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April 30, 2010

Local Government Energy Program
Energy Audit Final Report

Readington Department of Public Works Building

287 Mountain Road, Whitehouse Station, NJ 08889

Project Number: LGEA53

Table of Contents

INTRODUCTION

As an approved energy consulting firm under the Local Government Energy Audit Program (LGEA), Steven Winter Associates, Inc. (SWA) was selected to perform an energy audit and assessment for the Township of Readington municipal buildings. The audit, conducted on February 5, 2010 included a review of the:

- Municipal Building
- Department of Public Works (DPW) Building

The buildings are located in Whitehouse Station, NJ. A separate energy audit report is issued for each of the referenced buildings.

This report addresses the Readington DPW building located at 287 Mountain Road, Whitehouse Station, NJ. The current conditions and energy-related information were collected in order to analyze and facilitate the implementation of energy conservation measures for the building.

The Readington DPW building is a single-story structure built in 1978 with a partial mezzanine. The building underwent an addition/renovation in 1993, adding an office building and a small garage bay. The building consists of 11,036 square feet of conditioned space. The building houses administrative offices, locker rooms, bathrooms, kitchen/lunchroom area, 3 triple truck size garage bays, 2 repair bays and one single truck bay. The Readington DPW is occupied on weekdays, Monday through Friday from 7:00 am to 3:30 pm by a minimum of 5 employees.

The goal of this Local Government Energy Audit (LGEA) is to provide sufficient information to the Township of Readington to make decisions regarding the implementation of the most appropriate and most cost effective energy conservation measures for the Readington DPW building.

Launched in 2008, the LGEA Program provides subsidized energy audits for municipal and local government-owned facilities, including offices, courtrooms, town halls, police and fire stations, sanitation buildings, transportation structures, schools and community centers. For projects awarded on or prior to December 31, 2009 the program will subsidize 75% of the cost of the audit. If the net cost of the installed measures recommended by the audit, after applying eligible NJ SmartStart Buildings incentives, exceeds the remaining cost of the audit, then that additional 25% will also be paid by the program. The Board of Public Utilities (BPUs) Office of Clean Energy has assigned TRC Energy Services to administer the Program.

EXECUTIVE SUMMARY

The energy audit performed by Steven Winter Associates (SWA) encompasses the Readington DPW building located at Mountain Road, Whitehouse Station, NJ. The Readington DPW building is a single-story building with a partial mezzanine, comprising of a total conditioned floor area of 11,036 square feet. The original structure was built in 1978 with renovations/additions in 1993, adding an office building and a single truck bay.

Based on the field visits performed by the SWA staff on February 5, 2010 and the results of a comprehensive energy analysis, this report describes the site's current conditions and recommendations for improvements. Suggestions for measures related to energy conservation and improved comfort are provided in the scope of work. Energy and resource savings are estimated for each measure that results in a reduction of heating, cooling, and electric usage.

From January 2009 to December 2009 the Readington DPW building consumed 97,920 kWh or $17,177 worth of electricity at an approximate rate of $0.175/kWh and 7,095 therms or $8,168 worth of natural gas at an approximate rate of $1.151/therm. The joint energy consumption for the building, including both electricity and natural gas, was 1,044 MMBtu of energy that cost a total of $25,345.

SWA has entered energy information about the Readington DPW building in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. Currently a benchmark score could not be generated for this building since DPW buildings are not an available space type in the EPA database. Therefore it is designated as "Other", which is not eligible to receive an Energy Star rating. SWA encourages the Township of Readington to continue entering utility data in *Energy Star Portfolio Manager* in order to track weather normalized source energy use over time. EPA is continually working to expand the available space types.

The Energy Star Portfolio Manager was able to calculate a Site Energy Use Intensity (SEUI). The SEUI is 95.0 kBtu/sqft/yr (which includes 5.0 kBtu/sqft/yr for lighting that is unrelated to the DPW building) compared to the national average of "Other" space type of 104.0 kBtu/sqft/yr. Implementing this report's recommendations will reduce use by approximately 17.7 kBtu/sqft/yr, which when implemented would bring the building's energy consumption even lower than the national average. There may be energy procurement opportunities for the Readington DPW building to reduce annual electric utility costs, which are $2,489 higher, when compared to the average estimated NJ commercial electric rates. The gas rates are very competitive when compared to the average estimated NJ commercial gas rates.

Based on the assessment of the Readington DPW, SWA has separated the recommendations into three categories (See Section 4 for more details). These are summarized as follows:

Category I Recommendations: Capital Improvement Measures

- Install NEMA Premium motors when replacements are required
- With next major renovation, replace old metal standing seam roofs with new highly insulated roofs
- With next major renovation, add insulation to exposed CMU walls of office building
- Replace the domestic hot water (DHW) heater at the end of its useful operating life with a high efficiency inline condensing type gas fired heater without storage

Category II Recommendations: Operations and Maintenance

- Lower the thermostat set point to slightly above freezing temperature for the emergency generator shed
- Install CO/CO_2 detectors which automatically power the exhaust fan(s) for safety purposes
- Maintain garage doors so that they fully close and are sealed all around
- Maintain roofs and verify water is draining correctly
- Maintain downspouts - repair / install missing downspouts as needed
- Provide weather stripping on all doors and windows
- Provide air sealing for any other accessible gaps or penetrations in the thermal envelope
- Provide water efficient fixtures and controls
- Use Energy Star labeled appliances
- Use smart power electric strips
- Create an energy educational program

Category III Recommendations: Energy Conservation Measures - Upgrades with associated energy savings

At this time, SWA highly recommends a total of **4** Energy Conservation Measures (ECMs) for the Readington DPW building as summarized in the following Table 1. The total investment cost for these ECMs with incentives is **$3,989**. SWA estimates a first year savings of **$1,109** with a simple payback of **3.6 years**. SWA also recommends **7** ECMs with a total first year savings of **$26,543** as summarized in Table 2. SWA estimates that implementing these recommended ECMs will reduce the carbon footprint of the Readington DPW building by **92,615 lbs of CO_2** which is the equivalent of removing 8 cars off the road for a year and eliminating enough CO_2 as can be absorbed by 226 trees.

