the New Jersey Smart Start Program, 2010 Lighting Controls Application. Incentive is based on the use of five wall-mounted occupancy sensors.

ECM-8 Reduced Water Use

Budgetary Cost	Annual Utility Savings				Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Water	Natural Gas	Total	ROI			
$	Gallons	Therms	$		$	Years	Years
120	1,800	13	20	1.5	NA	6.1	NA

* There is no incentive available through the New Jersey Smart Start program for this ECM.

ECM-9 Hot Water Circulation with Timer

Budgetary Cost	Annual Utility Savings					Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total	ROI			
$	kW	kWh	Therms	$		$	Years	Years
300	0	400	-	75	2.8	NA	4.0	NA

* There is no incentive available through the New Jersey Smart Start program for this ECM.

APPENDIX A

Utility Usage Analysis

BPU ENERGY AUDIT PROGRAM
South Brunswick Fire District No. 2, Station 20
CHA Project # 20998

Electricity Cost Summary: Meter #278002878												
Period	Service Charge	Annual Demand kw	Summer Demand kw	Delivery kWh	Societal Benefits kWh	Securitization Transition kWh	Delivery Total	Generation kw	Transmission kw	Supply kWh	Supply Total	Total
January	$ 4.24	$ 128.51		$ 67.65	$ 60.36	$ 82.81	$ 343.57	$ 137.38	$ 50.91	$ 712.45	$ 900.74	$ 1,244.31
February	$ 4.24	$ 93.46		$ 64.14	$ 57.21	$ 78.90	$ 297.95	$ 137.31	$ 51.74	$ 718.31	$ 907.36	$ 1,205.31
March	$ 4.24	$ 86.45		$ 55.54	$ 49.55	$ 68.34	$ 264.12	$ 137.31	$ 51.74	$ 613.94	$ 802.99	$ 1,067.11
April	$ 4.24	$ 86.45		$ 59.09	$ 52.71	$ 72.69	$ 275.18	$ 137.31	$ 51.74	$ 638.27	$ 827.32	$ 1,102.50
May	$ 4.27	$ 117.44		$ 50.34	$ 44.60	$ 61.50	$ 278.15	$ 137.31	$ 51.74	$ 532.68	$ 721.73	$ 999.88
June	$ 4.27	$ 82.33	$ 152.79	$ 81.54	$ 42.35	$ 58.40	$ 421.68	$ 174.78	$ 50.92	$ 603.74	$ 829.44	$ 1,251.12
July	$ 4.27	$ 110.55	$ 205.17	$ 117.98	$ 61.27	$ 84.49	$ 583.73	$ 179.11	$ 50.83	$ 920.03	$ 1,149.97	$ 1,733.70
August	$ 4.27	$ 167.00	$ 309.94	$ 131.64	$ 67.61	$ 91.32	$ 771.78	$ 179.11	$ 50.83	$ 981.32	$ 1,211.26	$ 1,983.04
September	$ 4.27	$ 94.08	$ 174.62	$ 100.60	$ 51.68	$ 69.58	$ 494.83	$ 179.11	$ 52.05	$ 732.44	$ 963.60	$ 1,458.43
October	$ 4.27	$ 87.03		$ 49.40	$ 42.05	$ 57.15	$ 239.90	$ 181.78	$ 52.22	$ 497.20	$ 731.20	$ 971.10
November	$ 4.27	$ 40.38		$ 20.84	$ 17.57	$ 24.04	$ 107.10	$ 51.23	$ 14.71	$ 206.11	$ 272.05	$ 379.15
December	$ 4.27	$ 101.14		$ 71.74	$ 60.39	$ 82.62	$ 320.16	$ 181.87	$ 52.22	$ 714.00	$ 948.09	$ 1,268.25
Totals	$ 51.12	$ 1,194.82	$ 842.52	$ 870.50	$ 607.35	$ 831.84	$ 4,398.15	$ 1,813.61	$ 581.65	$ 7,870.49	$ 10,265.75	$ 14,663.90

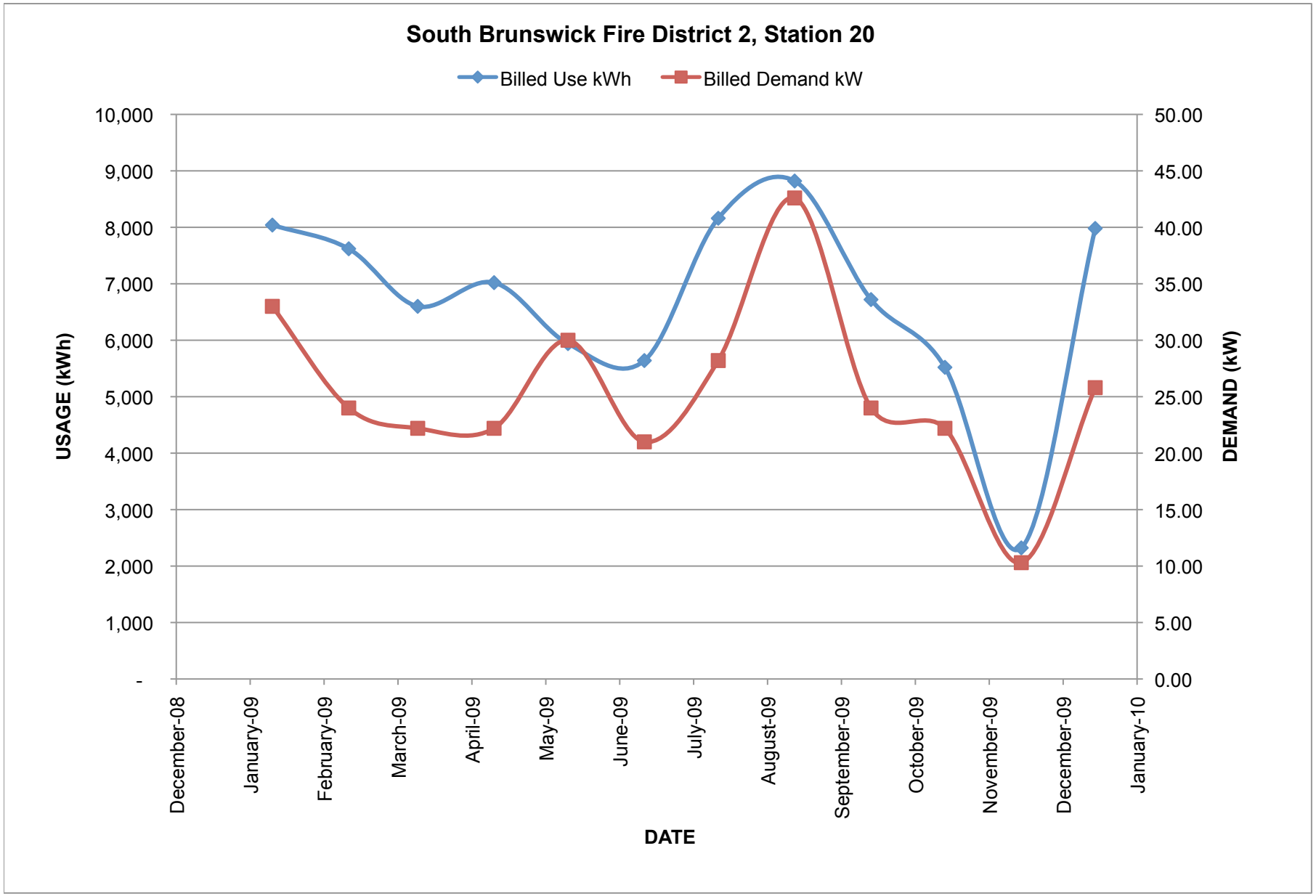
PSE&G Rate Schedule "GLP"

BPU ENERGY AUDIT PROGRAM
South Brunswick Fire District No. 2, Station 20
CHA Project # 20998

Electricity Cost Summary: Meter #278002878						
Period	Billed Use	Billed Demand	Total Cost	Demand Unit Cost	Suppy Unit Cost	Blended Cost
	kWh	kW	$	$/kW	$/kWh	$/kWh
January-09	8,040	33.00	$ 1,244.31	$ 9.60	$ 0.11	$ 0.1548
February-09	7,620	24.00	$ 1,205.31	$ 11.77	$ 0.12	$ 0.1582
March-09	6,600	22.20	$ 1,067.11	$ 12.41	$ 0.12	$ 0.1617
April-09	7,020	22.20	$ 1,102.50	$ 12.41	$ 0.12	$ 0.1571
May-09	5,940	30.00	$ 999.88	$ 10.22	$ 0.12	$ 0.1683
June-09	5,640	21.00	$ 1,251.12	$ 21.94	$ 0.14	$ 0.2218
July-09	8,160	28.20	$ 1,733.70	$ 19.35	$ 0.15	$ 0.2125
August-09	8,820	42.60	$ 1,983.04	$ 16.59	$ 0.14	$ 0.2248
September-09	6,720	24.00	$ 1,458.43	$ 20.83	$ 0.14	$ 0.2170
October-09	5,520	22.20	$ 971.10	$ 14.46	$ 0.12	$ 0.1759
November-09	2,322	10.30	$ 379.15	$ 10.32	$ 0.12	$ 0.1633
December-09	7,980	25.80	$ 1,268.25	$ 12.99	$ 0.12	$ 0.1589
Totals	80,382	305.50	$ 14,663.90			$ 0.1824
Monthly Ave.	6,699	25.46	$ 1,221.99	$ 14.51	$ 0.13	
Max. Demand		42.60				

Account Number: 62 926 029 58
Meter Number: 278002878
Rate Schedule: GLP
Utility Company: PSE&G

Notes:
Total Billed Use kWh is the sum of each month's use in kWh.
Total Billed Billed Demand is the highest month's demand.
Total Cost is sum of each month's total billing including all charges.
(See Chart 2 "Total Column".)
Demand Unit Cost per month is kW charges from Chart 2 divided by kW used.
Does not incled Service Charge from Chart 2.
Supply Unit Cost per month is kWh charges from Chart 2 divided by kWh used.
Does not include Service Charge from Chart 2
Total Demand Unit Cost is total kW charges from chart 2 divided by total kW used.
Total Supply Unit Cost per year total kWh charges from chart 2 divided by total kWh.
Blended Rate per month is the Cost divided by the kWh used for that month.
Total Blended Rate is the Total Cost divided by the Total Use for the year.


South Brunswick Fire District 2, Station 20
Billed Use kWh
Billed Demand kW
USAGE (kWh)
DEMAND (kW)
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
-
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
December-08
January-09
February-09
March-09
April-09
May-09
June-09
July-09
August-09
September-09
October-09
November-09
December-09
January-10
DATE

PSE&G SERVICE TERRITORY
Last Updated: 04/21/10

***CUSTOMER CLASS - R – RESIDENTIAL C – COMMERCIAL I -INDUSTRIAL**

Supplier	Telephone & Web Site	*Customer Class
American Powernet Management, LP 437 North Grove St. Berlin, NJ 08009	877-977-2636 www.americanpowernet.com	**C** **ACTIVE**
Commerce Energy, Inc. 4400 Route 9 South, Suite 100 Freehold, NJ 07728	(800) 556-8457 www.commerceenergy.com	**C** **ACTIVE**
ConEdison Solutions Cherry Tree Corporate Center 535 State Highway 38 Cherry Hill, NJ 08002	(888) 665-0955 www.conedsolutions.com	**C** **ACTIVE**
Constellation NewEnergy, Inc. 900A Lake Street, Suite 2 Ramsey, NJ 07446	(888) 635-0827 www.newenergy.com	**C/I** **ACTIVE**
Credit Suisse, (USA) Inc. 700 College Road East Princeton, NJ 08450	212-538-3124 www.creditsuisse.com	**C** **ACTIVE**
Direct Energy Services, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com	**C/I** **ACTIVE**
FirstEnergy Solutions 300 Madison Avenue Morristown, NJ 07962	(800) 977-0500 www.fes.com	**C/I** **ACTIVE**
Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, N.J. 08701	(800) 805-8586 www.gesc.com	**R/C/I** **ACTIVE**
Glacial Energy of New Jersey, Inc. 207 LaRoche Avenue Harrington Park, NJ 07640	1-877-569-2841 www.glacialenergy.com	**C/I** **ACTIVE**

Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com	**C/I** **ACTIVE**
Integrys Energy Services, Inc. 99 Wood Ave, South, Suite 802 Iselin, NJ 08830	1-877-763-9977 www.integrysenergy.com	**C/I** **ACTIVE**
Liberty Power Delaware, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(866)769-3799 www.libertypowercorp.com	**C/I** **ACTIVE**
Liberty Power Holdings, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(866) 769-3799 www.libertypowercorp.com	**C/I** **ACTIVE**
Linde Energy Services 575 Mountain Avenue Murray Hill, NJ 07974	(800) 247-2644 www.linde.com	**C/I** **ACTIVE**
Palmco Power NJ, LLC One Greentree Centre 10000 Lincoln Drive East, Suite 201 Marlton, NJ 08053	(877) 726-5862 www.PalmcoEnergy.com	**C/I** **ACTIVE**
Pepco Energy Services, Inc. 112 Main St. Lebanon, NJ 08833	(800) ENERGY-9 (363-7499) www.pepco-services.com	**C/I** **ACTIVE**
Sempra Energy Solutions The Mac-Cali Building 581 Main Street, 8th Floor Woodbridge, NJ 07095	(877) 273-6772 www.semprasolutions.com	**C/I** **ACTIVE**
South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037	(800) 756-3749 www.south jerseyenergy.com	**C/I** **ACTIVE**

Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 07928	(800) 225-1560 www.spragueenergy.com	**C/I** **ACTIVE**
Strategic Energy, LLC 55 Madison Avenue, Suite 400 Morristown, NJ 07960	(888) 925-9115 www.sel.com	**C/I** **ACTIVE**
Suez Energy Resources NA, Inc. 333 Thornall Street, 6th Floor Edison, NJ 08837	(888) 644-1014 www.suezenergyresources.com	**C/I** **ACTIVE**
UGI Energy Services, Inc. 704 East Main Street Suite 1 Moorestown, NJ 08057	(856) 273-9995 www.ugienergyservices.com	**C/I** **ACTIVE**

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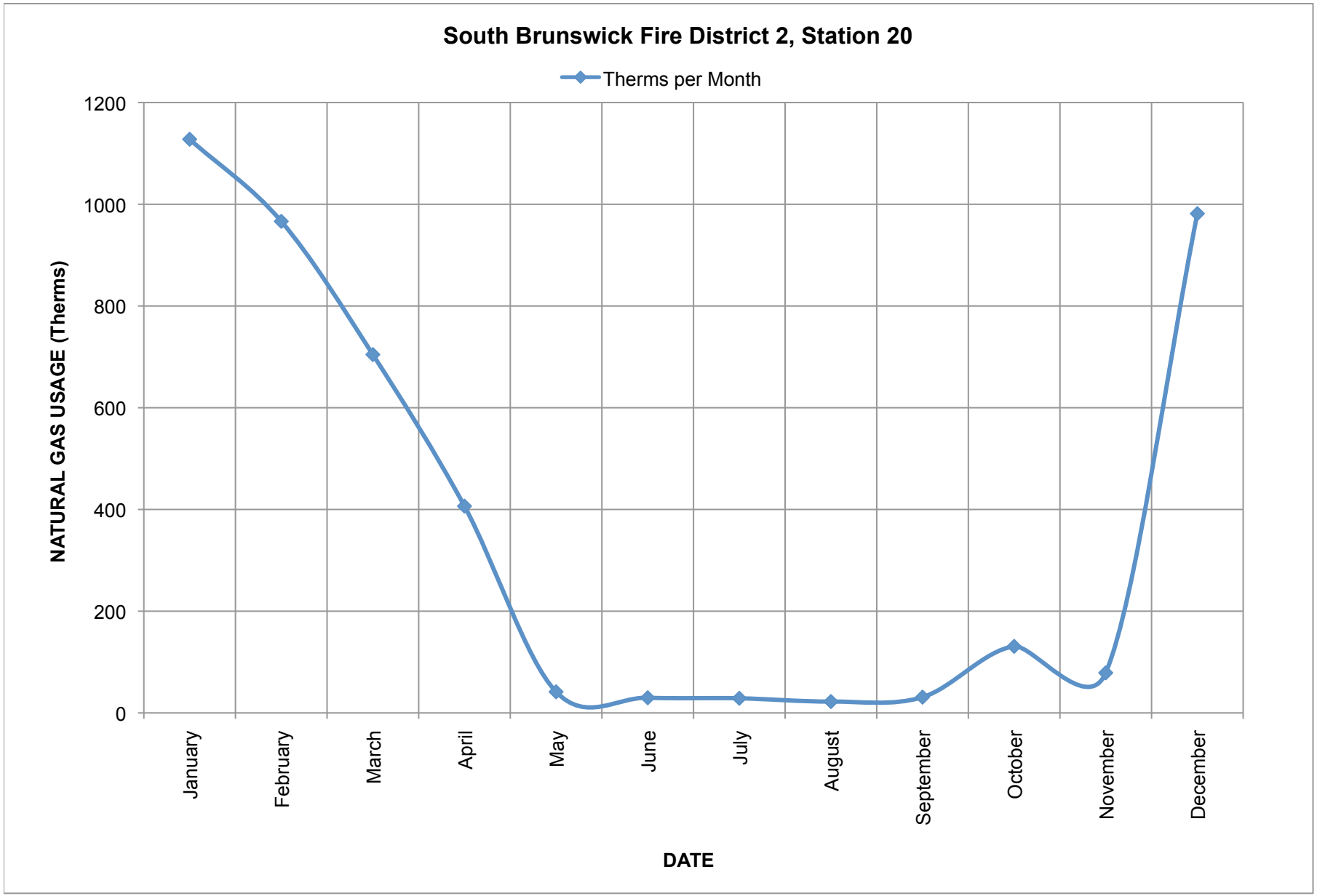
BPU ENERGY AUDIT PROGRAM
South Brunswick Fire District No. 2, Station 20
CHA Project # 20998

Gas Cost Summary: Meter #2599593										
Period	Service Charge	Therms	Distribution	Demand	Balancing Charge	Societal Benefits	Total Demand	Total Supply	Total Cost	Blended Cost $/Therm
January	$ 9.93	1127.803	$ 294.62		$ 106.28	$ 55.67	$ 466.50	$ 1,015.76	$ 1,482.26	$ 1.31
February	$ 9.93	966.423	$ 252.46		$ 90.73	$ 47.76	$ 400.88	$ 736.88	$ 1,137.76	$ 1.18
March	$ 9.93	704.506	$ 184.04		$ 65.66	$ 34.82	$ 294.45	$ 478.08	$ 772.53	$ 1.10
April	$ 9.93	406.521	$ 106.20			$ 20.09	$ 136.22	$ 251.81	$ 388.03	$ 0.95
May	$ 10.09	41.491	$ 11.00			$ 2.03	$ 23.12	$ 23.53	$ 46.65	$ 1.12
June	$ 10.12	29.818	$ 7.93			$ 1.46	$ 19.51	$ 17.10	$ 36.61	$ 1.23
July	$ 10.12	28.753	$ 7.65			$ 1.41	$ 19.18	$ 17.72	$ 36.90	$ 1.28
August	$ 10.12	22.363	$ 5.95			$ 1.20	$ 17.27	$ 12.54	$ 29.81	$ 1.33
September	$ 10.12	31.003	$ 8.24			$ 1.69	$ 20.05	$ 15.60	$ 35.65	$ 1.15
October	$ 10.12	130.858	$ 34.80			$ 6.48	$ 51.40	$ 79.13	$ 130.53	$ 1.00
November	$ 10.12	78.835	$ 20.97		$ 5.51	$ 3.63	$ 40.23	$ 53.03	$ 93.26	$ 1.18
December	$ 10.12	981.624	$ 261.05		$ 91.59	$ 45.20	$ 407.96	$ 689.16	$ 1,097.12	$ 1.12
Totals	$ 120.65	4549.998	$ 1,194.91	$ -	$ 359.77	$ 221.44	$ 1,896.77	$ 3,390.34	$ 5,287.11	$ 1.16

PSE&G Rate Schedule "GSGH"

Notes: **Chart 4** **Gas Cost Summary**

This chart provides gas cost breakdowns and sums totals. Sum totals are "Total Demand", 1st, 3rd, 4th, 5th, 6th columns and Total Cost = Total Demand + Total Supply".
Blended Cost = Total divided by Therms.
All numbers are in $ except Therms.


