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A. Executive Summary

Metro Energy Solutions ("Metro Energy"), an independent energy services and energy consulting company headquartered in West Caldwell, New Jersey, is pleased to provide to the [name of municipality] this energy audit and analysis for designated facilities throughout the [name of municipality]. Metro Energy specializes in assisting private and public sector clients in designing, installing and retrofitting mechanical and electrical equipment, implementing process improvements that use less energy and improve building comfort, while at the same time lowering the facility's operating and maintenance costs.

The following represents the scope of services that were provided for this project. It is important to note that the energy conservation measures outlined in Section B of this report are not only payback driven but include measures identified for renewable and/or environmental benefits, for energy cost savings, operation and maintenance concerns, and to increase comfort levels. A wide range of measures were evaluated, with a wide range of payback periods, with the ultimate goal of providing a range of options for [name of municipality] to consider.

Energy Audit and Analysis – Scope of Work

1. Metro Energy conducted a detailed site inspection of each facility and its operations, including interviews with operators. Client participation was essential to the preparation of this audit report. Interviews and site visits included participation by your staff. Inspection of each building was conducted in sequence with one another.

2. Metro Energy conducted a review and audit of all mechanical and electrical equipment and systems in these facilities to understand their condition, age, operating characteristics, etc., and to identify potential energy savings or operational improvements associated with these systems.

3. Metro Energy generated a list of current mechanical and electrical equipment in each facility along with a proposed Energy Conservation Measures (ECMs). We also provided a description of each recommendation, including justification for the recommendation. An economic analysis, inclusive of estimates of applicable savings and capital costs, was developed for each of these recommendations. The analyses are spreadsheet based and include estimated energy savings, simple payback, and estimated return on investment and are included in Section D. The calculations are based upon industry accepted norms for construction cost opinions, energy cost projections, and comparative energy usage based on building type, square footage, and age. Potential rebate amounts are incorporated in the calculations where applicable.

4. This document will serve as the formal report of all findings, analyses and recommendations as they relate to equipment inventory and energy savings opportunities that can be realized by the [name of municipality].

5. Metro Energy has identified and estimated potential rebates for energy projects offered through the New Jersey BPU's SmartStart Buildings program or the Clean Energy Program.

Energy Audit and Analysis – Findings and Conclusions

The potential ECM's and renewable energy measures evaluated and presented in this Report include a wide spectrum of measures, including several that show fairly long-paybacks and that might not otherwise be seriously considered or recommended to a completely 'bottom-line-oriented' entity, or that may not even by recommended for other facilities where cost-effectiveness may be the top priority. To the extent that [name of municipality] wishes to use its facility as a show-place that maximizes energy efficiency, there is a plethora of identified measures identified in this Report, which [name of municipality] can consider and utilize in accordance with its available capital budget and other considerations.

Provided in Section D is a summary of the identified potential energy efficiency and renewable energy measures that could be implemented at the [name of municipality] facilities. To the extent energy savings maximization is important but not the only objective, and issues such as capital budget, paybacks and aesthetic consideration come into play, we provide information in the detailed descriptions which would allow for a prioritization of measures.

In summary, [name of municipality] has an opportunity to make significant infrastructure improvements to their facilities, to save on utility costs and to support Governor Corzine's energy efficiency and renewable energy initiatives.

PROJECT OVERVIEW

The Township of [name of municipality] is comprised of twelve (12) buildings. Together, the [name of municipality] buildings total approximately 201,839 square feet. Based upon the information provided, [name of municipality] currently uses approximately 3,841,902 kWh per year and $467,284 in annual electric costs. The average electric cost for this 12-month period was approximately $0.122 per kWh. The total annual gas consumption is about 178,889 therms per year resulting in approximately $234,616 in annual natural gas costs (average $1.31/therm). The total utility cost is approximately $701,900 per year. The total energy cost per square foot is over $3.48 per square foot. A typical commercial office building operates anywhere from $1.25-$2.50 per sq ft.

During our pre-qualification meeting and following several site visits Metro Energy determined that there are several potential opportunities for operating cost savings, as well as, upgrades of critical need items throughout the facilities. Our investigation included evaluating potential projects identified by our engineers as well as those recommended by [name of municipality] personnel.

The rates used to calculate electric and natural gas cost savings were calculated for each building based on the utility data provided by [name of municipality] and is included in their respective Energy Use Analysis write-up for each section of this report.

Please note that the above average fuel prices are based on 2006 bills. BGS-FP customers in June 2007 incurred a 10% increase and it is anticipated that the same increase will occur in 2008. Additionally, we have included an annual inflation rate for every year after 2008 of 4%.

Metro Energy has identified thirty-eight (38) energy conservation measures (ECMs). The estimated total cost to install all of the measures is $3,511,212 and includes engineering and design. Please refer to Section 4: Energy Conservation Measure Spreadsheet for estimated energy savings, project costs and payback periods.

Note that construction costs are only estimates based on historic data compiled from similar installations, and engineering opinion. Budget costs are not reduced by available rebates as all NJ SmartStart and Office of Clean Energy rebate estimates are provided separately. Additional engineering will be required for each measure identified in this report.

At the beginning of each section please find a breakout of each ECM identified throughout [name of municipality]. Also included in each ECM is a short description of the opportunity, an energy savings calculation, estimated budget cost and any rebates available (if any) for each.

B. Energy Audit and Analysis

1. Municipal Building

100 Municipal Boulevard, [name of municipality], NJ

Background Information:

Structure Description:
(107,659 square feet)
This is a 3-story masonry structure that consists of offices, conference rooms, a court room, a computer room and a 911 communication room. The 911 communication area is occupied continuously, while all of the other areas are occupied during normal business hours from 8:00 am to 4:30 pm, Monday through Friday.

The building appears to be in excellent condition.

Lighting Description:

Lighting System
The lighting system includes a combination of 2x4 (3 and 4) lamp, 2-foot (2) lamp, 3-foot (1) lamp, 4-foot (2) lamp, 2x2 (2) lamp, 1x4 (2) lamp, 250-watt Metal Halide, 100-watt Mercury Vapor and incandescent lamps. Most of the fluorescent and incandescent fixtures are not energy efficient and should be replaced.

Heating, Ventilation, and Air Conditioning (HVAC) and other mechanical systems:

Heating and Cooling System
Heating hot water is generated in HydroTherm Multi-temp MC-3465 modular boilers with total input and output of 3,573 and 2,745 MBH respectively. Heating hot water is circulated with (2) 5-hp pumps to heating coils in the air handling units. The perimeter heating system consists of electric cabinet and baseboard heaters.

Chilled water is generated by a York Millennium YPC FN-14SC-46-C-S-C direct-fired absorption chiller coupled with a 2-cell Marley NC3202GS induced draft cross-flow cooling tower. Chilled water is circulated at 45°F to cooling coils in AH-1, 2 and 3. Conditioned air is distributed through a variable air volume system to the interior zones by AH-1, which is outfitted with a variable frequency drive on the supply fan and induction VAV boxes. Some of the VAV boxes are equipped with electric reheat coils. There is an energy recovery wheel inside AH-1 to recover energy from exhaust air and preheat incoming outdoor air. The computer room is air conditioned with (2) 10-ton Liebert split air conditioning units. In addition, (2) Trane high-efficiency packaged rooftop air conditioning units rated at 5 and 3 tons were installed in 2005 to provide space cooling for the Mayor's offices and video/TV room respectively. The shooting range is served with a 15-ton Trane rooftop packaged air conditioning unit installed in 1993. There are (4) air-cooled direct

expansion (DX) air conditioning units serving various areas. Conditioned air from these units is distributed through a constant air volume system.

Table 1: Air Handling Unit Schedule

Unit	Service	Location	Supply Air Quantity (CFM)	Fan (HP)	Cooling Capacity (MBH)	Heating Capacity (MBH)
AH-1	Interior	MER#1	63,300	125	2,509.7	628.0
AH-2	Perimeter	MER#1	14,775	15	154.0	787.0
AH-3	911 Communication	MER#2	6,400	5	244.9	188.0
SS-1	Conference Room	MER#2	8,400	5	243.0	199.6
SS-2	Traffic & Detectors	MER#2	8,400	5	224.3	189.6
SS-3	BCI & Internal Records	MER#2	6,800	5	196.7	193.3
SS-4	Council Chamber	Council	7,200	5	190.2	217.6
Total					**3,762.8**	**2403.1**

Controls

Space temperature and HVAC system operation are controlled with a Barber-Colman Network 8000 direct digital controls system, which provides only basic control features. The capability of the existing control system to conserve energy is limited.

Windows

The windows in this building are double paned and mounted on aluminum frames. These windows range from average to good condition and are not recommended to be replaced at this time.

Energy Use Analysis

Figure 1 illustrates the estimated monthly electricity usage from August 2006 to July 2007. The total consumption and cost for this period was 2,956,279 kWh and $343,703, respectively. The electric rate for this period was $0.116 per kWh. Typical natural gas usage is presented in Figure 2. The total gas consumption and cost for this period were 53,266 therms and about $60,821, respectively, resulting in a rate of $1.14/therm.

It should be noted that some of the months were grouped together in the billing in both accounts. For example, February and March electric consumption was all billed into one month. The consumption for the months in question was split based on available data and yearly trends. These months are indicated in red in the figures below.

The average annual energy requirement of the building was 27.46 kWh/square foot and 0.49 therms/square foot.

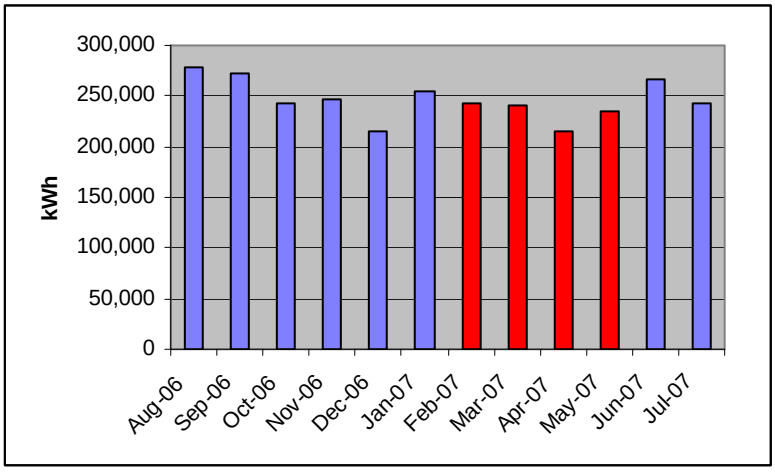

Figure 1: Annual Electricity Usage

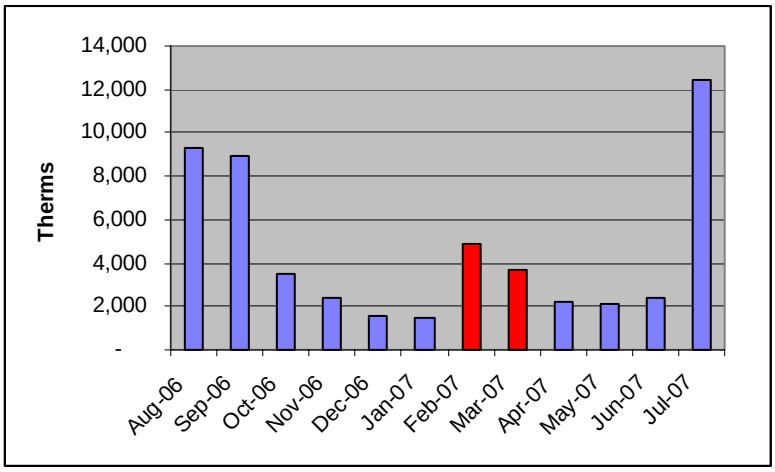

Figure 2: Annual Gas Usage

Table 2: Equipment Life Expectancy Data

Equipment Item	Median Life (Yrs)	# of Units	Condition
Modular boilers, gas-fired	25	NA	Good condition
Rooftop air conditioning units	20	4	Good condition
Air handling units	20	7	Fair condition
Cooling tower	20	1	Good condition
Chiller, gas-fired	25 - 30	1	Good condition
DDC control system	20	1	Good condition

ENERGY CONSERVATION MEASURES (ECM)

ECM 1 – Lighting Replacement and Occupancy Sensors Installation

Metro Energy recommends upgrading the existing T-12 and incandescent lighting as identified in Attachment A to high efficiency standards to create lighting uniformity throughout the buildings. In general the energy efficient lighting upgrade project would involve installing energy-efficient lighting retrofit parts and materials and new energy-efficient luminaires to the existing lighting systems. The strategies included in this section focused on maximizing energy savings while maintaining the existing look of each lamp, therefore, proposed lamp styles will remain consistent with existing lamp styles. In addition, Metro Energy also recommends installing occupancy sensors in specified areas of the facility. (Please refer to Attachment A: Lighting Retrofit Spreadsheets for a line-by-line proposal spreadsheet for detailed strategies and sensor locations).

Estimated Energy Savings:
The annual energy savings are estimated to be 74kW, 390,809kWh and $45,334. In addition the project will generate maintenance savings from avoided costs related to changing fixtures. Please refer to Attachment A for the Lighting Spreadsheets and energy savings calculations.

Assumptions:
The Lighting Annual Savings assume the annual hours per year of operation as outlined under the column entitled "Hours Code" in Attachment A and the O&M savings for the first (3) years are calculated by assuming that we will avoid total existing lamp & ballast maintenance costs by installing newer technologies with warranties. Years (4) & (5) are calculated using just the avoided existing ballasts costs only because the warranties on the ballasts are 5-years and the 3-year warranty on the lamps has now expired. Years (6) through (10) are the calculated by using difference between the cost to maintain the existing system and the cost to maintain the proposed system.

Estimated NJ SmartStart® Rebate:
The estimated rebate is $18,620.

Estimated Installation Cost:
The estimated cost to install high efficiency lighting throughout the facility is $238.831.

ECM 2 – Direct Digital Controls Enhancement

Metro Energy recommends adding advanced DDC control features to the existing DDC control system. These advanced control features include CO_2 based demand controlled ventilation, optimum start/stop, night purge, heating hot water outdoor air reset control, chilled water and condenser water temperature reset control, enthalpy controlled economizer cycle and demand limiting control. Energy savings will result from both reduced equipment operation and elimination of overheating.

Estimated Energy Savings:
A typical DDC system will save approximately 15% of the annual heating and cooling operating cost as a result of reduced operation and accurate control, outdoor air reduction capabilities and adjustability. We estimated the total cooling capacity for the building is approximately 272 tons excluding the (2) computer room Liebert units. The average cooling efficiency is approximately 1.41 kW/ton for the air-cooled rooftop air conditioning units.

Electric Savings:

Table 3: Annual Equivalent Full-Load Cooling Hours

ANNUAL EQUIVALENT FULL-LOAD COOLING HOURS		
Mean Temperature	Number of Occurrences	Degree Hours
97	5	160
92	33	891
87	92	2,024
82	330	5,610
77	257	3,084
72	236	1,652
67	204	408
	Total (deg-hrs)	**13,829**
	CFLH (hrs/yr)	**576**

Absorption Chiller:

$1.14/therm x (272 tons x 12,000 Btu/h-ton/1.0 COP) / 100,000 Btu/therm x 576 hours/yr x 15%

= $3,215/yr.

Air-cooled Rooftop Air Conditioning Units:

$0.116/kWh x 1.41 kW/ton x 28 tons x 576 hours/yr x 15%

= $396/yr.

Gas Savings:

Table 4: Annual Equivalent Full-Load Heating Hours

ANNUAL EQUIVALENT FULL-LOAD HEATING HOURS		
Mean Temperature	Number of Occurrences	Degree Hours
62	268	804
57	191	1,528
52	223	2,899
47	196	3,528
42	171	3,933
37	311	8,708
32	221	7,293
27	98	3,724
22	48	2,064
17	20	960
12	7	371
7	9	522
2	0	0
	Total (deg-hrs)	**36,334**
	CFLH (hrs/yr)	**727**

3,573,000 Btu/hr x 727 hrs/yr/100,000 Btu/therm x 15% = 3,896 Therms
$1.14/therm x 3,896 therms = $4441 Annual Savings
Total Savings: $3,948 + $406 + $4441= $8795

Estimated NJ SmartStart® Rebate:
NJ SmartStart® custom rebate will be determined by the utility company.

Estimated Installation Cost:
Estimated cost to enhance the existing DDC system as outlined above assuming (100) points is $84,000. The cost includes carbon dioxide sensors for demand controlled ventilation, humidity sensors for enthalpy control and programming for chilled and hot water reset schedules, optimum start/stop and demand limiting control.

ECM 3 – Variable Speed Pumping System

Based on our survey results and detailed conversation with site personnel, the cooling coils in the air handing units are equipped with 3-way valves. The chilled water pumps are running at a constant speed, regardless of the building load variation. In a variable speed pumping system, the pressure sensor monitors the pressure drop in the system, transmits the signal to the pump drive, and varies the speed of the pump to deliver only the pressure or flow required. Significant energy savings are realized at reduced operating conditions. The 3-way valves must be replaced with 2-way valves to work with VFDs. Metro Energy recommends installing variable speed drives to control the chilled water pumps.

Estimated Energy Savings:
Chilled water is circulated through (2) (one operating and one standby) 40-hp constant speed pumps. We estimate a 20% reduction in flow, and pump horsepower would be cut nearly in half based on the affinity laws for pumps:

$$HP_1/HP_2 = (GPM_1/GPM_2)^3$$
$$40/ HP_2 = (1/0.8)^3$$
$$HP_2 = 20.5$$

Estimated Annual Savings:

$0.116/kWh x (40 HP - 20.5 HP) x 0.746 kW/HP x 4,000 Hrs/Yr = $6,750

Estimated NJ SmartStart® Rebate:
The estimated rebate is $4,800.

Estimated Installation Cost:
The estimated installed cost for (2) 40-hp VFDs, including new motors and conversion of three-way valves on AH-1, AH-2 and AH-3, is $80,080.

ECM 4 –Variable Frequency Drives on Cooling Tower

Metro Energy recommends installing (2) variable frequency drives on the cooling tower fans. A variable frequency drive automatically minimizes the tower's noise level during periods of reduced load and/or reduced ambient temperature without sacrificing the system's ability to maintain a constant cold water temperature. Energy savings will be realized from reduced fan operation.

Estimated Energy Savings:
This 2-cell cooling tower has (2) 10-hp single speed fans. These fans were sized for peak load operation. We estimate a 20% reduction in airflow, and fan horsepower would be cut nearly in half based on the affinity laws for fans:

$$HP_1/HP_2 = (CFM_1/CFM_2)^3$$
$$20/ HP_2 = (1/0.8)^3$$
$$HP_2 = 10.2$$

Estimated Annual Savings:

$0.116/kWh x (20 HP - 10.2 HP) x 0.746 kW/HP x 4,000 Hrs/Yr = $3,392

Estimated Installation Cost:
The estimated installed cost is approximately $32,480.

ECM 5 – Water Conservation Recommendations

Waterless Urinals, low flow toilets and Aerators
There are (44) toilets, (25) urinals, (6) showers, and (48) faucets located in the facility. Metro Energy recommends replacing the toilets with dual flush low flow toilets, replacing the urinals with waterless urinals, installing low flow shower head aerators (2.0 gpm), and retrofitting the faucets with low flow aerators (0.5 gpm).

Estimated Utility Cost Savings:
These calculations are based on the assumption that this building has approximately 100 patrons (visitors and staff) per day, half of which are men and the other half are women. 30 of the patrons are assumed to be working in the police department section, 25 of which are male. It is assumed that all of the men use a urinal twice a day and a toilet once a day while the women use a toilet three times a day. The showers are assumed to be used by half of the police department for ten minutes a day. For each urinal or toilet flush, it is assumed that a sink is used for fifteen seconds.

Main Building:

50 flushes per day x 1.0 gallons saved per urinal = 50 gallons saved per day multiplied by 250 days = 12,500 gallons per year.

160 flushes per day x 0.6 gallons saved per toilet = 96 gallons saved per day multiplied by 250 days = 24,000 gallons per year.

52.5 minutes of faucet use per day x 1.5 gpm saved = 78.75 gallons saved per day multiplied by 250 days = 19,688 gallons per year.

Police Department:

50 flushes per day x 1.0 gallons saved per urinal = 50 gallons saved per day multiplied by 365 days = 18,250 gallons per year.

40 flushes per day x 0.6 gallons saved per toilet = 24 gallons saved per day multiplied by 365 days = 8,760 gallons per year.

22.5 minutes of faucet use per day x 1.5 gpm saved = 33.75 gallons saved per day multiplied by 365 days = 12,319 gallons per year.

6 showers x 25 minutes per day x 1.5 gpm = 225 gallons saved per day multiplied by 365 days = 82,125 gallons per year.

Savings:

Assuming that 40% of the 114,132 gallons saved by faucets and showers is heated to 120F and that the fuel used is gas, energy savings can be calculated as 302 therms.

Metro Energy assumed a cost of $4 per thousand gallons of water (including sewer costs). The total annual utility cost savings is estimated to be $1,055. In addition the proposed technology will reduce maintenance costs by $100 per urinal for the first year in use for a total annual maintenance savings of $2,500.

Estimated Installation Cost:
The total cost for low flow aerators, waterless urinals, and dual flush low flow toilets is estimated to be $47,639. In addition, there is a $20 per month maintenance fee for each waterless urinal to change the chemicals inside of them.

ECM 6 – PV Solar System

The roof of this building is completely flat. There is a series of piping running along the roof which will obstruct any solar panel implementation but these pipes only occupy a small percentage of the roof. There are several rooftop units but, again these only occupy a small portion of the roof. The building was re-roofed about 14 years ago and there are several areas that leak into the building. These leaks began around 2001. The building is about 75% through its useful life, but because of all of the leaks, it might be beneficial to replace the roof relatively soon. Because solar panels have the same useful life as a standard roof, it will be best to install solar panels when or following the roof replacement.

Metro Energy recommends the installation of solar panels. Metro conducted both a facility walkthrough and a satellite image analysis and based on the estimated total available area we recommend the installation of a system rated at approximately 91.5 kW dc. During our analysis our engineers looked at the total unobstructed available area of each section of the roof with southern exposure.

Additional engineering and analysis is required to confirm the system type, sizing, costs and savings. A system higher than this can be utilized on this roof but a system lower than 100 kW is recommended to take advantage of a higher rebate rate. Also, the roof still has several years left in its useful life but its condition is deteriorating so it needs to be decided if the roof is going to be re-roofed soon.

The proposed Photovoltaic (PV) Power system is comprised of a PV array, inverter(s) and all of the necessary wiring and interconnection equipment. The array output will feed power into the DC to AC inverters, which will then be connected to the building's electrical panel.

Estimated Energy Savings:
The energy savings generated by the installation of approximately 91.5 kW of photovoltaic power is estimated to be 98,253 kWh. At an average price of $0.116/kWh, the total energy savings would be $11,397 per year.

Solar Renewable Energy Credit:
There is a solar renewable energy credit (SREC) of approximately $.45/kWh based on the New Jersey Clean Energy Program which would result in additional revenues of $44,214. Total annual savings and credits are estimated to be $55,611.

New Jersey State law now requires that the utility must interconnect and net meter your photovoltaic system provided your system passes the local electrical inspection (National Electric Code) and meets the utility safety requirements as outlined in the law. A signed copy of the interconnection and net metering agreement is entered into by the Owner and the utility and is binding and transferable, provided the safety requirements are maintained. Net metering is the term given which allows your utility meter to literally "spin backwards" when you are producing more electricity than you are using. During the day, the occupants of the business may be off for a holiday or weekend while the photovoltaic system is making more than what the facility is presently using. The excess electricity then spins the meter backward and the utility gives you credit at the retail rate for the power they buy back from you. This credit shows up on your monthly electric bill as your meter actually registers the backfeed amount. The meter spins forward (you purchase) at night, during rainy weather, or when your electric demand exceeds the amount of power you are generating on the roof at that given moment. This amount is annualized at the end of the year, especially during some months when it is possible to have a negative electric bill.

Estimated Installation Cost:
The total cost for the standard solar panels placed on the roof is $871,270.

2. Animal Shelter

125 Municipal Boulevard, [name of municipality], NJ

Background Information:

Structure Description:
(3,865 square feet)
This is a one story structure that consists of areas for cats and dogs, offices and storage rooms. The building appears to be in structurally good condition. It is open weekdays from 8:30 am to 2:00 pm, and then from 3:00 pm to 5:00 pm. Wednesday late night hours are from 5:30 pm to 8:00 pm. And also Saturday from 10:00 am to 1:00 pm.