There are various incentives that the Township of Readington could apply for that could also help lower the cost of installing the ECMs, such as enroll in the NJ Smart Start program through the New Jersey Office of Clean Energy. This incentive program can help provide technical assistance for the building in the implementation phase of any energy conservation project. A new NJ Clean Power program, Direct Install, could also assist to cover up to 80% of the capital investment.

Renewable ECMs require application approval and negotiations with the utility and proof of performance. There is also a utility-sponsored loan program through JCP&L that would allow the building to pay for the installation of the PV system through a loan issued by JCP&L.

The following tables summarize the proposed Energy conservation Measures (ECMs) and their economic relevance. In order to clearly present the overall energy opportunities for the building and ease the decision and choice of which ECM to implement, SWA calculated each ECM independently and did not incorporate slight/potential overlaps between some of the summarized ECMs (i.e. lighting change influence on heating/cooling).

Table 1 - Highly Recommended 0-5 Year Payback ECMs																		
ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
1	Install (1) beverage vending machine energy miser	www.usatech.com and established costs	279	0	279	1,456	0.5	0	0.5	0	255	12	3,058	1.1	996	83	91	2,158	2,607
2a	Replace (2) incandescent with CFLs	RS Means, Lit Search	150	None at this time	150	55	0.0	0	0.0	70	80	5	398	1.9	165	33	45	206	98
2b	Install (3) occupancy sensors in office bathroom, rear hall, and lunchroom	RS Means, Lit Search	660	60	600	700	0.3	0	0.2	0	123	12	1,470	4.9	145	12	17	586	1,253
3	Replace (1) old office condenser - 5 Ton - SEER is 10.0 with new condenser - SEER 16	Energy Star purchasing and procurement site, similar projects	3,420	460	2,960	2,584	0.9	0	0.8	200	652	15	9,782	4.5	230	15	21	4,568	4,626
	Totals		**4,509**	**520**	**3,989**	**4,795**	**1.7**	**0**	**1.5**	**270**	**1,109**	**-**	**14,708**	**3.6**	**269**	**-**	**26**	**7,518**	**8,585**

Assumptions: Discount Rate: 3.2% per DOE FEMP; Energy Price Escalation Rate: 0% per DOE FEMP Guidelines
Note: A 0.0 electrical demand reduction/month indicates that it is very low/negligible

Table 2 - Recommended 5-10 Year Payback ECMs																			
ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
2c	replace (9) incandescent Exit sign fixtures with LED Exit sign type	RS Means, Lit Search	1,665	0	1,665	1,364	0.5	0	0.4	26	265	15	3,974	6.3	139	9	14	1,408	2,442
2d	Replace (103) T12 fixtures throughout the bldg with new T8 fixtures	RS Means, Lit Search	22,145	1,545	20,600	10,735	3.8	0	3.3	455	2,334	15	35,004	8.8	70	5	7	6,647	19,221
2e	Replace (10) exterior Metal Halide fixtures with pulse start MH type	RS Means, Lit Search	6,500	250	6,250	3,013	1.1	0	0.9	160	687	15	10,309	9.1	65	4	7	1,780	5,395
4	replace one (1) old kitchen refrigerator with an 18 cu ft Energy Star model	Energy Star purchasing and procurement site, similar projects	750	0	750	350	0.1	0	0.1	50	111	12	1,335	6.7	78	7	10	334	627
5	Install 25 kW Solar Photovoltaic system	Similar Projects	175,000	25,000	150,000	29,500	25	0	9.1	0	22,563	25	390,063	6.6	2	0	13	138,247	52,820
6	replace (1) old 80% eff locker rm / break rm furnace with a condensing Energy Star model - 93% eff	Energy Star purchasing and procurement site, similar projects	2,900	400	2,500	209	0.1	112	1.1	110	276	15	4,139	9.1	66	4	7	724	1,613
7	replace (1) old 80% eff office furnace with a condensing Energy Star model - 93% eff	Energy Star purchasing and procurement site, similar projects	3,760	400	3,360	223	0.1	137	1.3	110	307	15	4,606	10.9	37	2	4	245	1,913
	Totals		**212,720**	**27,595**	**185,125**	**45,394**	**30.7**	**249**	**16.3**	**911**	**26,543**	**-**	**449,430**	**7.0**	**143**	**-**	**12**	**149,385**	**84,030**