South Brunswick Fire District 2, Station 20
Therms per Month
NATURAL GAS USAGE (Therms)
1200
1000
800
600
400
200
0
January
February
March
April
May
June
July
August
September
October
November
December
DATE

PSE&G SERVICE TERRITORY
Last Updated: 04/21/10

***CUSTOMER CLASS** - R – RESIDENTIAL C – COMMERCIAL I - INDUSTRIAL

Supplier	Telephone & Web Site	*Customer Class
Cooperative Industries 412-420 Washington Avenue Belleville, NJ 07109	800-6BUYGAS (6-289427) www.cooperativenet.com	**C/I** **ACTIVE**
Direct Energy Services, LLP 120 Wood Avenue, Suite 611 Iselin, NJ 08830	866-547-2722 www.directenergy.com	**R/C/I** **INACTIVE**
Dominion Retail, Inc. 395 Highway 170 - Suite 125 Lakewood, NJ 08701	866-275-4240 http://retail.dom.com	**R/C** **ACTIVE**
Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701	800-805-8586 www.gesc.com	**R/C/I** **ACTIVE**
UGI Energy Services, Inc. **d/b/a GASMARK** 704 East Main Street, Suite 1 Moorestown, NJ 08057	856-273-9995 www.ugienergyservices.com	**C/I** **ACTIVE**
Great Eastern Energy 116 Village Riva, Suite 200 Princeton, NJ 08540	888-651-4121 www.greateastern.com	**C/I** **ACTIVE**

Hess Energy, Inc. One Hess Plaza Woodbridge, NJ 07095	800-437-7872 www.hess.com	**C/I** **ACTIVE**
Hudson Energy Services, LLC 545 Route 17 South Ridgewood, NJ 07450	877- Hudson 9 www.hudsonenergyservices.com	**C** **ACTIVE**
Intelligent Energy 2050 Center Avenue, Suite 500 Fort Lee, NJ 07024	800-724-1880 www.intelligentenergy.org	**R/C/I** **ACTIVE**
Keil & Sons 1 Bergen Blvd. Fairview, NJ 07002	1-877-Systrum www.systrumenergy@aol.com	**R/C/I** **ACTIVE**
Metromedia Energy, Inc. 6 Industrial Way Eatontown, NJ 07724	877-750-7046 www.metromediaenergy.com	**C** **ACTIVE**
Metro Energy Group, LLC 14 Washington Place Hackensack, NJ 07601	888-53-Metro www.metroenergy.com	**R/C** **ACTIVE**
MxEnergy, Inc. 510 Thornall Street, Suite 270 Edison, NJ 088327	800-375-1277 www.mxenergy.com	**R/C** **ACTIVE**
NATGASCO (Mitchell Supreme) 532 Freeman Street Orange, NJ 07050	800-840-4GAS www.natgasco.com	**C** **ACTIVE**
Palmco Energy NJ, LLC One Greentree Centre 10000 Lincoln Drive East, Suite 201 Marlton, NJ 08053	877-726-5862 www.PalmcoEnergy.com	**C/I** **ACTIVE**

Pepco Energy Services, Inc. 112 Main Street Lebanon, NJ 08833	800-363-7499 www.pepco-services.com	**C/I** **ACTIVE**
PPL EnergyPlus, LLC 811 Church Road - Office 105 Cherry Hill, NJ 08002	800-281-2000 www.pplenergyplus.com	**C/I** **ACTIVE**
Sempra Energy Solutions The Mac-Cali Building 581 Main Street, 8th fl. Woodbridge, NJ 07095	877-273-6772 800-2 SEMPRA www.semprasolutions.com	**C/I** **ACTIVE**
South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037	800-756-3749 www.sjindustries.com/sje.htm	**C/I** **ACTIVE**
Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 07928	800-225-1560 www.spragueenergy.com	**C/I** **ACTIVE**
Stuyvesant Energy LLC 10 West Ivy Lane, Suite 4 Englewood, NJ 07631	800-646-6457 www.stuyfuel.com	**C** **ACTIVE**
Woodruff Energy 73 Water Street Bridgeton, NJ 08302	800-557-1121 www.woodruffenergy.com	**R/C/I** **ACTIVE**

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BPU ENERGY AUDIT PROGRAM

South Brunswick Fire District No. 2, Station 20

CHA Project Number 20998

Water Cost Summary: Account Number #3034300					
Period	Consumption Gallons	Base Charge	Water Charge	Total Cost	Water cost per 1000 gallons
11/12/08	2000	$ 90.79	$ 4.86	$ 95.65	$ 2.43
2/24/09	5000	$ 90.79	$ 12.15	$ 102.94	$ 2.43
5/22/09	3000	$ 100.30	$ 8.04	$ 108.34	$ 2.68
8/24/09	5000	$ 100.30	$ 13.40	$ 113.70	$ 2.68
Totals		$ 382.18	$ 38.45	$ 420.63	

South Brunswick Township Water & Sewer

Notes: **Chart 5** **Water Cost Summary**

This chart provides water cost breakdowns and sums totals.

All numbers are in $ except gallons.

APPENDIX B

HVAC Equipment List

BPU ENERGY AUDIT PROGRAM
South Brunswick Fire District No. 2, Station 20
CHA Project # 20998

HVAC Equipment List											
Item	**Quanity**	**Manufacturer**	**Model Number**	**Serial number**	**Cooling Capacity**	**Condition**	**Fuel**	**Heating Input MBH**	**Heating Output MBH**	**Refrigerant**	**Comments**
AHU-1	1	Carrier	58EFBO75-2	3496800118	-	Good	Natural Gas	75	60	-	Serves Member's Room and Kitchen
ACCU-1	1	Carrier	38CKBO36520	-	3 Tons	Good	-	-	-		Serves Member's Room and Kitchen
AHU-2	1	Carrier	40RM024	-	-	Good	-	-	-	-	Serves Lobby and Meeting/Training Room
ACCU-2	1	Carrier	38AKSO24-510	1897F70531	20 Tons	Good	-	-	-	R-22	Serves Lobby and Meeting/Training Room
DF-2	1	Reznor	X300-8	-	-	Good	Natural Gas	300	240	-	Serves Lobby and Meeting/Training Room
AHU-3	1	Carrier	40RM016	-	-	Good	-	-	-	-	Serves Lobby and Office Spaces
ACCU-3	1	Carrier	38AKSO16-510	1897F70451	15 Tons	Good	-	-	-	R-22	Serves Lobby and Office Spaces
DF-3	1	Reznor	X150-8	-	-	Good	Natural Gas	150	120	-	Serves Lobby and Office Spaces
AHU-4	1	Carrier	40RM007	-	-	Good	-	-	-	-	Serves Workout Room
ACCU-4	1	Carrier	38AK-007-501	-	6 Tons	Good	-	-	-	R-22	Serves Workout Room
DF-4	1	Carrier	CAEL HEAT 007A00	-	-	Good	Electricity	51	51	-	Serves Workout Room
AHU-5	1	Sanyo	12XS71	-	1 Ton	Good	-	-	-	-	Serves Communication Room
HV-1	1	Carrier	58EFBO75-2	-	-	Good	Natural Gas	75	60	-	Serves Storage Mezzanine
IRH - 1 through 4	4	Robert Gordon Infrared	CTH2-40	-	-	Good	Natural Gas	40	-	-	Serves Engine Deck
IRH - 5 through 8	4	Robert Gordon Infrared	CTH2-80	-	-	Good	Natural Gas	80	-	-	Serves Engine Deck

APPENDIX C

ECM-1 Demand Ventilation (AHU 2 & 3)

BPU ENERGY AUDIT PROGRAM
South Brunswick Fire District No. 2, Station 20
CHA Project # 20998

ECM-1 Demand Ventilation (AHU2 & 3)

Item	Budgetary Costs	Annual Utility Savings			ROI	Potential Incentive	Payback (Without Incentive)	Payback (With Incentive)
		Electricity	Natural Gas	Total				
	$	KWH	Therms	$		$	Years	Years
AHU-2	$2,000	$148	$416	$565		0	3.5	3.5
AHU-3	$2,000	$124	$302	$426		0	4.7	4.7
Combined	$4,000	$272	$719	$991		0	4.0	4.0

BPU ENERGY AUDIT PROGRAM
South Brunswick Fire District No. 2, Station 20
CHA Project # 20998

ECM-1 Demand Ventilation AHU 2

	Total CFM	OA CFM	OA%
Org. Scheduled CFM	6000	1200	20%
Derated CFM	6000	400	7%
SA Enthalpy	26		
SA Set Point (WINTER)	70		
SA Setpoint (SUMMER)	75		
Balance Point	65		
Heating Equipment Efficiency	80%		
Cooling Equip Efficiency (kW/Ton)	0.972		
Electrical Cost ($/kW)	$0.18		
Natural Gas Cost ($/Therm)	$1.16		

Simple Payback Analysis	
Cost	$1,599.20
Incentive	$0.00
Adjusted Cost	$1,599.20
Savings/yr	$564.92
Payback in years	2.83

			EXISTING					PROPOSED DEMAND CONTROL VENTILATION					SAVINGS		
Avg. DB Bin Temp °F	**OA Enthalpy Btu/lb**	**Occupied Bin Hours**	**OA CFM**	**Cooling Load MBH**	**Heating Load MBH**	**Cooling kWH**	**Heating Therm**	**Derated O.A. CFM**	**Cooling Load MBH**	**Heating Load MBH**	**Cooling kWH**	**Heating Therms**	**Cooling kWH**	**Heating Therms**	**$**
100	49.1	0	1200	125		0		400	42		0		0		$0.00
95	42.5	1	1200	89		7		400	30		2		5		$0.88
90	39.5	10	1200	73		59		400	24		20		39		$7.18
85	36.6	39	1200	57		181		400	19		60		121		$21.99
80	34	149	1200	43		521		400	14		174		348		$63.40
75	31.6	185	1200	30		453		400	10		151		302		$55.10
70	29.2	198	1200		0		0	400		0		0		0	$0.00
65	27	254	1200		6		13	400		2		4		9	$10.18
60	24.5	276	1200		13		29	400		4		10		19	$22.13
55	21.4	179	1200		19		28	400		6		9		19	$21.53
50	18.7	182	1200		26		38	400		9		13		25	$29.19
45	16.2	182	1200		32		47	400		11		16		31	$36.48
40	14.4	195	1200		39		61	400		13		20		40	$46.90
35	12.6	304	1200		45		110	400		15		37		74	$85.31
30	10.7	218	1200		52		90	400		17		30		60	$69.92
25	8.6	99	1200		58		46	400		19		15		31	$35.72
20	6.8	75	1200		65		39	400		22		13		26	$30.07
15	5.5	37	1200		71		21	400		24		7		14	$16.32
10	4.1	14	1200		78		9	400		26		3		6	$6.74
5	2.6	7	1200		84		5	400		28		2		3	$3.65
0	1	4	1200		91		3	400		30		1		2	$2.25
-5	0	0	1200		97		0	400		32		0		0	$0.00
-10	-1.5	0	1200		104		0	400		35		0		0	$0.00
Total		**2608**		**417**	**881**	**1,222**	**538**		**139**	**294**	**407**	**179.47**	**814**	**358.94**	**$564.92**

BPU ENERGY AUDIT PROGRAM
South Brunswick Fire District No. 2, Station 20
CHA Project # 20998

ECM-1 Demand Ventilation AHU 3

	Total CFM	OA CFM	OA%
Org. Scheduled CFM	4120	800	19%
Derated CFM	4120	265	6%
SA Enthalpy	26		
SA Set Point (WINTER)	72		
SA Setpoint (SUMMER)	72		
Balance Point	65		

Heating Equipment Efficiency	80%
Cooling Equip Efficiency (kW/Ton)	1.21

Electrical Cost ($/kW)	$0.18
Natural Gas Cost ($/Therm)	$1.16

Simple Payback Analysis	
Cost	$1,599.20
Incentive	$0.00
Adjusted Cost	$1,599.20
Savings/yr	$425.96
Payback in years	3.75

			EXISTING					PROPOSED DEMAND CONTROL VENTILATION					SAVINGS		
Avg. DB Bin Temp °F	**OA Enthalpy Btu/lb**	**Occupied Bin Hours**	**OA CFM**	**Cooling Load MBH**	**Heating Load MBH**	**Cooling kWH**	**Heating Therm**	**Derated O.A. CFM**	**Cooling Load MBH**	**Heating Load MBH**	**Cooling kWH**	**Heating Therms**	**Cooling kWH**	**Heating Therms**	**$**
100	49.1	0	800	83		0		265	28		0		0		$0.00
95	42.5	1	800	59		6		265	20		2		4		$0.73
90	39.5	10	800	49		49		265	16		16		33		$5.98
85	36.6	39	800	38		150		265	13		50		100		$18.30
80	34	149	800	29		433		265	10		143		289		$52.78
75	31.6	185	800	20		376		265	7		125		251		$45.87
70	29.2	198	800		2		3	265		1		1		2	$2.12
65	27	254	800		6		12	265		2		4		8	$9.53
60	24.5	276	800		10		23	265		3		8		15	$17.76
55	21.4	179	800		15		21	265		5		7		14	$16.32
50	18.7	182	800		19		28	265		6		9		19	$21.47
45	16.2	182	800		23		34	265		8		11		23	$26.35
40	14.4	195	800		28		43	265		9		14		29	$33.46
35	12.6	304	800		32		78	265		11		26		52	$60.31
30	10.7	218	800		36		63	265		12		21		42	$49.09
25	8.6	99	800		41		32	265		13		11		22	$24.95
20	6.8	75	800		45		27	265		15		9		18	$20.91
15	5.5	37	800		49		15	265		16		5		10	$11.31
10	4.1	14	800		54		6	265		18		2		4	$4.65
5	2.6	7	800		58		3	265		19		1		2	$2.51
0	1	4	800		62		2	265		21		1		1	$1.54
-5	0	0	800		67		0	265		22		0		0	$0.00
-10	-1.5	0	800		71		0	265		23		0		0	$0.00
Total		**2608**		**278**	**617**	**1,014**	**390**		**92**	**204**	**336**	**129.08**	**678**	**260.6**	**$425.96**

BPU ENERGY AUDIT PROGRAM
South Brunswick Fire District No. 2, Station 20
CHA Project # 20998

ECM-1 Demand Ventilation (AHU2 & 3)

Multipliers	
Material	0.98
Labor	1.21
Equipment	1.07

Installation Costs

	Qty	Unit	Unit Costs			Subtotal Costs			Total Cost	Remarks
			Material	Labor	Equipment	Material	Labor	Equipment		
Carbon Dioxide Sensors	1	ea	$250	$100		$245	$121	$0	$366	
Wiring and Connections	1	ea	$50	$150		$49	$182	$0	$231	
Control Programming	1	ea	$0	$500		$0	$605	$0	$605	
Modulating Motor Damper	1	ea	$135	$150		$135	$150	$0	$285	

Subtotal	$1,487
10% Contingency	$149
10% OH	$164
10% Profit	$180
Total	$1,979

APPENDIX D

ECM-2 Meeting Room Supply Air Demand Modulation (AHU 2)

BPU ENERGY AUDIT PROGRAM
South Brunswick Fire District No. 2, Station 20
CHA Project # 20998

ECM-2 Meeting Room Supply Air Demand Modulation (AHU 2)

Item	Budgetary Costs	Annual Utility Savings			ROI	Potential Incentive	Payback (Without Incentive)	Payback (With Incentive)
		Electricity	Natural Gas	Total				
	$	KWH	Therms	$		$	Years	Years
Modification AHU 2	$13,923	$2,449	$0	$2,449			5.7	5.7

BPU ENERGY AUDIT PROGRAM
South Brunswick Fire District No. 2, Station 20
CHA Project # 20998

ECM-2 Meeting Room Supply Air Demand Modulation (AHU 2)

	Total CFM	OA CFM	OA%
Org. Scheduled CFM	6000	1200	20%
Derated CFM	2700	1200	44%
Leaving Air Enthalpy	23.5		
Leaving Air Temperature (WINTER)	95		
Leaving Air Temperature (SUMMER)	55		
Space Temperature Set Point (Summer)	75		
Space Temperature Set Point (Winter)	70		
Setback Temperature (SUMMER)	80		
Setback Temperature (WINTER)	60		

Heating Equipment Efficiency	80%
Cooling Equip Efficiency (kW/Ton)	1.21
Motor Efficiency	87.5%
Motor Size (HP)	3
Power (Volts)	208
Current (Amps)	11

Electrical Cost ($/kW)	$0.18
Natural Gas Cost ($/Therm)	$1.16

Simple Payback Analysis	
Cost	$13,922.65
Incentive	$0.00
Adjusted Cost	$13,922.65
Savings/yr	$2,449.02
Payback in years	5.68