Lighting Description:

Lighting System
The lighting system includes a combination of 4-foot (2) lamp, 4-foot (3) lamp, 2-foot (2) lamp, 8-foot (4) lamp, and incandescent lamps. Most of the fluorescent and incandescent fixtures are not energy efficient and should be replaced.

Heating, Ventilation, and Air Conditioning (HVAC) and other mechanical systems:

Heating and Cooling System

Heating is provided by (1) Peerless ECT-05 cast iron boiler, with an input of 214,000 BTU/H and an output of 186,000 BTU/H. The oil-fired boiler was installed in 1985 with the building. The oil burner is a Beckett AFG flame retention unit. The Honeywell operating aqua-stat is set at 175°F. The Turbo domestic hot water heater holds 100 gallons. There is also a Bailey energy recovery unit located in the attic which recovers heat from exhaust air and preheats outdoor air.

The boiler feeds a cast iron radiator located in the reception area and also two rooms with radiant floors. These two rooms are where the animal's cages are placed. Hot water from the boiler flows through the pipes under the floors.

The cooling is supplied by (1) Trane thru-the-wall cooling unit in the reception area and several window air conditioners throughout the shelter.

Controls:
A Barber Colman thermostat is used to control heating. The standard thermostat is currently set at 56ºF, with no programmable setback function.

Windows:
The windows in this building are double pane, mounted on aluminum frames. Some of the windows also have storm windows which vary in condition. The majority of the windows and frames are in good condition; however, a select few are in poor condition and allow air to infiltrate the building.

Energy Use Analysis:
Figure 1 illustrates the monthly electricity usage from August 2006 to July 2007. The total cost and consumption was $6,237 and 51,942 kWh respectively. The average electric cost for this period was $0.120 per kWh. The total annual oil consumption between August of 2006 and August 2007 is 2,014 gallons per year resulting in approximately $3,779 in oil costs (average $1.88/gal).

The average annual energy requirement of the building was 13.44 kWh/square foot and 0.521 gallons/square foot.

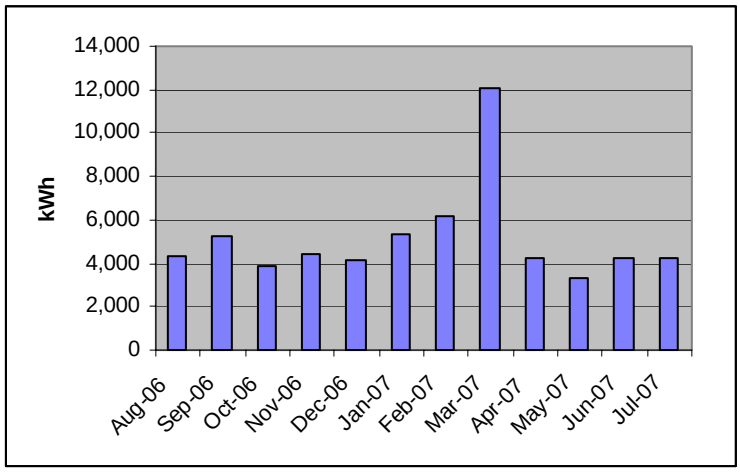

Figure 1: Monthly Electricity Usage

Table 5: Equipment Life Expectancy Data

Equipment Item	Median Life (Yrs)	# of Units	Condition
Boiler, hot water	30	1	Fair condition, should last another 9 years. Hot water reset control would improve energy efficiency.
A/C Cooling Unit	20-25	1	Good condition
Energy Recovery Unit	20	1	Fair condition
A/C Window Units	20	N/A	Fair condition
Thermostat	15	N/A	Heating Thermostat needs setback control

ENERGY CONSERVATION MEASURES (ECM)

ECM 1 – Lighting Replacement and Occupancy Sensors Installation

Metro Energy recommends upgrading the existing T-12 and incandescent lighting as identified in Attachment A to high efficiency standards to create lighting uniformity throughout the buildings. In general the energy efficient lighting upgrade project would involve installing energy-efficient lighting retrofit parts and materials and new energy-efficient luminaires to the existing lighting systems. The strategies included in this section focused on maximizing energy savings while maintaining the existing look of each lamp, therefore, proposed lamp styles will remain consistent with existing lamp styles. Metro Energy also recommends installing occupancy sensors in specified areas of the facility. (Please refer to Attachment A: Lighting Retrofit Spreadsheets for a line-by-line proposal spreadsheet for detailed strategies).

Estimated Energy Savings:
The annual energy savings are estimated to be 3.58 kW, 7,706 kWh and $925. In addition the project will generate maintenance savings from avoided costs related to changing fixtures. Please refer to Attachment A for the Lighting Spreadsheets and energy savings calculations.

Estimated NJ SmartStart®Rebate:
The estimated rebate is $620.

Assumptions:
The Lighting Annual Savings assume the annual hours per year of operation as outlined under the column entitled "Hours Code" in Attachment A and the O&M savings for the first (3) years are calculated by assuming that we will avoid total existing lamp & ballast maintenance costs by installing newer technologies with warranties. Years (4) & (5) are calculated using just the avoided existing ballasts costs only because the warranties on the ballasts are 5-years and the 3-year warranty on the lamps has now expired. Years (6) through (10) are the calculated by using difference between the cost to maintain the existing system and the cost to maintain the proposed system.

Estimated Installation Cost:
The estimated cost to install high efficiency lighting throughout the facility is $10,126.

ECM 2 – Programmable Thermostat

Metro Energy recommends installing a 7-day programmable thermostat to replace the existing Barber Coleman thermostat in the office area only. Programmable thermostats are easy to use, contribute to the overall system performance, maximize energy savings, and provide complete comfort control. The precise temperature control of a programmable, energy-saving thermostat would save wear and tear on the shelter's heating equipment by properly cycling the equipment. Another benefit is once the programmable thermostat is set to the desired winter temperatures and times there is automatic energy savings with little maintenance.

Estimated Energy Savings:

Heating Degree-day zone: 2.5
Annual Heating Oil Fuel Consumption for Office Area Only: 705 gallons
Cost of Electric Heating Fuel: $1.88
*Savings factor derived from heating degree-day zone: 0.15

(Savings factor) x (Annual heating electric fuel consumption) = kWh/yr
(0.15) x (705 gallons) = 105.75 gallons

(Annual energy savings) x (Cost of Electric heating fuel) = $/yr
(105.75 gallons) x ($1.88) = $199/yr

Estimated Installation Cost:
The total cost of installing a programmable thermostat is $448.

*Savings factor for programmable thermostats heating energy savings are based on a nightly setback of 8 degrees.

ECM 3 –Outdoor Air Reset Control

Metro Energy recommends adding an outdoor reset/cutout boiler control to the existing Peerless cast iron boiler. Some central boiler systems, like the one in the Animal Shelter are totally uncontrolled, providing heat with no regard for how much is needed. The boiler starts up in the fall and remains on throughout the heating season until they shut off in the spring. The proposed outdoor air reset controls to be installed on the boiler can reduce energy waste by lowering hot water supply temperature to reduce distribution loss and eliminating overheating conditions. It can save 7-9% of heating fuel use.

Estimated Energy Savings:
Annual Heating Oil Fuel Consumption: 2,014 gallons
Cost of Electric Heating Fuel: $1.88

0.08 x (Annual heating electric fuel consumption) = kWh/yr
0.08 x (2,014 gallons) = 161 gallons/year

(Annual energy savings) x (Cost of Electric heating fuel) = $/yr
(161 gallons/year) x ($1.88) = $303/yr

Estimated Installation Cost:
The total cost of installing outdoor reset/cutout boiler controls is $4,200.

ECM 4 –Hot Water Pipe Insulation

Metro Energy recommends insulating all of the hot water pipes in the boiler room. The hot water pipes in the boiler room were not insulated which can lead to substantial heat loss. Pipe insulation reduces pipe heat loss through conduction, convection and radiation. With little maintenance this is a cost-effective measure.

Estimated Energy Savings:
Linear feet of 2" diameter pipe: 30 feet
Cost of Electric Heating Fuel: $1.88
Savings factor for hot water 2" diameter pipe: 1.84

(Linear feet of un-insulated 2" diameter pipe) x (Savings factor for 2" diameter pipe) = Savings/yr
(30 feet) x (1.84) = 55 /year

(Annual energy savings) x (Cost of Electric heating fuel) = $/yr
(55/year) x ($1.88) = $103/yr

Estimated Installation Cost:
The total cost of installing insulation on 30' of pipe is $319.

ECM 5 – Window Replacement

The windows in this building are double pane, mounted on aluminum frames. Some of the windows also have storm windows which vary in condition. The majority of the windows and frames are in good condition; however, a select few are in poor condition and allow air to infiltrate the building. At the direction of [name of municipality], Metro Energy investigated replacing the existing double pane windows with new energy efficient windows. Metro Energy recommends replacing the existing windows with new energy efficient windows. The new windows will be triple pane, low e, argon filled windows on aluminum frames.

Estimated Energy Savings:
Energy savings that could be realized from a window replacement is a result of reduced heat conduction and air infiltration. Additional measurement and analysis needs to be conducted to identify exact quantities, pricing and savings.

Table 6: Estimated Replacement Window Area (sq ft):

Direction	Animal Shelter
N	0
S	7.5
E	10
W	60
Total	**77.5**

Table 7: Energy Savings Analysis:

	Energy savings – winter (Gallons of Oil)	Energy savings – summer (kWh)
Reduced heat conduction	54.22	138.70
Reduced air infiltration	71.79	187.60
Total Energy savings/year	**126.01**	**326.30**
Annual savings @$1.88/gal & $0.120/kWh	**$236.90**	**$39.16**

The total cost savings are estimated at $276.06.

Estimated Installation Cost:
The implementation cost to replace existing windows with the proposed windows is $5,494.

ECM 6 – Water Conservation Recommendations

There is (1) toilet, (4) faucets, (1) shower and (1) bathtub located in the facility. Metro Energy recommends replacing the toilet with a dual flush low flow toilet, retrofitting the faucets with low flow aerators (0.5 gpm), and replacing the showerhead with a low flow shower head aerator (2.0 gpm). There are no recommendations for the bathtub because it is not used.

Estimated Utility Cost Savings:
These calculations are based on the assumption that this building has approximately 5 staff members. It is assumed that each staff member uses the toilet twice a day and for each flush, it is assumed that a sink is used for fifteen seconds. Additionally, the sinks and shower are assumed to be used for several minutes of cleaning up after handling the animals.

10 flushes per day x 0.6 gallons saved per toilet = 6 gallons saved per day multiplied by 300 days = 1,800 gallons per year

10 minutes of sink use per day x 1.7 gpm saved = 17 gallons saved per day multiplied by 300 days = 5,100 gallons per year

10 minutes of shower use per day x 1.5 gpm saved= 15 gallons saved per day multiplied by 300 days = 4,500 gallons per year.

In addition, assuming that 40% of the 9,600 gallons saved by faucets is heated to 120F, energy savings can be calculated to be 18 gallons of oil.

Metro Energy assumed a cost of $4 per thousand gallons of water (including sewer costs). The total annual utility cost savings is estimated to be (26,700 gal x $.004) + (18 gal x $1.88) = $79.

Estimated Installation Cost:
The total cost for low flow aerators, a low flow shower head and a dual flush low flow toilet is $1,042. In addition, there is a $20 per month maintenance fee for each waterless urinal to change the chemicals inside of them.

ECM 7 – PV Solar System

The roof on the animal shelter was built in 1985. It is made up of asphalt shingles and appears to be in relatively good condition. The main section of the roof is pitched and faces southwest and northeast. There are three skylights on the main roof facing the southwest but they have been painted over. Overall, the roof appears to be in good condition; however, roof replacement options should be considered as the roof is approaching the end of its useful life. Because solar panels

have a lifespan of approximately 20-25 years, the most beneficial time to install them would be when the roof is being replaced.

As a result, there are several options to look at when installing solar panels. Solar panels integrated in the roof can be considered if the roof is being replaced. If the new roof is to be metal, flexible solar panels can be used. If the roof is going to be left as is, or the new roof is going to be constructed in the same fashion, then standard solar panels placed on top of the shingles should be looked at.

Metro Energy conducted both a facility walkthrough and a satellite image analysis and based on the estimated total available area we recommend the installation of a system rated at approximately 9.4 kW dc on the southwest face of the roof, below the three skylights. During our analysis our engineers looked at the total unobstructed available area of each section of the roof with southern exposure.

For purposes of this analysis and to illustrate revenues and costs generated from a standard system Metro Energy assumes the existing roof will be kept in place and a photovoltaic power system will be installed on the existing roof. The proposed Photovoltaic (PV) Power system is comprised of a PV array, inverter(s) and all of the necessary wiring and interconnection equipment. The array output will feed power into the DC to AC inverters, which will then be connected to the building's electrical panel.

Estimated Energy Savings:
The energy savings generated by the installation of approximately 9.4 kW of photovoltaic power is estimated to be 10,400 kWh. At an average price of $0.120/kWh, the total energy savings would be $1,248 per year.

Solar Renewable Energy Credit:
There is a solar renewable energy credit (SREC) of approximately $.45/kWh based on the New Jersey Clean Energy Program which would result in additional revenues of $4,680. Total annual savings and credits are estimated to be $5,928.

New Jersey State law now requires that the utility must interconnect and net meter your photovoltaic system provided your system passes the local electrical inspection (National Electric Code) and meets the utility safety requirements as outlined in the law. A signed copy of the interconnection and net metering agreement is entered into by the Owner and the utility and is binding and transferable, provided the safety requirements are maintained. Net metering is the term given which allows your utility meter to literally "spin backwards" when you are producing more electricity than you are using. During the day, the occupants of the business may be off for a holiday or weekend while the photovoltaic system is making more than what the facility is presently using. The excess electricity then spins the meter backward and the utility gives you credit at the retail rate for the power they buy back from you. This credit shows up on your monthly electric bill as your meter actually registers the backfeed amount. The meter spins forward (you purchase) at night, during rainy weather, or when your electric demand exceeds the amount of power you are generating on the roof at that given moment. This amount is annualized at the end of the year, especially during some months when it is possible to have a negative electric bill.

Estimated Installation Cost:
The total cost of a 9.4kW photovoltaic power system is $94,752.

3. Recreation Center

328 Plainfield Avenue, [name of municipality], NJ

Background Information:

Structure Description:
(29,285 square feet)
This is a 2-story masonry structure. The original building was erected in 1923 and an addition was built in 1950. The building houses offices, classrooms, an auditorium and a warehouse. It is open from 8:00 AM to 10:00 PM Mondays through Fridays as well as from 9:00 AM to 5:00 PM on Saturdays.

Overall, the building appears to be in fair condition.

Lighting Description:

Lighting System
The lighting system includes a combination of 2x4 (2 and 4) lamp, 3-foot (1) lamp, 4-foot (1, 2 and 4) lamp, 8-foot (2) lamp, 2x2 (2) lamp, 1x4 (2) lamp, 250-watt Metal Halide, 100-watt Mercury Vapor and incandescent lamps. Most of the fluorescent and incandescent fixtures are not energy efficient and should be replaced.

Heating, Ventilation, and Air Conditioning (HVAC) and other mechanical systems:

Heating and Cooling System

Low pressure steam is generated in a steel boiler built in 1951. According to the maintenance staff, the boiler was converted from an oil-fired to a gas-fired unit in the 1990's. It is equipped with an Industrial Combustion ML-84S gas-fired burner. During our survey, we were informed that the boiler had tube leaks and had been scheduled for repair. Low pressure steam is distributed through a 2-pipe system throughout the cast-iron radiators around the perimeter of the building. The warehouse is heated with (2) Modine gas-fired unit heaters.

Space cooling in the auditorium is provided with a York blower unit coupled with an air-cooled condensing unit rated at 3.5 tons. All of the offices and classrooms are air conditioned with individual window air conditioners. There are approximately 30–35 window air conditioners each rated from 7,000 to 32,000 Btu/h.

Controls
Space temperature is controlled through a pneumatic control system, which is reportedly not working properly due to severe air leaks.

Windows

The windows in this building are all single paned, glass mounted on either aluminum or wooden frames. The condition of the windows is generally very poor and should be considered for replacement.

Energy Use Analysis

Figure 2 illustrates the monthly electricity usage from July 2006 to June 2007. The total cost and consumption for this period was $31,891 and 224,520 kWh, respectively, resulting in a rate of $0.142/kWh. Typical natural gas usage is presented in Figure 3. The total cost and consumption for this period was $31,171 and 30,282 therms, respectively. From the billing information, it appears that the recreation center purchases gas from a third party supplier. For the purposes of the analysis, Metro Energy assumes that the gas rate for this building is approximately $1.03/therm.

The average annual energy requirement of the building was 7.67 kWh/square foot and 1.03 therms/square foot.

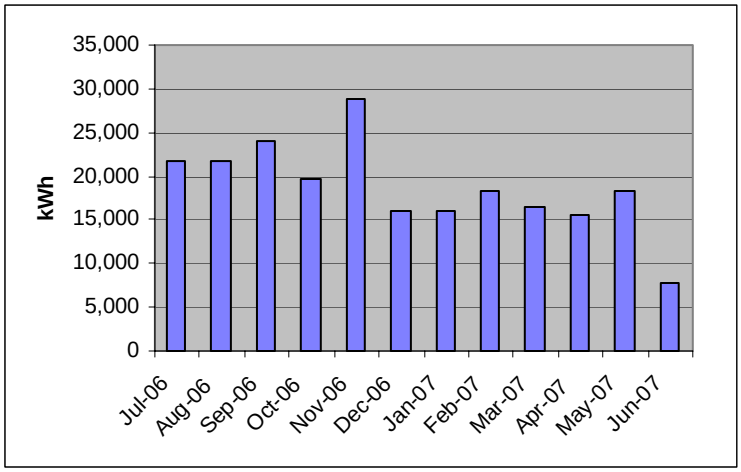

Figure 2: Annual Electricity Usage

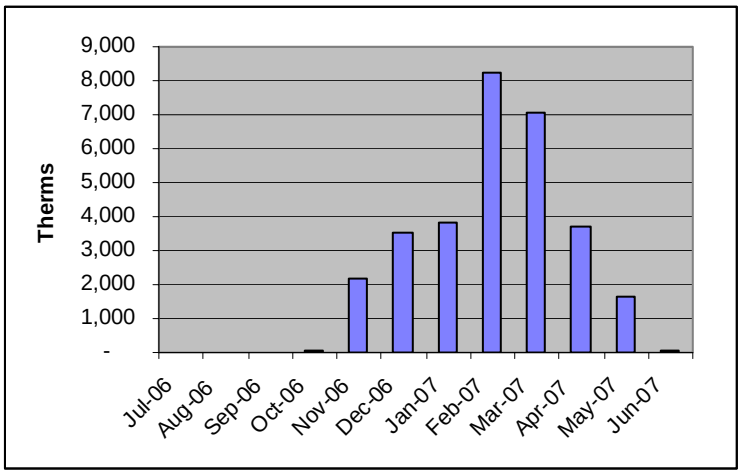

Figure 3: Annual Gas Usage

Table 8: Equipment Life Expectancy Data

Equipment Item	Median Life (Yrs)	# of Units	Condition
Boiler, gas-fired steel	35	1	Poor condition.
Window air conditioners	15	33	Good-to-fair condition.
Split air conditioning unit	20	1	Fair condition
Pneumatic control system	20	1	Poor condition with excessive air leaks

ENERGY CONSERVATION MEASURES (ECM)

ECM 1 – Lighting Replacement and Occupancy Sensors Installation

Metro Energy recommends upgrading the existing T-12 and incandescent lighting as identified in Attachment A to high efficiency standards to create lighting uniformity throughout the buildings. In general the energy efficient lighting upgrade project would involve installing energy-efficient lighting retrofit parts and materials and new energy-efficient luminaires to the existing lighting systems. The strategies included in this section focused on maximizing energy savings while maintaining the existing look of each lamp, therefore, proposed lamp styles will remain consistent with existing lamp styles. In addition, Metro Energy also recommends installing occupancy sensors in specified areas of the facility. (Please refer to Attachment A: Lighting Retrofit Spreadsheets for a line-by-line proposal spreadsheet for detailed strategies and sensor locations).

Estimated Energy Savings:
The annual energy savings are estimated to be 38kW, 152,910kWh and $21,713. In addition the project will generate maintenance savings from avoided costs related to changing fixtures. Please refer to Attachment A for the Lighting Spreadsheets and energy savings calculations.

Assumptions:
The Lighting Annual Savings assume the annual hours per year of operation as outlined under the column entitled "Hours Code" in Attachment A and the O&M savings for the first (3) years are calculated by assuming that we will avoid total existing lamp & ballast maintenance costs by installing newer technologies with warranties. Years (4) & (5) are calculated using just the avoided existing ballasts costs only because the warranties on the ballasts are 5-years and the 3-year warranty on the lamps has now expired. Years (6) through (10) are the calculated by using difference between the cost to maintain the existing system and the cost to maintain the proposed system.

Estimated NJ SmartStart® Rebate:
The estimated rebate is $4,570.

Estimated Installation Cost:
The estimated cost to install high efficiency lighting throughout the facility is $57,161.

ECM 2 – Boiler Replacement

According to the maintenance staff and the boiler certificate, the boiler was built in 1951 and appears to be in poor condition. During our survey, we noticed that the boiler had heat tube leaks. We estimated the thermal efficiency to be 70% based on empirical data. The average life cycle for a steel boiler is 35 years. It has apparently exceeded its useful life. Metro Energy recommends replacing the aging boiler with (2) smaller high efficiency units with a thermal efficiency of 86%.

Estimated Energy Savings:
Energy savings = Current Gas Consumption x (1-70%/86%) = 30,282 x (1-.7/.86) = 5,634 therms
Cost savings = 5,634 therms x $1.03/therm = $5,803

Estimated NJ SmartStart® Rebate:
The estimated rebate is $ 8,000.

Estimated Installation Cost:
Based on preliminary engineering analysis, it appears that the existing boiler is oversized. However for the purpose of this study, we assume that the boiler will be replaced with two 4,000 MBH steam boilers. The estimated installed cost is approximately $201,600.

ECM 3 – Electronic Heating Controls

Based on our survey and detailed discussion with the site maintenance staff, the existing pneumatic controls system is not working properly due to excessive air leaks, resulting in an overheating condition in the building. The existing controls system has exceeded its useful life and is due for replacement. Metro Energy recommends installing the electronic heating control system with advanced energy management features including outdoor reset/cutout control features. Energy savings will result from both reduced equipment operation and elimination of overheating.

Estimated Energy Savings:
Based on the empirical data, the new electronic control system will save approximately 8% of the annual heating operating cost as a result of reduced operation and accurate control, temperature setback capabilities and adjustability.

Energy savings = Current Gas Consumption x 8% = 30,282 x 8% = 2,422 therms
Cost savings = 2,422 therms x $1.03/therm = $2,495

Estimated NJ Smart Start® Rebate:
NJ SmartStart® custom rebate will be determined by the utility company.

Estimated Installation Cost:
Estimated installed cost is $61,600 and includes converting about 30 zones (classrooms or offices), wiring and front end.

ECM 4 – Windows Replacement

The windows in this building are all low efficiency, single paned glass. The majority of them are mounted on aluminum frames, while others are mounted on wooden frames. The windows are generally in very poor condition, including various cracks in the glass. Metro Energy recommends replacing the existing single pane windows with new energy efficient windows. The new windows will be double or triple pane, low e, argon filled windows on aluminum frames.

Estimated Energy Savings:
Energy savings that could be realized from a window replacement is a result of reduced heat conduction and air infiltration. Additional measurement and analysis needs to be conducted to identify exact quantities, pricing and savings.

Table 10: Estimated Replacement Window Area (sq ft):

Direction	Recreation Center
N	236
S	513
E	1054
W	1351
Total	**3154**

Table 11: Energy Savings Analysis:

	Energy savings – winter (MMBtu)	Energy savings – summer (kWh)
Reduced heat conduction	380	8820.10
Reduced air infiltration	937	17,626.80
Total Energy savings/year	**1317 MMBtu (13,170 therms of gas)**	**26,446.90 kWh**
Annual savings @$1.03/therm & $0.142/kWh	**$13,565**	**$3,755**

The total annual cost savings were estimated at $17,321.