1. HISTORIC ENERGY CONSUMPTION

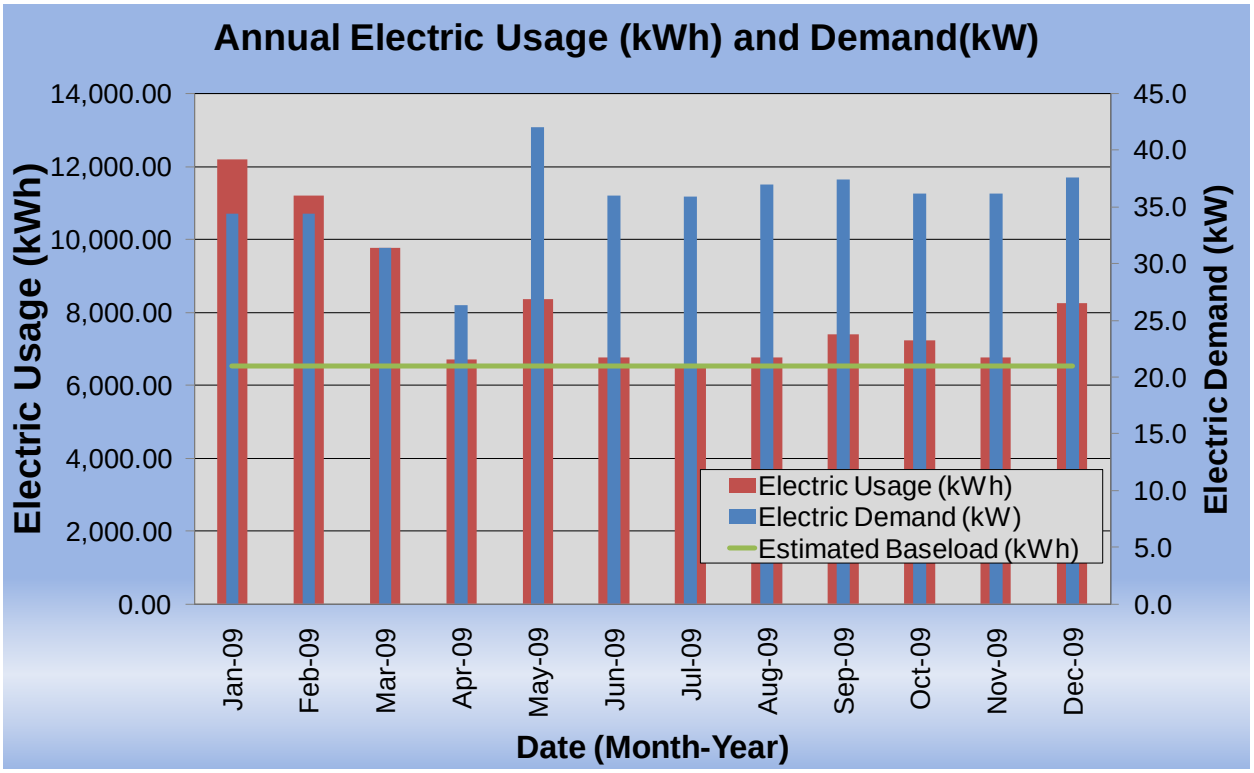
1.1 Energy usage and cost analysis

SWA analyzed utility bills from March 2008 through December 2009 that were received from the utility companies supplying the Readington DPW with electric and natural gas.

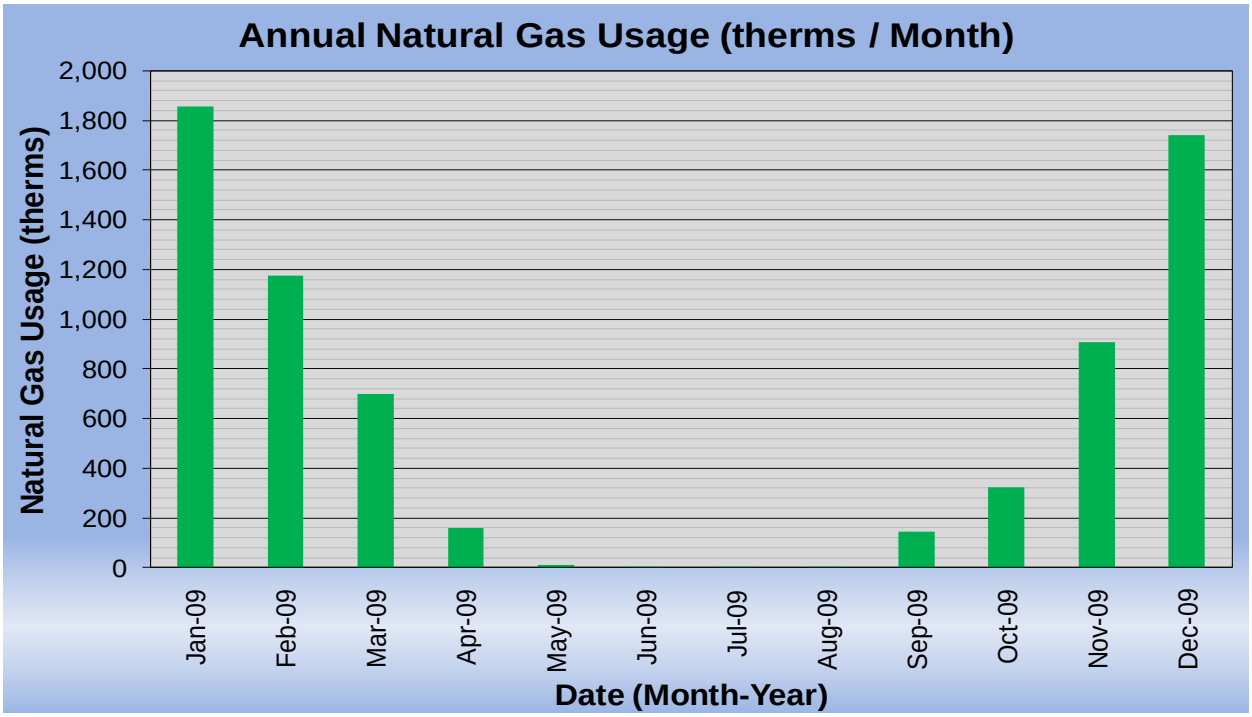
Electricity - The Readington DPW is currently served by one electric meter. The Readington DPW building currently buys electricity from Readington Electric Utility at **an average rate of $0.175/kWh** based on 12 months of utility bills from January 2009 to December 2009. The Readington DPW building purchased **approximately 97,920 kWh or $17,177 worth of electricity** in the previous year. The average monthly demand was 35.4 kW.