								EXISTING						PROPOSED VFD MODULATION								SAVINGS			
Avg. DB Bin Temp °F	OA Enthalpy Btu/lb	Mixed Air Enthalpy Btu/lb	Mixed Air DB Temp °F	Mixed Air Setback °F	Ex. Equip Bin Hours	Occupied Bin Hours	UnOcc Bin Hours	Total Air Flow CFM	Cooling Load MBH	Heating Load MBH	Cooling kWH	Heating Therm	Motor Load kWH	Derated Total Air CFM	Mixed Air Enthalpy Btu/lb	Mixed Air DB Temp °F	Cooling Load MBH	Heating Load MBH	Cooling kWH	Heating Therms	Derated Motor Load kWH	Cooling kWH	Heating Therms	Fan Motor kWH	$
100	41.7	27.1	80.0	-32.0	0	0	0	6000	98		0		0	2700	31.6	86.1	98		0		0	0		0	$0.00
95	39.6	26.7	79.0	-28.0	3	1	2	6000	87		9		6	2700	30.7	83.9	87		9		4	0		2	$0.38
90	37.9	26.4	78.0	-24.0	34	10	24	6000	78		78		68	2700	29.9	81.7	78		78		45	0		23	$4.27
85	35.8	26.0	77.0	-20.0	131	39	92	6000	66		261		262	2700	29.0	79.4	66		261		172	0		90	$16.44
80	34.0	25.6	76.0	-16.0	500	149	351	6000	57		852		1,001	2700	28.2	77.2	57		852		657	0		344	$62.76
75	32.1	25.2	75.0	-12.0	620	185	435	6000	46		866		1,241	2700	27.3	75.0	46		866		815	0		427	$77.83
70	30.0	24.8	70.0	-8.0	664	198	466	6000	35		701		1,329	2700	26.4	72.8	35		701		872	0		457	$83.35
65	26.6	24.1	69.0	-4.0	854	254	600	6000	17		429		1,710	2700	24.9	70.6	17		429		1,122	0		588	$107.20
60	23.7	23.5	68.0	0.0	927	276	651	6000	1		30		1,856	2700	23.6	68.3	1		30		1,218	0		638	$116.36
55	21.0	23.0	67.0	4.0	600	179	421	6000		181		260	1,201	2700	22.4	66.1		84		121	788		139	413	$236.78
50	19.2	22.6	66.0	8.0	610	182	428	6000		188		274	1,221	2700	21.6	63.9		91		132	801		142	420	$240.74
45	16.2	22.0	65.0	12.0	611	182	429	6000		194		283	1,223	2700	20.3	61.7		97		142	803		142	420	$240.86
40	14.3	21.7	64.0	16.0	656	195	461	6000		201		313	1,313	2700	19.4	59.4		104		162	862		152	451	$258.24
35	12.5	21.3	63.0	20.0	1023	304	719	6000		207		504	2,048	2700	18.6	57.2		110		268	1,344		236	704	$402.63
30	10.3	20.9	62.0	24.0	734	218	516	6000		214		373	1,469	2700	17.6	55.0		117		203	964		170	505	$288.78
25	8.3	20.5	61.0	28.0	334	99	235	6000		220		174	669	2700	16.7	52.8		123		98	439		77	230	$131.23
20	6.6	20.1	60.0	32.0	252	75	177	6000		227		136	505	2700	16.0	50.6		130		78	331		58	173	$99.28
15	4.8	19.8	59.0	36.0	125	37	88	6000		233		69	250	2700	15.2	48.3		136		40	164		29	86	$49.07
10	3.5	19.5	58.0	40.0	47	14	33	6000		240		27	94	2700	14.6	46.1		143		16	62		11	32	$18.53
5	1.9	19.2	57.0	44.0	22	7	15	6000		246		14	44	2700	13.9	43.9		149		8	29		5	15	$9.08
0	-0.6	18.7	56.0	48.0	13	4	9	6000		253		8	26	2700	12.8	41.7		156		5	17		3	9	$5.24
-5	-1.4	18.5	55.0	52.0	0	0	0	6000		259		0	0	2700	12.4	39.4		162		0	0		0	0	$0.00
-10	-3.2	18.2	54.0	56.0	0	0	0	6000		266		0	0	2700	11.6	37.2		168		0	0		0	0	$0.00
Total					**8760**	**2608**	**6152**		**485**	**3,130**	**3,226**	**2,435**	**17,538**				**485**	**1,769**	**3,226**	**1272**	**11,509**	**0**	**1163.3**	**6028.5**	**$2,449.02**

BPU ENERGY AUDIT PROGRAM
South Brunswick Fire District No. 2, Station 20
CHA Project # 20998

ECM-2 Meeting Room Supply Air Demand Modulation (AHU 2)

Multipliers	
Material	1
Labor	1.21
Equipment	1.07

Installation Costs

Item	Qty	Unit	Unit Costs			Subtotal Costs			Total Cost	Remarks
			Material	Labor	Equipment	Material	Labor	Equipment		
VAV 1	1	ea	$503	$118		$503	$143	$0	$646	
VAV 2	1	ea	$468	$89		$468	$107	$0	$575	
VFD (3 HP Motor)	1	ea	$1,000	$490		$1,000	$593	$0	$1,593	
SP Sensor & Wiring	1	ea	$1,500	$200		$1,500	$242	$0	$1,742	
Controls	1	ea	$1,114	$893		$1,114	$1,081	$0	$2,195	
General Construction	1	ea	$2,500	$1,000		$2,500	$1,210	$0	$3,710	

Subtotal	$10,460
10% Contingency	$1,046
10% OH	$1,151
10% Profit	$1,266
Total	$13,923

APPENDIX E

ECM-3 Modify Meeting Room (AHU 2) Demand Ventilation & Supply Air Demand Modulation

BPU ENERGY AUDIT PROGRAM
South Brunswick Fire District No. 2, Station 20
CHA Project # 20998

ECM-3 Modify Meeting Room (AHU 2) Demand Ventilation & Supply Air Demand Modualtion

Item	Budgetary Costs	Annual Utility Savings			ROI	Potential Incentive	Payback (Without Incentive)	Payback (With Incentive)
		Electricity	Natural Gas	Total				
	$	KWH	Therms	$		$	Years	Years
Modification AHU 2	$15,900	$1,492	$1,793	$3,285			4.8	4.8

BPU ENERGY AUDIT PROGRAM
South Brunswick Fire District No. 2, Station 20
CHA Project # 20998

ECM-3 Modify Meeting Room (AHU 2) Demand Ventilation & Supply Air Demand Modualtion

	Total CFM	OA CFM	OA%
Org. Scheduled CFM	6000	1200	20%
Derated CFM	2700	400	15%
Leaving Air Enthalpy	23.5		
Leaving Air Temperature (WINTER)	95		
Leaving Air Temperature (SUMMER)	55		
Space Temperature Set Point (Summer)	75		
Space Temperature Set Point (Winter)	70		
Setback Temperature (SUMMER)	80		
Setback Temperature (WINTER)	60		

Heating Equipment Efficiency	80%
Cooling Equip Efficiency (kW/Ton)	1.21
Motor Efficiency	87.5%
Motor Size (HP)	3
Power (Volts)	208
Current (Amps)	11

Electrical Cost ($/kW)	$0.18
Natural Gas Cost ($/Therm)	$1.16

Simple Payback Analysis	
Cost	$ 15,529.84
Incentive	$0.00
Adjusted Cost	$15,529.84
Savings/yr	$3,285.35
Payback in years	4.7

								EXISTING						PROPOSED VFD MODULATION								SAVINGS			
Avg. DB Bin Temp °F	OA Enthalpy Btu/lb	Mixed Air Enthalpy Btu/lb	Mixed Air DB Temp °F	Mixed Air Setback °F	Ex. Equip Bin Hours	Occupied Bin Hours	UnOcc Bin Hours	Total Air Flow CFM	Cooling Load MBH	Heating Load MBH	Cooling kWH	Heating Therm	Motor Load kWH	Derated Total Air CFM	Mixed Air Enthalpy Btu/lb	Mixed Air DB Temp °F	Cooling Load MBH	Heating Load MBH	Cooling kWH	Heating Therms	Derated Motor Load kWH	Cooling kWH	Heating Therms	Fan Motor kWH	$
100	41.7	27.1	80.0	-32.0	0	0	0	6000	98		0		0	2700	26.2	78.7	33		0		0	0		0	$0.00
95	39.6	26.7	79.0	-28.0	3	1	2	6000	87		9		6	2700	25.9	78.0	29		3		4	6		2	$1.44
90	37.9	26.4	78.0	-24.0	34	10	24	6000	78		78		68	2700	25.6	77.2	26		26		45	52		23	$13.80
85	35.8	26.0	77.0	-20.0	131	39	92	6000	66		261		262	2700	25.3	76.5	22		87		172	174		90	$48.21
80	34.0	25.6	76.0	-16.0	500	149	351	6000	57		852		1,001	2700	25.1	75.7	19		284		657	568		344	$166.35
75	32.1	25.2	75.0	-12.0	620	185	435	6000	46		866		1,241	2700	24.8	75.0	15		289		815	578		427	$183.17
70	30.0	24.8	70.0	-8.0	664	198	466	6000	35		701		1,329	2700	24.5	74.3	12		234		872	467		457	$168.56
65	26.6	24.1	69.0	-4.0	854	254	600	6000	17		429		1,710	2700	24.0	73.5	6		143		1,122	286		588	$159.33
60	23.7	23.5	68.0	0.0	927	276	651	6000	1		30		1,856	2700	23.5	72.8	0		10		1,218	20		638	$120.02
55	21.0	23.0	67.0	4.0	600	179	421	6000		181		260	1,201	2700	23.1	72.0		67		96	788		164	413	$265.48
50	19.2	22.6	66.0	8.0	610	182	428	6000		188		274	1,221	2700	22.9	71.3		69		101	801		173	420	$277.22
45	16.2	22.0	65.0	12.0	611	182	429	6000		194		283	1,223	2700	22.4	70.6		71		104	803		179	420	$284.64
40	14.3	21.7	64.0	16.0	656	195	461	6000		201		313	1,313	2700	22.1	69.8		73		115	862		199	451	$312.96
35	12.5	21.3	63.0	20.0	1023	304	719	6000		207		504	2,048	2700	21.9	69.1		76		184	1,344		320	704	$500.12
30	10.3	20.9	62.0	24.0	734	218	516	6000		214		373	1,469	2700	21.5	68.3		78		136	964		237	505	$367.43
25	8.3	20.5	61.0	28.0	334	99	235	6000		220		174	669	2700	21.2	67.6		80		63	439		111	230	$170.91
20	6.6	20.1	60.0	32.0	252	75	177	6000		227		136	505	2700	21.0	66.9		82		49	331		87	173	$132.36
15	4.8	19.8	59.0	36.0	125	37	88	6000		233		69	250	2700	20.7	66.1		84		25	164		44	86	$66.87
10	3.5	19.5	58.0	40.0	47	14	33	6000		240		27	94	2700	20.5	65.4		86		10	62		17	32	$25.82
5	1.9	19.2	57.0	44.0	22	7	15	6000		246		14	44	2700	20.3	64.6		89		5	29		9	15	$13.00
0	-0.6	18.7	56.0	48.0	13	4	9	6000		253		8	26	2700	19.9	63.9		91		3	17		5	9	$7.65
-5	-1.4	18.5	55.0	52.0	0	0	0	6000		259		0	0	2700	19.8	63.1		93		0	0		0	0	$0.00
-10	-3.2	18.2	54.0	56.0	0	0	0	6000		266		0	0	2700	19.5	62.4		95		0	0		0	0	$0.00
Total					**8760**	**2608**	**6152**		**485**	**3,130**	**3,226**	**2,435**	**17,538**				**162**	**1,134**	**1,075**	**889**	**11,509**	**2,151**	**1546.1**	**6028.5**	**$3,285.35**

BPU ENERGY AUDIT PROGRAM
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ECM-3 Modify Meeting Room (AHU 2) Demand Ventilation & Supply Air Demand Modualtion

Multipliers	
Material	1
Labor	1.21
Equipment	1.07

Installation Costs

Item	Qty	Unit	Unit Costs			Subtotal Costs			Total Cost	Remarks
			Material	Labor	Equipment	Material	Labor	Equipment		
VAV 1	1	ea	$503	$118		$503	$143	$0	$646	
VAV 2	1	ea	$468	$89		$468	$107	$0	$575	
VFD (3 HP Motor)	1	ea	$1,000	$490		$1,000	$593	$0	$1,593	
SP Sensor & Wiring	1	ea	$1,500	$200		$1,500	$242	$0	$1,742	
Controls	1	ea	$1,114	$893		$1,114	$1,081	$0	$2,195	
General Construction	1	ea	$2,500	$1,000		$2,500	$1,210	$0	$3,710	
Carbon Dioxide Sensors	1	ea	$250	$100		$250	$121	$0	$371	
Wiring and Connections	1	ea	$50	$150		$50	$182	$0	$232	
Controls Programming	1	ea	$0	$500		$0	$605	$0	$605	
Modulating Motor Damp	1	ea	$135	$150		$135	$182	$0	$317	

Subtotal	$11,984
10% Contingency	$1,198
10% OH	$1,318
10% Profit	$1,450
Total	$15,951

BPU ENERGY AUDIT PROGRAM
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ECM-3 Modify Meeting Room (AHU 2) Demand Ventilation & Supply Air Demand Modualtion

Multipliers	
Material	1
Labor	1.21
Equipment	1.07

Installation Costs

Item	Qty	Unit	Unit Costs			Subtotal Costs			Total Cost	Remarks
			Material	Labor	Equipment	Material	Labor	Equipment		
VAV 1	1	ea	$503	$118		$503	$143	$ -	$646	
VAV 2	1	ea	$468	$89		$468	$107	$ -	$575	
VFD (3 HP Motor)	1	ea	$1,000	$490		$1,000	$593	$ -	$1,593	
SP Sensor & Wiring	1	ea	$1,500	$200		$1,500	$242	$ -	$1,742	
Controls	1	ea	$1,114	$893		$1,114	$1,081	$ -	$2,195	
General Construction	1	ea	$2,500	$1,000		$2,500	$1,210	$ -	$3,710	
Carbon Dioxide Sensors	1	ea	$250	$100		$250	$121	$ -	$371	
Wiring and Connections	1	ea	$50	$150		$50	$182	$ -	$232	
Controls Programming	1	ea	$0	$500		$0	$605	$ -	$605	
Modulating Motor Damper	1	ea	$135	$150		$135	$182		$317	

Subtotal	$11,984
10% Contingency	$1,198
10% OH	$1,318
10% Profit	$1,450
Total	$15,951

APPENDIX F

ECM-4 Combined Demand Ventilation (AHU 2 & 3) & Supply Air Demand Modulation (AHU 2)

BPU ENERGY AUDIT PROGRAM
South Brunswick Fire District No. 2, Station 20
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ECM-4 Combined Demand Ventilation (AHU 2 & 3) & Supply Air Demand Modulation (AHU 2)

Item	Budgetary Costs	Annual Utility Savings			ROI	Potential Incentive	Payback (Without Incentive)	Payback (With Incentive)
		Electricity	Natural Gas	Total				
	$	KWH	Therms	$		$	Years	Years
Modification AHU 2	$15,900	$1,492	$1,793	$3,285			4.8	
AHU 3 Demand Reduction	$2,000	$124	$302	$426			4.7	
Combined	$17,900	$1,616	$2,096	$3,711			4.8	

APPENDIX G

ECM-5 Lighting Fixture Modifications

BPU ENERGY AUDIT PROGRAM
South Brunswick Fire District No. 2, Station 20
CHA Project # 20998

ECM-5 Lighting Fixture Modifications

Item	Budgetary Costs	Annual Utility Savings			ROI	Potential Incentive	Payback (Without Incentive)	Payback (With Incentive)
		Electricity	Natural Gas	Total				
	$	KWH	Therms	$		$	Years	Years
Exit Sign Upgrades	$1,501	$355	$0	$355		0	4.2	4.2
K Fixture Upgrades	$262	$243	$0	$243		0	1.1	1.1
L Fixture Upgrades	$198	$60	$0	$60		0	3.3	3.3
Combined	$1,962	$657		$657		0	3.0	3.0

BPU ENERGY AUDIT PROGRAM
South Brunswick Fire District 2, Station 20
CHA Project # 20998