Estimated Installation Cost:
The implementation cost to replace the existing windows with the proposed windows is $176,624.

ECM 5 – Water Conservation Recommendations

Waterless Urinals, low flow toilets and Aerators
There are (28) toilets, (12) urinals, and (27) faucets, approximately five of which have low flow aerators, located in the facility. Metro Energy recommends replacing the toilets with dual flush low flow toilets, replacing the urinals with waterless urinals, and retrofitting the remaining faucets with low flow aerators (0.5 gpm).

Estimated Utility Cost Savings:
These calculations are based on the assumption that this building has approximately 150 patrons (visitors and staff) per day, half of which are men and the other half are women. It is assumed that all of the men use the urinal once a day and the women use the toilet at least once a day. For each urinal or toilet flush, it is assumed that a sink is used for fifteen seconds.

75 flushes per day x 1.0 gallons saved per urinal = 75 gallons saved per day multiplied by 300 = 22,500 gallons per year.

75 flushes per day x 0.6 gallons saved per toilet = 45 gallons saved per day multiplied by 300 days = 13,500 gallons per year.

37.5 minutes per day x 1.7 gpm = 63.75 gallons saved per day multiplied by 300 days = 19,125 gallons per year.

The type of domestic hot water heater in this building is unavailable. However, for the purposes of energy savings associated with water usage, we will assume that the water is heated with gas. Assuming that 40% of the 19,125 gallons saved by faucets is heated to 120F, energy savings can be calculated as 51 therms.

Metro Energy assumed a cost of $4 per thousand gallons of water (including sewer costs). The total annual utility cost savings is estimated to be $273. In addition the proposed technology will reduce maintenance costs by $100 per urinal for the first year in use for a total annual maintenance savings of $1,200.

Estimated Installation Cost:
The total cost for low flow aerators, waterless urinals, and dual flush low flow toilets is estimated to be $27,496. In addition, there is a $20 per year maintenance fee for each waterless urinal to change the chemicals inside of them.

ECM 6 – PV Solar System

The roof of this building consists of multiple sections, the majority of which is flat. There are some small inclines and some parts of the roof are shaded by various objects. The condition of the roof ranges from average to poor. It should be noted that this condition exists for only part of the roof as many of the sections were inaccessible at the time of the audit. The age of the roof is not known, however, judging by the condition of the roof, it is estimated that it is approaching the end of its useful life. If it is at the end of its useful life, it is recommended that any solar opportunities are only implemented when or after the roof is replaced.

Metro Energy recommends the installation of solar panels. Metro Energy conducted both a facility walkthrough and a satellite image analysis and based on the estimated total available area we recommend the installation of a system rated at approximately 22.9 kW dc on various parts of the roof. During our analysis our engineers looked at the total unobstructed available area of each section of the roof with southern exposure. Additional engineering and analysis is required to confirm the system type, sizing, costs and savings.

The proposed Photovoltaic (PV) Power system is comprised of a PV array, inverter(s) and all of the necessary wiring and interconnection equipment. The array output will feed power into the DC to AC inverters, which will then be connected to the building's electrical panel.

Estimated Energy Savings:
The energy savings generated by the installation of approximately 22.9 kW of photovoltaic power is estimated to be 24,578 kWh. At an average price of $0.142/kWh, the total energy savings would be $3,490 per year.

Solar Renewable Energy Credit:

There is a solar renewable energy credit (SREC) of approximately $.45/kWh based on the New Jersey Clean Energy Program which would result in additional revenues of $11,060. Total annual savings and credits are estimated to be $14,550.

New Jersey State law now requires that the utility must interconnect and net meter your photovoltaic system provided your system passes the local electrical inspection (National Electric Code) and meets the utility safety requirements as outlined in the law. A signed copy of the interconnection and net metering agreement is entered into by the Owner and the utility and is binding and transferable, provided the safety requirements are maintained. Net metering is the term given which allows your utility meter to literally "spin backwards" when you are producing more electricity than you are using. During the day, the occupants of the business may be off for a holiday or weekend while the photovoltaic system is making more than what the facility is presently using. The excess electricity then spins the meter backward and the utility gives you credit at the retail rate for the power they buy back from you. This credit shows up on your monthly electric bill as your meter actually registers the backfeed amount. The meter spins forward (you purchase) at night, during rainy weather, or when your electric demand exceeds the amount of power you are generating on the roof at that given moment. This amount is annualized at the end of the year, especially during some months when it is possible to have a negative electric bill.

Estimated Installation Cost:
The total cost for the standard solar panels placed on the roof is $230,920.

4. Senior Center

2965 Woodbridge Avenue, [name of municipality], NJ

Background Information:

Structure Description:
(8,200 square feet)
This is a single-story masonry structure erected in 1992. It includes offices, halls and community rooms. The building is occupied during normal business hours from 8:00 AM to 4:30 PM, Monday through Friday.

Overall, the building appears to be in good condition.

Lighting Description:

Lighting System
The lighting system includes a combination of 2x4 (3 and 4) lamp, 4-foot (2) lamp, 2x2 (2) lamp, 175-watt Mercury Vapor, and incandescent lamps. Most of the fluorescent and incandescent fixtures are not energy efficient and should be replaced.

Heating, Ventilation, and Air Conditioning (HVAC) and other mechanical systems:

Heating and Cooling System

Heating hot water is generated in a Weil-McLain LGB-7 cast-iron sectional boiler rated at 18.9 horsepower. The gas-fired hydronic boiler was installed in 1992 and appears to be in good-to-fair condition. Heating hot water is circulated with (3) zone circulators throughout the baseboard convectors around the perimeter of the building and the heating coils in the air conditioning units.

Space cooling in the community rooms is provided with (2) Carrier 40RR-024 direct expansion packaged air handling units, each rated at 20 tons. The rest of the building is served with a Carrier 40RR-014 packaged air handling unit rated at 12.5 tons. These units were installed in 1992 and are approaching the end of their useful life.

Controls
Two Honeywell thermostats in the community rooms are programmable units, while the one in the office is a standard unit without setback/up feature.

Windows
The windows in this building are double paned glass mounted on aluminum frames and are in fair to good condition. Replacement is not recommended at this time.

Energy Use Analysis

Figure 4 illustrates the monthly electricity usage from August 2006 to July 2007. The electric cost and consumption for this 12-month period was $19,540 and 129,150 kWh, respectively, at a rate of $0.151 per kWh. Typical natural gas usage is presented in Figure 5 for the same period. October 2006 billing data is unavailable, so the total consumption is estimated using available data. The total annual gas consumption is estimated to be about 7,899 therms per year at a rate of approximately $1.38/therm.

The average annual energy requirement of the building was 15.75 kWh/square foot and 0.96 therms/square foot.

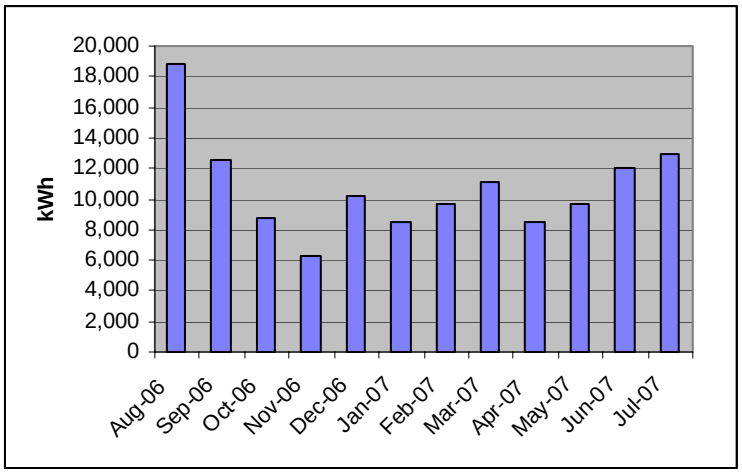

Figure 4: Annual Electricity Usage

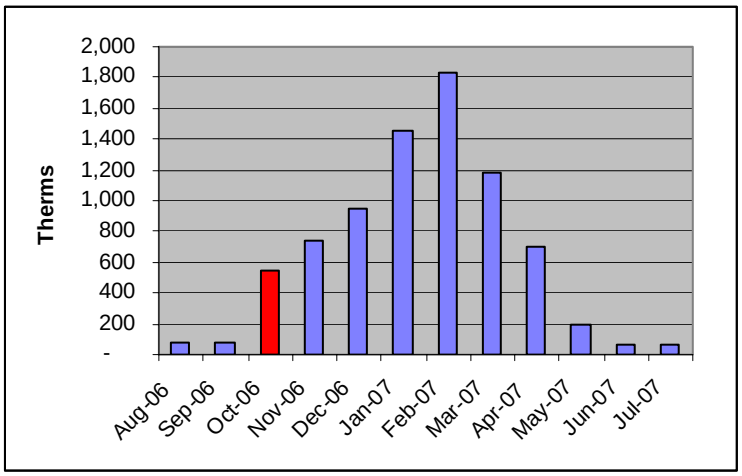

Figure 5: Annual Gas Usage

Table 12: Equipment Life Expectancy Data

Equipment Item	Median Life (Yrs)	# of Units	Condition
Boiler, gas-fired	25	1	Fair condition
Condensing Units	15	3	Poor condition
Air Handling Units	20	3	Good-to-fair condition
Thermostats	15	3	Good condition

ENERGY CONSERVATION MEASURES (ECM)

ECM 1 – Lighting Replacement and Occupancy Sensors Installation

Metro Energy recommends upgrading the existing T-12 and incandescent lighting as identified in Attachment A to high efficiency standards to create lighting uniformity throughout the buildings. In general the energy efficient lighting upgrade project would involve installing energy-efficient lighting retrofit parts and materials and new energy-efficient luminaires to the existing lighting systems. The strategies included in this section focused on maximizing energy savings while maintaining the existing look of each lamp, therefore, proposed lamp styles will remain consistent with existing lamp styles. In addition, Metro Energy also recommends installing occupancy sensors in specified areas of the facility. (Please refer to Attachment A: Lighting Retrofit Spreadsheets for a line-by-line proposal spreadsheet for detailed strategies and sensor locations).

Estimated Energy Savings:
The annual energy savings are estimated to be 13kW, 38,501kWh and $5,814. In addition the project will generate maintenance savings from avoided costs related to changing fixtures. Please refer to Attachment A for the Lighting Spreadsheets and energy savings calculations.

Assumptions:
The Lighting Annual Savings assume the annual hours per year of operation as outlined under the column entitled "Hours Code" in Attachment A and the O&M savings for the first (3) years are calculated by assuming that we will avoid total existing lamp & ballast maintenance costs by installing newer technologies with warranties. Years (4) & (5) are calculated using just the avoided existing ballasts costs only because the warranties on the ballasts are 5-years and the 3-year warranty on the lamps has now expired. Years (6) through (10) are the calculated by using difference between the cost to maintain the existing system and the cost to maintain the proposed system.

Estimated NJ SmartStart® Rebate:
The estimated rebate is $1,810.

Estimated Installation Cost:
The estimated cost to install high efficiency lighting throughout the facility is $21,167.

ECM 2 –High Efficiency Condensing Units

The air conditioning units were installed in 1992 and are approaching the end of their useful life. Metro Energy recommends replacing these inefficient condensing units with high-efficiency equivalent units with Puron (R-410A) refrigerant.

Estimated Energy Savings:
The total cooling capacity for the air conditioning units is 52.5 tons. The high efficiency units operate at 12.5 EER, compared with 8.0 EER for the existing units.

Electric Savings

$0.151/kWh x (12/8.0 EER – 12/12.5 EER) kW/ton x 52.5 tons x 576 hours/yr. = $2,466

Estimated NJ SmartStart® Rebate:
The estimated rebate is $4,148.

Estimated Installation Cost:
The estimated installed cost is $112,000.

ECM 3 – Programmable Thermostat in Office

Heating hot water is circulated with (3) zone circulators controlled with individual thermostats. One of the thermostats in the office area is a standard thermostat that does not provide a temperature setback during unoccupied hours. Metro Energy recommends replacing the thermostat with a 7-day programmable unit that provides automatic temperature setback during unoccupied hours.

Estimated Energy Savings:
For purposes of this analysis, we estimated energy savings based on a 10°F setback and 15% in the office area. We estimated the office area consumed 25% of the total heating gas consumption.

Cooling savings were not calculated due to the fact that the employees turn off the air conditioning unit before leaving the office.

Energy savings = Current Gas Consumption x (7,899) x 25% x 15% = 296 therms
Cost savings = 296 therms x $1.38/therm = $408

Estimated NJ SmartStart® Rebate:
NJ SmartStart® custom rebate will be determined by the NJ SmartStart Program Manager.

Estimated Installation Cost:
Estimated installed cost is $448.

ECM 4 – Hot Water Outdoor Air Reset Control

The boiler supplies hot water at a fixed 180°F to the baseboard convectors and heating coils in the air handling units regardless of outdoor conditions. A significant part of a building's heating load varies based on the outdoor temperature. A hot water reset control system can decrease the hot water supply temperature during low building heating load conditions, and then reset it when building load increases. Metro Energy recommends installing a hot water outdoor air reset controls package.

Estimated Energy Savings:
Empirical data show 8% savings can be realized by resetting supply water temperature for a boiler. Based on empirical data, hot water supply temperature will fluctuate from 180°F to 120°F depending on the outdoor conditions

Energy savings = Current Gas Consumption x (8 %) = 7,899 x 8% = 632 therms
Cost savings = 632 therms x $1.38/therm = $872

Estimated NJ SmartStart ®Rebate:
NJ SmartStart® custom rebate will be determined by the NJ SmartStart Program Manager.

Estimated Installation Cost:
The estimated installed cost is $4,200.

ECM 5 – Water Conservation Recommendations

Waterless Urinals, low flow toilets and Aerators
There are (12) toilets, (4) urinals, and (13) faucets located in the facility. Metro Energy recommends replacing the toilets with dual flush low flow toilets, replacing the urinals with waterless urinals, and retrofitting the faucets with low flow aerators (0.5 gpm).

Estimated Utility Cost Savings:
These calculations are based on the assumption that this building has approximately 60 patrons (visitors and staff) per day, half of which are men and the other half are women. It is assumed that all of the men use the urinal twice a day and the women use the toilet at least twice a day. Additionally, it is assumed that a third of the patrons use a toilet one extra time. For each urinal or toilet flush, it is assumed that a sink is used for fifteen seconds.

60 flushes per day x 1.0 gallons saved per urinal = 60 gallons saved per day multiplied by 250 = 15,000 gallons per year.

80 flushes per day x 0.6 gallons saved per toilet = 48 gallons saved per day multiplied by 250 days = 12,000 gallons per year.

35 minutes of sink use per day x 1.7 gpm saved= 59.5 gallons saved per day multiplied by 250 days = 14,875 gallons per year.

The type of domestic hot water heater in this building is unavailable. However, for the purposes of energy savings associated with water usage, we will assume that the water is heated with gas. Assuming that 40% of the 14,875 saved by faucets is heated to 120F, energy savings can be calculated as 39 therms.

Metro Energy assumed a cost of $4 per thousand gallons of water (including sewer costs). The total annual utility cost savings is estimated to be $221. In addition the proposed technology will reduce maintenance costs by $100 per urinal for the first year in use for a total annual maintenance savings of $400.

Estimated Installation Cost:
The total cost for low flow aerators, waterless urinals, and dual flush low flow toilets is estimated to be $11,116. In addition, there is a $20 per year maintenance fee for each waterless urinal to change the chemicals inside of them.

ECM 6– PV Solar System

The roof of this building consists of multiple pitched sections facing different directions. If the roof is approaching the end of its useful life, it is recommended that any solar opportunities are only implemented when the roof is being replaced.

Metro Energy recommends the installation of solar panels. Metro conducted both a facility walkthrough and a satellite image analysis and based on the estimated total available area we recommend the installation of a system rated at approximately 14.6 kW dc. During our analysis our engineers looked at the total unobstructed available area of each section of the roof with southern exposure.

Additional engineering and analysis is required to confirm the system type, sizing, costs and savings. It needs to be determined if it is more beneficial to implement solar panels on the existing roof or to wait until the roof is being renovated or replaced. Seeing as solar panels have the same lifespan as a standard roof, the most beneficial time for this opportunity would be when the roof is being redone.

The proposed Photovoltaic (PV) Power system is comprised of a PV array, inverter(s) and all of the necessary wiring and interconnection equipment. The array output will feed power into the DC to AC inverters, which will then be connected to the building's electrical panel.

Estimated Energy Savings:
The energy savings generated by the installation of approximately 14.6 kW of photovoltaic power is estimated to be 17,063 kWh. At an average price of $0.151/kWh, the total energy savings would be $2,577 per year.

Solar Renewable Energy Credit:
In addition, there is a solar renewable energy credit (SREC) of approximately $.45/kWh based on the New Jersey Clean Energy Program which would result in additional revenues of $7,678. Total annual savings and credits are estimated to be $10,255.

New Jersey State law now requires that the utility must interconnect and net meter your photovoltaic system provided your system passes the local electrical inspection (National Electric Code) and meets the utility safety requirements as outlined in the law. A signed copy of the interconnection and net metering agreement is entered into by the Owner and the utility and is binding and transferable, provided the safety requirements are maintained. Net metering is the term given which allows your utility meter to literally "spin backwards" when you are producing more electricity than you are using. During the day, the occupants of the business may be off for a holiday or weekend while the photovoltaic system is making more than what the facility is presently using. The excess electricity then spins the meter backward and the utility gives you credit at the retail rate for the power they buy back from you. This credit shows up on your monthly electric bill as your meter actually registers the backfeed amount. The meter spins forward (you purchase) at night, during rainy weather, or when your electric demand exceeds the amount of

power you are generating on the roof at that given moment. This amount is annualized at the end of the year, especially during some months when it is possible to have a negative electric bill.

Estimated Installation Cost:
The total cost for the standard solar panels placed on the roof is $146,765.

5. Community Center

1070 Grove Ave, [name of municipality], NJ

Background Information:

Structure Description:
(Totaling 13,738 square feet)
This is a single-story masonry building. It includes offices, meeting rooms, an arts-and- crafts room, a game room and a gymnasium. The building is occupied during normal business hours from 8:00 AM to 4:30 PM, Monday through Friday.

Overall, the building appears to be in good condition.

Lighting Description:

Lighting System
The lighting system includes a combination of 2x4 (3 and 4) lamp, 4-foot (1 and 2) lamp, 2x2 (2) lamp, 250-watt Mercury Vapor, and incandescent lamps. Most of the fluorescent and incandescent fixtures are not energy efficient and should be replaced.

Heating, Ventilation, and Air Conditioning (HVAC) and other mechanical systems:

Heating and Cooling System
Space heating and cooling is provided with (3)Trane rooftop air conditioning units that serve the offices, meeting rooms, game room, arts-and-crafts room. The gymnasium is heated with a Trane rooftop heating and ventilation unit. Due to the age of the unit, we were unable to find the nameplate on the unit. The rooftop air conditioning units are equipped with DX cooling coils and gas-fired heating elements. The total cooling capacity is approximately 30 tons. These units were 17 years old and near the end of their useful life.

Controls
Space temperature in the gymnasium is controlled with a Honeywell standard thermostat. Space temperature in the rest of the building is controlled with (3) Honeywell programmable thermostats.

Windows
The windows in this building are double paned glass, mounted on aluminum frames. The windows are in fair condition and no replacement is recommended at this time.

Energy Use Analysis
Figure 6 illustrates the estimated monthly electricity usage from July 2006 to June 2007. The total annual cost and consumption for this period was $4,649 and 32,052 kWh respectively. The average electric cost for this 12-month period was about $0.145 per kWh. Typical natural gas usage is

presented in Figure 7 for May 2006 to April 2007. September, November, and December 2006 bills are unavailable; thus using the available data, an estimate is made. The total annual gas consumption is estimated to be about 12,130 therms per year at a rate of approximately $1.29/therm.

The average annual energy requirement of the building was 2.33 kWh/square foot and 0.883 therms/square foot.

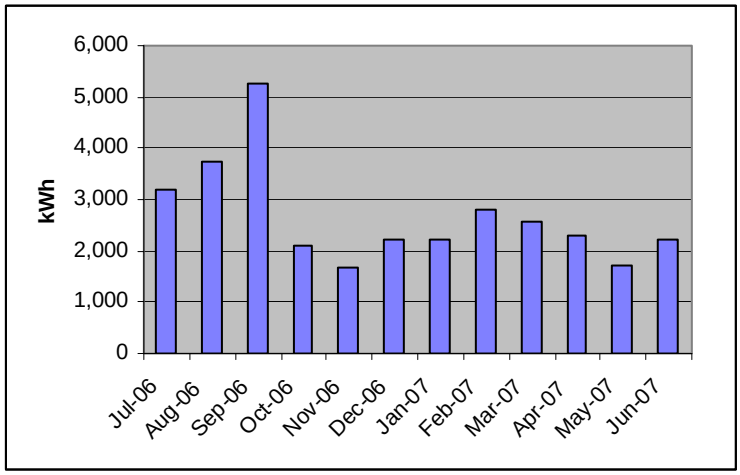

Figure 6: Annual Electricity Usage

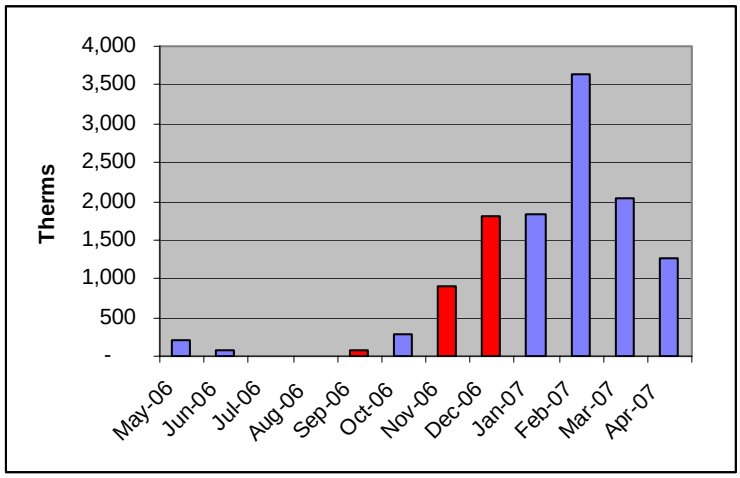

Figure 7: Annual Gas Usage

Table 13: Equipment Life Expectancy Data

Equipment Item	Median Life (Yrs)	# of Units	Condition
Rooftop air conditioning units	15	4	Fair-to-poor condition
Thermostats	15	4	Good condition

ENERGY CONSERVATION MEASURES (ECM)

ECM 1 – Lighting Replacement and Occupancy Sensors Installation

Metro Energy recommends upgrading the existing T-12 and incandescent lighting as identified in Attachment A to high efficiency standards to create lighting uniformity throughout the buildings. In general the energy efficient lighting upgrade project would involve installing energy-efficient lighting retrofit parts and materials and new energy-efficient luminaires to the existing lighting systems. The strategies included in this section focused on maximizing energy savings while maintaining the existing look of each lamp, therefore, proposed lamp styles will remain consistent with existing lamp styles. In addition, Metro Energy also recommends installing occupancy sensors in specified areas of the facility. (Please refer to Attachment A: Lighting Retrofit Spreadsheets for a line-by-line proposal spreadsheet for detailed strategies and sensor locations).

Estimated Energy Savings:
The annual energy savings are estimated to be 11kW, 36,953kWh and $5,358. In addition the project will generate maintenance savings from avoided costs related to changing fixtures. Please refer to Attachment A for the Lighting Spreadsheets and energy savings calculations.

Assumptions:
The Lighting Annual Savings assume the annual hours per year of operation as outlined under the column entitled "Hours Code" in Attachment A and the O&M savings for the first (3) years are calculated by assuming that we will avoid total existing lamp & ballast maintenance costs by installing newer technologies with warranties. Years (4) & (5) are calculated using just the avoided existing ballasts costs only because the warranties on the ballasts are 5-years and the 3-year warranty on the lamps has now expired. Years (6) through (10) are the calculated by using difference between the cost to maintain the existing system and the cost to maintain the proposed system.

Estimated NJ SmartStart® Rebate:
The estimated rebate is $1,890.

Estimated Installation Cost:
The estimated cost to install high efficiency lighting throughout the facility is $20,774.