Natural gas - The Readington DPW is currently served by one main meter for natural gas. The Readington DPW buys natural gas from PSE&G at **an average aggregated rate of $1.151/therm** based on 12 months of utility bills for January 2009 to December 2009. The Readington DPW purchased **approximately 7,095 therms or $8,168 worth of natural gas** in 2009.

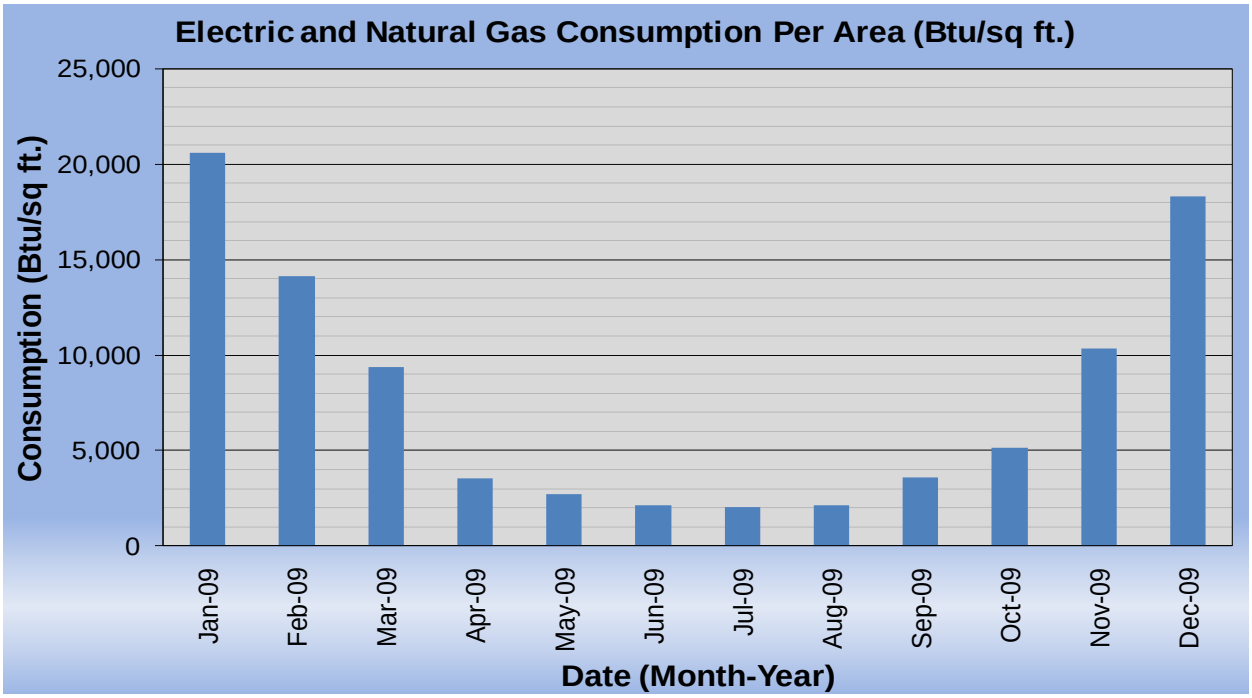
The following chart shows electricity use for the Readington DPW building based on utility bills for the 12 month period of January 2009 to December 2009. The one electric meter includes usage by many lights outside the DPW garage building. The monthly usage rates stay fairly steady and pick up in the winter when more lighting hours are used. The summer demand peaks are due to air-conditioning.



The following chart shows the natural gas consumption for the Readington DPW building based on natural gas bills for the 12 month period of January 2009 to December 2009. Note: There is no gas usage during the summer months because gas is used for heating only.

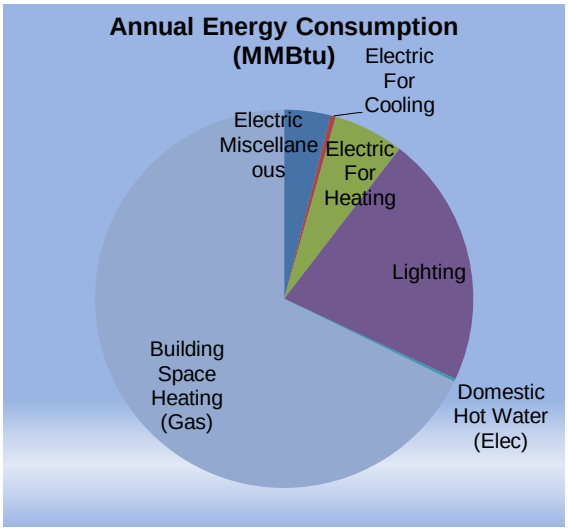


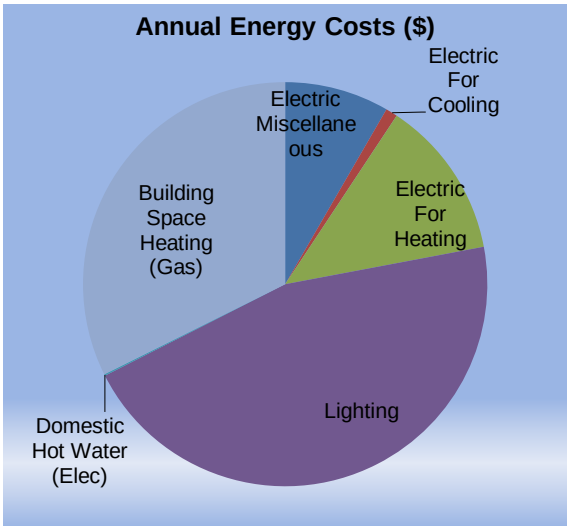
The following chart shows combined natural gas and electric consumption in Btu/sq ft for the Readington DPW building based on utility bills for the 12 month period of January 2009 to December 2009.