ECM-5 Lighting Fixture Modifications

EXISTING LIGHTING FIXTURES AND CONTROLS										
Location	Fixture Description	No. of Fixture	Lamp Type & No.	Ballast Type & No.	Fixture Watts	Total Watts	Hours of Operation	Control	kwh/Year	Operational Cost/Year
101 - Lobby	Compact fluorescent downlight	9	(2) 26W PL	(1) Electronic	51	459	2080	Switch	954.72	$174.14
101 - Lobby	3' fluorescent in display case	2	(1) 25W T-8	(1) Electronic	27	54	8760	Breaker	473.04	$86.28
101 - Lobby	Q - 8' fluorescent direct/indirect linear fixture	2	(4) 32W T-8	(1) Electronic	107	214	2080	Switch	445.12	$81.19
101 - Lobby	X - Compact fuorescent exit sign	1	(2) 7W PL	(1) Electronic	16	16	8760	Breaker	140.16	$25.57
102 - Coordinator	C - 4' fluorescent fixture	4	(3) 32W T-8	(2) Electronic	81	324	2080	Dual Switch	673.92	$122.92
103 - Fire Company	C - 4' fluorescent fixture	4	(3) 32W T-8	(2) Electronic	81	324	12	Dual Switch	3.89	$0.71
104 - Fire District	C - 4' fluorescent fixture	4	(3) 32W T-8	(2) Electronic	81	324	416	Dual Switch	134.78	$24.58
105 - General Office	C - 4' fluorescent fixture	4	(3) 32W T-8	(1) Electronic	81	324	2080	Switch	673.92	$122.92
105A - Corridor	C - 4' fluorescent fixture	3	(3) 32W T-8	(1) Electronic	81	243	2080	Switch	505.44	$92.19
105A - Corridor	X - Compact fuorescent exit sign	1	(2) 7W PL	(1) Electronic	16	16	8760	Switch	140.16	$25.57
106 - Storage	F - 4' fluorescent industrial fixture	1	(2) 32W T-8	(1) Electronic	61	61	260	Switch	15.86	$2.89
107 - Conference	C - 4' fluorescent fixture	6	(3) 32W T-8	(2) Electronic	81	486	96	Dual Switch	46.66	$8.51
108 - Line Officers	A - 4' fluorescent fixture	4	(3) 32W T-8	(1) Electronic	81	324	416	Motion Sensor	134.78	$24.58
109 - Communications	A - 4' fluorescent fixture	3	(3) 32W T-8	(1) Electronic	81	243	416	Motion Sensor	101.09	$18.44
110 - Meeting Training Room	A - 4' fluorescent fixture	14	(3) 32W T-8	(1) Electronic	81	1134	240	Switch	272.16	$49.64
110 - Meeting Training Room	E - Emergency fixture	2	(2) 8W 12V Halogen	(1) Electronic	16	32	8760	Breaker	280.32	$51.13
110 - Meeting Training Room	K - 8" incandescent downlight	16	(1) 150W A-Lamp	-	150	2400	240	Switch	576.00	$105.06
110 - Meeting Training Room	L - Wall sconce	12	(1) 150W Halogen	-	150	1800	240	Switch	432.00	$78.80
110 - Meeting Training Room	M - 4' fluorescent strip fixture	22	(1) 32W T-8	(1) Electronic	28	616	240	Switch	147.84	$26.97
110 - Meeting Training Room	X - Compact fuorescent exit sign	2	(2) 7W PL	(1) Electronic	16	32	8760	Breaker	280.32	$51.13
111 - Kitchen	A - 4' fluorescent fixture	3	(3) 32W T-8	(1) Electronic	81	243	252	Switch	61.24	$11.17
112 - Storage	F - 4' fluorescent industrial fixture	1	(2) 32W T-8	(1) Electronic	61	61	52	Switch	3.17	$0.58
113 - Women's Lockers	A - 4' fluorescent fixture	1	(3) 32W T-8	(1) Electronic	81	81	520	Switch	42.12	$7.68
113 - Women's Lockers	H - Compact fluorescent downlight	1	(2) 26W PL	(1) Electronic	51	51	520	Switch	26.52	$4.84
114 - Chair Storage	F - 4' fluorescent industrial fixture	2	(2) 32W T-8	(1) Electronic	61	122	24	Switch	2.93	$0.53
115 - Janitor	F - 4' fluorescent industrial fixture	1	(2) 32W T-8	(1) Electronic	61	61	24	Switch	1.46	$0.27
116 - Women's Toilet	A - 4' fluorescent fixture	2	(3) 32W T-8	(1) Electronic	81	162	520	Motion Sensor	84.24	$15.37
116 - Women's Toilet	B - 4' fluorescent fixture	3	(2) 32W T-8	(1) Electronic	55	165	520	Motion Sensor	85.80	$15.65
116 - Women's Toilet	D - 4' fluorescent fixture	1	(2) 32W T-8	(1) Electronic	61	61	520	Motion Sensor	31.72	$5.79
117 - Men's Toilet	A - 4' fluorescent fixture	2	(3) 32W T-8	(1) Electronic	81	162	520	Motion Sensor	84.24	$15.37
117 - Men's Toilet	B - 4' fluorescent fixture	1	(2) 32W T-8	(1) Electronic	55	55	520	Motion Sensor	28.60	$5.22
117 - Men's Toilet	D - 4' fluorescent fixture	1	(2) 32W T-8	(1) Electronic	61	61	520	Motion Sensor	31.72	$5.79
118 - Men's Locker	A - 4' fluorescent fixture	2	(3) 32W T-8	(1) Electronic	81	162	520	Switch	84.24	$15.37
118 - Men's Locker	H - Compact fluorescent downlight	2	(2) 26W PL	(1) Electronic	51	102	520	Switch	53.04	$9.67
119 - Members	A - 4' fluorescent fixture	6	(3) 32W T-8	(1) Electronic	81	486	520	Switch	252.72	$46.10
119 - Members	K - 8" incandescent downlight	17	(1) 150W A-Lamp	-	150	2550	520	Switch	1326.00	$241.86
119 - Members	X - Compact fuorescent exit sign	2	(2) 7W PL	(1) Electronic	16	32	8760	Breaker	280.32	$51.13
120 - Vestibule	B - 4' fluorescent fixture	1	(2) 32W T-8	(1) Electronic	55	55	2080	Switch	114.40	$20.87
121 - Corridor	B - 4' fluorescent fixture	5	(2) 32W T-8	(1) Electronic	55	275	2080	Switch	572.00	$104.33
121 - Corridor	E - Emergency fixture	2	(2) 8W 12V Halogen	(1) Electronic	16	32	8760	Breaker	280.32	$51.13
121 - Corridor	X - Compact fuorescent exit sign	3	(2) 7W PL	(1) Electronic	16	48	8760	Breaker	420.48	$76.70
122 - Workout	A - 4' fluorescent fixture	9	(3) 32W T-8	(1) Electronic	81	729	1040	Switch	758.16	$138.29
123 - Shop Storage	F - 4' fluorescent industrial fixture	6	(2) 32W T-8	(1) Electronic	61	366	104	Switch	38.06	$6.94

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124 - Corridor	A - 4' fluorescent fixture	1	(3) 32W T-8	(1) Electronic	81	81	104	Switch	8.42	$1.54
124 - Corridor	E - Emergency fixture	1	(2) 8W 12V Halogen	(1) Electronic	16	16	8760	Breaker	140.16	$25.57
124 - Corridor	X - Compact fuorescent exit sign	2	(2) 7W PL	(1) Electronic	16	32	8760	Breaker	280.32	$51.13
125 - Engines	B - 4' fluorescent fixture	1	(2) 32W T-8	(1) Electronic	55	55	104	Switch	5.72	$1.04
125 - Engines	E - Emergency fixture	1	(2) 8W 12V Halogen	(1) Electronic	16	16	8760	Breaker	140.16	$25.57
125 - Engines	G - 8' fluorescent industrial fixture (2 of 5 rows)	12	(2) 86W T8	(1) Electronic	160	1920	312	Switch	599.04	$109.26
125 - Engines	G - 8' fluorescent industrial fixture (3 of 5 rows)	16	(2) 86W T8	(1) Electronic	160	2560	104	Switch	266.24	$48.56
125 - Engines	G - 8' fluorescent industrial fixture (2 lights on permanently)	2	(2) 86W T8	(1) Electronic	160	320	8760	Breaker	2803.20	$511.30
125 - Engines	X - Compact fuorescent exit sign	3	(2) 7W PL	(1) Electronic	16	48	8760	Breaker	420.48	$76.70
126 - Mechanical	F - 4' fluorescent industrial fixture	2	(2) 32W T-8	(1) Electronic	61	122	12	Switch	1.46	$0.27
127 - Electrical	F - 4' fluorescent industrial fixture	3	(2) 32W T-8	(1) Electronic	61	183	12	Switch	2.20	$0.40
128 - Generator	F - 4' fluorescent industrial fixture	3	(2) 32W T-8	(1) Electronic	61	183	12	Switch	2.20	$0.40
129 - Washer	H - Compact fluorescent downlight	1	(2) 26W PL	(1) Electronic	51	51	104	Switch	5.30	$0.97
130 - Wash Down	H - Compact fluorescent downlight	1	(2) 26W PL	(1) Electronic	51	51	104	Switch	5.30	$0.97
131 - Alcove	F - 4' fluorescent industrial fixture	1	(2) 32W T-8	(1) Electronic	61	61	104	Switch	6.34	$1.16
200 - Storage Mezzanine	N - 4' fluorescent fixture	12	(2) 32W T-8	(1) Electronic	58	696	104	Switch	72.38	$13.20
200 - Storage Mezzanine	X - Compact fuorescent exit sign	1	(2) 7W PL	(1) Electronic	16	16	8760	Breaker	140.16	$25.57
Exterior	J - Compact fluorescent downlight	12	(1) 22W PL	(1) Electronic	22	264	4380	Photocell	1156.32	$210.91
Exterior	R - Weatherproof remote double head	5	(2) 8W 12V Halogen	-	16	80	4380	Photocell	350.40	$63.91
Exterior	SL-1 - Pole mounted light	4	(1) 250W MH	Magnetic	295	1180	4380	Photocell	5168.40	$942.72
Exterior	SL-2 - Pole mounted light	2	(2) 250W MH	Magnetic	590	1180	4380	Switch	5168.40	$942.72
Exterior	SL-3 - Pole mounted light	2	(1) 400 W MH	Magnetic	461	922	4380	Photocell	4038.36	$736.60
Exterior	SL-4 - Building mounted light	1	(1) 400 W MH	Magnetic	461	461	4380	Photocell	2019.18	$368.30
Exterior	SL-5 - Pole mounted light	3	(1) 100 W MH	Magnetic	122	366	4380	Photocell	1603.08	$292.40
Exterior	SL-6 - Flag pole flood light	2	(1) 100 W MH	Magnetic	122	244	4380	Photocell	1068.72	$194.93
TOTAL									**36567.64**	**$6,669.94**

Energy Cost: $0.1824

Notes: **Existing Lighting Fixture Schedule**

Total Watts = No. of Fixture x Fixture Watts

kwh/Year = Total Watts/1000 x Hours of Operation

Operational Cost/Year = kwh/Year x Energy Cost

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ECM-5 Lighting Fixture Modifications

Existing Fixtures					**Proposed Replacement Fixture**									**Savings After Retrofit**		
Location	Fixture Description and System Watts	Fixture Watts	kwh/Year	Operational Cost/Year	Fixture Description	No. of Fixtures	Fixture Watts	Total Watts	Hours of Operation	kwh/Year	Operational Cost/Year	Installed Cost Per Fixture	Total Installed Cost	kwh Savings /Year	Cost Savings /Year	Payback in Years
101 - Lobby	Compact Fluorescent Downlight, (2) PL, 51W	51	955	$174.14		9		0	2080	0	$0.00		$0.00	0	$0.00	0.00
101 - Lobby	3' Fluorescent in Display Case, (1) T8, 27W	27	473	$86.28		2		0	8760	0	$0.00		$0.00	0	$0.00	0.00
101 - Lobby	O - 8' Fluorescent, (4) T8, 107W	107	445	$81.19		2		0	2080	0	$0.00		$0.00	0	$0.00	0.00
101 - Lobby	X - Compact Fluorescent Exit Sign, 16W	16	140	$25.57	LED Exit Sign (Replace lamps)	1	1.2	1.2	8760	11	$1.92	$100.09	$100.09	130	$23.65	4.23
102 - Coordinator	C - 4' Fluorescent, (3) T8, 81W	81	674	$122.92		4		0	2080	0	$0.00		$0.00	0	$0.00	0.00
103 - Fire Company	C - 4' Fluorescent, (3) T8, 81W	81	4	$0.71		4		0	12	0	$0.00		$0.00	0	$0.00	0.00
104 - Fire District	C - 4' Fluorescent, (3) T8, 81W	81	135	$24.58		4		0	416	0	$0.00		$0.00	0	$0.00	0.00
105 - General Office	C - 4' Fluorescent, (3) T8, 81W	81	674	$122.92		4		0	2080	0	$0.00		$0.00	0	$0.00	0.00
105A - Corridor	C - 4' Fluorescent, (3) T8, 81W	81	505	$92.19		3		0	2080	0	$0.00		$0.00	0	$0.00	0.00
105A - Corridor	X - Compact Fluorescent Exit Sign, 16W	16	140	$25.57	LED Exit Sign (Replace lamps)	1	1.2	1.2	8760	11	$1.92	$100.09	$100.09	130	$23.65	4.23
106 - Storage	F - 4' Fluorescent, (2) T8, 61W	61	16	$2.89		1		0	260	0	$0.00		$0.00	0	$0.00	0.00
107 - Conference	C - 4' Fluorescent, (3) T8, 81W	81	47	$8.51		6		0	96	0	$0.00		$0.00	0	$0.00	0.00
108 - Line Officers	A - 4' Fluorescent, (3) T8, 81W	81	135	$24.58		4		0	416	0	$0.00		$0.00	0	$0.00	0.00
109 - Communications	A - 4' Fluorescent, (3) T8, 81W	81	101	$18.44		3		0	416	0	$0.00		$0.00	0	$0.00	0.00
110 - Meeting Training Room	A - 4' Fluorescent, (3) T8, 81W	81	272	$49.64		14		0	240	0	$0.00		$0.00	0	$0.00	0.00
110 - Meeting Training Room	E - Emergency, (2) Halogen, 16W	16	280	$51.13		2		0	8760	0	$0.00		$0.00	0	$0.00	0.00
110 - Meeting Training Room	K - 8" Incandescent Downlight, A Lamp, 150W	150	576	$105.06	Compact Fluorescent (Lamp only)	16	45	720	240	173	$31.52	$7.95	$127.20	403	$73.54	1.73
110 - Meeting Training Room	L - Wall Sconce, Halogen, 150W	150	432	$78.80	Compact Fluorescent (Lamp only)	12	36	432	240	104	$18.91	$16.50	$198.00	328	$59.89	3.31
110 - Meeting Training Room	M - 4' Fluorescent Strip, (1) T8, 28W	28	148	$26.97		22		0	240	0	$0.00		$0.00	0	$0.00	0.00
110 - Meeting Training Room	X - Compact Fluorescent Exit Sign, 16W	16	280	$51.13	LED Exit Sign (Replace lamps)	2	1.2	2.4	8760	21	$3.83	$100.09	$200.18	259	$47.30	4.23
111 - Kitchen	A - 4' Fluorescent, (3) T8, 81W	81	61	$11.17		3		0	252	0	$0.00		$0.00	0	$0.00	0.00
112 - Storage	F - 4' Fluorescent, (2) T8, 61W	61	3	$0.58		1		0	52	0	$0.00		$0.00	0	$0.00	0.00
113 - Women's Lockers	A - 4' Fluorescent, (3) T8, 81W	81	42	$7.68		1		0	520	0	$0.00		$0.00	0	$0.00	0.00
113 - Women's Lockers	H - Compact Fluorescent Downlight, (2) PL, 51W	51	27	$4.84		1		0	520	0	$0.00		$0.00	0	$0.00	0.00
114 - Chair Storage	F - 4' Fluorescent, (2) T8, 61W	61	3	$0.53		2		0	24	0	$0.00		$0.00	0	$0.00	0.00
115 - Janitor	F - 4' Fluorescent, (2) T8, 61W	61	1	$0.27		1		0	24	0	$0.00		$0.00	0	$0.00	0.00
116 - Women's Toilet	A - 4' Fluorescent, (3) T8, 81W	81	84	$15.37		2		0	520	0	$0.00		$0.00	0	$0.00	0.00
116 - Women's Toilet	B - 4' Fluorescent, (2) T8, 55W	55	86	$15.65		3		0	520	0	$0.00		$0.00	0	$0.00	0.00
116 - Women's Toilet	D - 4' Fluorescent, (2) T8, 61W	61	32	$5.79		1		0	520	0	$0.00		$0.00	0	$0.00	0.00
117 - Men's Toilet	A - 4' Fluorescent, (3) T8, 81W	81	84	$15.37		2		0	520	0	$0.00		$0.00	0	$0.00	0.00
117 - Men's Toilet	B - 4' Fluorescent, (2) T8, 55W	55	29	$5.22		1		0	520	0	$0.00		$0.00	0	$0.00	0.00
117 - Men's Toilet	D - 4' Fluorescent, (2) T8, 61W	61	32	$5.79		1		0	520	0	$0.00		$0.00	0	$0.00	0.00
118 - Men's Locker	A - 4' Fluorescent, (3) T8, 81W	81	84	$15.37		2		0	520	0	$0.00		$0.00	0	$0.00	0.00
118 - Men's Locker	H - Compact Fluorescent Downlight, (2) PL, 51W	51	53	$9.67		2		0	520	0	$0.00		$0.00	0	$0.00	0.00
119 - Members	A - 4' Fluorescent, (3) T8, 81W	81	253	$46.10		6		0	520	0	$0.00		$0.00	0	$0.00	0.00
119 - Members	K - 8" Incandescent Downlight, A Lamp, 150W	150	1326	$241.86	Compact Fluorescent (lamp only)	17	45	765	520	398	$72.56	$7.95	$135.15	928	$169.30	0.80
119 - Members	X - Compact Fluorescent Exit Sign, 16W	16	280	$51.13	LED Exit Sign (Replace lamps)	2	1.2	2.4	8760	21	$3.83	$100.09	$200.18	259	$47.30	4.23
120 - Vestibule	B - 4' Fluorescent, (2) T8, 55W	55	114	$20.87		1		0	2080	0	$0.00		$0.00	0	$0.00	0.00
121 - Corridor	B - 4' Fluorescent, (2) T8, 55W	55	572	$104.33		5		0	2080	0	$0.00		$0.00	0	$0.00	0.00
121 - Corridor	E - Emergency, (2) Halogen, 16W	16	280	$51.13		2		0	8760	0	$0.00		$0.00	0	$0.00	0.00
121 - Corridor	X - Compact Fluorescent Exit Sign, 16W	16	420	$76.70	LED Exit Sign (Replace lamps)	3	1.2	3.6	8760	32	$5.75	$100.09	$300.27	389	$70.94	4.23
122 - Workout	A - 4' Fluorescent, (3) T8, 81W	81	758	$138.29		9		0	1040	0	$0.00		$0.00	0	$0.00	0.00
123 - Shop Storage	F - 4' Fluorescent, (2) T8, 61W	61	38	$6.94		6		0	104	0	$0.00		$0.00	0	$0.00	0.00
124 - Corridor	A - 4' Fluorescent, (3) T8, 81W	81	8	$1.54		1		0	104	0	$0.00		$0.00	0	$0.00	0.00
124 - Corridor	E - Emergency, (2) Halogen, 16W	16	140	$25.57		1		0	8760	0	$0.00		$0.00	0	$0.00	0.00
124 - Corridor	X - Compact Fluorescent Exit Sign, 16W	16	280	$51.13	LED Exit Sign (Replace lamps)	2	1.2	2.4	8760	21	$3.83	$100.09	$200.18	259	$47.30	4.23
125 - Engines	B - 4' Fluorescent, (2) T8, 55W	55	6	$1.04		1		0	104	0	$0.00		$0.00	0	$0.00	0.00
125 - Engines	E - Emergency, (2) Halogen, 16W	16	140	$25.57		1		0	8760	0	$0.00		$0.00	0	$0.00	0.00
125 - Engines	G - 8' Fluorescent, (2) T8, 160W	160	599	$109.26		12		0	312	0	$0.00		$0.00	0	$0.00	0.00
125 - Engines	G - 8' Fluorescent, (2) T8, 160W	160	266	$48.56		16		0	104	0	$0.00		$0.00	0	$0.00	0.00
125 - Engines	G - 8' Fluorescent, (2) T8, 160W	160	2803	$511.30		2		0	8760	0	$0.00		$0.00	0	$0.00	0.00
125 - Engines	X - Compact Fluorescent Exit Sign, 16W	16	420	$76.70	LED Exit Sign (Replace lamps)	3	1.2	3.6	8760	32	$5.75	$100.09	$300.27	389	$70.94	4.23
126 - Mechanical	F - 4' Fluorescent, (2) T8, 61W	61	1	$0.27		2		0	12	0	$0.00		$0.00	0	$0.00	0.00
127 - Electrical	F - 4' Fluorescent, (2) T8, 61W	61	2	$0.40		3		0	12	0	$0.00		$0.00	0	$0.00	0.00
128 - Generator	F - 4' Fluorescent, (2) T8, 61W	61	2	$0.40		3		0	12	0	$0.00		$0.00	0	$0.00	0.00
129 - Washer	H - Compact Fluorescent Downlight, (2) PL, 51W	51	5	$0.97		1		0	104	0	$0.00		$0.00	0	$0.00	0.00
130 - Wash Down	H - Compact Fluorescent Downlight, (2) PL, 51W	51	5	$0.97		1		0	104	0	$0.00		$0.00	0	$0.00	0.00
131 - Alcove	F - 4' Fluorescent, (2) T8, 61W	61	6	$1.16		1		0	104	0	$0.00		$0.00	0	$0.00	0.00
200 - Storage Mezzanine	N - 4' Fluorescent, (2) T8, 58W	58	72	$13.20		12		0	104	0	$0.00		$0.00	0	$0.00	0.00
200 - Storage Mezzanine	X - Compact Fluorescent Exit Sign, 16W	16	140	$25.57	LED Exit Sign (Replace lamps)	1	1.2	1.2	8760	11	$1.92	$100.09	$100.09	130	$23.65	4.23
Exterior	J - Compact Fluorescent Downlight, (1) PL, 22W	22	1156	$210.91		12		0	4380	0	$0.00		$0.00	0	$0.00	0.00
Exterior	R - Weatherproof Remote Double Head, Halogen, 16W	16	350	$63.91		5		0	4380	0	$0.00		$0.00	0	$0.00	0.00
Exterior	SL-1 - Pole mounted light	295	5168	$942.72		4		0	4380	0	$0.00		$0.00	0	$0.00	0.00
Exterior	SL-2 - Pole mounted light	590	5168	$942.72		2		0	4380	0	$0.00		$0.00	0	$0.00	0.00