ECM 2 – Rooftop Air Conditioning Unit Replacement

The existing rooftop air conditioning units were installed in 1990 and appear to be in poor physical condition. The average life cycle for an air-cooled rooftop air conditioning unit is approximately 15 years. These units are approaching the end of their useful life. Metro Energy recommends replacing these inefficient rooftop units with high-efficiency equivalent units. Savings will be realized from the efficient operation and reduced maintenance cost.

Estimated Energy Savings:
The total cooling and heating capacities for the rooftop units are estimated to be 30 tons and 932 MBH respectively. The high efficiency units operate at 12.5 EER for cooling and 82% for heating, compared with 8.0 EER and 70% for the existing units.

Heating Savings:

Gymnasium HV unit
$1.29/therm x 350,000 Btu/hr x 2,538 hrs/yr/100,000 Btu/therm x (1/70% - 1/82%)
= $2,396

All RTAC units
$1.29/therm x 582,000 Btu/hr x 727 hrs/yr/100,000 Btu/therm x (1/70% - 1/82%)
= $1,141

Cooling Savings:
$0.145/kWh x (12/8.0 EER – 12/12.5 EER) kW/ton x 30 tons x 576 hours/yr. = $1,353

Total Savings:

$2,396 + $1,141 + $1,353 = $4,890

Estimated NJ SmartStart® Rebate:
The estimated rebate is $2,370.

Estimated Installed Cost
The estimated Installed cost is approximately $67,200 and includes replacement of the existing units with three high efficiency gas fired roof top units, rated at about 10 tons each.

ECM 3 –Programmable Thermostat in Gymnasium

During our survey, we found that the gas-fired heating ventilation unit for the gymnasium was controlled through a standard thermostat that did not provide a temperature setback during unoccupied hours. Metro Energy recommends replacing the thermostat with a 7-day programmable unit that provides automatic temperature setback during unoccupied hours. We were unable to find any nameplate on the unit. However, based on the size of the unit, we estimated a heating capacity of approximately 350 MBH. .

Estimated Energy Savings:
For purposes of this analysis, we estimated energy savings based on an 8°F setback and 10% of total heating savings.

Energy savings = Current Gas Consumption (12,130 therms) x 35% x 10% = 425 therms
Cost savings = 425 therms x $1.29/therm = $548

Estimated Installation Cost:
Estimated installed cost is $448.

Estimated NJ SmartStart® Rebate:
NJ SmartStart® custom rebate will be determined by the utility company.

ECM 4 – Water Conservation Recommendations

Waterless Urinals, low flow toilets and Aerators
There are approximately (13) toilets, (2) urinals, and (8) faucets located in the facility. (Not all of the rooms were accessible and thus, these numbers are not exact.) The majority of the faucets have efficient aerators. Metro Energy recommends replacing the toilets with dual flush low flow toilets, replacing the urinals with waterless urinals, and retrofitting the remaining inefficient faucets with low flow aerators (0.5 gpm).

Estimated Utility Cost Savings:
These calculations are based on the assumption that this building has approximately 40 patrons (visitors and staff) per day, half of which are men and the other half are women. It is assumed that all of the men use the urinal once a day and the women use the toilet at least once a day. For each urinal or toilet flush, it is assumed that a sink is used for fifteen seconds.

20 flushes per day x 1.0 gallons saved per urinal = 20 gallons saved per day multiplied by 250 = 5,000 gallons per year.

20 flushes per day x 0.6 gallons saved per toilet = 12 gallons saved per day multiplied by 250 days = 3,000 gallons per year.

10 minutes of faucet use per day x 1.7 gpm = 17 gallons saved per day multiplied by 250 days = 4,250 gallons per year

The type of domestic hot water heater in this building is unavailable. However, for the purposes of energy savings associated with water usage, we will assume that the water is heated with gas. Assuming that 40% of the 4,250 gallons saved by faucets is heated to 120F, energy savings can be calculated as 11 therms.

Metro Energy assumed a cost of $4 per thousand gallons of water (including sewer costs). The total annual utility cost savings is estimated to be $63. In addition the proposed technology will reduce maintenance costs by $100 per urinal for the first year in use for a total annual maintenance savings of $200.

Estimated Installation Cost:
The total cost for low flow aerators, waterless urinals, and dual flush low flow toilets is estimated to be $10,136. In addition, there is a $20 per month maintenance fee for each waterless urinal to change the chemicals inside of them.

ECM 5 – PV Solar System

The roof of this building consists of a flat section surrounded by four other sections, each of which is a pitched roof. As a result, there is very little area on the flat section that is not shaded or occupied by rooftop units. The pitched sections are made up of asphalt shingles and appear to be in fair condition. The age of the roof was not known at the time of our site visit. If the roof is at the end of its useful life, it is recommended that any solar opportunities are only implemented when the roof is or has been replaced.

Metro Energy recommends the installation of solar panels. Metro conducted both a facility walkthrough and a satellite image analysis and based on the estimated total available area we recommend the installation of a system rated at approximately 3.7 kW dc. During our analysis our engineers looked at the total unobstructed available area of each section of the roof with southern exposure.

Additional engineering and analysis is required to confirm the system type, sizing, costs and savings. Additionally, because the age of the roof is unknown, it needs to be determined if it is more beneficial to implement solar panels on the existing roof or to wait until the roof is being renovated or replaced. Seeing as solar panels have the same lifespan as a standard roof, the most beneficial time for this opportunity would be when the roof is being redone.

The proposed Photovoltaic (PV) Power system is comprised of a PV array, inverter(s) and all of the necessary wiring and interconnection equipment. The array output will feed power into the DC to AC inverters, which will then be connected to the building's electrical panel.

Estimated Energy Savings:
The energy savings generated by the installation of approximately 3.7 kW of photovoltaic power is estimated to be 4,435 kWh. At an average price of $0.145/kWh, the total energy savings would be $643 per year.

Solar Renewable Energy Credit:
There is a solar renewable energy credit (SREC) of approximately $.45/kWh based on the New Jersey Clean Energy Program which would result in additional revenues of $1,996. Total annual savings and credits are estimated to be $2,639.

New Jersey State law now requires that the utility must interconnect and net meter your photovoltaic system provided your system passes the local electrical inspection (National Electric Code) and meets the utility safety requirements as outlined in the law. A signed copy of the interconnection and net metering agreement is entered into by the Owner and the utility and is binding and transferable, provided the safety requirements are maintained. Net metering is the term given which allows your utility meter to literally "spin backwards" when you are producing more electricity than you are using. During the day, the occupants of the business may be off for a holiday or weekend while the photovoltaic system is making more than what the facility is presently using. The excess electricity then spins the meter backward and the utility gives you credit at the retail rate for the power they buy back from you. This credit shows up on your monthly electric bill as your meter actually registers the backfeed amount. The meter spins forward

(you purchase) at night, during rainy weather, or when your electric demand exceeds the amount of power you are generating on the roof at that given moment. This amount is annualized at the end of the year, especially during some months when it is possible to have a negative electric bill.

Estimated Installation Cost:
The total cost for the standard solar panels placed on the roof is $41,772.

6. Municipal Garage

745 New Durham Road, [name of municipality], NJ

Background Information:

Structure Description:
(6,770 square feet)
This is a single-story maintenance garage. It includes offices, a locker room, a parts room and vehicle bay area. In addition, there is an additional office trailer located next to the garage. The buildings are occupied from 7:00 AM to 4:00 PM, Monday through Friday.

Overall, the buildings appear to be in fair condition.

Lighting Description:

Lighting System
The lighting system includes a combination of 2x4 (4) lamp, 4-foot (2 and 3) lamp, 8-foot (2) lamp, 1x4 (2) lamp, 250-watt Metal Halide, and incandescent lamps. Most of the fluorescent and incandescent fixtures are not energy efficient and should be replaced.

Heating, Ventilation, and Air Conditioning (HVAC) and other mechanical systems:

Heating and Cooling System

Heating hot water is generated in a Burham 4-W-20 cast-iron sectional boiler with an input and output of 75 and 60 MBH respectively. It was built in 1970 and appears to be in fair-to-poor condition. The average life cycle for a cast-iron boiler is approximately 35 years. Heating hot water is circulated throughout the baseboard convectors in the building except the bay area, which is heated by (9) Modine gas-fired unit heaters.

Space cooling in the offices and locker room is provided with (3) window air conditioners, each rated at 12,500 Btu/h.

Controls
Space heating is controlled with a Honeywell standard thermostat in the supervisor's office. All of the window air conditioners and gas-fired unit heaters are controlled with individual unit-mounted thermostats.

Windows
The windows on the main garage are all single paned glass, mounted on aluminum frames. Generally, the windows are in poor condition and should be considered for replacement. The office trailer windows are all double paned glass on aluminum frames and are not recommended for replacement.

Energy Use Analysis

Figure 8 illustrates the estimated monthly electricity usage from July 2006 to June 2007. The total annual consumption for this period was about 85,920 kWh at a cost of $11,650. The average electric cost for this 12-month period was about $0.136 per kWh. Typical natural gas usage is presented in Figure 9. The gas is delivered using PSE&G pipes but is supplied by a third party. As a result, the exact cost is also not known for most of the months; however, for a few of the months, the Price to Compare from PSE&G is shown in the bills. Using these numbers, an estimate is made for the price of the gas. The total annual gas consumption is 26,285 therms resulting in an average of approximately $1.51/therm.

The average annual energy requirement of the building was 12.69 kWh/square foot and 3.88 therms/square foot.

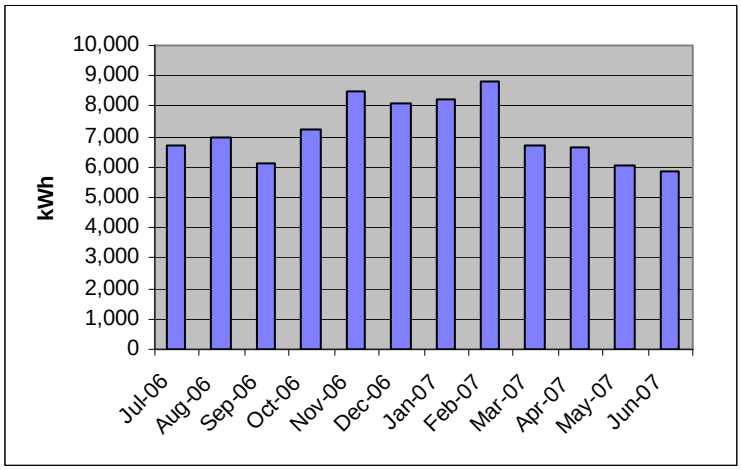

Figure 8: Annual Electricity Usage

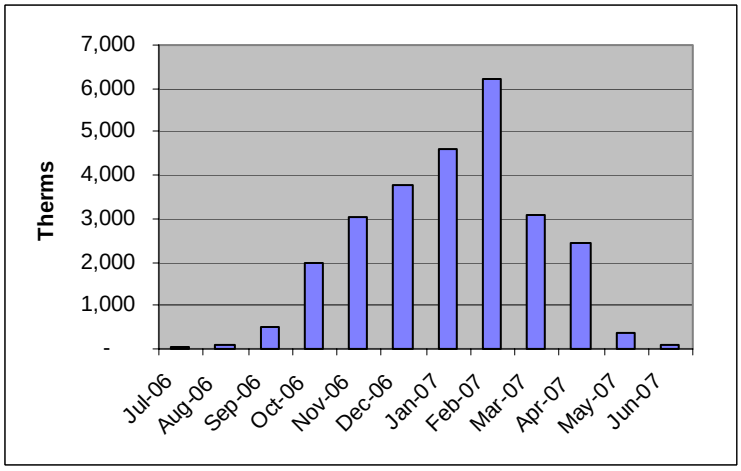

Figure 9: Annual Gas Usage

Table 14: Equipment Life Expectancy Data

Equipment Item	Median Life (Yrs)	# of Units	Condition
Boiler, gas-fired	35	1	At the end of its lifespan
Window A/C units	15	3	Fair condition
Unit heaters, gas-fired	20	9	Good-to-fair condition
Thermostats	15	10	Outdated, should be upgraded to setback programmable thermostats

ENERGY CONSERVATION MEASURES (ECM)

ECM 1 – Lighting Replacement and Occupancy Sensors Installation

Metro Energy recommends upgrading the existing T-12 and incandescent lighting as identified in Attachment A to high efficiency standards to create lighting uniformity throughout the buildings. In general the energy efficient lighting upgrade project would involve installing energy-efficient lighting retrofit parts and materials and new energy-efficient luminaires to the existing lighting systems. The strategies included in this section focused on maximizing energy savings while maintaining the existing look of each lamp, therefore, proposed lamp styles will remain consistent with existing lamp styles. In addition, Metro Energy also recommends installing occupancy sensors in specified areas of the facility. (Please refer to Attachment A: Lighting Retrofit Spreadsheets for a line-by-line proposal spreadsheet for detailed strategies and sensor locations).

Estimated Energy Savings:
The annual energy savings are estimated to be 15kW, 36,898kWh and $5,018. In addition the project will generate maintenance savings from avoided costs related to changing fixtures. Please refer to Attachment A for the Lighting Spreadsheets and energy savings calculations.

Assumptions:
The Lighting Annual Savings assume the annual hours per year of operation as outlined under the column entitled "Hours Code" in Attachment A and the O&M savings for the first (3) years are calculated by assuming that we will avoid total existing lamp & ballast maintenance costs by installing newer technologies with warranties. Years (4) & (5) are calculated using just the avoided existing ballasts costs only because the warranties on the ballasts are 5-years and the 3-year warranty on the lamps has now expired. Years (6) through (10) are the calculated by using difference between the cost to maintain the existing system and the cost to maintain the proposed system.

Estimated NJ SmartStart® Rebate:
The estimated rebate is $2,280.

Estimated Installation Cost:
The estimated cost to install high efficiency lighting throughout the facility is $32,673.

ECM 2 –Programmable Thermostats

During our survey, Metro Energy found that the gas-fired unit heaters were controlled through individual standard thermostats, and the boiler was also controlled through a standard thermostat in the supervisor's office. These thermostats appear to be in poor condition. The one in the office does not have a cover. Metro Energy recommends replacing all of the existing thermostats with 7-day programmable units that provide automatic temperature setback during unoccupied hours.

Estimated Energy Savings:
For purposes of this analysis, we estimated energy savings based on a 10°F setback and 10-15% of total heating savings. The total heating capacity of the boiler and unit heaters is approximately 750 MBH.

Energy savings = Current Gas Consumption (26,285) x 10% = 2,628 therms
Cost savings = 2,628 therms x $1.51herm = $3,968

Estimated NJ SmartStart® Rebate:
NJ SmartStart® custom rebate will be determined by the utility company.

Estimated Installation Cost:
Estimated cost for (10) programmable thermostats is $4,480.

ECM 3 - Boiler Replacement

According to the maintenance staff and the boiler certificate, the boiler was built in 1970 and appears to be in poor condition. We estimated the thermal efficiency to be 70% based on empirical data. The average life cycle for a gas-fired atmospheric boiler is 25 years. It has apparently exceeded its useful life. Metro Energy recommends replacing the aging boiler with a high efficiency boiler with a thermal efficiency of 93% or higher.

Estimated Energy Savings:
$1.51/therm x 60,000 Btu/hr x 2,538 hrs/yr/100,000 Btu/therm x (1/70% - 1/93%)
= $811

Estimated Installation Cost:
The estimated installed cost is $13,440.

Estimated NJ SmartStart® Rebate:
The estimated rebate is $150

ECM 4 –Waste Oil Furnace

At present, space heating in the garage bay area is provided with (9) gas-fired unit heaters. Based on our conversation with township personnel, the maintenance garage generates and collects approximately 3,000 gallons of waste oil annually. The waste oil is then disposed. Metro Energy recommends the installation of a waste oil furnace to supplement some of the existing heating in the garage.

Estimated Energy Savings:
For the purpose of this energy analysis, we assume an 80% thermal efficiency for the existing gas-fired unit heaters in the garage and an 84% thermal efficiency for a new waste oil-fired furnace.

Total heating available from 3,000 gallon waste oil:

134,000 Btu/gallon x 3,000 gallon x 84%/1,000,000 Btu/MMBtu = 337.68 MMBtu

$1.51/therm x 337.68 MMBtu x 10 therms/MMBtu/ 80% efficiency = $6,374

Estimated Installation Cost:
The estimated installed cost for (2) 350 MBH waste oil-fired furnace with a #2 oil backup tank is $50,400.

ECM 5 – Windows Replacement

The windows in the garage are single paned mounted on aluminum frames. These windows are generally in poor condition. For example, some of the windows on the west facing wall have multiple cracks in them. The windows on the office trailer, however, are double paned glass on aluminum frames and are in good condition. Metro Energy recommends replacing the single pane windows with new energy efficient windows. The new windows will be double or triple pane, low e, argon filled windows on aluminum frames.

Estimated Energy Savings:
Energy savings that could be realized from a window replacement is a result of reduced heat conduction and air infiltration. Additional measurement and analysis needs to be conducted to identify exact quantities, pricing and savings.

Table 15: Estimated Window Replacement Area (ft^2):

Direction	Municipal Garage
N	200
S	0
E	60
W	378
Total	**638**

Table 16: Energy Savings Analysis:

	Energy savings – winter (MMBtu)	Energy savings – summer (kWh)
Reduced heat conduction	95	1784.15
Reduced air infiltration	223	4194.90
Total Energy savings/year	**318 MBtu (3,180 therms of gas)**	**5979.05 kWh**
Annual savings @$1.51/therm & $0.136/kWh	**$4802**	**$813**

The total cost savings were estimated at $5,616

Estimated Installation Cost:
The implementation cost to replace existing windows with the proposed windows is $35,728.

ECM 6 – Water Conservation Recommendations

Waterless Urinals, low flow toilets and Aerators
There are (2) toilets, (2) urinals, and (3) faucets located in the main warehouse. There are (3) toilets, (1) urinal, and (3) faucets (only 2 work) in the office trailer outside of the warehouse. Metro Energy recommends replacing the toilets with dual flush low flow toilets, replacing the urinals with waterless urinals, and placing low flow aerators (0.5 gpm) on the faucets.

Estimated Utility Cost Savings:
These calculations are based on the assumption that this building has approximately 15 male workers per day. It is assumed that all of the men use the urinal twice a day and a toilet once a day. For each urinal or toilet flush, it is assumed that a sink is used for fifteen seconds.

30 flushes per day x 1.0 gallons saved per urinal = 30 gallons saved per day multiplied by 250 = 7,500 gallons per year.

15 flushes per day x 0.6 gallons saved per toilet = 9 gallons saved per day multiplied by 250 days = 2,250 gallons per year.

11.25 minutes of faucet use per day x 1.7 gpm saved = 19.13 gallons saved per day multiplied by 250 days = 4,783 gallons per year.

The type of domestic hot water heater in this building is unavailable. However, for the purposes of energy savings associated with water usage, we will assume that the water is heated with gas. Assuming that 40% of the 4,783 gallons saved by faucets is heated to 120F, energy savings can be calculated as 13 therms.

Metro Energy assumed a cost of $4 per thousand gallons of water (including sewer costs). The total annual utility cost savings is estimated to be $78. In addition the proposed technology will reduce maintenance costs by $100 per urinal for the first year in use for a total annual maintenance savings of $200.

Estimated Installation Cost:
The total cost for low flow aerators, waterless urinals, and dual flush low flow toilets is estimated to be $5,544. In addition, there is a $20 per year maintenance fee for each waterless urinal to change the chemicals inside of them.

ECM 7 – PV Solar System

There are (2) buildings that comprise this DPW garage. There is the garage itself and an office trailer. Both roofs are flat and there is no shading on either. The age of the roofs was not available at the time of the audit. If they are at the end of their useful life, it is recommended that any solar opportunities are only implemented when the roofs are or have been replaced.

Metro Energy recommends the installation of solar panels. Metro conducted both a facility walkthrough and a satellite image analysis and based on the estimated total available area we recommend the installation of a system rated at approximately 8.7 kW dc on the flat roof as well as the southeast and southwest faces of the pitched roof. During our analysis our engineers looked at the total unobstructed available area of each section of the roof with southern exposure.

Additional engineering and analysis is required to confirm the system type, sizing, costs and savings. Additionally, because the age of the roof is unknown, it needs to be determined if it is more beneficial to implement solar panels on the existing roof or to wait until the roof is being renovated or replaced. Seeing as solar panels have the same lifespan as a standard roof, the most beneficial time for this opportunity would be when the roof is being redone.

The proposed Photovoltaic (PV) Power system is comprised of a PV array, inverter(s) and all of the necessary wiring and interconnection equipment. The array output will feed power into the DC to AC inverters, which will then be connected to the building's electrical panel.

Estimated Energy Savings:
The energy savings generated by the installation of approximately 8.7 kW of photovoltaic power is estimated to be 9,575 kWh. At an average price of $0.136/kWh, the total energy savings would be $1,302 per year.

Solar Renewable Energy Credit:
There is a solar renewable energy credit (SREC) of approximately $.45/kWh based on the New Jersey Clean Energy Program which would result in additional revenues of $4,309. Total annual savings and credits are estimated to be $5,611.

New Jersey State law now requires that the utility must interconnect and net meter your photovoltaic system provided your system passes the local electrical inspection (National Electric Code) and meets the utility safety requirements as outlined in the law. A signed copy of the interconnection and net metering agreement is entered into by the Owner and the utility and is binding and transferable, provided the safety requirements are maintained. Net metering is the term given which allows your utility meter to literally "spin backwards" when you are producing more electricity than you are using. During the day, the occupants of the business may be off for a holiday or weekend while the photovoltaic system is making more than what the facility is presently using. The excess electricity then spins the meter backward and the utility gives you credit at the retail rate for the power they buy back from you. This credit shows up on your monthly electric bill as your meter actually registers the backfeed amount. The meter spins forward (you purchase) at night, during rainy weather, or when your electric demand exceeds the amount of power you are generating on the roof at that given moment. This amount is annualized at the end of the year, especially during some months when it is possible to have a negative electric bill.

Estimated Installation Cost:
The total cost for the standard solar panels placed on the roof is $98,220.

7. Firehouse #1

25 Plainfield Avenue, [name of municipality], NJ

Background Information:

Structure Description:
(8,640 square feet)
This is a fire station facility. It includes truck bays, a lounge and offices. The building is used 24 hours a day, 7 days per week.

Overall, the building appears to be structurally and aesthetically in good condition.

Lighting Description:

Lighting System
The lighting system includes a combination of 2-foot (2) lamp, 4-foot (2 and 4) lamp, 8-foot (2 and 4) lamp, and incandescent lamps. Most of the fluorescent and incandescent fixtures are not energy efficient and should be replaced.

Heating, Ventilation, and Air Conditioning (HVAC) and other mechanical systems:

Heating and Cooling System

Heating is provided by (2) Weil McLain PFG series 6 natural gas-fired boilers. The first (image to the left) was installed in 1993 and the second in 2002, they are each rated with an input of 305,000 BTU/H and output of 247,000 BTU/H. The boilers feed (3) unit heaters in the truck bays along with several cast iron radiators throughout the building. Each boiler serves its own zone, one for the first floor and another for the second.

The space cooling is provided by several window air conditioning units.

Controls
A Honeywell dial mechanical heating thermostat is set at 62° in the main lounge area.

Windows

The windows in this building are predominantly single paned glass mounted on old wooden frames. Some of the windows on the second floor are double paned glass and are in good condition. These are not recommended to be replaced at this time. Several of the windows have air conditioning units mounted in them. The single paned windows range from poor to average condition.

Energy Use Analysis

Figure 10 illustrates the estimated monthly electricity usage from August 2006 to July 2007. The consumption and cost for this 12-month period were 36,564 kWh and $5,314, respectively, resulting in a rate of $0.145/kWh. Typical natural gas usage is presented in Figure 11. The total gas consumption was 7,129 therms. The exact rate of gas is not known because the gas was purchased through a third party for the first six months and those rates are unknown. The gas for this building is estimated to be at the same rate as the second firehouse ($1.36/therm).

The average annual energy requirement of the building was 4.23 kWh/square foot and 0.825 therms/square foot.