The following table and pie charts show energy use for the DPW Building based on utility bills for the 12 month period of January 2009 through December 2009. Note electrical cost at $51/MMBtu of energy is more than 4 times as expensive to use as natural gas at $12/MMBtu.

2009 Annual Energy Consumption / Costs					
	MMBtu	% MMBtu	$	% $	$/MMBtu
Electric Miscellaneous	41	4%	$2,109	8%	51
Electric For Cooling	5	0%	$239	1%	51
Electric For Heating	63	6%	$3,214	13%	51
Lighting (inc. yard and playfield lighting connected to DPW meter)	223	21%	$11,483	45%	51
Domestic Hot Water (Elec)	3	0%	$134	1%	51
Building Space Heating	709	68%	$8,168	32%	12
Totals	1,044	100%	$25,345	100%	24
Total Electric Usage	334	32%	$17,178	68%	51
Total Gas Usage	709	68%	$8,168	32%	12
Totals	1,044	100%	$25,345	100%	24





1.2 Utility rate

The Readington DPW building currently purchases electricity from JCP&L at a general service market rate for electricity use (kWh) with a separate (kW) demand charge. The Readington DPW building currently pays an average rate of approximately $0.175/kWh based on the 12 months of utility bills of January 2009 to December 2009.

The Readington DPW building currently purchases natural gas supply from the PSE&G at a general service market rate for natural gas (therms). PSE&G also acts as the transport company. There is one gas meter that provides natural gas service to the Readington DPW

building currently. The average aggregated rate (supply and transport) for the meter is approximately $1.151/therm based on 12 months of utility bills for January 2009 to December 2009.

Some of the minor unusual utility fluctuations that showed up for a couple of months on the utility bills may be due to adjustments between estimated and actual meter readings.

1.3 Energy benchmarking

SWA has entered energy information about the Readington DPW building in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. The DPW Facility is comprised of non-eligible "Other" space type. This building type is used to classify a facility or a portion of a facility where the primary activity does not fall into any of the available space types. Consequently, the Readington DPW is not eligible to receive a national energy performance rating at this time.

The Site Energy Use Intensity is 95.0 kBtu/sqft/yr (which includes 5.0 kBtu/sqft/yr for lighting that is unrelated to DPW building) as compared to the national average of "Other" space type buildings, 104.0 kBtu/sqft/yr. Implementing this report's highly recommended Energy Conservations Measures (ECMs) will reduce use by approximately 1.5 kBtu/sqft/yr, with an additional 16.2 kBtu/sqft/yr from the recommended ECMs. These recommendations could account for at least 17.7 kBtu/sqft/yr and therefore reduce the site energy utilization index to 77.3 kBtu/sqft/yr.

Per the LGEA program requirements, SWA has assisted the Township of Readington to create an *Energy Star Portfolio Manager* account and share the Readington DPW facilities information to allow future data to be added and tracked using the benchmarking tool. SWA has shared this Portfolio Manager site information with the Township of Readington (user name of "readingtontwp" with a password of "readingtontwp") and TRC Energy Services (user name of TRC-LGEA).

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Readington Township - DPW building

Building ID: 2063071
For 12-month Period Ending: December 31, 2009[1]
Date SEP becomes ineligible: N/A
Date SEP Generated: April 01, 2010

Facility	**Facility Owner**	**Primary Contact for this Facility**
Readington Township - DPW building 287 Mountain Road Whitehouse Station , NJ 08889	N/A	N/A

Year Built: 1978
Gross Floor Area (ft²): 11,036

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

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	334,103
Natural Gas (kBtu)[4]	719,618
Total Energy (kBtu)	1,053,721

Energy Intensity[5]	
Site (kBtu/ft²/yr)	95
Source (kBtu/ft²/yr)	169

Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	89

Electric Distribution Utility
FirstEnergy - Jersey Central Power & Lt Co

National Average Comparison	
National Average Site EUI	104
National Average Source EUI	213
% Difference from National Average Source EUI	-20%
Building Type	Other

Stamp of Certifying Professional

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

Certifying Professional
N/A

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

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

EPA Form 5900-16

2. FACILITY AND SYSTEMS DESCRIPTION

2.1. Building Characteristics

The DPW building is a single-story building (slab on grade, including a partial mezzanine with storage areas). The Readington DPW Building was originally constructed in 1978 with additions/ alterations done in 1993, adding an office building and a small garage bay. The building is comprised of 11,036 square feet of conditioned space. The building houses administrative offices, locker rooms, bathrooms, kitchen/lunchroom area, 3 triple truck size garage bays, 2 repair bays and one single truck bay. .

Front Façade (garage and attached offices)

Rear and Right Side Façade

Rear and Left Side Façade

2.2. Building occupancy profiles

The maximum occupancy for the Department of Public Works building is approximately 23 employees with generally 5 employees in the building at any one time. The building is generally operated from 7:00 am to 3:30 pm Monday through Friday for 35 hours / week. The building may be utilized during nights and weekends for emergencies.