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Exterior	SL-3 - Pole mounted light	461	4038	$736.60		2		0	4380	0	$0.00		$0.00	0	$0.00	0.00
Exterior	SL-4 - Building mounted light	461	2019	$368.30		1		0	4380	0	$0.00		$0.00	0	$0.00	0.00
Exterior	SL-5 - Pole mounted light	122	1603	$292.40		3		0	4380	0	$0.00		$0.00	0	$0.00	0.00
Exterior	SL-6 - Flag pole flood light	122	1069	$194.93		2		0	4380	0	$0.00		$0.00	0	$0.00	0.00
Totals			36568	$6,669.94									$1,961.70	3604	$657.45	2.98

Energy Cost: $0.1824

Notes: **Lighting Fixture Replacement Savings**

Total Watts = No. of Fixture x Fixture Watts
kwh/Year = Total Watts/1000 x Hours of Operation
Operational Cost/Year = kwh/Year x Energy Cost
Total Installed Cost = Number of Fixtures x Installed Cost Per Fixture
Yearly $ Savings = Savings kwh/Year x Energy Cost
Payback in Years = Total Installed Cost/Yearly $ Savings

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ECM-5 Lighting Fixture Modifications
EXIT SIGNS

Multipliers	
Material	0.98
Labor	1.21
Equipment	1.07

Installation Costs											
	Qty	Unit	Unit Costs			Subtotal Costs			Total Cost w/o Incentive	Incentive Available	Remarks
			Material	Labor	Equipment	Material	Labor	Equipment			
Exit Sign Lamps Replacement	15	ea	$15	$50		$221	$908	$0	$1,128	$ -	
and rewiring.						$0	$0	$0	$0		

Subtotal	$1,128
10% Contingency	$113
10% OH	$124
10% Profit	$136
Total	$1,501
Incentive	$0
Total Cost with Incentive	$1,501

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ECM-5 Lighting Fixture Modifications
CFL Lamps
Owner Installed

Multipliers	
Material	1
Labor	1.21
Equipment	1.07

Installation Costs											
	Qty	Unit	Unit Costs			Subtotal Costs			Total Cost w/o Incentive	Incentive Available	Remarks
			Material	Labor	Equipment	Material	Labor	Equipment			
K Fixture lamps	33	ea	$8	$0	$0	$262	$0	$0	$262	$ -	Owner Installed
L Fixture lamps	12	ea	$17	$0	$0	$198	$0	$0	$198	$ -	Owner Installed

Subtotal	$460
10% Contingency	$0
10% OH	$0
10% Profit	$0
Total	$460
Incentive	$0
Total Cost with Incentive	$460

APPENDIX H

ECM-6 Lighting Control Modifications

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ECM-6 Lighting Control Modifications

Item	Budgetary Costs	Annual Utility Savings			ROI	Potential Incentive	Payback (Without Incentive)	Payback (With Incentive)
		Electricity	Natural Gas	Total				
	$	KWH	Therms	$		$	Years	Years
Motion Sensor Control								
Selected Office Areas	$339	$68	$0	$68		60	5.0	4.1
Fire Company Office	$113	$0	$0	$0		20	628.6	517.4
Kitchen	$113	$6	$0	$6		20	20.3	16.7
Combined	$566	$73		$73		100	7.7	6.3

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ECM-6 Lighting Control Modifications

EXISTING LIGHTING FIXTURES AND CONTROLS										
Location	Fixture Description	No. of Fixture	Lamp Type & No.	Ballast Type & No.	Fixture Watts	Total Watts	Hours of Operation	Control	kwh/Year	Operational Cost/Year
101 - Lobby	Compact fluorescent downlight	9	(2) 26W PL	(1) Electronic	51	459	2080	Switch	954.72	$174.14
101 - Lobby	3' fluorescent in display case	2	(1) 25W T-8	(1) Electronic	27	54	8760	Breaker	473.04	$86.28
101 - Lobby	Q - 8' fluorescent direct/indirect linear fixture	2	(4) 32W T-8	(1) Electronic	107	214	2080	Switch	445.12	$81.19
101 - Lobby	X - Compact fuorescent exit sign	1	(2) 7W PL	(1) Electronic	16	16	8760	Breaker	140.16	$25.57
102 - Coordinator	C - 4' fluorescent fixture	4	(3) 32W T-8	(2) Electronic	81	324	2080	Dual Switch	673.92	$122.92
103 - Fire Company	C - 4' fluorescent fixture	4	(3) 32W T-8	(2) Electronic	81	324	12	Dual Switch	3.89	$0.71
104 - Fire District	C - 4' fluorescent fixture	4	(3) 32W T-8	(2) Electronic	81	324	416	Dual Switch	134.78	$24.58
105 - General Office	C - 4' fluorescent fixture	4	(3) 32W T-8	(1) Electronic	81	324	2080	Switch	673.92	$122.92
105A - Corridor	C - 4' fluorescent fixture	3	(3) 32W T-8	(1) Electronic	81	243	2080	Switch	505.44	$92.19
105A - Corridor	X - Compact fuorescent exit sign	1	(2) 7W PL	(1) Electronic	16	16	8760	Switch	140.16	$25.57
106 - Storage	F - 4' fluorescent industrial fixture	1	(2) 32W T-8	(1) Electronic	61	61	260	Switch	15.86	$2.89
107 - Conference	C - 4' fluorescent fixture	6	(3) 32W T-8	(2) Electronic	81	486	96	Dual Switch	46.66	$8.51
108 - Line Officers	A - 4' fluorescent fixture	4	(3) 32W T-8	(1) Electronic	81	324	416	Motion Sensor	134.78	$24.58
109 - Communications	A - 4' fluorescent fixture	3	(3) 32W T-8	(1) Electronic	81	243	416	Motion Sensor	101.09	$18.44
110 - Meeting Training Room	A - 4' fluorescent fixture	14	(3) 32W T-8	(1) Electronic	81	1134	240	Switch	272.16	$49.64
110 - Meeting Training Room	E - Emergency fixture	2	(2) 8W 12V Halogen	(1) Electronic	16	32	8760	Breaker	280.32	$51.13
110 - Meeting Training Room	K - 8" incandescent downlight	16	(1) 150W A-Lamp	-	150	2400	240	Switch	576.00	$105.06
110 - Meeting Training Room	L - Wall sconce	12	(1) 150W Halogen	-	150	1800	240	Switch	432.00	$78.80
110 - Meeting Training Room	M - 4' fluorescent strip fixture	22	(1) 32W T-8	(1) Electronic	28	616	240	Switch	147.84	$26.97
110 - Meeting Training Room	X - Compact fuorescent exit sign	2	(2) 7W PL	(1) Electronic	16	32	8760	Breaker	280.32	$51.13
111 - Kitchen	A - 4' fluorescent fixture	3	(3) 32W T-8	(1) Electronic	81	243	252	Switch	61.24	$11.17
112 - Storage	F - 4' fluorescent industrial fixture	1	(2) 32W T-8	(1) Electronic	61	61	52	Switch	3.17	$0.58
113 - Women's Lockers	A - 4' fluorescent fixture	1	(3) 32W T-8	(1) Electronic	81	81	520	Switch	42.12	$7.68
113 - Women's Lockers	H - Compact fluorescent downlight	1	(2) 26W PL	(1) Electronic	51	51	520	Switch	26.52	$4.84
114 - Chair Storage	F - 4' fluorescent industrial fixture	2	(2) 32W T-8	(1) Electronic	61	122	24	Switch	2.93	$0.53
115 - Janitor	F - 4' fluorescent industrial fixture	1	(2) 32W T-8	(1) Electronic	61	61	24	Switch	1.46	$0.27
116 - Women's Toilet	A - 4' fluorescent fixture	2	(3) 32W T-8	(1) Electronic	81	162	520	Motion Sensor	84.24	$15.37
116 - Women's Toilet	B - 4' fluorescent fixture	3	(2) 32W T-8	(1) Electronic	55	165	520	Motion Sensor	85.80	$15.65
116 - Women's Toilet	D - 4' fluorescent fixture	1	(2) 32W T-8	(1) Electronic	61	61	520	Motion Sensor	31.72	$5.79
117 - Men's Toilet	A - 4' fluorescent fixture	2	(3) 32W T-8	(1) Electronic	81	162	520	Motion Sensor	84.24	$15.37
117 - Men's Toilet	B - 4' fluorescent fixture	1	(2) 32W T-8	(1) Electronic	55	55	520	Motion Sensor	28.60	$5.22
117 - Men's Toilet	D - 4' fluorescent fixture	1	(2) 32W T-8	(1) Electronic	61	61	520	Motion Sensor	31.72	$5.79
118 - Men's Locker	A - 4' fluorescent fixture	2	(3) 32W T-8	(1) Electronic	81	162	520	Switch	84.24	$15.37
118 - Men's Locker	H - Compact fluorescent downlight	2	(2) 26W PL	(1) Electronic	51	102	520	Switch	53.04	$9.67
119 - Members	A - 4' fluorescent fixture	6	(3) 32W T-8	(1) Electronic	81	486	520	Switch	252.72	$46.10
119 - Members	K - 8" incandescent downlight	17	(1) 150W A-Lamp	-	150	2550	520	Switch	1326.00	$241.86
119 - Members	X - Compact fuorescent exit sign	2	(2) 7W PL	(1) Electronic	16	32	8760	Breaker	280.32	$51.13
120 - Vestibule	B - 4' fluorescent fixture	1	(2) 32W T-8	(1) Electronic	55	55	2080	Switch	114.40	$20.87
121 - Corridor	B - 4' fluorescent fixture	5	(2) 32W T-8	(1) Electronic	55	275	2080	Switch	572.00	$104.33
121 - Corridor	E - Emergency fixture	2	(2) 8W 12V Halogen	(1) Electronic	16	32	8760	Breaker	280.32	$51.13
121 - Corridor	X - Compact fuorescent exit sign	3	(2) 7W PL	(1) Electronic	16	48	8760	Breaker	420.48	$76.70
122 - Workout	A - 4' fluorescent fixture	9	(3) 32W T-8	(1) Electronic	81	729	1040	Switch	758.16	$138.29
123 - Shop Storage	F - 4' fluorescent industrial fixture	6	(2) 32W T-8	(1) Electronic	61	366	104	Switch	38.06	$6.94

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124 - Corridor	A - 4' fluorescent fixture	1	(3) 32W T-8	(1) Electronic	81	81	104	Switch	8.42	$1.54
124 - Corridor	E - Emergency fixture	1	(2) 8W 12V Halogen	(1) Electronic	16	16	8760	Breaker	140.16	$25.57
124 - Corridor	X - Compact fuorescent exit sign	2	(2) 7W PL	(1) Electronic	16	32	8760	Breaker	280.32	$51.13
125 - Engines	B - 4' fluorescent fixture	1	(2) 32W T-8	(1) Electronic	55	55	104	Switch	5.72	$1.04
125 - Engines	E - Emergency fixture	1	(2) 8W 12V Halogen	(1) Electronic	16	16	8760	Breaker	140.16	$25.57
125 - Engines	G - 8' fluorescent industrial fixture (2 of 5 rows)	12	(2) 86W T8	(1) Electronic	160	1920	312	Switch	599.04	$109.26
125 - Engines	G - 8' fluorescent industrial fixture (3 of 5 rows)	16	(2) 86W T8	(1) Electronic	160	2560	104	Switch	266.24	$48.56
125 - Engines	G - 8' fluorescent industrial fixture (2 lights on permanently)	2	(2) 86W T8	(1) Electronic	160	320	8760	Breaker	2803.20	$511.30
125 - Engines	X - Compact fuorescent exit sign	3	(2) 7W PL	(1) Electronic	16	48	8760	Breaker	420.48	$76.70
126 - Mechanical	F - 4' fluorescent industrial fixture	2	(2) 32W T-8	(1) Electronic	61	122	12	Switch	1.46	$0.27
127 - Electrical	F - 4' fluorescent industrial fixture	3	(2) 32W T-8	(1) Electronic	61	183	12	Switch	2.20	$0.40
128 - Generator	F - 4' fluorescent industrial fixture	3	(2) 32W T-8	(1) Electronic	61	183	12	Switch	2.20	$0.40
129 - Washer	H - Compact fluorescent downlight	1	(2) 26W PL	(1) Electronic	51	51	104	Switch	5.30	$0.97
130 - Wash Down	H - Compact fluorescent downlight	1	(2) 26W PL	(1) Electronic	51	51	104	Switch	5.30	$0.97
131 - Alcove	F - 4' fluorescent industrial fixture	1	(2) 32W T-8	(1) Electronic	61	61	104	Switch	6.34	$1.16
200 - Storage Mezzanine	N - 4' fluorescent fixture	12	(2) 32W T-8	(1) Electronic	58	696	104	Switch	72.38	$13.20
200 - Storage Mezzanine	X - Compact fuorescent exit sign	1	(2) 7W PL	(1) Electronic	16	16	8760	Breaker	140.16	$25.57
Exterior	J - Compact fluorescent downlight	12	(1) 22W PL	(1) Electronic	22	264	4380	Photocell	1156.32	$210.91
Exterior	R - Weatherproof remote double head	5	(2) 8W 12V Halogen	-	16	80	4380	Photocell	350.40	$63.91
TOTAL									**17501.50**	**$3,192.27**

Energy Cost: $0.1824

Notes: **Existing Lighting Fixture Schedule**

Total Watts = No. of Fixture x Fixture Watts

kwh/Year = Total Watts/1000 x Hours of Operation

Operational Cost/Year = kwh/Year x Energy Cost

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ECM-6 Lighting Control Modifications

Multipliers	
Material	0.98
Labor	1.21
Equipment	1.07

Installation Costs											
	Qty	Unit	Unit Costs			Subtotal Costs			Total Cost w/o Incentive	Incentive Available	Remarks
			Material	Labor	Equipment	Material	Labor	Equipment			
Motion Sensor (Wall Mounted)	1	ea	$25	$50		$25	$61	$0	$85	$20	

Subtotal	$85
10% Contingency	$9
10% OH	$9
10% Profit	$10
Total	$113
Incentive	$20
Total Cost with Incentive	$93