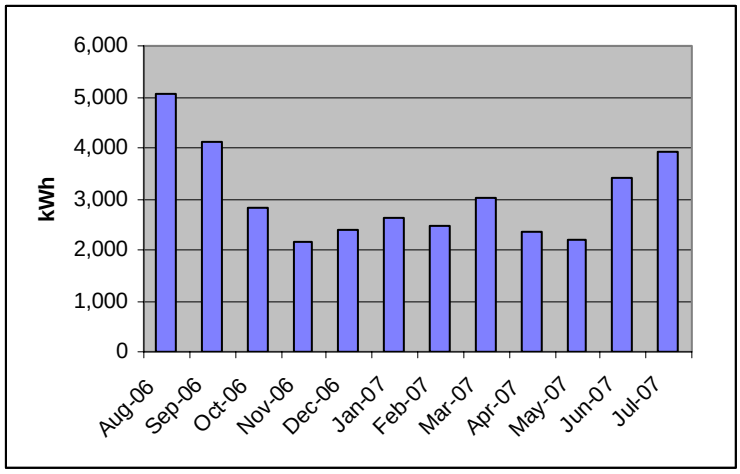

Figure 10: Annual Electricity Usage

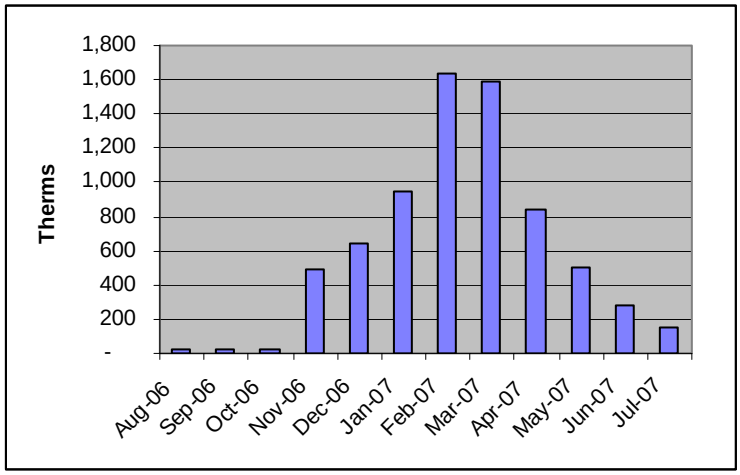

Figure 11: Annual Gas Usage

Table 18: Equipment Life Expectancy Data

Equipment Item	Median Life (Yrs)	# of Units	Condition
Boiler, hot water	35	1	Good condition.
Wall A/C units	20	N/A	Fair condition.
Controls	25	1	Old Honeywell Dial thermostat should be replaced with new Programmable Setback Thermostat

ENERGY CONSERVATION RETROFIT MEASURES (ECM)

ECM 1 – Lighting Replacement and Occupancy Sensors Installation

Metro Energy recommends upgrading the existing T-12 and incandescent lighting as identified in Attachment A to high efficiency standards to create lighting uniformity throughout the buildings. In general the energy efficient lighting upgrade project would involve installing energy-efficient lighting retrofit parts and materials and new energy-efficient luminaires to the existing lighting systems. The strategies included in this section focused on maximizing energy savings while maintaining the existing look of each lamp, therefore, proposed lamp styles will remain consistent with existing lamp styles. In addition, Metro Energy also recommends installing occupancy sensors in specified areas of the facility. (Please refer to Attachment A: Lighting Retrofit Spreadsheets for a line-by-line proposal spreadsheet for detailed strategies and sensor locations).

Estimated Energy Savings:
The annual energy savings are estimated to be 6kW, 51,839kWh and $7,517. In addition the project will generate maintenance savings from avoided costs related to changing fixtures. Please refer to Attachment A for the Lighting Spreadsheets and energy savings calculations.

Assumptions:
The Lighting Annual Savings assume the annual hours per year of operation as outlined under the column entitled "Hours Code" in Attachment A and the O&M savings for the first (3) years are calculated by assuming that we will avoid total existing lamp & ballast maintenance costs by installing newer technologies with warranties. Years (4) & (5) are calculated using just the avoided existing ballasts costs only because the warranties on the ballasts are 5-years and the 3-year warranty on the lamps has now expired. Years (6) through (10) are the calculated by using difference between the cost to maintain the existing system and the cost to maintain the proposed system.

Estimated NJ SmartStart® Rebate:
The estimated rebate is $690.

Estimated Installation Cost:
The estimated cost to install high efficiency lighting throughout the facility is $10,428.

ECM 2 – Programmable Setback Thermostats

Metro Energy recommends the installation of a 7-day programmable setback thermostat to replace the previous out of date mechanical thermostat. Programmable thermostats are easy to use, contribute to the overall system performance, maximize energy savings, and provide complete comfort control. The precise temperature control of a programmable, energy-saving thermostat would save wear and tear on the Fire Houses' heating equipment by properly cycling the equipment. A benefit of the setback function is once the desired seasonal temperature and time is set, there is automatic energy savings with little maintenance.

Estimated Energy Savings:
Heating degree-day zone: 2.5
Annual heating natural gas fuel consumption (excluding domestic hot water): 5,522 Therms/yr
Cost per therm of natural gas: $1.36
*Savings factor derived from heating degree-day zone: 0.10
(Savings factor) x (Annual heating fuel consumption) = Therms/yr
0.10 x 5,522 Therms/yr = 552.2 Therms/yr

(Annual energy savings) x (Cost per therm) = $/yr
552.2 Therms/yr x $1.36 = $751/yr

*Savings factor for programmable thermostats heating energy savings are from a nightly setback of 8 degrees.

Estimated Installation Cost:
The total cost of installing (1) programmable thermostat is $448.

ECM 3 –Outdoor Air Reset Control

Metro Energy recommends the installation of an outdoor reset/cutout boiler control to the (2) existing Weil-McLain cast iron boilers in Fire House #1. Some central boiler systems, like that in Fire Headquarters #1 are totally uncontrolled, providing heat with no regard for how much is needed. The boiler starts up in the fall and remains on throughout the heating season until they shut off in the spring. The outdoor air reset control installed on the boiler can reduce energy waste by lowering hot water supply temperature to reduce distribution loss and eliminating overheating conditions. It can save 7-9% of heating fuel use, with a payback of 6-7 years.

Energy Savings
Annual heating natural gas consumption: 5,522 therms
Cost per therm of natural gas: $1.36
0.08 x (Annual heating fuel consumption) = therms/yr
0.08 x (5,522 therms) = 442 therms/year

(Annual energy savings) x (Cost per therm) = $/yr
(442 therms/year) x ($1.36) = $601/yr

Estimated NJ SmartStart® Rebate:
NJ SmartStart® custom rebate will be determined by the utility company.

Estimated Installation Cost:
The total cost of installing (2) outdoor reset/cutout boiler controls is $4,480.

ECM 4 – Windows Replacement

The majority of the windows in this building are single paned glass mounted on wooden frames. Some of these windows also have storm windows while for others, the storm windows are missing. These windows are mostly in poor condition. On the second floor, many of the windows are

newer and have double paned glass mounted on newer wooden frames. These are in good condition and are not recommended to be replaced. Metro Energy recommends replacing the existing single pane windows with new energy efficient windows. The new windows will be double or triple pane, low e, argon filled windows on aluminum frames.

Estimated Energy Savings:
Energy savings that could be realized from a window replacement is a result of reduced heat conduction and air infiltration. Additional measurement and analysis needs to be conducted to identify exact quantities, pricing and savings.

Table 19: Estimated Replacement Window Area (ft^2):

Direction	Firehouse 1
N	121
S	48
E	8
W	40
Total	**217**

Table 20: Energy Savings Analysis:

	Energy savings – winter (MMBtu)	Energy savings – summer (kWh)
Reduced heat conduction	32.26	606.84
Reduced air infiltration	22.39	421.20
Total Energy savings/year	**54.65 MMBtu (546.63 therms of gas)**	**1028.04**
Annual savings @$1.36 /therm & $0.145/kWh	**$743**	**$149**

The total cost savings were estimated at $892.

Estimated Installation Cost:
The implementation cost to replace existing windows with the proposed windows is $12,152

ECM 5 – Water Conservation Recommendations

Waterless Urinals, low flow toilets and Aerators
There are (6) toilets, (4) urinals, (8) faucets, and (1) shower located in the facility. Metro Energy recommends replacing the toilets with dual flush low flow toilets, replacing the urinals with waterless urinals, retrofitting the faucets with low flow aerators (0.5 gpm), and replacing the showerheads with low flow shower head aerators (2.0 gpm). Four (4) of the toilets, two (2) of the urinals, and three (3) of the sinks are located in a portion of the building that, until recently, was condemned. The plumbing in that section is very old and there are many problems, such as dirty water being used in the flushing process. While these units are rarely if ever used, they, as well as the plumbing, should be looked into for replacement.

Estimated Utility Cost Savings:
These calculations are based on the assumption that this building has approximately 15 male firemen who use the urinals two times a day and a toilet once a day. For each urinal or toilet flush, it is assumed that a sink is used for fifteen seconds. Finally, it is assumed that a third of the men take a ten minute shower throughout the day.

30 flushes per day x 1.0 gallons saved per urinal = 30 gallons saved per day multiplied by 365 = 10,950 gallons per year.

15 flushes per day x 0.6 gallons saved per toilet = 9 gallons saved per day multiplied by 365 days = 3,285 gallons per year.

11.25 minutes of sink use per day x 1.7 gpm saved = 19.13 gallons saved per day multiplied by 365 days = 6,981 gallons per year

50 minutes of shower use per day x 1.5 gpm saved = 75 gallons saved per day multiplied by 365 days = 27,375 gallons per year.

The type of domestic hot water heater in this building is unavailable. However, for the purposes of energy savings associated with water usage, we will assume that the water is heated with gas. Assuming that 40% of the 34,356 gallons saved by faucets and showers is heated to 120F, energy savings can be calculated as 91 therms.

Metro Energy assumed a cost of $4 per thousand gallons of water (including sewer costs). The total annual utility cost savings is estimated to be $318. In addition the proposed technology will reduce maintenance costs by $100 per urinal for the first year in use for a total annual maintenance savings of $400.

Estimated Installation Cost:
The total cost for low flow aerators, low flow shower heads, waterless urinals, and dual flush low flow toilets is estimated to be $6,983. This cost does not include plumbing repairs needed by the facility. In addition, there is a $20 per year maintenance fee for each waterless urinal to change the chemicals inside of them.

ECM 6 – PV Solar System

The roof on this structure consists of three sections: a flat section on the east side of the structure, a second flat section on the north side of the structure, and a larger pitched section which is the main part of the firehouse. The eastern flat section is the roof for a part of the building owned by the police department so it will not be part of this recommendation. The other flat section is blocked from southern exposure by the pitched roof. As a result, only the pitched roof will be considered for purposes of this recommendation.

From a visual inspection, the roof appeared to be in fair condition. The pitched roof has two additional sections. The main section of it has a south face and a north face. The smaller section is attached to the western side of the main section and has an east and west face.

Metro Energy recommends the installation of solar panels. Metro Energy conducted both a facility walkthrough and a satellite image analysis and based on the estimated total available area we recommend the installation of a system rated at approximately 2.3 kW dc. During our analysis our engineers looked at the total unobstructed available area of each section of the roof with southern exposure.

Additional engineering and analysis is required to confirm the system type, sizing, costs and savings. It needs to be determined if it is more beneficial to implement solar panels on the existing roof or to wait until the roof is being renovated or replaced. Seeing as solar panels have the same lifespan as a standard roof, the most beneficial time for this opportunity would be when the roof is being redone.

The proposed Photovoltaic (PV) Power system is comprised of a PV array, inverter(s) and all of the necessary wiring and interconnection equipment. The array output will feed power into the DC to AC inverters, which will then be connected to the building's electrical panel.

Estimated Energy Savings:
The energy savings generated by the installation of approximately 2.3 kW of photovoltaic power is estimated to be 2,686 kWh. At an average price of $0.145/kWh, the total energy savings would be $389 per year.

Solar Renewable Energy Credit:
There is a solar renewable energy credit (SREC) of approximately $.45/kWh based on the New Jersey Clean Energy Program which would result in additional revenues of $1,209. Total annual savings and credits are estimated to be $1,598.

New Jersey State law now requires that the utility must interconnect and net meter your photovoltaic system provided your system passes the local electrical inspection (National Electric Code) and meets the utility safety requirements as outlined in the law. A signed copy of the interconnection and net metering agreement is entered into by the Owner and the utility and is binding and transferable, provided the safety requirements are maintained. Net metering is the term given which allows your utility meter to literally "spin backwards" when you are producing more electricity than you are using. During the day, the occupants of the business may be off for a holiday or weekend while the photovoltaic system is making more than what the facility is presently using. The excess electricity then spins the meter backward and the utility gives you credit at the retail rate for the power they buy back from you. This credit shows up on your monthly electric bill as your meter actually registers the backfeed amount. The meter spins forward (you purchase) at night, during rainy weather, or when your electric demand exceeds the amount of power you are generating on the roof at that given moment. This amount is annualized at the end of the year, especially during some months when it is possible to have a negative electric bill.

Estimated Installation Cost:
The total cost for the standard solar panels placed on the roof is $23,063.

8. Firehouse #2

1997 Lincoln Avenue, [name of municipality], NJ

<u>*Background Information:*</u>

Structure Description:
(8,407 square feet)
This is a recently renovated fire station facility. It includes truck bays, a lounge and offices. The building is used 24 hours a day, 7 days per week.

Overall, the buildings appear to be structurally and aesthetically in good condition.

Lighting Description:

<u>Lighting System</u>
The lighting system includes a combination of 2x4 (4) lamp, 4-foot (1 and 4) lamp, 8-foot (3 and 4)lamp and incandescent lamps. Most of the fluorescent and incandescent fixtures are energy efficient but can still be made to be more efficient.

Heating, Ventilation, and Air Conditioning (HVAC) and other mechanical systems:

<u>Heating and Cooling System</u>

(1) Carrier Comfort 92 gas furnace has a capacity of 60,000-120,000 BTU/H, which supplies (2) Modine "Hot Dawgs" unit heaters in the truck bay. The furnace is new, and was installed in November 2005.

A Carrier Weathermaster gas heating/electric cooling rooftop unit with an 8 ½ nominal ton capacity, a maximum input of 125,000 BTU/H, and an output of 102,500 BTU/H, supplies the recent renovation additions.

The main vestibule area is supplied by the Carrier condenser with Puron R-410A Refrigerant.

<u>Controls</u>
There are (2) setback programmable thermostats that are used for heating and cooling. (1) Honeywell thermostat set at 72°F continuously and (1) White Rodgers thermostat are set at 69°F and set back to 68°F. The setback is minimal due to the fact the buildings is used 24 hours a day, 7 days per week.

Windows

The windows in this building are double paned glass, mounted on aluminum frames. As the building was recently renovated, the windows and frames are all in good condition and are not recommended for replacement.

Energy Use Analysis

Figure 12 illustrates the estimated monthly electricity usage from August 2006 to July 2007. The total consumption and cost for this period was 96,080 kWh and $12,602, respectively. The electric rate for this period was $0.131 per kWh. Typical natural gas usage is presented in Figure 13. The total gas consumption and cost for this period were 3,177 therms and $4,324, respectively, at a rate of $1.36/therm.

The average annual energy requirement of the building was 11.43 kWh/square foot and 0.378 therms/square foot.

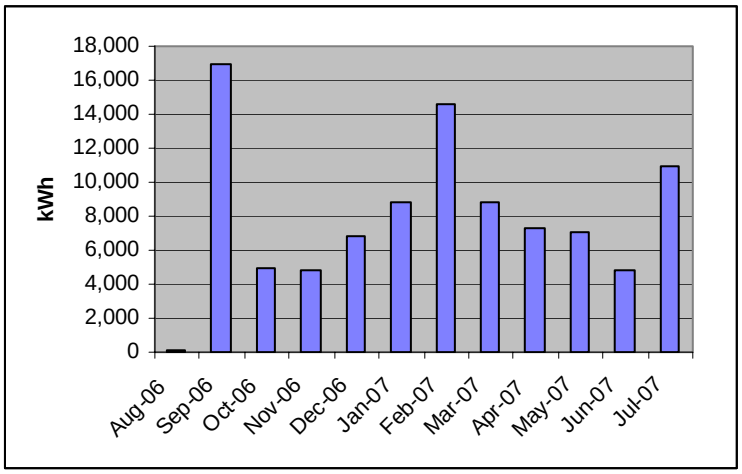

Figure 12: Annual Electricity Usage

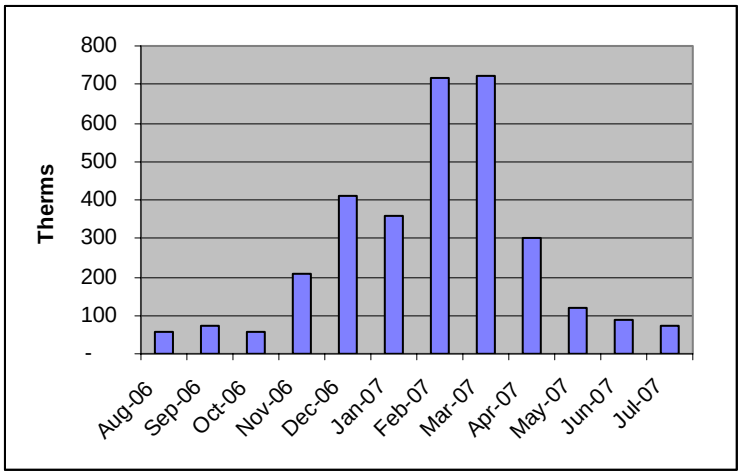

Figure 13: Annual Gas Usage

Table 21: Equipment Life Expectancy Data

Equipment Item	Median Life (Yrs)	# of Units	Condition
Furnace, gas	30	1	New installed in 2005
Rooftop Cooling Unit	20-25	1	Good condition
Package Cooling & Heating Unit	20-25	1	Good condition
Thermostat(s)	20	N/A	New and up to date

ENERGY CONSERVATION MEASURES (ECM)

Due to the recent renovations of Fire House #2, all heating, ventilation & air conditioning equipment is either new or in great condition. The thermostatic controls have setback capabilities and are programmable to conserve energy, however since this is a 7 days a week, 24 hour establishment, the setback setting would be less sensible than buildings with 8 hour occupancy.

ECM 1 – Lighting Replacement and Occupancy Sensors Installation

Metro Energy recommends upgrading the existing T-12 and incandescent lighting as identified in Attachment A to high efficiency standards to create lighting uniformity throughout the buildings. In general the energy efficient lighting upgrade project would involve installing energy-efficient lighting retrofit parts and materials and new energy-efficient luminaires to the existing lighting systems. The strategies included in this section focused on maximizing energy savings while maintaining the existing look of each lamp, therefore, proposed lamp styles will remain consistent with existing lamp styles. In addition, Metro Energy also recommends installing occupancy sensors in specified areas of the facility. (Please refer to Attachment A: Lighting Retrofit Spreadsheets for a line-by-line proposal spreadsheet for detailed strategies and sensor locations).

Estimated Energy Savings:
The annual energy savings are estimated to be 9kW, 70,499kWh and $9,235. In addition the project will generate maintenance savings from avoided costs related to changing fixtures. Please refer to Attachment A for the Lighting Spreadsheets and energy savings calculations.

Assumptions:
The Lighting Annual Savings assume the annual hours per year of operation as outlined under the column entitled “Hours Code” in Attachment A and the O&M savings for the first (3) years are calculated by assuming that we will avoid total existing lamp & ballast maintenance costs by installing newer technologies with warranties. Years (4) & (5) are calculated using just the avoided existing ballasts costs only because the warranties on the ballasts are 5-years and the 3-year warranty on the lamps has now expired. Years (6) through (10) are the calculated by using difference between the cost to maintain the existing system and the cost to maintain the proposed system.

Estimated NJ SmartStart® Rebate:
The estimated rebate is $1,070.

Estimated Installation Cost:
The estimated cost to install high efficiency lighting throughout the facility is $17,139.

ECM 2 – Water Conservation Recommendations

Waterless Urinals, low flow toilets and Aerators
There are (3) toilets, (3) urinals, (4) faucets, and (2) showers located in the facility. Metro Energy recommends replacing the toilets with dual flush low flow toilets, replacing the urinals with

waterless urinals, placing low flow aerators (0.5 gpm) on the faucets, and replacing the showerheads with low flow shower head aerators (2.0 gpm).

Estimated Utility Cost Savings:
These calculations are based on the assumption that this building has approximately 15 male firemen who use the urinals two times a day and a toilet once a day. For each urinal or toilet flush, it is assumed that a sink is used for fifteen seconds. Finally, it is assumed that a third of the men take a ten minute shower throughout the day.

30 flushes per day x 1.0 gallons saved per urinal = 30 gallons saved per day multiplied by 365 = 10,950 gallons per year.

15 flushes per day x 0.6 gallons saved per toilet = 9 gallons saved per day multiplied by 365 days = 3,285 gallons per year.

11.25 minutes of sink use per day x 1.7 gpm saved = 19.13 gallons saved per day multiplied by 365 days = 6,981 gallons per year

50 minutes of shower use per day x 1.0 gpm saved = 50 gallons saved per day multiplied by 365 days = 18,250 gallons per year.

The type of domestic hot water heater in this building is unavailable. However, for the purposes of energy savings associated with water usage, we will assume that the water is heated with gas. Assuming that 40% of the 25,231 gallons saved by faucets and showers is heated to 120F, energy savings can be calculated as 67 therms.

Metro Energy assumed a cost of $4 per thousand gallons of water (including sewer costs). The total annual utility cost savings is estimated to be $249. In addition the proposed technology will reduce maintenance costs by $100 per urinal for the first year in use for a total annual maintenance savings of $300.

Estimated Installation Cost:
The total cost for low flow aerators, low flow shower heads, waterless urinals, and dual flush low flow toilets is estimated to be $4,422. In addition, there is a $20 per year maintenance fee for each waterless urinal to change the chemicals inside of them.

ECM 3 – PV Solar System

The roof on this building is flat and was renovated in early 2007 per [name of municipality] personnel. There are two portions of the roof that solar panels would be a viable opportunity: the northwestern corner and the southeastern corner. The other areas are occupied by rooftop units and other obstructions such as a tower on the southwestern side. Overall, the roof appears to be in good condition.

Metro Energy recommends the installation of solar panels. Metro conducted both a facility walkthrough and a satellite image analysis and based on the estimated total available area we

recommend the installation of a system rated at approximately 9.9 kW dc. During our analysis our engineers looked at the total unobstructed available area of each section of the roof with southern exposure. Additional engineering and analysis is required to confirm the exact system type, sizing, location, costs and savings.

The proposed Photovoltaic (PV) Power system is comprised of a PV array, inverter(s) and all of the necessary wiring and interconnection equipment. The array output will feed power into the DC to AC inverters, which will then be connected to the building's electrical panel.

Estimated Energy Savings:
The energy savings generated by the installation of approximately 9.9 kW of photovoltaic power is estimated to be 10,943 kWh. At an average price of $0.131/kWh, the total energy savings would be $1,434 per year.

Solar Renewable Energy Credit:
In addition, there is a solar renewable energy credit (SREC) of approximately $.45/kWh based on the New Jersey Clean Energy Program which would result in additional revenues of $4,924. Total annual savings and credits are estimated to be $6,358.

New Jersey State law now requires that the utility must interconnect and net meter your photovoltaic system provided your system passes the local electrical inspection (National Electric Code) and meets the utility safety requirements as outlined in the law. A signed copy of the interconnection and net metering agreement is entered into by the Owner and the utility and is binding and transferable, provided the safety requirements are maintained. Net metering is the term given which allows your utility meter to literally "spin backwards" when you are producing more electricity than you are using. During the day, the occupants of the business may be off for a holiday or weekend while the photovoltaic system is making more than what the facility is presently using. The excess electricity then spins the meter backward and the utility gives you credit at the retail rate for the power they buy back from you. This credit shows up on your monthly electric bill as your meter actually registers the backfeed amount. The meter spins forward (you purchase) at night, during rainy weather, or when your electric demand exceeds the amount of power you are generating on the roof at that given moment. This amount is annualized at the end of the year, especially during some months when it is possible to have a negative electric bill.

Estimated Installation Cost:
The total cost for the standard solar panels placed on the roof is $100,639.

9. Firehouse #3

847 Amboy Ave, [name of municipality], NJ

Background Information:

Structure Description:
(Totaling 5,045 square feet)
This is a fire station facility. It includes truck bays, lounges and offices. The building is used 24 hours a day, 7 days per week.