2.3. Building envelope

2.3.1. Exterior Walls

The exterior envelope of the garage building is of the Butler building style. It is mostly constructed of a vertical metal panel system over a steel frame with an unconfirmed thickness of XPS (extruded polystyrene) insulation and an exposed CMU (Concrete Masonry Unit) base. The interior is mostly painted metal panels and unfinished particle board. The office area is constructed of exposed CMU (Concrete Masonry Unit) and with an unconfirmed level of EPS

(expanded polystyrene) insulation in the hollow cores of the CMU block. The interior is mostly painted CMU.

Note: Wall insulation levels could be partially verified in the field and are based on available construction plans.

During the field audit exterior and interior wall surfaces were inspected. They were observed to be in overall age appropriate condition with some signs of uncontrolled moisture, air-leakage and other energy-compromising issues detected on all facades, mainly attributed to rust in the garage building and lack of insulation in the office building.

The following specific exterior wall problem spots and areas were identified:

Exposed CMU blocks do not provide effective insulation in the office building

Corroded seams in wall due to rust

In light of the exterior wall conditions mentioned above, SWA has the following recommendation:

1. Replace corroded wall panel sections (mainly recorded in the front and in the corners of the garage)

2. Add insulation to exterior walls of office building. SWA suggests (with next major renovation) applying 2" XPS rigid foam boards to the exterior and covering it with preferred exterior finish.

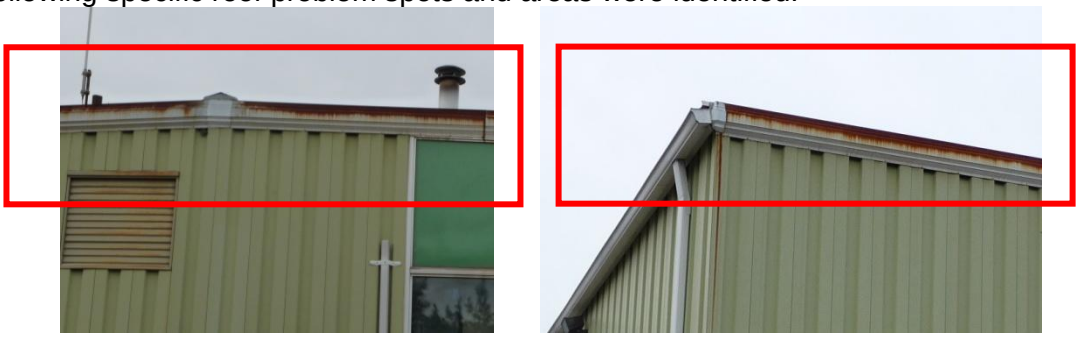
2.3.2. Roof

The garage building's roof is predominantly a low-pitched gabled type over a metal structure with a standing-seam metal finish. It is original and has never been replaced since it was installed in 1978. Roof insulation could not be determined due to weather conditions. Based on the year the project was built and other sections of the building, SWA suspects batt insulation. The office part of the building is covered by a flat, no parapet type roof over a metal structure with a standing seam finish. There have been 4 inches of foil faced fiberglass batt roof insulation (R-13) installed between metal purlins. This roof has never been replaced, originally installed in 1993.

Note: Roof insulation levels could partially be verified in the field and are based on available construction plans and reports from building management/maintenance personnel. Due to snow conditions SWA was not able to access the roof.

During the field audit, roofs, related flashing, gutters and downspouts were inspected. The main garage roof was found to be in poor condition, mainly attributed to rust corrosion, with signs of uncontrolled moisture leakage. Building management reported that the roof leaks. Visual evidence of rust and corrosion could be seen. The garage roof is close to the end of its useful life (30 years) and should be replaced. The office building has minimal amounts of thermal insulation and tape between seams of batt insulation is failing due to age causing additional air leakage through insulation.

The following specific roof problem spots and areas were identified:



Garage roof has rust damage attributed to uncontrolled moisture leakage and due to the metal roofing material approaching the end of its useful lifespan.

Office building contains minimal fiberglass batt insulation between metal studs, with failing tape at seams

In light of the exterior wall conditions mentioned above SWA has the following recommendation:
1. Unclog and maintain all roof drains/scuppers.

2. With next major renovation, replace standing seam metal roof due to age with new Energy star roof w/adequate insulation (SWA recommends R-30 minimum).

2.3.3. Base

The building's base is composed of a slab-on-grade floor with a perimeter footing and poured concrete foundation walls. Slab/perimeter insulation levels could not be verified in the field and are based on partial construction plans only. Based on the plans, there are 2" of rigid board insulation at the interior of the foundation walls and extending 2' vertically and horizontally from the foundation walls under the slab. This is standard for this type of structure. SWA does not recommend any additional insulation as it would not be cost effective.

There weren't any reported problems with water seepage through the slab or other issues related to thermal performance or moisture.

2.3.4. Windows

The building contains three different types of windows.

1. (8) double-hung type windows with an aluminum frame, clear double glazing with interior blinds. The windows are located on the office addition and are original/have never been replaced (installed in 1993).
2. (2) slider type windows with an aluminum frame, clear double glazing and no interior or exterior shading devices. The windows are located in the lunch room, on the front side of the building and were replaced approximately in 2005.
3. (6) fixed type windows with an aluminum frame, clear double glazing and no interior or exterior shading devices. The windows are located on the left side of the building and are original/have never been replaced, installed in 1978.

Windows, shading devices, sills, related flashing and caulking were inspected from the exterior and interior as far as accessibility allowed. Based on signs of moisture, air-leakage and other energy compromising issues, the windows were observed to be in acceptable condition with some visible damage to the window frames or to the caulking.