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ECM-6 Lighting Control Modifications																	
Exististing Lighting Fixture Controls										**Proposed Lighting Fixture Controls**					**Savings After retrofit**	
Location	Fixture Description	No. of Fixture	Lamp Type & No.	Fixture Watts	Total Watts	Hours of Operation	Control	kwh/Year	Operational Cost/Year	Modified Control	New Hours of Operation	kwh/Year	Operational Cost/Year	Installation Cost*	Cost Savings /Year	Payback in Years
101 - Lobby	Compact fluorescent downlight	9	(2) 26W PL	51	459	2080	Switch	954.72	$174.14							
101 - Lobby	3' fluorescent in display case	2	(1) 25W T-8	27	54	8760	Breaker	473.04	$86.28							
101 - Lobby	Q - 8' fluorescent direct/indirect linear fixture	2	(4) 32W T-8	107	214	2080	Switch	445.12	$81.19							
101 - Lobby	X - Compact fuorescent exit sign	1	(2) 7W PL	16	16	8760	Breaker	140.16	$25.57							
102 - Coordinator	C - 4' fluorescent fixture	4	(3) 32W T-8	81	324	2080	Dual Switch	673.92	$122.92	Wall Motion Sensor *	1560	505.44	$92.19	$93.14	$30.73	3.0
103 - Fire Company	C - 4' fluorescent fixture	4	(3) 32W T-8	81	324	12	Dual Switch	3.89	$0.71	Wall Motion Sensor *	9	2.92	$0.53	$93.14	$0.18	525.3
104 - Fire District	C - 4' fluorescent fixture	4	(3) 32W T-8	81	324	416	Dual Switch	134.78	$24.58	Wall Motion Sensor *	312	101.09	$18.44	$93.14	$6.15	15.2
105 - General Office	C - 4' fluorescent fixture	4	(3) 32W T-8	81	324	2080	Switch	673.92	$122.92	Wall Motion Sensor	1560	505.44	$92.19	$93.14	$30.73	3.0
105A - Corridor	C - 4' fluorescent fixture	3	(3) 32W T-8	81	243	2080	Switch	505.44	$92.19							
105A - Corridor	X - Compact fuorescent exit sign	1	(2) 7W PL	16	16	8760	Switch	140.16	$25.57							
106 - Storage	F - 4' fluorescent industrial fixture	1	(2) 32W T-8	61	61	260	Switch	15.86	$2.89							
107 - Conference	C - 4' fluorescent fixture	6	(3) 32W T-8	81	486	96	Dual Switch	46.66	$8.51							
108 - Line Officers	A - 4' fluorescent fixture	4	(3) 32W T-8	81	324	416	Motion Sensor	134.78	$24.58							
109 - Communications	A - 4' fluorescent fixture	3	(3) 32W T-8	81	243	416	Motion Sensor	101.09	$18.44							
110 - Meeting Training Room	A - 4' fluorescent fixture	14	(3) 32W T-8	81	1134	240	Switch	272.16	$49.64							
110 - Meeting Training Room	E - Emergency fixture	2	(2) 8W 12V Halogen	16	32	8760	Breaker	280.32	$51.13							
110 - Meeting Training Room	K - 8" incandescent downlight	16	(1) 150W A-Lamp	150	2400	240	Switch	576.00	$105.06							
110 - Meeting Training Room	L - Wall sconce	12	(1) 150W Halogen	150	1800	240	Switch	432.00	$78.80							
110 - Meeting Training Room	M - 4' fluorescent strip fixture	22	(1) 32W T-8	28	616	240	Switch	147.84	$26.97							
110 - Meeting Training Room	X - Compact fuorescent exit sign	2	(2) 7W PL	16	32	8760	Breaker	280.32	$51.13							
111 - Kitchen	A - 4' fluorescent fixture	3	(3) 32W T-8	81	243	252	Switch	61.24	$11.17	Wall Motion Sensor	126	30.62	$5.58	$93.14	$5.58	16.7
112 - Storage	F - 4' fluorescent industrial fixture	1	(2) 32W T-8	61	61	52	Switch	3.17	$0.58							
113 - Women's Lockers	A - 4' fluorescent fixture	1	(3) 32W T-8	81	81	520	Switch	42.12	$7.68							
113 - Women's Lockers	H - Compact fluorescent downlight	1	(2) 26W PL	51	51	520	Switch	26.52	$4.84							
114 - Chair Storage	F - 4' fluorescent industrial fixture	2	(2) 32W T-8	61	122	24	Switch	2.93	$0.53							
115 - Janitor	F - 4' fluorescent industrial fixture	1	(2) 32W T-8	61	61	24	Switch	1.46	$0.27							
116 - Women's Toilet	A - 4' fluorescent fixture	2	(3) 32W T-8	81	162	520	Motion Sensor	84.24	$15.37							
116 - Women's Toilet	B - 4' fluorescent fixture	3	(2) 32W T-8	55	165	520	Motion Sensor	85.80	$15.65							
116 - Women's Toilet	D - 4' fluorescent fixture	1	(2) 32W T-8	61	61	520	Motion Sensor	31.72	$5.79							
117 - Men's Toilet	A - 4' fluorescent fixture	2	(3) 32W T-8	81	162	520	Motion Sensor	84.24	$15.37							
117 - Men's Toilet	B - 4' fluorescent fixture	1	(2) 32W T-8	55	55	520	Motion Sensor	28.60	$5.22							
117 - Men's Toilet	D - 4' fluorescent fixture	1	(2) 32W T-8	61	61	520	Motion Sensor	31.72	$5.79							
118 - Men's Locker	A - 4' fluorescent fixture	2	(3) 32W T-8	81	162	520	Switch	84.24	$15.37							
118 - Men's Locker	H - Compact fluorescent downlight	2	(2) 26W PL	51	102	520	Switch	53.04	$9.67							
119 - Members	A - 4' fluorescent fixture	6	(3) 32W T-8	81	486	520	Switch	252.72	$46.10							
119 - Members	K - 8" incandescent downlight	17	(1) 150W A-Lamp	150	2550	520	Switch	1326.00	$241.86							
119 - Members	X - Compact fuorescent exit sign	2	(2) 7W PL	16	32	8760	Breaker	280.32	$51.13							
120 - Vestibule	B - 4' fluorescent fixture	1	(2) 32W T-8	55	55	2080	Switch	114.40	$20.87							
121 - Corridor	B - 4' fluorescent fixture	5	(2) 32W T-8	55	275	2080	Switch	572.00	$104.33							
121 - Corridor	E - Emergency fixture	2	(2) 8W 12V Halogen	16	32	8760	Breaker	280.32	$51.13							
121 - Corridor	X - Compact fuorescent exit sign	3	(2) 7W PL	16	48	8760	Breaker	420.48	$76.70							
122 - Workout	A - 4' fluorescent fixture	9	(3) 32W T-8	81	729	1040	Switch	758.16	$138.29							
123 - Shop Storage	F - 4' fluorescent industrial fixture	6	(2) 32W T-8	61	366	104	Switch	38.06	$6.94							
124 - Corridor	A - 4' fluorescent fixture	1	(3) 32W T-8	81	81	104	Switch	8.42	$1.54							
124 - Corridor	E - Emergency fixture	1	(2) 8W 12V Halogen	16	16	8760	Breaker	140.16	$25.57							
124 - Corridor	X - Compact fuorescent exit sign	2	(2) 7W PL	16	32	8760	Breaker	280.32	$51.13							
125 - Engines	B - 4' fluorescent fixture	1	(2) 32W T-8	55	55	104	Switch	5.72	$1.04							
125 - Engines	E - Emergency fixture	1	(2) 8W 12V Halogen	16	16	8760	Breaker	140.16	$25.57							
125 - Engines	G - 8' fluorescent industrial fixture (2 of 5 rows)	12	(2) 86W T8	160	1920	312	Switch	599.04	$109.26							
125 - Engines	G - 8' fluorescent industrial fixture (3 of 5 rows)	16	(2) 86W T8	160	2560	104	Switch	266.24	$48.56							
125 - Engines	G - 8' fluorescent industrial fixture (2 lights on pe	2	(2) 86W T8	160	320	8760	Breaker	2803.20	$511.30							
125 - Engines	X - Compact fuorescent exit sign	3	(2) 7W PL	16	48	8760	Breaker	420.48	$76.70							
126 - Mechanical	F - 4' fluorescent industrial fixture	2	(2) 32W T-8	61	122	12	Switch	1.46	$0.27							
127 - Electrical	F - 4' fluorescent industrial fixture	3	(2) 32W T-8	61	183	12	Switch	2.20	$0.40							
128 - Generator	F - 4' fluorescent industrial fixture	3	(2) 32W T-8	61	183	12	Switch	2.20	$0.40							
129 - Washer	H - Compact fluorescent downlight	1	(2) 26W PL	51	51	104	Switch	5.30	$0.97							
130 - Wash Down	H - Compact fluorescent downlight	1	(2) 26W PL	51	51	104	Switch	5.30	$0.97							
131 - Alcove	F - 4' fluorescent industrial fixture	1	(2) 32W T-8	61	61	104	Switch	6.34	$1.16							
200 - Storage Mezzanine	N - 4' fluorescent fixture	12	(2) 32W T-8	58	696	104	Switch	72.38	$13.20							
200 - Storage Mezzanine	X - Compact fuorescent exit sign	1	(2) 7W PL	16	16	8760	Breaker	140.16	$25.57							
Exterior	J - Compact fluorescent downlight	12	(1) 22W PL	22	264	4380	Photocell	1156.32	$210.91							

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Exterior	R - Weatherproof remote double head	5	(2) 8W 12V Halogen	16	80	4380	Photocell	350.40	$63.91							
TOTAL								**17501.50**	**$3,192.27**					$465.70	$73.37	6.3

Energy Cost: $0.1824

Notes: **Existing Lighting Fixture Control Modifications Schedule**

* Existing Dual switching operates inner lamp on one switch and 2 outer lamps on one switch.
  Modification is to control the 2 outer lamps on a motion sensor
* Installation Cost is Cost with Incentive.

Total Watts = No. of Fixture x Fixture Watts
kwh/Year = Total Watts/1000 x Hours of Operation
Operational Cost/Year = kwh/Year x Energy Cost

OperationalHours Savings Based on EPRI Predictions
- Private Offices: 25%
- Conference Rooms: 35%
- Restrooms: 40%
- Kitchens: 50%

APPENDIX I

ECM-7 Combined Lighting Fixture and Control Modifications

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ECM-7 Combined Lighting Fixture & Control Modifications

Item	Budgetary Costs	Annual Utility Savings			ROI	Potential Incentive	Payback (Without Incentive)	Payback (With Incentive)
		Electricity	Natural Gas	Total				
	$	KWH	Therms	$		$	Years	Years
Lighting Fixture Modification	$1,962	$657	$0	$657			3.0	3.0
Lignting Control Modifications	$566	$73	$0	$73		100	7.7	6.3
Combined	$2,527	$731	$0	$731		100	3.5	3.3

APPENDIX J

ECM-8 Reduced Water Use

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ECM-8 Reduced Water Use

Budgetary Costs	Annual Utility Savings			ROI	Potential Incentive	Payback (Without Incentive)	Payback (With Incentive)
	Water	Natural Gas	Total				
$	1000 gallons	Therms	$		$	Years	Years
$120	$5	$15	$20		0	6.1	6.1

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Water Cost Summary: Account Number #3034300					
Period	Consumption Gallons	Base Charge	Water Charge	Total Cost	Water cost per 1000 gallons
11/12/08	2000	$ 90.79	$ 4.86	$ 95.65	$ 2.43
2/24/09	5000	$ 90.79	$ 12.15	$ 102.94	$ 2.43
5/22/09	3000	$ 100.30	$ 8.04	$ 108.34	$ 2.68
8/24/09	5000	$ 100.30	$ 13.40	$ 113.70	$ 2.68
Totals		$ 382.18	$ 38.45	$ 420.63	10.22

South Brunswick Township Water & Sewer

Notes: **Chart 5** **Water Cost Summary**
This chart provides water cost breakdowns and sums totals.
All numbers are in $ except gallons.

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South Brunswick Township
New Jersey

Billing Residential Rates

Meter Size

Size of Meter	Quarterly Base Charge
5/8"-3/4"	$13.37
1"	$24.06

Domestic Water & Sewer Charges

Water Charge:	Sewer Charge:
Each Customer Will be Charged a, Quarterly Base Charge, Plus Consumption Tier Rate Per 1,000 Gallons 0-18,000 $2.68 18,001-50,000 $3.10 50,001-100,000 $3.49 Over 100,000 $3.87	Number of Units x $118.20

Charges to connect to water and/or sewer
Service Charges

- Water: $65.00
- Sewer: $65.00

If tying into both Water and Sewer at the time of application, the Service Charge is:

- Water: $37.50
- Sewer: $37.50

Connection Charge

- **Water**
  $575.00 (up to a 2 inch line) For connection larger than 2 inches: All connections larger than 2" shall be installed by the applicant at the applicant's expense. Inspection of the installation will be made by an authorized representative of the township. All wet taps and connections made to the water system by owners of major subdivisions, townhouses, student dorms, apartments, mobile home parks, commercial and industrial properties shall be made by the owners at their expense.
- **Sewer (not applicable)**
  All sewer connections are done by the applicant at the applicants expense.

Facility Charges

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Simple Payback Analysis	
Cost	$120.00
Incentive	$0.00
Adjusted Cost	$120.00
Savings/yr	$19.64
Payback in years	6.11

ECM-8 Reduced Water Use

Existing Fixture								Replacement Fixture					Savings		
Fixture	**Flow Rate (gpm)**	**Annual Operation (min)**	**Quantity**	**Annual Water Use (gallons)**	**Annual Water Cost ($)**	**Annual Gas Use (Therms)**	**Annual Gas Cost ($)**	**Flow Rate**	**Annual Water Use (gallons)**	**Annual Water Cost ($)**	**Annual Gas Use (therms)**	**Annual Gas Cost ($)**	**Water**	**Gas**	**Total**
Shower Head	2.5	2000	3	5000	$13	36	$41.04	1.6	3200	8.576	23	26.22	$5	$14.82	$19.64

Energy Cost Calculator for Faucets and Showerheads

Vary utility cost, hours of operation, and /or efficiency level.

INPUT SECTION

Input the following data (if any parameter is missing, calculator will set to the default value).			Defaults	
Water Saving Product	Showerhead		*Faucet*	*Showerhead*
Flow Rate	1.6	gpm	*2.2 gpm*	*2.5 gpm*
Water Cost (including waste water charges)	2.68	$/1000 gal	*$4/1000 gal*	*$4/1000 gal*
Gas Cost	1.16	$/therm	*0.60 $/therm*	*0.60 $/therm*
Electricity Cost	.1824	$/kWh	*0.06 $/kWh*	*0.06 $/kWh*
Minutes per Day of Operation	10	minutes	*30 minutes*	*20 minutes*
Days per Year of Operation	200	days	*260 days*	*365 days*
Quantity to be Purchased	3	unit(s)	*1 unit*	*1 unit*

Calculate Reset

OUTPUT SECTION

Performance per: Showerhead	Your Choice	Base Model	FEMP Recommended Level	Best Available	Self Closing Faucet (gallon per cycle)
WATER USE ONLY					
Gallon per Minute	1.6 gpm	2.5	2.2	1.5	n/a
Annual Water Use	3200 gal	5000	4400	3000	n/a
Annual Water Cost	$ 9	$ 13	$ 12	$ 8	$ n/a
Lifetime Water Cost	$ 76	$ 109	$ 101	$ 67	$ n/a
WITH ELECTRIC WATER HEATING					
Annual Energy Use	416 kWh	650	572	390	n/a
Annual Energy Cost	$ 76	$ 119	$ 104	$ 71	$ n/a
Lifetime Energy Cost	$ 595	$ 930	$ 818	$ 558	$ n/a
Lifetime Energy and Water Cost Savings	$ 368	$ 0	$ 120	$ 414	$ n/a

Lifetime Energy and Water Cost Savings for 3 Showerhead(s)	$ 1104	$ 0	$ 360	$ 1242	$ n/a
WITH GAS WATER HEATING					
Annual Energy Use	23 therms	36	32	22	n/a
Annual Energy Cost	$ 27	$ 42	$ 37	$ 26	$ n/a
Lifetime Energy Cost	$ 224	$ 349	$ 307	$ 216	$ n/a
Lifetime Energy and Water Cost Savings	$ 158	$ 0	$ 50	$ 175	$ n/a
Lifetime Energy and Water Cost Savings for 3 Showerhead(s)	$ 474	$ 0	$ 150	$ 525	$ n/a

For electric water heating applications, your selection of an energy saving showerhead with a flow rate of 1.6 gallon(s) per minute will have a combined energy and water cost savings (per showerhead) of $ 368 over an estimated 10 year life expectancy compared to the base model.

For gas water heating applications, your selection of an energy saving showerhead with a flow rate of 1.6 gallon(s) per minute will have a combined energy and water cost savings (per showerhead) of $ 158 over an estimated 10 year life expectancy compared to the base model.

Assumptions

- "Base model" has an efficiency that just meets the national minimum standard for faucets or showerheads.
- Lifetime energy cost and lifetime water cost is the sum of the discounted value of the annual energy and water costs based on an assumed faucet or showerhead life of 10 years.
- Future gas and electricity price trends and a discount rate of 3.2% are based on Federal guidelines.
- $0.06 per kWh is the Federal average electricity price in the U.S.
- $0.60 per therm is the Federal average gas price in the U.S.
- The assumed combined water and waste-water price is $4.00/1000 gallons.

Disclaimer

This cost calculator is a screening tool that estimates a product's lifetime energy cost savings at various efficiency levels. Maintenance and installation costs do not vary significantly among the same product having different efficiencies; so, these costs are not included in this calculator tool. For a detailed life-cycle cost analysis, FEMP has developed a tool called Building Life-Cycle Cost (BLCC). This downloadable tool allows the user to vary interest rates, installation costs, maintenance costs, salvage values, and life expectancy for a product or an entire energy project.

BPU ENERGY AUDIT PROGRAM
South Brunswick Fire District No. 2, Station 20
CHA Project # 20998

ECM-8 Reduced Water Use

Multipliers	
Material	1
Labor	1.21
Equipment	1.07

Installation Costs										
Item	Qty	Unit	Unit Costs			Subtotal Costs			Total Cost	Remarks
			Material	Labor	Equipment	Material	Labor	Equipment		
Shower Heads **	3	ea	$40	**$0**		$120	$0	$0	$120	

** Intallation by Owner

Subtotal		$120
Total		$120

APPENDIX K

ECM-9 Hot Water Circulation with Timer

BPU ENERGY AUDIT PROGRAM
South Brunswick Fire District No. 2, Station 20
CHA Project # 20998

ECM-9 Hot Water Circulation with Timer

Item	Budgetary Costs	Annual Utility Savings			ROI	Potential Incentive	Payback (Without Incentive)	Payback (With Incentive)
		Electricity	Natural Gas	Total				
	$	KWH	Therms	$		$	Years	Years
Occupancy Timer	$258	$76		$76		0	3.4	3.4

BPU ENERGY AUDIT PROGRAM
South Brunswick Fire District No. 2, Station 20
CHA Project # 20998

ECM-9 Hot Water Circulation with Timer

Existing Water Flow Until Hot Water at Fixture

Item	Operation Time Minutes/Use	Flow Rate GPM	Use	Total Gallons	Total Wasted Water Cost
Showers	3.5	2.5	200	1750	$4.69
Kitchen Sink	3.5	2.5	36	315	$0.84
Total Water Cost					**$ 5.53**

Pump Operations Cost

	Pump (watts)	Operation Time Hours	Operational Cost
Pump w/ Aquastat	125	4380	$ 99.86
Pump w/ Aquastat & Timer	125	1060	$ 24.17
Savings			**$ 75.70**

Water Cost per 1000 gallons	$2.68
Pump w/ aquastat operates 24hrs/365days at 50% of the time	
Pump with aquastat & Occupancy timer operates 8hrs/365days at 50% of the time	
kWh Cost	$ 0.1824

BPU ENERGY AUDIT PROGRAM
South Brunswick Fire District No. 2, Station 20
CHA Project # 20998

ECM-9 Hot Water Circulation with Timer

Multipliers	
Material	0.98
Labor	1.21
Equipment	1.07

Installation Costs											
	Qty	Unit	Unit Costs			Subtotal Costs			Total Cost w/o Incentive	Incentive Available	Remarks
			Material	Labor	Equipment	Material	Labor	Equipment			
Timer	1	ea	$61	$35		$60	$42	$0	$102	$ -	
Electrical	1	ea	$50	$35		$49	$42	$0	$91		

Subtotal	$193
10% Contingency	$19
10% OH	$21
10% Profit	$23
Total	$258
Incentive	$0
Total Cost with Incentive	$258

APPENDIX L

Photovoltaic (PV) Rooftop Solar Power Generation

PVWatts AC Energy & Cost Savings

Cautions for Interpreting the Results

Station Identification	
Cell ID:	0267371
State:	New Jersey
Latitude:	40.5 ° N
Longitude:	74.8 ° W
PV System Specifications	
DC Rating:	4.00 kW
DC to AC Derate Factor:	0.770
AC Rating:	3.08 kW
Array Type:	Fixed Tilt
Array Tilt:	40.5 °
Array Azimuth:	180.0 °
Energy Specifications	
Cost of Electricity:	18.2 ¢/kWh

Results

Month	Solar Radiation (kWh/m^2/day)	AC Energy (kWh)	Energy Value ($)
1	3.30	325	59.28
2	4.03	354	64.57
3	5.14	489	89.19
4	5.33	470	85.73
5	5.68	498	90.84
6	5.66	465	84.82
7	5.64	473	86.28
8	5.41	454	82.81
9	5.23	440	80.26
10	4.60	416	75.88
11	3.42	309	56.36
12	3.07	294	53.63
Year	4.71	4987	909.63

Output Results as Text

Saving Text from a Browser

Run PVWATTS v.2 for another location

Run PVWATTS v.1

Please send questions and comments to Webmaster
Disclaimer and copyright notice.