Overall, the buildings appear to be structurally and aesthetically in good condition.

Lighting Description:

Lighting System
The lighting system includes a combination of 2x4 (2 and 4) lamp, 4-foot (2 and 4) lamp, 8-foot (2 and 4) lamp, and incandescent lamps. Most of the fluorescent and incandescent fixtures are not energy efficient and should be replaced.

Heating, Ventilation, and Air Conditioning (HVAC) and other mechanical systems:

Heating and Cooling System

There are (2) boilers which feed (4) unit heaters in the truck bays and radiators throughout the building. The boilers are both Weil-McLain PFG Series 5 gas fired boilers with an input of 366,000 BTU/H and an output of 296,000 BTU/H. The first boiler was installed in 1993 and the other in 2001. Both boilers are not chemically treated to protect the heat exchangers from corrosion. The 1993 Weil-McLain boiler (picture to the right) feeds the basement through a Fedders Evap hot air blower. The other boiler feeds the first floor.

The building's cooling is provided by several window air conditioning units.

Controls

The (2) heating thermostats are inefficient bi-metallic mechanical Honeywell units with no setback or programmable functions. However, these thermostats are still operational.

Windows

The majority of the windows are single pane glass mounted on old wooden frames, many of which are chipped and have several cracks in them. Several of the windows contain window units. Some of the windows have storm windows which vary in condition; others have screens over them. There are several double paned windows, most of which are located on the second floor. These are not recommended to be replaced.

Energy Use Analysis

Figure 14 illustrates the monthly electricity usage from July 2006 to June 2007. The total annual cost and consumption for this period was $9,092 and 65,522 kWh respectively. The average electric cost for this 12-month period was about $0.139 per kWh. Typical natural gas usage is presented in Figure 15. The September and October 2006 gas bills were unavailable and we assumed that the usage and billing was included in the November Billing. The total annual gas consumption is estimated to be about 7,161 therms per year at an average rate of $1.32/therm.

The average annual energy requirement of the building was 12.99 kWh/square foot and 1.42 therms/square foot.

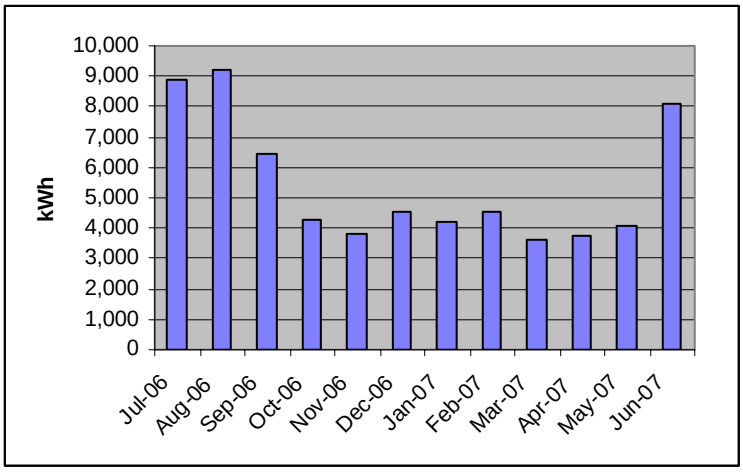

Figure 14: Annual Electricity Usage

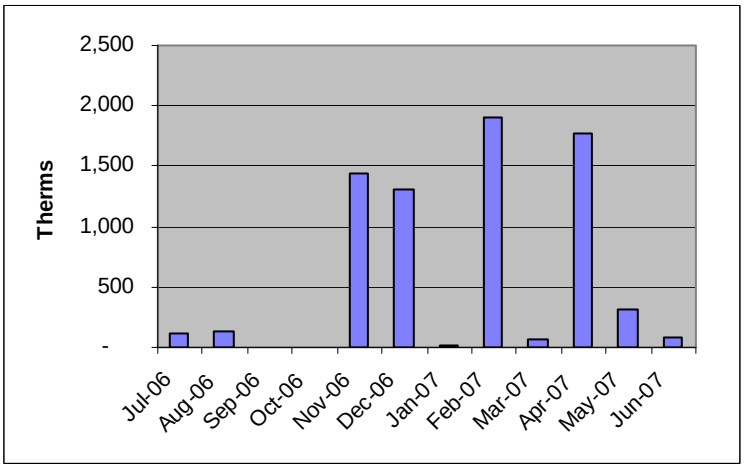

Figure 15: Annual Gas Usage

Table 22: Equipment Life Expectancy Data

Equipment Item	Median Life (Yrs)	# of Units	Condition
Boiler, gas	35	2	Fair condition
A/C Window Units	20	N/A	Fair condition
Hot Air Blower	20	1	Fair condition
Thermostat(s)	20	N/A	Outdated, should be upgraded to setback programmable thermostats

ENERGY CONSERVATION MEASURES (ECM)

ECM 1 – Lighting Replacement

Metro Energy recommends upgrading the existing T-12 and incandescent lighting as identified in Attachment A to high efficiency standards to create lighting uniformity throughout the buildings. In general the energy efficient lighting upgrade project would involve installing energy-efficient lighting retrofit parts and materials and new energy-efficient luminaires to the existing lighting systems. The strategies included in this section focused on maximizing energy savings while maintaining the existing look of each lamp, therefore, proposed lamp styles will remain consistent with existing lamp styles. (Please refer to Attachment A: Lighting Retrofit Spreadsheets for a line-by-line proposal spreadsheet for detailed strategies and sensor locations).

Estimated Energy Savings:
The annual energy savings are estimated to be 4kW, 38,093kWh and $5,295. In addition the project will generate maintenance savings from avoided costs related to changing fixtures. Please refer to Attachment A for the Lighting Spreadsheets and energy savings calculations.

Assumptions:
The Lighting Annual Savings assume the annual hours per year of operation as outlined under the column entitled "Hours Code" in Attachment A and the O&M savings for the first (3) years are calculated by assuming that we will avoid total existing lamp & ballast maintenance costs by installing newer technologies with warranties. Years (4) & (5) are calculated using just the avoided existing ballasts costs only because the warranties on the ballasts are 5-years and the 3-year warranty on the lamps has now expired. Years (6) through (10) are the calculated by using difference between the cost to maintain the existing system and the cost to maintain the proposed system.

Estimated NJ SmartStart® Rebate:
The estimated rebate is $780.

Estimated Installation Cost:
The estimated cost to install high efficiency lighting throughout the facility is $8,996.

ECM 2 – Programmable Setback Thermostats

Metro Energy recommends the installation of a 7-day programmable setback thermostat to replace the previous out of date mechanical thermostat. Programmable thermostats are easy to use, contribute to the overall system performance, maximize energy savings, and provide complete comfort control. The precise temperature control of a programmable, energy-saving thermostat would save wear and tear on the Fire Houses' heating equipment by properly cycling the equipment. A benefit of the setback function is once the desired seasonal temperature and time is set, there is automatic energy savings with little maintenance.

Estimated Energy Savings:
Heating degree-day zone: 3.02

Annual heating natural gas fuel consumption (excluding domestic hot water): 6,081 Therms/yr
Cost per therm of natural gas: $1.32
*Savings factor derived from heating degree-day zone: 0.10

(Savings factor) x (Annual heating fuel consumption) = Therms/yr
0.10 x 6,081 Therms/yr = 608 Therms/yr

(Annual energy savings) x (Cost per therm) = $/yr
608 Therms/y x $1.32 = $803/yr

*Savings factor for programmable thermostats heating energy savings are from a nightly setback of 8 degrees.

Estimated Installation Cost:
The total cost of installing (2) programmable thermostats is $896

ECM 3 –Hot Water Pipe Insulation

Metro Energy recommends insulating all of the hot water pipes in the boiler room. The hot water pipes in the boiler room were not insulated which leads to substantial heat loss. Pipe insulation reduces pipe heat loss through conduction, convection and radiation.

Estimated Energy Savings:
Cost per therm of natural gas: $1.32
Savings factor for hot water 2" diameter pipe: 2.58
(Linear feet of un-insulated 2" diameter pipe) x (Savings factor for 2" diameter pipe) = /yr
(25') x (2.58) = 64.5 therms/year

(Annual energy savings) x (Cost per therm) = $/yr
(64.5 therms/year) x ($1.32) = $85/yr

Estimated NJ SmartStart® Rebate:
NJ SmartStart® custom rebate will be determined by the utility company.

Estimated Installation Cost:
Linear feet of un-insulated 2" diameter pipe: 25'
The estimated total cost of installing insulation on 25' of pipe is $224.

Maintenance Note:
From the field survey, Metro Energy noticed the (2) National U.S. Radiator unit heaters and the surrounding pipes in the main truck bay area are heavily corroded and rusted. Although this may not be an energy efficient measure, these (2) radiator unit heaters are at the end of their life cycle and should be replaced.

ECM 4 –Outdoor Air Reset Control

Metro Energy recommends the installation of an outdoor reset/cutout boiler control to the (2) existing Weil McLain cast iron boilers in Fire House #3. Some central boiler systems, like that in Fire House #3 are totally uncontrolled, providing heat with no regard for how much is needed. The boiler starts up in the fall and remains on throughout the heating season until they shut off in the spring. The outdoor air reset control installed on the boiler can reduce energy waste by lowering hot water supply temperature to reduce distribution loss and eliminating overheating conditions. It can save 7-9% of heating fuel use, with a payback of 13-14 years.

Estimated Energy Savings:
Annual Heating Natural Gas Consumption: 6,081 therms
Cost per therm of natural gas: $1.32
0.08 x (Annual heating fuel consumption) = therms/yr
0.08 x (6,081 therms) = 486 therms/year

(Annual energy savings) x (Cost per therm) = $/yr
(486 therms/year) x ($1.32) = $642/yr

Estimated NJ SmartStart® Rebate:
NJ SmartStart® custom rebate will be determined by the utility company.

Estimated Installation Cost:
The total cost of installing (2) outdoor reset/cutout boiler controls is $4,480.

ECM 5 – Windows Replacement

Most of the windows in this building are single paned glass mounted on wooden frames. The frames are in very poor condition. Metro Energy recommends replacing the existing single pane windows with new energy efficient windows. The new windows will be double or triple pane, low e, argon filled windows on aluminum frames.

Estimated Energy Savings:
Energy savings that could be realized from a window replacement is a result of reduced heat conduction and air infiltration. Additional measurement and analysis needs to be conducted to identify exact quantities, pricing and savings.

Table 23: Estimated Window Replacement Area (sq ft):

Direction	Firehouse #3
N	0
S	73
E	81
W	44
Total	**198**

Table 24: Energy Savings Analysis:

	Energy savings – winter (MMBtu)	Energy savings – summer (kWh)
Reduced heat conduction	29.35	552.13
Reduced air infiltration	33.82	636.20
Total Energy savings/year	**63.17 MBtu (631.85 therms of gas)**	**1188.33**
Annual savings @$1.32/therm & $0.139/kWh	**$834**	**$165**

The total cost savings were estimated at $999.

Estimated Installation Cost:
The implementation cost to replace the existing windows with the proposed windows is $11,088

ECM 6 – Water Conservation Recommendations

Waterless Urinals, low flow toilets and Aerators
There are (4) toilets, (4) urinals, (5) faucets, and (2) shower located in the facility. Metro Energy recommends replacing the toilets with dual flush low flow toilets, replacing the urinals with waterless urinals, placing low flow aerators (0.5 gpm) on the faucets, and replacing the showerheads with low flow shower head aerators (2.0 gpm).

Estimated Utility Cost Savings:
These calculations are based on the assumption that this building has approximately 10 male firemen who use the urinals two times a day and a toilet once a day. For each urinal or toilet flush, it is assumed that a sink is used for fifteen seconds. Finally, it is assumed that three of the men take a ten minute shower throughout the day.

20 flushes per day x 1.0 gallons saved per urinal = 20 gallons saved per day multiplied by 365 = 7,300 gallons per year.

10 flushes per day x 0.6 gallons saved per toilet = 6 gallons saved per day multiplied by 365 days = 2,190 gallons per year.

7.5 minutes of faucet use per day x 1.7 gpm saved = 12.75 gallons saved per day multiplied by 365 days = 4,654 gallons per year

30 minutes of shower use per day x 1.5 gpm saved = 45 gallons saved per day multiplied by 365 days = 16,425 gallons per year.

The type of domestic hot water heater in this building is unavailable. However, for the purposes of energy savings associated with water usage, we will assume that the water is heated with gas.

Assuming that 40% of the 21,079 gallons saved by faucets and showers is heated to 120F, energy savings can be calculated as 56 therms.

Metro Energy assumed a cost of $4 per thousand gallons of water (including sewer costs). The total annual utility cost savings is estimated to be $195. In addition the proposed technology will reduce maintenance costs by $100 per urinal for the first year in use for a total annual maintenance savings of $400.

Estimated Installation Cost:
The total cost for low flow aerators, low flow shower heads, waterless urinals, and dual flush low flow toilets is estimated to be $5,594. In addition, there is a $20 per year maintenance fee for each waterless urinal to change the chemicals inside of them.

ECM 7 – PV Solar System

The roof of this building consists of two sections. There is a flat section on the eastern side of the building accessible from the window. It is shaded from western exposure by the taller, pitched section of the roof. The flat section appears to be in fair condition. The pitched section is made up of asphalt shingles, some of which appear to be in poor condition. The pitched roof faces several directions; northeast, southeast, southwest, and northwest. The age of the roof was not available; however, judging by the quality of the shingles, it is estimated that the roof is approaching the end of its useful life. If it is indeed at the end of its useful life, it is recommended that any solar opportunities are only implemented when the roof is being replaced.

Metro Energy recommends the installation of solar panels. Metro conducted both a facility walkthrough and a satellite image analysis and based on the estimated total available area we recommend the installation of a system rated at approximately 5.2 kW dc. During our analysis our engineers looked at the total unobstructed available area of each section of the roof with southern exposure.

Additional engineering and analysis is required to confirm the system type, sizing, costs and savings. Additionally, because the age of the roof is unknown, it needs to be determined if it is more beneficial to implement solar panels on the existing roof or to wait until the roof is being renovated or replaced. Seeing as solar panels have the same lifespan as a standard roof, the most beneficial time for this opportunity would be when the roof is or has been replaced.

The proposed Photovoltaic (PV) Power system is comprised of a PV array, inverter(s) and all of the necessary wiring and interconnection equipment. The array output will feed power into the DC to AC inverters, which will then be connected to the building's electrical panel.

Estimated Energy Savings:
The energy savings generated by the installation of approximately 5.2 kW of photovoltaic power is estimated to be 5,184 kWh. At an average price of $0.139/kWh, the total energy savings would be $721 per year.

Solar Renewable Energy Credit:
There is a solar renewable energy credit (SREC) of approximately $.45/kWh based on the New Jersey Clean Energy Program which would result in additional revenues of $2,333. Total annual savings and credits are estimated to be $3,053.

New Jersey State law now requires that the utility must interconnect and net meter your photovoltaic system provided your system passes the local electrical inspection (National Electric Code) and meets the utility safety requirements as outlined in the law. A signed copy of the interconnection and net metering agreement is entered into by the Owner and the utility and is binding and transferable, provided the safety requirements are maintained. Net metering is the term given which allows your utility meter to literally "spin backwards" when you are producing more electricity than you are using. During the day, the occupants of the business may be off for a holiday or weekend while the photovoltaic system is making more than what the facility is presently using. The excess electricity then spins the meter backward and the utility gives you credit at the retail rate for the power they buy back from you. This credit shows up on your monthly electric bill as your meter actually registers the backfeed amount. The meter spins forward (you purchase) at night, during rainy weather, or when your electric demand exceeds the amount of power you are generating on the roof at that given moment. This amount is annualized at the end of the year, especially during some months when it is possible to have a negative electric bill.

Estimated Installation Cost:
The total cost for the standard solar panels placed on the roof is $52,416.

10. Firehouse #4

850 Dover Road, [name of municipality], NJ

Background Information:

Structure Description:
(3,535 square feet)
This is a fire station facility. It includes truck bays, lounges and offices. The building is used 24 hours a day, 7 days per week. It was constructed in 1967.

Overall, the buildings appear to be in fair condition. It is of the older headquarters in [name of municipality].

Lighting Description:

Lighting System
The lighting system includes a combination of 2x4 (4) lamp, 4-foot (2) lamp, 8-foot (2) lamp, 300-watt Flood, 400-watt Metal Halide and incandescent lamps. Most of the fluorescent and incandescent fixtures are not energy efficient and should be replaced.

Heating, Ventilation, and Air Conditioning (HVAC) and other mechanical systems:

Heating and Cooling System

There are (2) Continental MFG cast iron gas fired boilers, rated at 272,000 BTU/H input and 217,600 BTU/H output that feed the perimeter baseboards and (4) Modine radiator heaters. The boilers were installed in 1965 and are outmoded and energy inefficient. [name of municipality] has recently replaced its aquastats.

Cooling is provided by window air conditioning units.

Controls
There are (3) dial mechanical Honeywell standard thermostats used to control heating by zone circulators. The thermostats are set at 72°F.

Windows
The windows are single paned glass mounted on aluminum frames and are generally in average to poor condition. Some of the windows have cracks in them allowing a large amount of air to infiltrate the building. Many of the windows have storm windows or screens which also range in condition.

Energy Use Analysis

Figure 16 illustrates the estimated monthly electricity usage from July 2006 to June 2007. The May 2007 bill was unavailable so an estimate was made based on the available data. The total annual consumption for this period was estimated to be 54,614 kWh at a cost of $7,350. The average electric cost for this 12-month period was about $0.137 per kWh. Typical natural gas usage is presented in Figure 17. All consumption from June 2006 to September 2006 was combined into one billing statement so, for the purpose of this analysis, the consumption was split up. The October 2006 bill was unavailable so an estimate was made. In addition, the cost of gas for most of the months is reasonable (approximately $1.30/therm) but for November 2006, the cost spikes to $110.00/therm. This building might have just been billed a lump sum for several months on one month's statement. This spike skews the average rate so the gas cost is assumed to be the same as Firehouse 2 ($1.36/therm). The annual gas consumption was about 5,788 therms.

The average annual energy requirement of the building was 15.45 kWh/square foot and 1.64 therms/square foot.

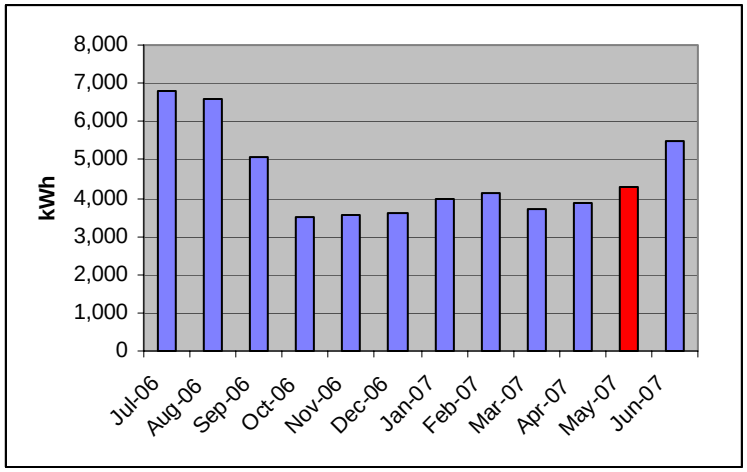

Figure 16: Annual Electricity Usage

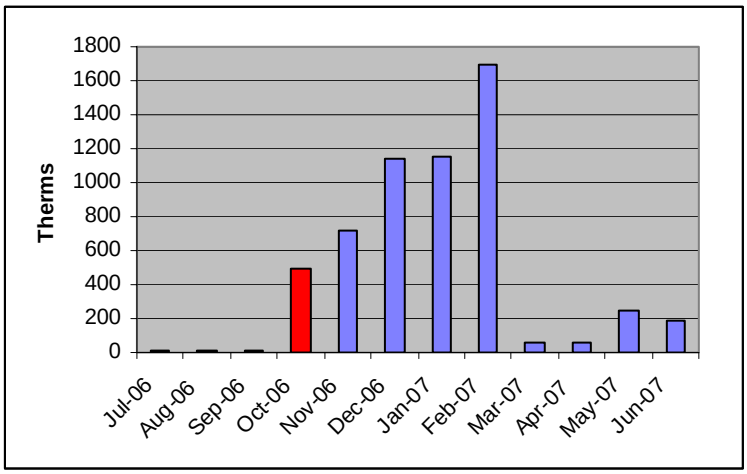

Figure 17: Annual Gas Usage

Table 25: Equipment Life Expectancy Data

Equipment Item	Median Life (Yrs)	# of Units	Condition
Boiler, hot water	35	1	At the end of its lifespan.
Window A/C units	20	N/A	Fair condition
Thermostat(s)	20	N/A	Outdated, should be upgraded to setback programmable thermostats

ENERGY CONSERVATION MEASURES (ECM)

ECM 1 – Lighting Replacement

Metro Energy recommends upgrading the existing T-12 and incandescent lighting as identified in Attachment A to high efficiency standards to create lighting uniformity throughout the buildings. In general the energy efficient lighting upgrade project would involve installing energy-efficient lighting retrofit parts and materials and new energy-efficient luminaires to the existing lighting systems. The strategies included in this section focused on maximizing energy savings while maintaining the existing look of each lamp, therefore, proposed lamp styles will remain consistent with existing lamp styles. (Please refer to Attachment A: Lighting Retrofit Spreadsheets for a line-by-line proposal spreadsheet for detailed strategies and sensor locations).

Estimated Energy Savings:
The annual energy savings are estimated to be 5kW, 44,510kWh and $6,098. In addition the project will generate maintenance savings from avoided costs related to changing fixtures. Please refer to Attachment A for the Lighting Spreadsheets and energy savings calculations.

Assumptions:
The Lighting Annual Savings assume the annual hours per year of operation as outlined under the column entitled "Hours Code" in Attachment A and the O&M savings for the first (3) years are calculated by assuming that we will avoid total existing lamp & ballast maintenance costs by installing newer technologies with warranties. Years (4) & (5) are calculated using just the avoided existing ballasts costs only because the warranties on the ballasts are 5-years and the 3-year warranty on the lamps has now expired. Years (6) through (10) are the calculated by using difference between the cost to maintain the existing system and the cost to maintain the proposed system.

Estimated NJ SmartStart® Rebate:
The estimated rebate is $590.

Estimated Installation Cost:
The estimated cost to install high efficiency lighting throughout the facility is $11,386.

ECM 2 – Programmable Thermostats

Metro Energy recommends the installation of 7-day programmable setback thermostats to replace the previous out of date mechanical thermostats. Programmable thermostats are easy to use, contribute to the overall system performance, maximize energy savings, and provide complete comfort control. The precise temperature control of a programmable, energy-saving thermostat would save wear and tear on the Fire Houses' heating equipment by properly cycling the equipment. A benefit of the setback function is once the desired seasonal temperature and time is set, there is automatic energy savings with little maintenance.

Estimated Energy Savings:
Heating degree-day zone: 3.02

Annual heating natural gas fuel consumption (excluding domestic hot water): 5,788 therms/yr
Cost per therm of natural gas: $1.36
*Savings factor derived from heating degree-day zone: 0.10
(Savings factor) x (Annual heating fuel consumption) = therms/yr
0.10 x 5,788 therms/yr = 578.8 Therms/yr

(Annual energy savings) x (Cost per therm) = $/yr
578.8 Therms/y x $1.36 = $787/yr

*Savings factor for programmable thermostats heating energy savings are from a nightly setback of 8 degrees.

Estimated NJ SmartStart® Rebate:
The NJ SmartStart®custom rebate will be determined by the utility company

Estimated Installation Cost:
The total cost of installing (3) programmable thermostats is $1,344

ECM 3- Boiler Replacement

The boilers' have recently been updated with hot water controls with a Honeywell operating aquastat and high limit aquastat with manual reset. However these boilers have surpassed their normal lifespan and are in need of replacement. It is important to understand that beyond just an energy savings stand point, replacing the boiler at the right time would prevent maintenance and reduce installation cost.

Estimated Energy Savings:
Annual gas fuel consumption: 5,788 therms/yr
Combustion efficiency of existing boiler: 70%
Cost per therm of natural gas: $1.36

Estimated Energy Savings:
Energy savings = Current Gas Consumption x (1-70%/93%) = 5,788 x (1-.7/.93) = 1,431 therms
Cost savings = 1,431 therms x $1.36/therm = $1,946

Estimated NJ SmartStart® Rebate:
Estimated rebate is $1,000.