In light of the window conditions mentioned above SWA has the following recommendation:

1. Maintain weather air sealing for windows. The perimeter of all window frames should also be regularly inspected and any missing or deteriorated caulked areas should be re-caulked to provide an unbroken seal around the window frames.

2.3.5. Exterior doors

The building contains several different types of exterior doors..

1. Insulated solid metal type exterior doors. They are located throughout the building and are original/have never been replaced.
2. Insulated solid metal with glass type exterior doors, located in the main entrance to the office building and are original/have never been replaced.
3. Insulated and thermally broken overhead garage type exterior doors. They are located on the front and rear sides of the building.

The doors were observed to be in good condition except for some missing or worn weather-stripping. SWA recommends checking the weather-stripping of each door (including garage doors) on a regular basis and replacing any broken seals immediately. Tight seals around the doors will help ensure that the building is kept continuously tight and insulated.

The following specific door problem areas were identified:

Light emitting through missing/worn weather stripping (typical at doors)

In light of the exterior wall conditions mentioned above SWA has the following recommendation:

1. Install/replace/maintain weather stripping around all exterior doors.

2.3.6. Building air tightness

Overall the field audit found the building to be acceptably air-tight, considering the building's use and occupancy, as described in more detail earlier in this chapter.

In addition to all the above mentioned findings, SWA recommends air sealing, caulking and/or insulating around all structural members, recessed lighting fixtures, electrical boxes and chimney walls that are part of or penetrate the exterior envelope and where air-leakage can occur.

The air tightness of buildings helps maximize all other implemented energy measures and investments and minimizes potentially costly long term maintenance/repair/replacement expenses.

The following specific air-sealing problem areas were identified:

Oversized diameter hole with one wire running through none caulked and none insulated penetration (Typical improperly air-sealed penetration)

2.4 HVAC Systems

The Readington Public Works building is heated and cooled by three separate systems. Ceiling hung natural gas fired infrared heaters provide heat to the truck bay area. A hot air furnace system with cooling evaporator coils provides conditioned air for the break room and locker room. Another similar system provides conditioned air to the front desk area and offices.

2.4.1 Heating

The main garage area heating is provided by five (5) garage 150,000 Btu/hr ceiling Gordon Ray Infrared convection heaters with combustion efficiency in excess of 95%. These heaters are operating beyond their estimated useful lives and should be replaced in kind in the near future prior to permanent failure. These natural gas fired heaters can heat a large area and are generally used in warehouses or other large open spaces. When the internal coils of the heater are activated, the molecules in them begin to vibrate and spin. This causes the heater to emit infrared waves. The waves move through the room and begin to heat an object they strike. The waves, however, don't heat the air in the room. This is because the heater heats with electromagnetic radiation (negligible increase in air temperature) as opposed to thermally (heating comes from increasing the air temperature). There are several advantages to using an infrared heater over a thermal heater. The first and best advantage is energy cost. Since the user is not trying to raise the ambient room temperature with the heater, there is less energy needed to produce the desired results. Also, if the user is heating the air, there is continual need to pump warm air into the lower areas of the building as the hot air rises. This doesn't happen with an infrared heater because the waves travel in a straight line until they hit something. Since this form of heating is not dependant on air movement, it is possible to set different temperature zones in a single room depending on the temperature people in the room are most comfortable at. An infrared heater heats instantaneously, so it doesn't need time to warm up, which not only

saves the occupant time, but also the cost of heating a cold room prior to people entering it. This method is clean, extremely efficient, and easy to maintain as it has no moving parts which can break. Five manual control thermostats are located on the garage outer walls and mostly left on average at a 65 deg F setting.

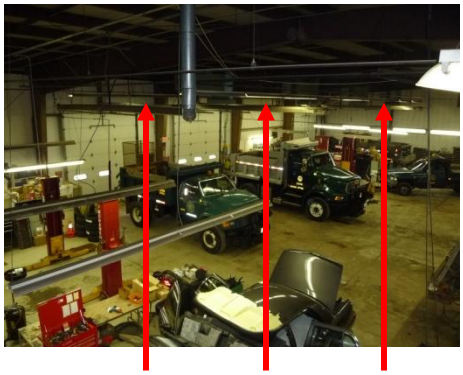
The break room, locker room and restroom are heated with hot air provided by a gas fired 75,000 Btu/hr input, 80% efficient Lennox furnace. All forced hot air is distributed via diffusers supported by the drop ceiling. There isn't any wall perimeter heating. The furnace is operating beyond its estimated useful life and SWA recommends that it is replaced with a condensing type furnace with 93% AFUE efficiency.

The front desk area and offices are heated with hot air provided by a gas fired 120,000 Btu/hr input, 80% efficient York Fraser Johnston furnace. All forced hot air is distributed via diffusers supported by the drop ceiling. There are two heating zones, each controlled by a programmable thermostat. There isn't any wall perimeter heating. The furnace is operating beyond its estimated useful life and breaks down often (roughly every 3 months). Office thermostats are set at 73 deg F during the day and 68 deg F on setback because the furnace often breaks down. SWA recommends that it is replaced with a condensing type furnace with 93% AFUE efficiency.

A typical furnace system arrangement draws fresh make-up air and brings it into a mixing chamber where it is combined with return air and filtered. The air (furnace) blower then pushes the filtered, conditioned air to the distribution system. The air is then distributed via diffusers into the building spaces

The emergency generator shed is heated by a ceiling mounted Qmark electric heater. This heater should be set to keep enclosure slightly above freezing temperatures only and separately the diesel tank heater should be kept at a level where the diesel can be readily pumped.