RReDC home page (http://rredc.nrel.gov)

Your Solar Electric Estimate

YOUR SOLAR RATING

The solar rating of your area is **Good** for adopting a solar system. (4.48 kWh/m^2 per day).
You may want to change some of the information to better match your situation.

Customize Your Assumptions

Price Installed $ 8 per watt DC.
This is a user-entered cost. Enter 0 to return to default.

Provide 35 % of my electricity, on average, over the course of a year.

Electric Rate: $	0.1824/kWh More
Monthly Electric Usage:	6,699 kWh/Month More
Utility Annual Inflation Rate:	3.78%
Utility Savings Method:	Net Metering (common)
Federal ITC Based Upon:	Gross Cost
Federal Income Tax Rate:	28%
State Income Tax Rate:	7.8% (Low: 1.40% - High: 8.97%) help

Loan Modeling: Borrow 0 % of $107,640 estimated cost
at 6.5 % interest (apr) re-paid over 30 years

---

f you agree **this is a smart investment**, we encourage
ou to work with a Professional to help you install your
ery own system.

http://www.solar-estimate.org/index.php?page=solar-installer&subpage=show&wantsolar=1&zipcode=08852

lick on the buttons to learn about our assumptions and other important information used to generate your estimate. Also, please review the
otes below.

Help us improve. We rely on feedback from our users to help keep our service accurate and useful:
› Send us your Feedback

Your Solar Electric Estimate by the Numbers

Building Type:	Commercial/Business
State & County:	NJ - Middlesex
Utility:	PUBLIC SERVICE ELEC AND GAS

Utility:	CO
Utility Type:	Investor-Owned Utility
Your Average Monthly Electricity Bill: (Assumed rate x average monthly useage)	$ 1,222 / Month
Tiered Rates Apply:	Yes - See Notes, below!
Time-of-Use Metering Offered:	Yes - See Notes, below!
Net-Metering Available:	Yes - See Notes, below!

ESTIMATED SYSTEM SIZE

The system size best for your situation will vary based upon product, building, geographic and other variables. We encourage you to work with a Solar Pro who can better estimate the system size best for your situation. We estimate your building will need a system sized between 18.72 kW and 28.08 kW of peak power. This estimate assumes the mid-point of this range.

Solar Rating:	**Good** 4.48 kWh/sq-m/day
Solar System Capacity Required:	23.40 kW of peak power (DC watts)
Roof Area Needed:	2,340 sq-ft
Equivalent Annual Production:	28,139 kWh electricity

ESTIMATED SYSTEM COST

This is only an estimate based upon many assumptions. Installation costs can vary considerably. We encourage you to work with a Solar Pro who can provide you with a more detailed cost estimate. We estimate that a 23 kW peak DC power system will cost between $149,760 and $224,640. This estimate assumes the mid-point of this cost range.

Assumed Installation Gross Cost: "Gross Cost" is the cost before any rebates, incentives, tax credits, etc. are applied. See the Cost Notes, below!	**$187,200** assuming $8 per watt DC

FINANCIAL INCENTIVES

Financial incentives shown are totals across all years. So, if an incentive spans multiple years then the value shown is the total of all years. For details, please refer to the table below "Cash Flow by Year and Cumulative Across Years"

NJ: Solar Renewable Energy Certificates (SREC) » link	$ 216,729
NJ Renewable Energy Incentive (Commercial) » link	$ 23,400

Federal Tax Credit (30% of Gross Cost at Installation) » link	$ 56,160
Modified Accelerated Cost Recovery System (MACRS) Depreciation (5 yr) » link	**YES**
ESTIMATED NET COST:	**$ -109,089**
ESTIMATED NET COST AT INSTALLATION:	**$ 107,640**
Cash & Loan Amounts:	$ 107,640 Cash $ 0 Borrowed
Loan Monthly Payment (6.5% apr, 30 years):	$ 0

CASH FLOW

Cash Flow Breakeven is where the chart crosses the $ zero point - this is when your investment has paid itself back in cash.

The chart above is a summary of the net cash flow you can expect over time. Net Cash Flow is the total cash after all costs (out-flows of cash) are reduced by financial incentives, annual utility savings and tax effects (in-flows of cash).

Average values are used together with your assumed income tax rate (36%). Any property appreciation has not been included, as this is generally not a cash flow (it's an investment). The loan modeled, if any, is included. Because this is a business, we have assumed utility savings result in loss of some expense write offs against income, but Modified Accelerated Cost Recovery System (MACRS) Depreciation applies (an income tax benefit). Because individual tax situations vary, we have not included Federal income tax liabilities that may result from having received non-federal incentives, if any (e.g. state rebate programs) as they are usually not taxed as earned income.

SAVINGS & BENEFITS

First-year Utility Savings:	**$5,132 to $13,343**
Average Monthly Utility Savings: *over 25-year expected life of system*	**$718 to $1,866**
Average Annual Utility Savings: *over 25-year expected life of system*	**$8,614 to $22,396**
25-year Utility Savings:	**$215,349 to $559,908**
Internal Rate of Return (IRR):	**24.1% - 34.4%**
Net Present Value (NPV):	**$149,853 - $265,640**
Profitability Index:	**2.4 - 3.5**
Greenhouse Gas (CO_2) Saved: *over 25-year system life*	**577 tons** **1,154,000 auto miles**

Cash Flow by Year and Cumulative Across Years

This cash flow table includes tax effects applied to utility savings and loan interest payments (if any). For commercial (business) situations we assume utility savings result in loss of some expense write offs against income: Utility Savings = ($'s saved on utility bill) x (1 - Income Tax Rate). "Tax Savings from MACRS depreciation" (below) is the

net cash saved on income taxes after the depreciation expense is written off. So the amount that was depreciated would be the cash value shown divided by the Income Tax Rate (more info.). Because individual tax situations vary, we have not included Federal income tax liabilities that may result from having received non-federal incentives, if any (e.g. state rebate programs) as they are usually not taxed as earned income. Any income from your system (e.g. performance-based incentives and "SREC's") may be taxed as income (also not shown).

Year of Operation:	**at Install**	**1**	**2**	**3**	**4**	**5**
Gross Cost	($187,200)					
NJ: Solar Renewable Energy Certificates (SREC)	$0	$17,740	$17,206	$16,688	$16,186	$15,699
NJ Renewable Energy Incentive (Commercial)	$23,400	$0	$0	$0	$0	$0
Federal Tax Credit (30% of Gross Cost at Installation)	$56,160	$0	$0	$0	$0	$0
Tax savings from MACRS Depreciation	$0	$9,718	$15,548	$9,329	$5,597	$5,597
Utility Savings	$0	$3,419	$3,549	$3,683	$3,822	$3,966
ANNUAL CASH FLOW	$-107,640	$30,877	$36,303	$29,700	$25,605	$25,263
Cumulative Cash Flow	$-107,640	$-76,763	$-40,460	$-10,760	**$14,845 Breakeven**	$40,108

Year of Operation:	**6**	**7**	**8**	**9**	**10**	**11**
Gross Cost						
NJ: Solar Renewable Energy Certificates (SREC)	$15,226	$14,768	$14,323	$13,892	$13,474	$13,069
NJ Renewable Energy Incentive (Commercial)	$0	$0	$0	$0	$0	$0
Federal Tax Credit (30% of Gross Cost at Installation)	$0	$0	$0	$0	$0	$0
Tax savings from MACRS Depreciation	$2,799	$0	$0	$0	$0	$0
Utility Savings	$4,116	$4,272	$4,433	$4,601	$4,775	$4,955
ANNUAL CASH FLOW	$22,141	$19,040	$18,756	$18,493	$18,249	$18,024

Cumulative Cash Flow	$62,249	$81,289	$100,045	$118,538	$136,787	$154,811

Year of Operation:	**12**	**13**	**14**	**15**	**16**	**17**
Gross Cost				($21,060) Inverter Replaced		
NJ: Solar Renewable Energy Certificates (SREC)	$12,675	$12,294	$11,924	$11,565	$0	$0
NJ Renewable Energy Incentive (Commercial)	$0	$0	$0	$0	$0	$0
Federal Tax Credit (30% of Gross Cost at Installation)	$0	$0	$0	$0	$0	$0
Tax savings from MACRS Depreciation	$0	$0	$0	$0	$0	$0
Utility Savings	$5,143	$5,337	$5,539	$5,748	$5,965	$6,191
ANNUAL CASH FLOW	$17,818	$17,631	$17,463	$-3,747	$5,965	$6,191
Cumulative Cash Flow	$172,629	$190,260	$207,723	$203,976	$209,941	$216,132

Year of Operation:	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Gross Cost								
NJ: Solar Renewable Energy Certificates (SREC)	$0	$0	$0	$0	$0	$0	$0	$0
NJ Renewable Energy Incentive (Commercial)	$0	$0	$0	$0	$0	$0	$0	$0
Federal Tax Credit (30% of Gross	$0	$0	$0	$0	$0	$0	$0	$0

Cost at Installation)								
Tax savings from MACRS Depreciation	$0	$0	$0	$0	$0	$0	$0	$0
Utility Savings	$6,425	$6,668	$6,920	$7,181	$7,453	$7,735	$8,027	$8,330
ANNUAL CASH FLOW	$6,425	$6,668	$6,920	$7,181	$7,453	$7,735	$8,027	$8,330
Cumulative Cash Flow	$222,557	$229,225	$236,145	$243,326	$250,779	$258,514	$266,541	$274,871

FAQ's: Frequently Asked Questions for NJ:

- Are renewable energy systems exempt from sales tax in New Jersey?
- Can I sell Solar Renewable Energy Certificates (SREC) in New Jersey?
- Where can I find more information about New Jersey Renewable energy programs and incentives?

Notes & Assumptions: Solar Electric (PV) Systems

* HOW TO REDUCE THE SYSTEM SIZE NEEDED & INCREASE SAVINGS

The estimate provided above assumes "base" electric rates apply. Other taxes and surcharges may be applied to your utility bill. We suggest you review a recent utility bill and change the "Assumed Electric Rate", above, as needed to better match your situation.

You may have other metered-rate options with your utility. Options such as Tiered billing rates, Time-Of-Use (TOU) metering, and Net-Metering, if available, can help reduce the system size you need to provide a "net-zero" energy bill. Sometimes people also reduce the size of their solar system to accommodate planned improvements in their building's energy efficiency, or to match a budget and/or the available space for installing a solar system.

Energy production from a solar electric (PV) system is a function of several factors, including the following. Our assumptions are:

Factor	Assumption
Solar resources	Assumed solar availability: As per Solar Radiance chart
Soiling or contamination of the PV panels	Clean, washed frequently: 100% design sunlight transmission
Temperature	25C, calm wind
System configuration (battery or non-battery)	Non-battery
Orientation to the sun	tilted at your latitude, full sun

Shading	None
PV Energy delivered as % of manufacturer's rating	95%
Soiling, wiring & power point tracking losses	9% (91% delivered)
Inverter Efficiency	90%
Total Energy Delivered	95% x 91% x 90% = 78%

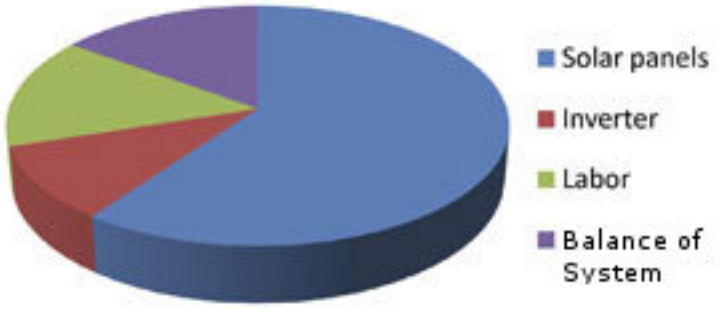
Energy Efficiency: Improving your building's energy efficiency will reduce the system size you need to attain a "net-zero" energy bill.
Tiered Rates: Often people are paying a "Tiered" rate for their electricity. This is a higher rate (higher than the "Base" rate) for electricity charged when a home or building uses more that a "Base" amount allocated for the building. Installing a solar system will reduce your electrical demand from the utility. This can result in a lower utility rate because you stay within the "Base" rate level. In this case, the more expensive "Tiered" rate electricity is eliminated, reducing your average electricity rate.
TOU Metering: Many utilities offer Time-of-Use (TOU) meters. This allows the price of electricity to vary by time of day (called "Peak" or "Off-Peak" periods) and by season (usually "Winter" versus "Summer" rates). If TOU metering is offered by your utility, a solar system may result in additional savings. This is because peak (more expensive electricity) rates often occur during the daytime. This is usually when a solar system is producing the most output, thus reducing your demand for peak-rate electricity from the utility.
Most utilities do charge for the purchase and installation of a time-of-use meter (normally a few hundred dollars). We have assumed the cost for this is part of the "Estimated Installation cost" shown above.
Net-Metering: With Net-Metering, surplus electricity generated by your renewable energy system will be credited back to your utility account. So if your solar system makes more electricity than you are using, the "meter spins backwards". You are not actually "selling" electricity, since in most states the utility will not reimburse you for excess electricity. But, if your utility offers "Net-Metering" you may be able to get credit for electricity provided back to the grid during peak periods. Combined with TOU metering, Net-Metering can result in multiplied savings since your electricity account may be gaining electricity credits during the time of peak utility rates -- Think of a hot, sunny summer day ... your solar system is producing power, spinning your electric meter backwards, and supplying the grid with electricity to run other people's air conditioners -- you're "spinning back" cost at peak rates! That's the savings power of Net-metering, combined with TOU rates.
Solar Power "Fixes" Energy Costs: The cost of sunshine is free. While the sun rises every morning, the cost of sunshine does not. Utility rates, on the other hand, tend to rise steadily in cost. So, the value of your savings from a solar system are likely to increase as time goes on. If you are on a fixed income (e.g. nearing or in retirement) this may be of particular interest to you.

THE COST TO GO SOLAR

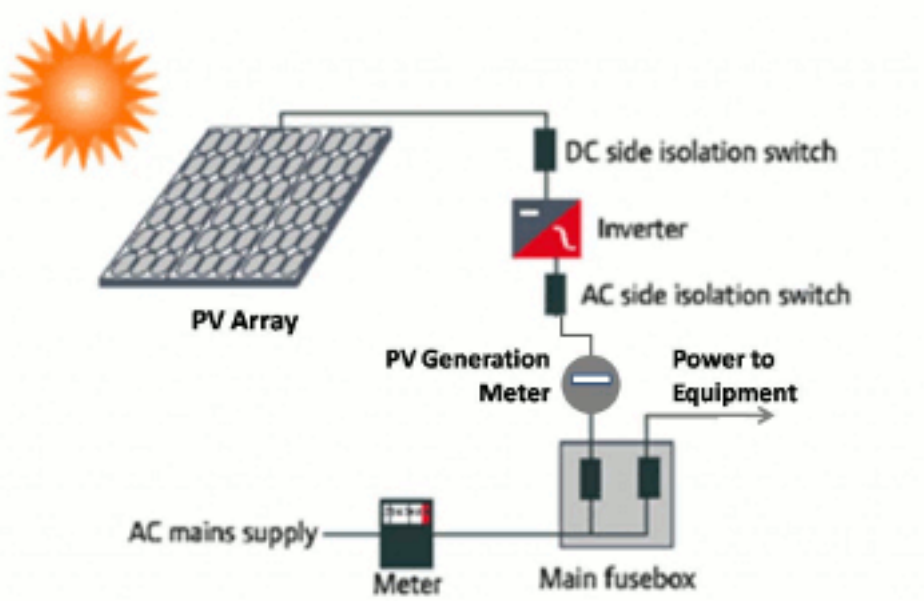
This is only an estimate based upon many assumptions and limited data entered by you: Installation costs can vary considerably. The cost to purchase and install a complete grid-tied solar photovoltaic (PV) system on a residential home is typically as further defined in the table, below. This includes the PV array, inverter and associated balance of system costs. It does not include the cost of options you may select, such as battery backup power storage, or the costs of building preparation work, like new shingles. Costs can also be higher if you add other features or have special installation needs (such as application over tile roofing) or you choose to use special mounting systems (such as sun tracking systems). Other factors may also affect price, including, but not limited to, your location, the building condition, type and location, its wiring, and warrantees offered.

Assumed Cost, per Watt DC

Item	System Size < 2kW	System Size ≥ 2kW
Assumed Total	$10 per watt DC (+/- 20%)	$9 per watt DC (+/- 20%)



About 60% of the cost to install a solar-electric (PV) system goes to the solar photovoltaic (PV) panels, 10% to an inverter, 15% to direct labor, and 15% to the "balance of system" (BOS) costs.



OTHER ASSUMPTIONS

This summary is based upon many assumptions and the limited data you entered. An actual site assessment by a qualified solar system retailer or contractor will be needed to determine the actual costs and benefits of installing a solar electric system.

HELPFUL PDF's & Links

Report on Solar-Estimate.org Estimator: Comparisons, Methods & Assumptio

 Payback & Other Financial Test for Solar on Your Home

The Dept. of Energy's: **PVWatts Online PV Calculator**

Natural Resources Canada's: **RETScreen Renewable Energy Calculators**

A Free Public Service of the Solar & Wind Communities since 2000

SOLAR-ESTIMATE.ORG is a free, public service. We believe the efficient use of energy and renewable energy systems makes for comfortable living and a more secure future. So we want to help you reduce your energy demands, increase your energy efficiency and help you utilize more energy from renewable energy systems and sources -- like solar electric (PV - photovoltaics), solar space (air), water & pool heating, wind turbines, biomass furnaces and ground-source heat pumps. Our mission is to serve as a convenient, user-friendly means for home and small commercial building owners to make preliminary evaluations of renewable and solar energy options for their location, run financial analysis and help find and verify the experience, quality and business status of certified solar contractors, and other professionals who can design, install and service renewable and solar energy and energy efficient power systems. (See How It Works). As a business verification service, we maintain the largest directory of current local solar installer and solar contractor profiles including extensive customer reviews and ratings of these professionals. Profiles are not limited to solar energy professionals, but include many other renewable energy, design, engineering and support professional services. We also serve as a consolidator of national and region-specific solar and energy efficiency programs, and utility information about renewable energy, solar energy and energy efficient measures. Our software tools and content include: Online solar estimator (solar calculator, analysis) to help you determine the costs and benefits of a renewable or solar energy system for your particular location and building needs, including financial analysis tools. We also provide a trusted means by which you, as a consumer, can review and access solar panel installers, solar contractors, solar pros and other solar, renewable energy and energy efficiency professional services. And we offer answers to frequently asked questions about renewable and solar power, links and resources to current information about solar power, solar energy, renewable energy, energy bill savings, energy efficiency data, solar incentives, tax credits, rebates and other programs and helpful information so you can learn about solar energy, help us promote renewable and solar power adoption and, hopefully, install a solar system for your home, building, company or community

and/or improve your energy efficiency and use. **Site Map**

A solar-powered site and service of Energy Matters LLC.