Estimated Installation Cost:
Cost of replacing (2) boilers is $36,960.

ECM 4–Hot Water Pipe Insulation

Metro Energy recommends insulating all of the hot water pipes in the boiler room. The hot water pipes in the boiler room were not insulated which leads to substantial heat loss. Pipe insulation reduces pipe heat loss through conduction, convection and radiation.

Estimated Energy Savings:
Cost per therm of natural gas: $1.36
Savings factor for hot water 1-1/2" diameter pipe: 2.10
(Linear feet of un-insulated 1-1/2" diameter pipe) x (Savings factor for 1-1/2" diameter pipe) = therms/yr
(35') x (2.10) = 73.5 therms/year

(Annual energy savings) x (Cost per therm) = $/yr
(73.5 therms/year) x ($1.36) = $100/yr

Estimated NJ SmartStart® Rebate:
NJ SmartStart® custom rebate will be determined by the utility company.

Estimated Installation Cost:
Linear feet of un-insulated 1-1/2" diameter pipe: 35'
The estimated total cost of installing insulation on 35' of pipe is $294.

ECM 5 –Outdoor Air Reset Control

If the ECM of replacing the boiler is not chosen, Metro Energy advises an outdoor reset/cutout boiler control be added to either the new boiler suggested in ECM 2 or the (2) existing Continental MFG cast iron gas fired boilers in Fire House #4. (Since they are modular boilers only (1) outdoor air reset control is needed) Some central boiler systems, like that in Fire House #4 are totally uncontrolled, providing heat with no regard for how much is needed. The boiler starts up in the fall and remains on throughout the heating season until they shut off in the spring. The outdoor air reset control installed on the boiler can reduce energy waste by lowering hot water supply temperature to reduce distribution loss and eliminating overheating conditions. It can save 7-9% of heating fuel use, with a payback of 5-6 years.

Estimated Energy Savings:
Annual heating natural gas consumption: 5,788 Therms
Cost per therm of natural gas: $1.36
0.08 x (Annual heating fuel consumption) = therms/yr
0.08 x (5,788 therms) = 463 therms/year

(Annual energy savings) x (Cost per therm) = $/yr
(463 therms/year) x ($1.36) = $630/yr

Estimated NJ SmartStart® Rebate:
NJ SmartStart® custom rebate will be determined by the utility company.

Estimated Installation Cost:
The total cost of installing (2) outdoor reset/cutout boiler controls: $8,400.

ECM 6 – Windows Replacement

The windows in this building are single paned glass mounted on aluminum frames. Most of the windows are in poor condition. Some of the windows have cracks on the glass while many of the frames are very old and poorly sealed. Metro Energy recommends replacing the existing double pane windows with new energy efficient windows. The new windows will be double or triple pane, low e, argon filled windows on aluminum frames.

Estimated Energy Savings:
Energy savings that could be realized from a window replacement is a result of reduced heat conduction and air infiltration. Additional measurement and analysis needs to be conducted to identify exact quantities, pricing and savings.

Table 26: Estimated Replacement Window Area (ft^2)

Direction	Firehouse 4
N	27
S	78
E	60
W	54
Total	**219**

Table 27: Energy Savings Analysis:

	Energy savings – winter (MMBtu)	Energy savings – summer (kWh)
Reduced heat conduction	32.56	612.43
Reduced air infiltration	35.50	667.90
Total Energy savings/year	**68.06 MMBtu (680.76 therms of gas)**	**1280.33**
Annual savings @$1.36/therm & $0.137/kWh	**$926**	**$175**

The total cost savings were estimated at $1,101.

Estimated Installation Cost:
The implementation cost to replace existing windows with the proposed windows is $12,264.

ECM 7 – Water Conservation Recommendations

Waterless Urinals, low flow toilets and Aerators
There are (4) toilets, (1) urinal, (5) faucets, and (1) shower which is not used located in the facility. Metro Energy recommends replacing the toilets with dual flush low flow toilets, replacing the urinals with waterless urinals, and placing low flow aerators (0.5 gpm) on the faucets.

Estimated Utility Cost Savings:
These calculations are based on the assumption that this building has approximately 8 male firemen who use the urinals twice a day and a toilet once a day. For each urinal or toilet flush, it is assumed that a sink is used for fifteen seconds.

16 flushes per day x 1.0 gallons saved per urinal = 16 gallons saved per day multiplied by 365 = 5,840 gallons per year.

8 flushes per day x 0.6 gallons saved per toilet = 4.8 gallons saved per day multiplied by 365 days = 1,752 gallons per year.

6 minutes of faucet use per day x 1.7 gpm = 10.2 gallons saved per day multiplied by 365 days = 3,723 gallons per year.

The type of domestic hot water heater in this building is unavailable. However, for the purposes of energy savings associated with water usage, we will assume that the water is heated with gas. Assuming that 40% of the 3,723 gallons saved by faucets is heated to 120F, energy savings can be calculated as 10 therms.

Metro Energy assumed a cost of $4 per thousand gallons of water (including sewer costs). The total annual utility cost savings is estimated to be $59. In addition the proposed technology will reduce maintenance costs by $100 per urinal for the first year in use for a total annual maintenance savings of $100.

Estimated Installation Cost:
The total cost for low flow aerators, waterless urinals, and dual flush low flow toilets is estimated to be $3,500. In addition, there is a $20 per year maintenance fee for each waterless urinal to change the chemicals inside of them.

ECM 8 – PV Solar System

The roof on this structure consists of two sections: a flat section on the west side of the structure and a pitched section on the east side. The pitched section shades the flat section and faces east and west. In addition, there are trees at various locations around the building which add to the shading. The roof was renovated two years ago per [name of municipality] personnel. From a visual inspection, the roof appears to be in fair condition.

Metro Energy recommends the installation of solar panels. Because the roof was inaccessible during the audit, Metro's analysis consists only of a satellite image analysis. Based on the

estimated total available area we recommend the installation of a system rated at approximately 6.2 kW dc. During our analysis our engineers estimated the total unobstructed available area of each section of the roof with southern exposure.

Additional engineering and analysis is required to confirm the system type, sizing, costs and savings. Additionally, because the age of the roof is unknown, it needs to be determined if it is more beneficial to implement solar panels on the existing roof or to wait until the roof is being renovated or replaced. Seeing as solar panels have the same lifespan as a standard roof, the most beneficial time for this opportunity would be when the roof is being redone.

The proposed Photovoltaic (PV) Power system is comprised of a PV array, inverter(s) and all of the necessary wiring and interconnection equipment. The array output will feed power into the DC to AC inverters, which will then be connected to the building's electrical panel.

Estimated Energy Savings:
The energy savings generated by the installation of approximately 6.2 kW of photovoltaic power is estimated to be 5,484 kWh. At an average price of $0.137/kWh, the total energy savings would be $751 per year.

Solar Renewable Energy Credit:
There is a solar renewable energy credit (SREC) of approximately $.45/kWh based on the New Jersey Clean Energy Program which would result in additional revenues of $2,468. Total annual savings and credits are estimated to be $3,219.

New Jersey State law now requires that the utility must interconnect and net meter your photovoltaic system provided your system passes the local electrical inspection (National Electric Code) and meets the utility safety requirements as outlined in the law. A signed copy of the interconnection and net metering agreement is entered into by the Owner and the utility and is binding and transferable, provided the safety requirements are maintained. Net metering is the term given which allows your utility meter to literally "spin backwards" when you are producing more electricity than you are using. During the day, the occupants of the business may be off for a holiday or weekend while the photovoltaic system is making more than what the facility is presently using. The excess electricity then spins the meter backward and the utility gives you credit at the retail rate for the power they buy back from you. This credit shows up on your monthly electric bill as your meter actually registers the backfeed amount. The meter spins forward (you purchase) at night, during rainy weather, or when your electric demand exceeds the amount of power you are generating on the roof at that given moment. This amount is annualized at the end of the year, especially during some months when it is possible to have a negative electric bill.

Estimated Installation Cost:
The total cost for the standard solar panels placed on the roof is $62,899.

11. Firehouse #5

1 Beverly Road, [name of municipality], NJ

Background Information:

Structure Description:
(3,625 square feet)
This is a fire station facility. It includes truck bays, lounges and offices. The building is used 24 hours a day, 7 days per week.

Overall, the buildings appear to be in good condition.

Lighting Description:

Lighting System
The lighting system includes a combination of 2x4 (4) lamp, 2-foot (2) lamp, 4-foot (4) lamp and incandescent lamps. Most of the fluorescent and incandescent fixtures are not energy efficient and should be replaced.

Heating, Ventilation, and Air Conditioning (HVAC) and other mechanical systems:

Heating and Cooling System

(1) Slant Fin Galaxy cast iron gas boiler rated at 300 MBH input and 240 MBH output supplies hot water to unit heaters in the truck bay and to the blower where forced hot air circulates through the ceiling diffusers. The hot water pipes are lacking proper insulation and greatly reduce the energy efficiency of the system. A combined length of 40 feet of both 2-1/2" & 1-1/4" hot water pipe needs to be covered.

Cooling is provided by air conditioning window units.

Controls
Two (2) Honeywell mechanical dial thermostats are located throughout the building. The thermostat in the truck bay is set at 65°F and around the lobby area and kitchen the thermostats are set at 72°F.

Windows
The windows in this building are mostly single paned glass mounted on aluminum frames. The quality ranges from average to poor and many of the screens on the windows have large holes.

Energy Use Analysis

Figure 18 illustrates the monthly electricity usage from October 2006 to September 2007. There are two accounts for this building with one of them accounting for approximately 95 % of the consumption. The February 2007 bill for the large account is unavailable so that month's consumption is estimated using available data. The October 2006, May 2007, and September 2007 bills for the smaller account are also unavailable, and estimated. However, these three months of consumption do not affect the analysis significantly because they account for a very small portion of the total consumption. The total annual consumption for this period was about 59,537 kWh. The average electric cost for this 12-month period was about $0.147 per kWh. Typical natural gas usage from September 2006 to August 2007 is presented in Figure 19. The February 2007 bill is unavailable for this account so an estimate was made again. The gas is delivered using PSE&G pipes but is supplied by a third party. As a result, the exact cost is not known for most of the months; thus it is assumed that the gas price is the same as for Firehouse 2 ($1.36/therm). Using these numbers, an estimate is made for the price of the gas. The total annual gas consumption is about 3,978 therms.

The average annual energy requirement of the building was 16.42 kWh/square foot and 1.10 therms/square foot.

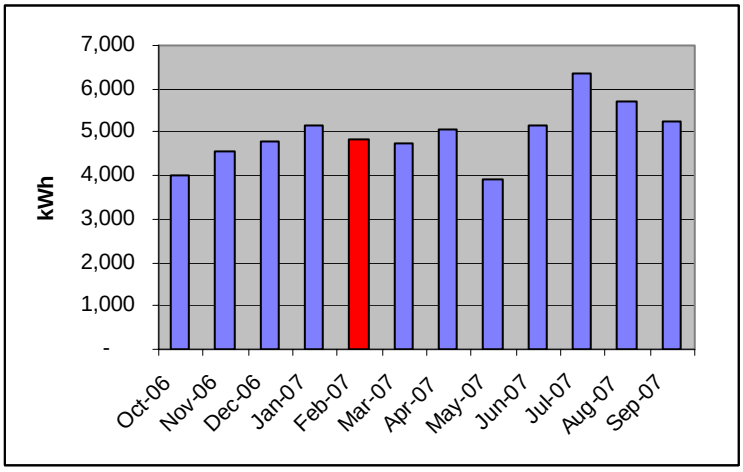

Figure 18: Annual Electricity Usage

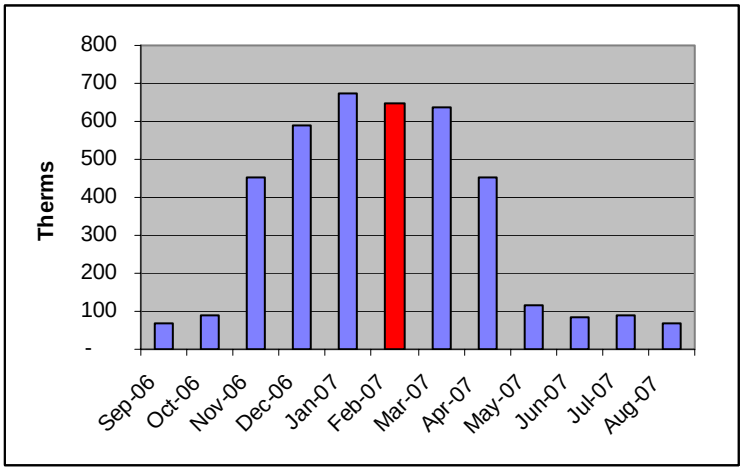

Figure 19: Annual Gas Usage

Table 28: Equipment Life Expectancy Data

Equipment Item	Median Life (Yrs)	# of Units	Condition
Boiler, gas	35	1	37 years old and breaks down often.
Blower, forced hot air	25	1	Fair condition.
A/C window units	25	NA	Fair condition.
Thermostat(s)	20	N/A	Should consider upgrade to programmable setback functions

ENERGY CONSERVATION MEASURES (ECM)

ECM 1 – Lighting Replacement

Metro Energy recommends upgrading the existing T-12 and incandescent lighting as identified in Attachment A to high efficiency standards to create lighting uniformity throughout the buildings. In general the energy efficient lighting upgrade project would involve installing energy-efficient lighting retrofit parts and materials and new energy-efficient luminaires to the existing lighting systems. The strategies included in this section focused on maximizing energy savings while maintaining the existing look of each lamp, therefore, proposed lamp styles will remain consistent with existing lamp styles. (Please refer to Attachment A: Lighting Retrofit Spreadsheets for a line-by-line proposal spreadsheet for detailed strategies and sensor locations).

Estimated Energy Savings:
The annual energy savings are estimated to be 6kW, 54,268kWh and $7,977. In addition the project will generate maintenance savings from avoided costs related to changing fixtures. Please refer to Attachment A for the Lighting Spreadsheets and energy savings calculations.

Assumptions:
The Lighting Annual Savings assume the annual hours per year of operation as outlined under the column entitled "Hours Code" in Attachment A and the O&M savings for the first (3) years are calculated by assuming that we will avoid total existing lamp & ballast maintenance costs by installing newer technologies with warranties. Years (4) & (5) are calculated using just the avoided existing ballasts costs only because the warranties on the ballasts are 5-years and the 3-year warranty on the lamps has now expired. Years (6) through (10) are the calculated by using difference between the cost to maintain the existing system and the cost to maintain the proposed system.

Estimated NJ SmartStart® Rebate:
The estimated rebate is $760.

Estimated Installation Cost:
The estimated cost to install high efficiency lighting throughout the facility is $12,917.

ECM 2 – Programmable Thermostats

Metro Energy recommends the installation of 7-day programmable setback thermostats to replace the previous out of date mechanical thermostats. Programmable thermostats are easy to use, contribute to the overall system performance, maximize energy savings, and provide complete comfort control. The precise temperature control of a programmable, energy-saving thermostat would save wear and tear on Fire Houses' heating equipment by properly cycling the equipment. A benefit of the setback function is once the desired seasonal temperature and time is set, there is automatic energy savings with little maintenance.

Estimated Energy Savings:
Heating Degree-day zone: 3.02

Annual heating natural gas fuel consumption (excluding domestic hot water): 3,186 Therms/yr
Cost per therm: $1.36
*Savings factor derived from heating degree-day zone: 0.10
(Savings factor) x (Annual heating fuel consumption) = therms/yr
0.10 x 3,186 therms/yr = 319 therms/yr

(Annual energy savings) x (Cost per therm) = $/yr
319 therms/y x $1.36 = $434/yr

*Savings factor for programmable thermostats heating energy savings are from a nightly setback of 8 degrees.

Estimated NJ SmartStart® Rebate:
NJ SmartStart® custom rebate will be determined by the utility company.

Estimated Installation Cost:
The total cost of installing (2) programmable thermostats is $896.

ECM 3 - Boiler Replacement

The 37 year old boiler is constantly being fixed; this boiler has surpassed its normal lifespan and will stop working within the next few years. With this in mind, beyond just an energy saving stand point, replacing the boiler would prevent the boiler from certain failure in the near future.

Estimated Energy Savings:
Annual gas fuel consumption (excluding domestic hot water): 3,186 therms/yr
Combustion efficiency of existing boiler: 75 %
Cost per therm of natural gas: $1.36/therm

Energy savings = Current Gas Consumption x (1-70%/93%) = 3,186 x (1-.7/.93) = 788 therms
Cost savings = 788 therms x $1.36/therm = $1,338

Estimated NJ SmartStart® Rebate:
The estimated rebate is $525.

Estimated Installation Cost:
Cost of replacing boiler and ancillary equipment is $22,400.

ECM 4 –Hot Water Pipe Insulation

Metro Energy recommends insulating all of the hot water pipes in the boiler room. The hot water pipes in the boiler room were not insulated which leads to substantial heat loss. Pipe insulation reduces pipe heat loss through conduction, convection and radiation.

Estimated Energy Savings:
Cost per therm of natural gas: $1.36
Savings factor for hot water 2-1/2" diameter pipe: 3.17
Savings factor for hot water 1-1/4" diameter pipe: 1.69
(Linear feet of un-insulated pipe) x (Savings factor for specific diameter of pipe) = /yr
(20') x (3.17) + (20') x (1.69) = 97.2 therms/year

(Annual energy savings) x (Cost per therm) = $/yr
(97.2 therms/year) x ($1.36) = $132/yr

Estimated NJ SmartStart® Rebate:
NJ SmartStart® custom rebate will be determined by the utility company.

Estimated Installation Cost:
Linear feet of un-insulated 2-1/2" diameter pipe: 20'
Linear feet of un-insulated 1-1/4" diameter pipe: 20'
The estimated total cost of installing insulation on 40' of pipe is $336.

ECM 5 –Outdoor Air Reset Control

Metro Energy recommends the installation of an outdoor reset/cutout boiler control to either the new boiler suggested in ECM 2 or the existing Slant Fin Galaxy cast iron boilers in Fire House #5. Some central boiler systems, like that in Fire House #5 are totally uncontrolled, providing heat with no regard for how much is needed. The boiler starts up in the fall and remains on throughout the heating season until they shut off in the spring. The outdoor air reset control installed on the boiler can reduce energy waste by lowering hot water supply temperature to reduce distribution loss and eliminating overheating conditions. It can save 7-9% of heating fuel use, with a payback of 8-9 years.

Estimated Energy Savings:
Annual heating natural gas consumption: 3,186 therms
Cost per therm of natural gas: $1.36
0.08 x (Annual heating fuel consumption) = therms/yr
0.08 x (3,186 therms) = 255 therms/year

(Annual energy savings) x (Cost per therm) = $/yr
(255 therms/year) x ($1.36) = $347/yr

Estimated NJ SmartStart® Rebate:
NJ SmartStart® custom rebate will be determined by the utility company.

Estimated Installation Cost:
The total cost of installing (1) outdoor reset/cutout boiler control is $2,240.

ECM 6 – Windows Replacement

The windows in this building are single paned glass mounted on aluminum frames. Some of the windows have screens on them, many of which have holes. The windows' and frames' condition range from average to poor. Metro Energy recommends replacing the existing windows with new energy efficient windows. The new windows will be double pane or triple pane, low e, argon filled windows on aluminum frames.

Estimated Energy Savings:
Energy savings that could be realized from a window replacement is a result of reduced heat conduction and air infiltration. Additional measurement and analysis needs to be conducted to identify exact quantities, pricing and savings.

Table 28: Estimated Replacement Window Area (ft^2)

Direction	Firehouse #5
N	54
S	36
E	41
W	35
Total	**166**

Table 29: Energy Savings Analysis:

	Energy savings – winter (MMBtu)	Energy savings – summer (kWh)
Reduced heat conduction	24.59	462.64
Reduced air infiltration	24.79	424.90
Total Energy savings/year	**49.38 MBtu (493.92 therms of gas)**	**887.54**
Annual savings @$1.36/therm & $0.147/kWh	**$672**	**$130**

The total cost savings were estimated at $802.

Estimated Installation Cost:
The implementation cost to replace existing windows with the proposed windows is $9,296.

ECM 7 – Water Conservation Recommendations

Waterless Urinals, low flow toilets and Aerators
There are (4) toilets, (2) urinals, (6) faucets, and (1) shower located in the facility. Metro Energy recommends replacing the toilets with dual flush low flow toilets, replacing the urinals with waterless urinals, retrofitting the faucets with low flow aerators (0.5 gpm), and replacing the showerheads with low flow shower head aerators (2.0 gpm).

Estimated Utility Cost Savings:
These calculations are based on the assumption that this building has approximately 8 male firemen who use the urinals two times a day and a toilet once a day. For each urinal or toilet flush, it is assumed that a sink is used for fifteen seconds. Finally, it is assumed that three of the men take a ten minute shower throughout the day.

16 flushes per day x 1.0 gallons saved per urinal = 16 gallons saved per day multiplied by 365 = 5,840 gallons per year.

8 flushes per day x 0.6 gallons saved per toilet = 4.8 gallons saved per day multiplied by 365 days = 1,752 gallons per year.

6 minutes of faucet use per day x 1.7 gpm saved = 10.2 gallons saved per day multiplied by 365 days = 3,723 gallons per year

30 minutes of shower use per day x 1.5 gpm = 45 gallons saved per day multiplied by 365 days = 16,425 gallons per year.

The type of domestic hot water heater in this building is unavailable. However, for the purposes of energy savings associated with water usage, we will assume that the water is heated with gas. Assuming that 40% of the 20,148 saved by faucets and showers is heated to 120F, energy savings can be calculated as 53 therms.

Metro Energy assumed a cost of $4 per thousand gallons of water (including sewer costs). The total annual utility cost savings is estimated to be $183. In addition the proposed technology will reduce maintenance costs by $100 per urinal for the first year in use for a total annual maintenance savings of $200.

Estimated Installation Cost:
The total cost for low flow aerators, low flow shower heads, waterless urinals, and dual flush low flow toilets is estimated to be $4,239. In addition, there is a $20 per year maintenance fee for each waterless urinal to change the chemicals inside of them.

ECM 8 – PV Solar System

The roof of this building consists of three flat sections constructed next to one another. The middle section is the tallest and creates some shade on the two shorter sections. There is no other

shading on the roof. The roof was replaced two years ago and is in good condition. However, it was inaccessible during the audit; thus a walkthrough was not conducted of the roof.

Metro Energy recommends the installation of solar panels. Metro conducted a satellite image analysis and based on the estimated total available area we recommend the installation of a system rated at approximately 6.7 kW dc. The solar panels will be on the southern section, the middle section, and part of the northern section. During our analysis our engineers looked at the total unobstructed available area of each section of the roof with southern exposure.

The proposed Photovoltaic (PV) Power system is comprised of a PV array, inverter(s) and all of the necessary wiring and interconnection equipment. The array output will feed power into the DC to AC inverters, which will then be connected to the building's electrical panel.

Estimated Energy Savings:
The energy savings generated by the installation of approximately 6.7 kW of photovoltaic power is estimated to be 6,869 kWh. At an average price of $0.147/kWh, the total energy savings would be $1,010 per year.

Solar Renewable Energy Credit:
In addition, there is a solar renewable energy credit (SREC) of approximately $.45/kWh based on the New Jersey Clean Energy Program which would result in additional revenues of $3,091. Total annual savings and credits are estimated to be $4,101.

New Jersey State law now requires that the utility must interconnect and net meter your photovoltaic system provided your system passes the local electrical inspection (National Electric Code) and meets the utility safety requirements as outlined in the law. A signed copy of the interconnection and net metering agreement is entered into by the Owner and the utility and is binding and transferable, provided the safety requirements are maintained. Net metering is the term given which allows your utility meter to literally "spin backwards" when you are producing more electricity than you are using. During the day, the occupants of the business may be off for a holiday or weekend while the photovoltaic system is making more than what the facility is presently using. The excess electricity then spins the meter backward and the utility gives you credit at the retail rate for the power they buy back from you. This credit shows up on your monthly electric bill as your meter actually registers the backfeed amount. The meter spins forward (you purchase) at night, during rainy weather, or when your electric demand exceeds the amount of power you are generating on the roof at that given moment. This amount is annualized at the end of the year, especially during some months when it is possible to have a negative electric bill.