APPENDIX M

Solar Thermal Domestic Hot Water Plant

RENEWABLE ENERGY
THE INFINITE POWER
OF TEXAS

Interactive Energy Calculators

Our calculators help you understand energy production and consumption in a whole new way. Use them to develop a personal profile of your own energy use.

Solar Water Heating Calculator

Water heating is a major energy consumer. Although the energy consumed daily is often less than for air conditioning or heating, it is required year round, making it a good application of solar energy. Use this calculator to explore the energy usage of your water heater, and to estimate whether a solar water heater could save you money.

Water Heater Characteristics			
Physical		**Thermal**	
? Diameter (feet)	2.3125	? Water Inlet Temperature (Degrees F)	50
? Capacity (gallons)	81	? Ambient Temperature (Degrees F)	60
? Surface Area (calculated - sq ft)	27.13	? Hot Water Temperature (Degrees F)	140
? Effective R-value	15.99	? Hot Water Usage (Gallons per Day)	15
Energy Use			
461.8		? Heat Delivered in Hot Water (BTU/hr)	
135.7		? Heat loss through insulation (BTU/hr)	

Gas vs. Electric Water Heating		
Gas		**Electric**
0.6586	? Overall Efficiency	0.7574
0.8521	? Conversion Efficiency	0.98

701.2 BTU/hr	? Power Into Water Heater	609.7 BTU/hr
Cost		
$ 1.16 /Therm	? Utility Rates	$ .1824 /kWh
$ 71.25313	? Yearly Water Heating Cost	$ 285.3168
How Does Solar Compare?		
? Solar Water Heater Cost: $ 9305		? Percentage Solar: 70
186.5581 years for gas	? Payback Time for Solar System	46.5898(years for electric

More information on solar water heating:

Fact sheet - Solar Water Heaters
Fact sheet - Solar Water Heaters for Swimming Pools
Kids fact sheet - Heat from the Sun

Return to Top of Page

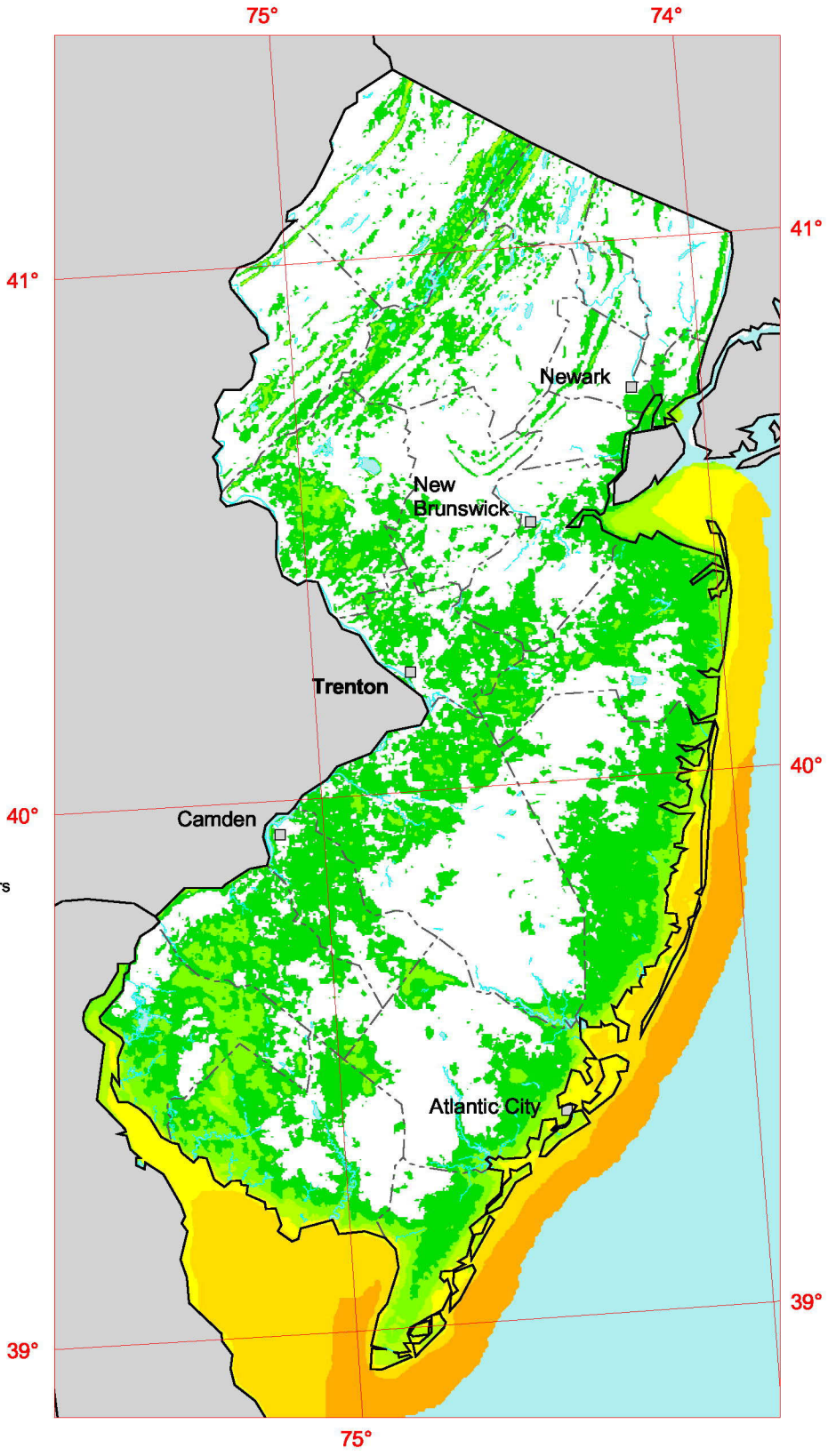
APPENDIX N

Wind

New Jersey

30 m Wind Speed Map

The annual wind speed estimates for this map were produced by TrueWind Solutions using their Mesomap system and historical weather data. It has been validated with available surface data by NREL and wind energy meteorological consultants.



15 0 15 30 45 Kilometers

10 0 10 20 30 Miles

Wind Speed at 30 Meters
m/s

- < 4.5
- 4.5 - 5.0
- 5.0 - 5.5
- 5.5 - 6.0
- 6.0 - 6.5
- 6.5 - 7.0
- 7.0 - 7.5
- 7.5 - 8.0
- 8.0 - 8.5
- > 8.5

U.S. Department of Energy
National Renewable Energy Laboratory

NREL

10-JAN-2003 1.1.8

APPENDIX O

EPA Portfolio Manager

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
South Brunswick Fire District No. 2, Station 20

Building ID: 2271791
For 12-month Period Ending: December 31, 2009[1]
Date SEP becomes ineligible: N/A
Date SEP Generated: April 29, 2010

Facility
South Brunswick Fire District No. 2, Station 20
573 Ridge Road
Monmouth Junction, NJ 08852

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 1998
Gross Floor Area (ft²): 16,000

Energy Performance Rating[2] (1-100) N/A

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	274,263
Natural Gas (kBtu)[4]	454,999
Total Energy (kBtu)	729,262

Energy Intensity[5]	
Site (kBtu/ft²/yr)	46
Source (kBtu/ft²/yr)	87

Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	66

Electric Distribution Utility
Public Service Elec & Gas Co

National Average Comparison	
National Average Site EUI	90
National Average Source EUI	189
% Difference from National Average Source EUI	-54%
Building Type	Other

Stamp of Certifying Professional

Based on the conditions observed at the time of my visit to this building, I certify that the information contained within this statement is accurate.

Certifying Professional
N/A

Meets Industry Standards[6] **for Indoor Environmental Conditions:**	
Ventilation for Acceptable Indoor Air Quality	**N/A**
Acceptable Thermal Environmental Conditions	**N/A**
Adequate Illumination	**N/A**

Notes:
1. Application for the ENERGY STAR must be submitted to EPA within 4 months of the Period Ending date. Award of the ENERGY STAR is not final until approval is received from EPA.
2. The EPA Energy Performance Rating is based on total source energy. A rating of 75 is the minimum to be eligible for the ENERGY STAR.
3. Values represent energy consumption, annualized to a 12-month period.
4. Natural Gas values in units of volume (e.g. cubic feet) are converted to kBtu with adjustments made for elevation based on Facility zip code.
5. Values represent energy intensity, annualized to a 12-month period.
6. Based on Meeting ASHRAE Standard 62 for ventilation for acceptable indoor air quality, ASHRAE Standard 55 for thermal comfort, and IESNA Lighting Handbook for lighting quality.

ENERGY STAR® Data Checklist for Commercial Buildings

In order for a building to qualify for the ENERGY STAR, a Professional Engineer (PE) must validate the accuracy of the data underlying the building's energy performance rating. This checklist is designed to provide an at-a-glance summary of a property's physical and operating characteristics, as well as its total energy consumption, to assist the PE in double-checking the information that the building owner or operator has entered into Portfolio Manager.

Please complete and sign this checklist and include it with the stamped, signed Statement of Energy Performance.
NOTE: You must check each box to indicate that each value is correct, OR include a note.

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	
Building Name	South Brunswick Fire District No. 2, Station 20	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	Other	Is this an accurate description of the space in question?		☐
Location	573 Ridge Road, Monmouth Junction, NJ 08852	Is this address accurate and complete? Correct weather normalization requires an accurate zip code.		☐
Single Structure	Single Facility	Does this SEP represent a single structure? SEPs cannot be submitted for multiple-building campuses (with the exception of acute care or children's hospitals) nor can they be submitted as representing only a portion of a building		☐
Area B - Offices (Office)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	
Gross Floor Area	5,570 Sq. Ft.	Does this square footage include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, atria, vent shafts, etc. Also note that existing atriums should only include the base floor area that it occupies. Interstitial (plenum) space between floors should not be included in the total. Finally gross floor area is not the same as leasable space. Leasable space is a subset of gross floor area.		☐
Weekly operating hours	30 Hours	Is this the total number of hours per week that the Office space is 75% occupied? This number should exclude hours when the facility is occupied only by maintenance, security, or other support personnel. For facilities with a schedule that varies during the year, "operating hours/week" refers to the total weekly hours for the schedule most often followed.		☐
Workers on Main Shift	6	Is this the number of employees present during the main shift? Note this is not the total number of employees or visitors who are in a building during an entire 24 hour period. For example, if there are two daily 8 hour shifts of 100 workers each, the Workers on Main Shift value is 100. The normal worker density ranges between 0.3 and 10 workers per 1000 square feet (92.8 square meters)		☐
Number of PCs	6	Is this the number of personal computers in the Office?		☐
Percent Cooled	50% or more	Is this the percentage of the total floor space within the facility that is served by mechanical cooling equipment?		☐
Percent Heated	50% or more	Is this the percentage of the total floor space within the facility that is served by mechanical heating equipment?		☐
Area A - Meeting (Other)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	

Gross Floor Area	2,480 Sq. Ft.	Does this square footage include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, atria, vent shafts, etc. Also note that existing atriums should only include the base floor area that it occupies. Interstitial (plenum) space between floors should not be included in the total. Finally gross floor area is not the same as leasable space. Leasable space is a subset of gross floor area.		☐
Number of PCs	N/A(Optional)	Is this the number of personal computers in the space?		☐
Weekly operating hours	4.7Hours(Optional)	Is this the total number of hours per week that the space is 75% occupied? This number should exclude hours when the facility is occupied only by maintenance, security, or other support personnel. For facilities with a schedule that varies during the year, "operating hours/week" refers to the total weekly hours for the schedule most often followed.		☐
Workers on Main Shift	N/A(Optional)	Is this the number of employees present during the main shift? Note this is not the total number of employees or visitors who are in a building during an entire 24 hour period. For example, if there are two daily 8 hour shifts of 100 workers each, the Workers on Main Shift value is 100.		☐

Area C - Engines/Mech (Other)

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	
Gross Floor Area	7,950 Sq. Ft.	Does this square footage include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, atria, vent shafts, etc. Also note that existing atriums should only include the base floor area that it occupies. Interstitial (plenum) space between floors should not be included in the total. Finally gross floor area is not the same as leasable space. Leasable space is a subset of gross floor area.		☐
Number of PCs	N/A(Optional)	Is this the number of personal computers in the space?		☐
Weekly operating hours	N/A(Optional)	Is this the total number of hours per week that the space is 75% occupied? This number should exclude hours when the facility is occupied only by maintenance, security, or other support personnel. For facilities with a schedule that varies during the year, "operating hours/week" refers to the total weekly hours for the schedule most often followed.		☐
Workers on Main Shift	N/A(Optional)	Is this the number of employees present during the main shift? Note this is not the total number of employees or visitors who are in a building during an entire 24 hour period. For example, if there are two daily 8 hour shifts of 100 workers each, the Workers on Main Shift value is 100.		☐

ENERGY STAR® Data Checklist for Commercial Buildings

Energy Consumption

Power Generation Plant or Distribution Utility: Public Service Elec & Gas Co

Fuel Type: Electricity

Meter: Electric Meter (kWh (thousand Watt-hours))
Space(s): Entire Facility
Generation Method: Grid Purchase

Start Date	End Date	Energy Use (kWh (thousand Watt-hours))
12/01/2009	12/31/2009	7,980.00
11/01/2009	11/30/2009	2,322.00
10/01/2009	10/31/2009	5,520.00
09/01/2009	09/30/2009	6,720.00
08/01/2009	08/31/2009	8,820.00
07/01/2009	07/31/2009	8,160.00
06/01/2009	06/30/2009	5,640.00
05/01/2009	05/31/2009	5,940.00
04/01/2009	04/30/2009	7,020.00
03/01/2009	03/31/2009	6,600.00
02/01/2009	02/28/2009	7,620.00
01/01/2009	01/31/2009	8,040.00
Electric Meter Consumption (kWh (thousand Watt-hours))		**80,382.00**
Electric Meter Consumption (kBtu (thousand Btu))		**274,263.38**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		**274,263.38**
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?		☐

Fuel Type: Natural Gas

Meter: Natural Gas (therms)
Space(s): Entire Facility

Start Date	End Date	Energy Use (therms)
12/01/2009	12/31/2009	981.62
11/01/2009	11/30/2009	78.84
10/01/2009	10/31/2009	130.86
09/01/2009	09/30/2009	31.00
08/01/2009	08/31/2009	22.36
07/01/2009	07/31/2009	28.75
06/01/2009	06/30/2009	29.82
05/01/2009	05/31/2009	41.49
04/01/2009	04/30/2009	406.52
03/01/2009	03/31/2009	704.51

02/01/2009	02/28/2009	966.42
01/01/2009	01/31/2009	1,127.80
Natural Gas Consumption (therms)		**4,549.99**
Natural Gas Consumption (kBtu (thousand Btu))		**454,999.00**
Total Natural Gas Consumption (kBtu (thousand Btu))		**454,999.00**
Is this the total Natural Gas consumption at this building including all Natural Gas meters?		☐

Additional Fuels	
Do the fuel consumption totals shown above represent the total energy use of this building? Please confirm there are no additional fuels (district energy, generator fuel oil) used in this facility.	☐

On-Site Solar and Wind Energy	
Do the fuel consumption totals shown above include all on-site solar and/or wind power located at your facility? Please confirm that no on-site solar or wind installations have been omitted from this list. All on-site systems must be reported.	☐

Certifying Professional

(When applying for the ENERGY STAR, the Certifying Professional must be the same as the PE that signed and stamped the SEP.)

Name: _____ Date: _____

Signature: _____

Signature is required when applying for the ENERGY STAR.

FOR YOUR RECORDS ONLY. DO NOT SUBMIT TO EPA.

Please keep this Facility Summary for your own records; do not submit it to EPA. Only the Statement of Energy Performance (SEP), Data Checklist and Letter of Agreement need to be submitted to EPA when applying for the ENERGY STAR.

Facility
South Brunswick Fire District No. 2, Station 20
573 Ridge Road
Monmouth Junction, NJ 08852

Facility Owner
N/A

Primary Contact for this Facility
N/A

General Information

South Brunswick Fire District No. 2, Station 20	
Gross Floor Area Excluding Parking: (ft^2)	16,000
Year Built	1998
For 12-month Evaluation Period Ending Date:	December 31, 2009

Facility Space Use Summary

Area B - Offices	
Space Type	Office
Gross Floor Area(ft^2)	5,570
Weekly operating hours	30
Workers on Main Shift	6
Number of PCs	6
Percent Cooled	50% or more
Percent Heated	50% or more

Area C - Engines/Mech	
Space Type	Other - Fire Station/Police Station
Gross Floor Area(ft^2)	7,950
Number of PCs°	N/A
Weekly operating hours°	N/A
Workers on Main Shift°	N/A

Area A - Meeting	
Space Type	Other - Social/Meeting
Gross Floor Area(ft^2)	2,480
Number of PCs°	N/A
Weekly operating hours°	4.7
Workers on Main Shift°	N/A

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 12/31/2009)	**Baseline** (Ending Date 12/31/2009)	**Rating of 75**	**Target**	**National Average**
Energy Performance Rating	N/A	N/A	75	N/A	N/A
Energy Intensity					
Site (kBtu/ft^2)	46	46	36	N/A	90
Source (kBtu/ft^2)	87	87	69	N/A	189
Energy Cost					
$/year	$ 19,951.01	$ 19,951.01	$ 15,718.31	N/A	$ 39,394.27
$/$ft^2$/year	$ 1.25	$ 1.25	$ 0.98	N/A	$ 2.47
Greenhouse Gas Emissions					
$MtCO_2e$/year	66	66	52	N/A	130
$kgCO_2e/ft^2$/year	4	4	3	N/A	8

More than 50% of your building is defined as Other. This building is currently ineligible for a rating. Please note the National Average column represents the CBECS national average data for Other. This building uses X% less energy per square foot than the CBECS national average for Other.

Notes:
o - This attribute is optional.
d - A default value has been supplied by Portfolio Manager.

APPENDIX P

Site Aerial Image


Ridge Rd
Ridge Rd
Ridge Rd
Ridge Rd
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