Estimated Installation Cost:
The total cost for the standard solar panels placed on the roof is $67,092.

12. Firehouse #6

71 Lincoln Highway, [name of municipality], NJ

Background Information:

Structure Description:
(3,070 square feet)
This is a fire station facility. It includes truck bays, lounges and offices. The building is used 24 hours a day, 7 days per week. This is the smallest firehouse in [name of municipality] that was surveyed.

Overall, the buildings appear to be in good condition.

Lighting Description:

Lighting System
The lighting system includes a combination of 2x4 (3 and 4) lamp, 2-foot (2) lamp, 4-foot (2) lamp, 8-foot (2) lamp, 300-watt Flood, and incandescent lamps. Most of the fluorescent and incandescent fixtures are not energy efficient and should be replaced.

Heating, Ventilation, and Air Conditioning (HVAC) and other mechanical systems:

Heating and Cooling System

The heating is supplied by a Lennox Pulse 21 model G2 gas fired furnace. Hot air from the furnace is disbursed through ceiling vents. It is rated at 60,000 BTU/H and was installed in 1995. There is also a Modine gas-fired unit heater with an output of 747,000 BTU/H in the truck bay area.

The cooling is provided by DX coils in the furnace. The Lennox Dimension with refrigerant (R-22) which was built in 1992 and is rated at 26,100 BTU/H. The other cooling unit is also a Lennox rated at 51,100 BTU/H and was installed in 1994.

Controls

Three different heating and cooling thermostats are located throughout the building. The Honeywell mechanical bi-metallic thermostat in the truck bay is set at 60°F. The Honeywell dial mechanical thermostat is set at 70°F in the summertime and 80°F in the wintertime. The last thermostat is in the living quarter and lobby with a programmable setback Simple Comfort 3000 which is set at 71°F and is setback to 70°F. The setback is so low because the fire headquarters is occupied 24 hours a day 7 days a week.

Windows

The windows in this building are double paned glass mounted on wood frames. At this time, no replacement is recommended.

Energy Use Analysis

Figure 20 illustrates the estimated monthly electricity usage from August 2006 to June 2007. The consumption for this period is 53,399 kWh at a cost of $7,293. The average electric cost for this period was about $0.137 per kWh. Typical natural gas usage is presented in Figure 21. One month of billing information (June 2007) is unavailable, so using the available data, an estimate is made. The total gas consumption for this period is about 3,246 therms at a rate of approximately $1.52/therm.

The average annual energy requirement of the building was 17.39 kWh/square foot and 1.06 therms/square foot.

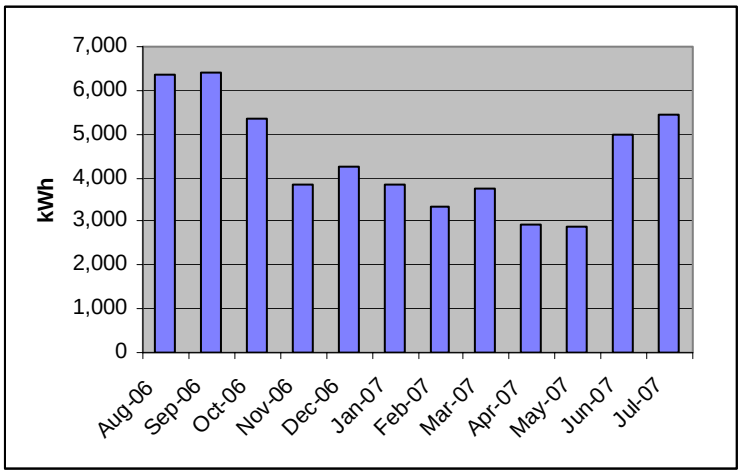

Figure 20: Annual Electricity Usage

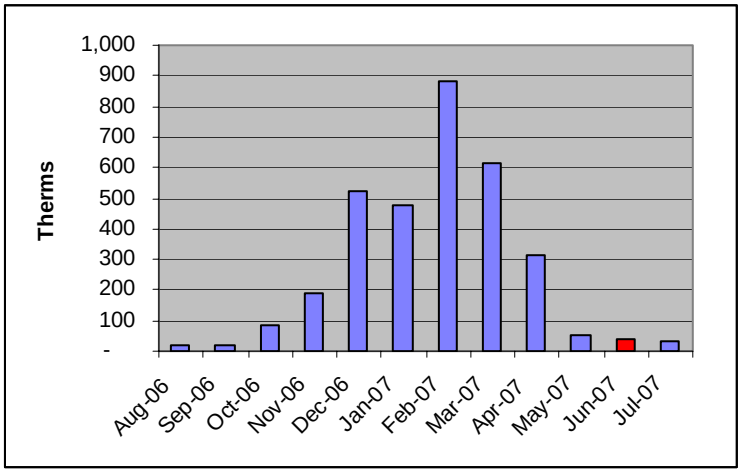

Figure 21: Annual Gas Usage

Table 30: Equipment Life Expectancy Data

Equipment Item	Median Life (Yrs)	# of Units	Condition
Furnace, gas	35	1	22 years old and fair condition.
Condenser cooling units	25	2	Fair condition.
Gas unit heater	25	N/A	Fair condition.
Thermostat(s)	20	3	The dial and bi-metallic thermostat should be upgraded to programmable setback functions

ENERGY CONSERVATION RETROFIT MEASURES (ECM)

ECM 1 – Lighting Replacement

Metro Energy recommends upgrading the existing T-12 and incandescent lighting as identified in Attachment A to high efficiency standards to create lighting uniformity throughout the buildings. In general the energy efficient lighting upgrade project would involve installing energy-efficient lighting retrofit parts and materials and new energy-efficient luminaires to the existing lighting systems. The strategies included in this section focused on maximizing energy savings while maintaining the existing look of each lamp, therefore, proposed lamp styles will remain consistent with existing lamp styles. (Please refer to Attachment A: Lighting Retrofit Spreadsheets for a line-by-line proposal spreadsheet for detailed strategies and sensor locations).

Estimated Energy Savings:
The annual energy savings are estimated to be 4kW, 36,091kWh and $4,944. In addition the project will generate maintenance savings from avoided costs related to changing fixtures. Please refer to Attachment A for the Lighting Spreadsheets and energy savings calculations.

Assumptions:
The Lighting Annual Savings assume the annual hours per year of operation as outlined under the column entitled "Hours Code" in Attachment A and the O&M savings for the first (3) years are calculated by assuming that we will avoid total existing lamp & ballast maintenance costs by installing newer technologies with warranties. Years (4) & (5) are calculated using just the avoided existing ballasts costs only because the warranties on the ballasts are 5-years and the 3-year warranty on the lamps has now expired. Years (6) through (10) are the calculated by using difference between the cost to maintain the existing system and the cost to maintain the proposed system.

Estimated NJ SmartStart® Rebate:
The estimated rebate is $530.

Estimated Installation Cost:
The estimated cost to install high efficiency lighting throughout the facility is $8,383.

ECM 2 – Programmable Thermostats

Metro Energy recommends the installation of 7-day programmable setback thermostats to replace the previous out of date mechanical thermostats. Programmable thermostats are easy to use, contribute to the overall system performance, maximize energy savings, and provide complete comfort control. The precise temperature control of a programmable, energy-saving thermostat would save wear and tear on the heating equipment by properly cycling the equipment. A benefit of the setback function is once the desired seasonal temperature and time is set, there is automatic energy savings with little maintenance.

Estimated Energy Savings:
Heating degree-day zone: 3.02

Annual heating natural gas fuel consumption (excluding domestic hot water): 3,000 therms/yr
Cost per therm of natural gas: $1.52
*Savings factor derived from heating degree-day zone: 0.10
(Savings factor) x (Annual heating fuel consumption) = therms/yr
0.10 x 3,000 therms/yr = 300 therms/yr

(Annual energy savings) x (Cost per therm) = $/yr
300 therms/y x $1.52 = $456/yr

*Savings factor for programmable thermostats heating energy savings are from a nightly setback of 8 degrees.

Estimated NJ SmartStart® Rebate:
NJ SmartStart® custom rebate will be determined by the utility company.

Estimated Installation Cost:
The total cost of installing (2) programmable thermostats is $896.

ECM 3 – Replace Condensing Units

Metro Energy recommends the replacement of the (2) outdoor Lennox cooling units in Fire House #6. Older cooling units do not operate as efficiently as they did when they were new. The significant advances in technological developments for air conditioning efficiency, makes many older air conditioning systems obsolete.

Estimated Energy Savings:

Lennox Model HS22
Power requirement of existing A/C unit: 2,126 Watts
Cooling capacity for existing A/C unit: 24,000 Btu/h
Cost per kWh: $0.137
Annual cooling hours (in thousands): 900 hours

Existing Energy Use per Unit
(Annual cooling hours) x (Cooling capacity of existing A/C units) / (EER) = kWh/yr
900 hours x 24,000 Btu/h / 9.0 (assumed EER) / 1,000 W/kW = 2,400 kWh/yr

New Energy Use per Unit
(Annual cooling hours) x (Cooling capacity of existing A/C units) / 13.0 = kWh/yr
900 hours x 24,000 Btu/h / 13.0 / 1,000 W/kW = 1,662 kWh/yr

Energy Savings
(Existing energy use per unit) - (New energy use per unit) = kWh/yr
(2,400 kWh/yr) - (1,662 kWh/yr) = 738 kWh/yr

(Annual energy savings) x (Cost per kWh) = (738 kWh/yr) x ($0.137) = $101/yr

Estimated NJ SmartStart® Rebate:
The estimated rebate is $184.

Lennox Model HS25

Power requirement of existing A/C unit: 4,280 Watts
Cooling capacity for existing A/C unit: 46,000 BTU/h
Cost per kWh: $0.137
Annual cooling hours (in thousands): 900 hours

Existing Energy Use per Unit
(Annual cooling hours) x (Cooling capacity of existing A/C units) / (EER) = kWh/yr
900 hours x 46,000 Btu/h / 8.0 (assumed) /1,000 W/kW= 5,175 kWh/yr

New Energy Use per Unit
(Annual cooling hours) x (Cooling capacity of existing A/C units) / 12.5 = kWh/yr
900 hours x 46,000 Btu/h / 12.5 / 1,000 W/kW = 3,312 kWh/yr

Energy Savings
(Existing energy use per unit) - (New energy use per unit) = kWh/yr
(5,175 kWh/yr) - (3,312 kWh/yr) = 1,863 kWh/yr

Cost Savings
(Annual energy savings) x (Cost per kWh) = (1863 kWh/yr) x ($0.137) = $255/yr

Estimated NJ SmartStart® Rebate:
The estimated rebate is $353.

Total Estimated Energy Savings:
The total annual energy savings is estimated to be 2,601 kWh and $356.

Total Estimated NJ SmartStart® Rebate:
The total rebate is estimated to be $537.

Total Estimated Installation Cost:
The total cost of replacing existing Lennox model HS22 with a more efficient unit is $5,600. The total cost of replacing existing Lennox model HS25 with a more efficient unit is $7,840.

ECM 4 – Water Conservation Recommendations

Waterless Urinals, low flow toilets and Aerators
There are (3) toilets, (2) urinals, (5) faucets, and (2) shower located in the facility. Metro Energy recommends replacing the toilets with dual flush low flow toilets, replacing the urinals with waterless urinals, placing low flow aerators (0.5 gpm) on the faucets, and replacing the showerheads with low flow shower head aerators (2.0 gpm).

Estimated Utility Cost Savings:
These calculations are based on the assumption that this building has approximately (8) male firemen who use the urinals two times a day and a toilet once a day. For each urinal or toilet flush, it is assumed that a sink is used for fifteen seconds. Finally, it is assumed that three of the men take a ten minute shower throughout the day.

16 flushes per day x 1.0 gallons saved per urinal = 16 gallons saved per day multiplied by 365 = 5,840 gallons per year.

8 flushes per day x 0.6 gallons saved per toilet = 4.8 gallons saved per day multiplied by 365 days = 1,752 gallons per year.

6 minutes of faucet use per day x 1.7 gpm saved = 10.2 gallons saved per day multiplied by 365 days = 3,723 gallons per year

30 minutes of shower use per day x 1.5 gpm = 45 gallons saved per day multiplied by 365 days = 16,425 gallons per year.

The type of domestic hot water heater in this building is unavailable. However, for the purposes of energy savings associated with water usage, we will assume that the water is heated with gas. Assuming that 40% of the 20,148 saved by faucets and showers is heated to 120F, energy savings can be calculated as 53 therms.

Metro Energy assumed a cost of $4 per thousand gallons of water (including sewer costs). The total annual utility cost savings is estimated to be $192. In addition the proposed technology will reduce maintenance costs by $100 per urinal for the first year in use for a total annual maintenance savings of $200.

Estimated Installation Cost:
The total cost for low flow aerators, low flow shower heads, waterless urinals, and dual flush low flow toilets is estimated to be $3,578. In addition, there is a $20 per year maintenance fee for each waterless urinal to change the chemicals inside of them.

ECM 5 – PV Solar System / Roof Replacement

The roof of this building is an entirely pitched roof with northeast, northwest, southeast, and southwest faces. The roof was replaced approximately ten years ago and appears to be in fair condition. There is no shading around the building.

Metro Energy recommends the installation of solar panels on the southwest and southeast faces of the roof. Metro conducted a satellite image analysis and based on the estimated total available area we recommend the installation of a system rated at approximately 6.2 kW dc. During our analysis our engineers looked at the total unobstructed available area of each section of the roof with southern exposure. Additional engineering and analysis is required to confirm the system type, sizing, costs and savings.

The proposed Photovoltaic (PV) Power system is comprised of a PV array, inverter(s) and all of the necessary wiring and interconnection equipment. The array output will feed power into the DC to AC inverters, which will then be connected to the building's electrical panel.

Estimated Energy Savings:
The energy savings generated by the installation of approximately 6.2 kW of photovoltaic power is estimated to be 6,912 kWh. At an average price of $0.137/kWh, the total energy savings would be $947 per year.

Solar Renewable Energy Credit:
There is a solar renewable energy credit (SREC) of approximately $.45/kWh based on the New Jersey Clean Energy Program which would result in additional revenues of $3,110. Total annual savings and credits are estimated to be $4,057.

New Jersey State law now requires that the utility must interconnect and net meter your photovoltaic system provided your system passes the local electrical inspection (National Electric Code) and meets the utility safety requirements as outlined in the law. A signed copy of the interconnection and net metering agreement is entered into by the Owner and the utility and is binding and transferable, provided the safety requirements are maintained. Net metering is the term given which allows your utility meter to literally "spin backwards" when you are producing more electricity than you are using. During the day, the occupants of the business may be off for a holiday or weekend while the photovoltaic system is making more than what the facility is presently using. The excess electricity then spins the meter backward and the utility gives you credit at the retail rate for the power they buy back from you. This credit shows up on your monthly electric bill as your meter actually registers the backfeed amount. The meter spins forward (you purchase) at night, during rainy weather, or when your electric demand exceeds the amount of power you are generating on the roof at that given moment. This amount is annualized at the end of the year, especially during some months when it is possible to have a negative electric bill.

Estimated Installation Cost:
The total cost for the standard solar panels placed on the roof is $62,899..

C. Environmental Benefits

As a result of the energy conservation and efficiency projects contained in this proposal, [name of municipality] will be continuing its efforts to both reduce its operating and maintenance costs through the installation of more energy efficient equipment, and also reduce the amount of pollution emitted into the atmosphere. Following is a summary of the environmental benefits of the project.

Global Warming - The progressive rise of the earth's surface temperatures, as well as changes in global climate patterns, are caused by anthropogenic (human-caused) emissions of gases – such as carbon dioxide, methane, sulfur dioxide and nitrogen oxides – which are contributing markedly to an increasing greenhouse effect. The planet's climate has changed significantly in the past as the result of natural influences, but the terms "global warming" or "climate change" are most often used to refer to the changes occurring now that are a result of the recent (one century) increase in emissions of greenhouse gases, primarily from the burning of fossil fuels.

Greenhouse Effect - The greenhouse effect is produced as atmospheric gases allow incoming solar radiation to pass through the earth's atmosphere, but prevent part of the outgoing infrared radiation from the earth's surface and lower atmosphere from escaping into outer space. This process occurs naturally and has kept the earth's temperature at a temperature range where human life can exist. Current life on earth could not be sustained without the natural greenhouse effect. Some greenhouse gases occur naturally in the atmosphere, while others result from human activities. Greenhouse gases that occur naturally include water vapor, carbon dioxide, methane, nitrous oxide, and ozone. Certain activities, however, add to the levels of most of these naturally occurring gases:

Carbon dioxide (CO_2) - A colorless, odorless, non-poisonous gas that is a normal part of the ambient air. Carbon dioxide is a product of fossil fuel combustion. Although carbon dioxide does not directly impair human health, it is a greenhouse gas that traps terrestrial infrared radiation (heat) and contributes to global warming.
CO2 reduced from measures identified in this report: **670.41 metric tons**

note:** Since every tree planted in tropical regions (where trees are the most effective at reducing global warming) removes about 50 pounds of carbon dioxide from the atmosphere each year, ***the CO_2 reductions resulting from this project are equivalent to planting 27,349 trees!

Nitrogen Oxides (NOx) - Gases consisting of one molecule of nitrogen and varying numbers of oxygen molecules. Nitrogen oxides are produced by the combustion of fossil fuels in vehicles and electric power plants. In the atmosphere, nitrogen oxides can contribute to formation of photochemical ozone (smog), impair visibility, and have health consequences. They are considered pollutants.
NOx reduced from measures identified in this report: **1.12 metric tons**

note: Since NO_x has a Global Warming Potential (a measure of how much a gas contributes to the greenhouse effect) of 296 times that of CO_2, ***the NO_x reductions resulting from this project are equivalent to planting 13,529 trees!***

Sulfur dioxide (SO_2) - A compound composed of one sulfur and two oxygen molecules. Sulfur dioxide emitted into the atmosphere through natural and anthropogenic processes is changed in a complex series of chemical reactions in the atmosphere to sulfate aerosols. These aerosols are believed to result in negative radiative forcing (i.e., tending to cool the earth's surface) and do result in acid deposition (e.g., acid rain). Acid rain has been shown to have *adverse impacts on forests, freshwaters and soils, killing off insect and aquatic lifeforms as well as causing damage to buildings and having possible impacts on human health.*
SO2 reduced from measures identified in this report: **1.23 metric tons**

These combined carbon equivalents equal ***over 40,878 trees planted*** *– or approximately* ***163 acres of tropical reforestation*** *– as well as significant acreage of* ***native forests protected*** *from the ravages of acid rain.*

Therefore, our project will result not just in improvements to the building's infrastructure, an increase in comfort and health for the residents, as well as reduced costs and energy use, but also in annual improvements to the environment from the significantly reduced levels of CO_2, NOx, and SO_2 being emitted into the atmosphere.

Benefits of Water Efficiency

The average household spends as much as $500 per year on its water and sewer bill. By making just a few simple changes to use water more efficiently, you could save about $132 per year. If all U.S. households installed water-efficient appliances, the country would save more than 3 trillion gallons of water and more than $17 billion dollars per year! Also, when water is used more efficiently, we reduce the need for costly water supply infrastructure investments and new wastewater treatment facilities.

It takes a considerable amount of energy to deliver and treat the water used everyday. American public water supply and treatment facilities consume about 50 billion kilowatt-hours (kWh) per year—enough electricity to power more than 4.5 million homes for an entire year. For example, letting a faucet run for five minutes uses about as much energy as letting a 60-watt light bulb run for 14 hours.

By reducing water use you can not only help reduce the energy required to supply and treat public water supplies but also can help address climate change. In fact:

- If 1 out of every 100 American homes retrofitted with water-efficient fixtures, we could save about 100 million kWh of electricity per year—avoiding 75,000 tons of greenhouse gas emissions. That is equivalent to removing nearly 15,000 automobiles from the road for one year!

- If 1 percent of American homes replaced an older toilet with a high-efficiency toilet (HET), the country would save more than 38 million kWh of electricity—enough to supply more than 43,000 households electricity for one month.

Depleting reservoirs and groundwater aquifers can put water supplies, human health, and the environment at serious risk. Lower water levels can lead to higher concentrations of natural contaminants, such as radon and arsenic, or human pollutants, such as agricultural and chemical wastes. Using water more efficiently helps maintain supplies at safe levels, protecting human health and the environment.

References:

The United Nations' Intergovernmental Panel on Climate Change (IPCC) Report,
Working Group I: The Scientific Basis: "Direct GWPs"; 2001

Trees for the Future: "Global Cooling Centers"; 2006.

Gray Russell, Certified Energy Professional, Green Living Solutions; 2007
Carbon dioxide (CO_2) - A colorless, odorless, non-poisonous gas that is a normal part of the.

United States Environmental Protection Agency Website

D. Energy Conservation Measure (ECM) Summary, Savings Summary and Financial Analysis

A. ECM Summary, Savings Summary and Financial Analysis

Metro Energy has prepared a summary of the ECM's identified throughout [name of municipality] included in this energy audit report. The ECM Summary and Analysis included on the following page includes the following information:

Column	Item
1	**Reference Column for Section of Proposal**
2	**Square Footage**
3	**Utility Cost (Electric and Gas) Does not include Water and Sewer**
4	**Utility Cost per sq foot (Electric and Gas) Before Upgrades**
5	**Utility Cost per sq foot (Electric and Gas) After Upgrades**
6	**ECM cumulative total Facility**
7	**Breakout of each Technology**
8	**Total Annual Kilowatt Hour Savings**
9	**Total Annual kW Demand Savings**
10	**Total Annual Natural Gas Savings (Therms)**
11	**Total Annual Water Savings (Gal)**
12	**Total Annual Electric Cost Savings ($)**
13	**Total Annual Natural Gas Cost Savings ($)**
14	**Total Annual Water Cost Savings ($)**
15	**Total Annual Cost Savings ($)**
16	**Total Annual O&M Savings ($) represents the savings that will be achieved from avoided maintenance costs the facility would have incurred if the equipment were not installed.**
17	**Estimated Utility Incentive/Rebate**
18	**Total Cost includes labor, material and engineering**
19	**Simple Payback Calculation in Years (Total Cost minus rebates divided by total Annual Savings)**
20	**Return on Investment Calculation (Total Savings divided by net cost)**
21	**NOX Reduced – Calculation for amounts of NOX reduced from each measure**
22	**CO2 Reduced - Calculation for amounts of CO2 reduced from each measure**
23	**SO2 Reduced - Calculation for amounts of SO2 reduced from each measure**

E. Project Implementation

A. Next Steps

Once [name of municipality] has approved of specific projects to be implemented, Metro Energy will need to confirm final budget cost estimates including a price for engineering design and bid specification development and implementation, prior to the coordination of financing. Metro Energy will then complete the engineering and design and prepare the bid specifications. Once the bid has been developed, approved and bid, the Metro Team will conduct the following services to ensure the most qualified company is selected:

Review Responses: Metro Energy will review all of the responses and create a rating system for [name of municipality] to evaluate the bidders.

Review All Correspondence and Amendments: Metro Energy will review all correspondence relating to the responses and be responsible to answer all questions related to the technical aspects of the project.

Review Contract/Energy Services Agreements: Metro Energy will review the energy related contracts that will be inclusive in the RFP and any and all drafts, revisions or amendments to the agreement.

Review Pricing: Metro Energy will review all pricing as submitted to [name of municipality] in the responses to the RFP. Metro Energy will also review all subsequent revisions.

Recommendation: Metro Energy will make a recommendation based upon an evaluation and rating system.

Negotiate Pricing: Once an ESCO or contractor is selected Metro Energy will assist [name of municipality] in negotiation efforts related to the proposed pricing. [name of municipality] will have the final determination as to any changes in pricing and Metro Energy will not commit to any pricing changes without written authorization by [name of municipality].

Facilitate Obtaining Utility Incentives: Metro Energy will submit for any utility incentives that are available for implementing this energy conservation initiative.

Project Management: Metro Energy will provide Project Management of contractors and subcontractors during the project implementation phases. Metro Energy will supply project management services for each project to ensure that projects are installed on time and within budget. Metro Energy will prepare project time, cost and financing schedules, including significant interim milestones and in strict accordance with the specifications. Metro Energy's fee includes weekly construction meetings during the installation phase of the project.

ATTACHMENT A – Lighting Retrofit Spreadsheets