Office furnace;



3 ceiling hung IR garage heaters;

Break & Locker Rooms furnace

2.4.2 Cooling

The Public Works Building cooling is provided by split systems, evaporator coils (located in the furnace discharge ductwork). These split systems' two (2) fan cooled outdoor condensers, are located behind the office building section at ground level. They use R-22 Freon for air cooling. Thermostat control issues are similar to those addressed in the above 2.4.1 Heating section. The Gibson – Nordyne condenser is associated with the break & locker room evaporator coil and has 70% estimated remaining useful life, however it is reported that it has not been operated in the last couple of years. The York condenser is associated with the offices evaporator coil and is operating beyond its estimated useful life. SWA recommends replacement with a high efficiency unit.

Break & Locker Rooms condenser

Office condenser

2.4.3 Ventilation

The Readington Public Works building is ventilated by one wall-mounted fan controlled by a manual timer which is reported to be seldom used. There are seven (7) ceiling air purifiers in the truck bay area, one (1) Microcan ceiling air purifier in the oil / tool room, one (1) Microcan ceiling air purifier in the break room and one (1) ceiling air purifiers in the locker room. Furthermore, the (2) furnaces bring in the building some fresh air. SWA recommends installation of several CO / CO_2 detectors with alarms for the garage, office and break / locker room areas which could automatically power the exhaust fan(s) when concentrations exceed ASHRAE standards.

2.4.4 Domestic Hot Water

The domestic hot water (DHW) for the Readington Public Works building is provided by an AO Smith electric heater with 50 gal storage and 3,000 Watt upper / 3,000 Watt lower coils. This heater has 80% estimated useful operating life left and appears in satisfactory condition. It was reported that the purified well water is very hard and heaters generally last only a couple of years. Considerations should be given to replacing it with a high efficiency inline instantaneous condensing type gas fired heater without storage when it has reached the end of its operating life. Adding an incoming water purifier could also help increase the DHW heater longevity.

DHW electric heater

2.5 Electrical systems

2.5.1 Lighting

Interior Lighting - The Readington DPW building currently consists mainly of T12 fluorescent fixtures in the office spaces and the garage areas, in addition there are sporadic incandescent light bulb fixtures (in the mechanical rooms). Based on measurements of lighting levels for each space, there are not any vastly over-illuminated areas. Energy and maintenance savings are available. SWA recommends replacing all T12 fixtures with T8 fixtures to reduce wattage with the same lumen output. In addition, SWA recommends replacing the screw-in incandescent light bulbs with screw in CFLs.

SWA also recommends installing three occupancy sensors in areas that are occupied only part of the day and payback on savings are justified, such as in the lunchroom, office bathroom & office hall way to rear door. Typically, occupancy sensors have an adjustable time delay that shuts down the lights automatically if no motion is detected within a set time period. Advance micro-phonic lighting sensors include sound detection as a mean to control lighting operation.

See attached lighting schedule in Appendix A for a complete inventory of lighting throughout the building and estimated power consumption.

Exit Lights - Exit signs were found to be two-bulb incandescent type fixtures. Energy and maintenance savings are available. SWA recommends replacing the incandescent exit signs with LED exit signs to reduce wattage with the same lumen output. An LED retrofit kit may be used or the entire exit sign may be replaced economically. Please note that building management has experimented with retrofit kit in individual locations.

Exterior Lighting - The exterior lighting fixtures surveyed during the building audit were metal halide lights. Please note that a number of exterior fixtures (gas pump station, playing field and yard lights) are connected to the DPW building electric meter but were not included in the scope of this report. The metal halide lights are controlled by timers. SWA recommends replacing the metal halide lights with pulse start metal halides to decrease the energy usage for the same amount of light and longer useful life. SWA does not recommend any changes to the controls at this time.

2.5.2 Appliances and process

Appliances, such as refrigerators, that are over 10 years of age should be replaced with newer efficient models with the Energy Star label. For example, Energy Star refrigerators use as little as 315 kWh / yr. When compared to the average electrical consumption of older equipment, Energy Star equipment results in a large savings. Building management should select Energy Star label appliances and equipment when replacing: refrigerators, printers, computers, copy machines, etc. More information can be found in the "Products" section of the Energy Star website at: http://www.energystar.gov. Also, energy vending miser devices are now available for conserving energy usage by Drinks and Snacks vending machines. When equipped with the vending miser devices, vending machines use less energy and are comparable in daily energy performance to new ENERGY STAR qualified machines. See section 4, Energy Conservation Measures for details on replacing refrigerators and installing energy misers on vending machines.

Computers left on in the building consume a lot of energy. A typical desk top computer uses 65 to 250 watts and uses the same amount of energy when the screen saver is left on. Televisions (DVDs, stereos, computers, and kitchen appliances which now have internal memories or clocks which always require a trickle of power) in meeting areas use approximately 3-5 watts of electricity when turned off. SWA recommends all computers and all appliances (i.e. coffee makers, televisions, etc) except for refrigerators and ice makers, be plugged in to power strips and turned off each evening just as the lights are turned off. The Readington Public Works building computers are generally NOT programmed for the power save mode, to shut down after a period of time that they have not been used.

2.5.3 Elevators

The Readington Public Works building is a single-story building without elevators.

2.5.4 Others electrical systems

Besides a few small transformers in satisfactory condition, there are not currently any other significant energy impacting electrical systems installed at the Public Works building.

3. EQUIPMENT LIST

Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Heating / Cooling	1 furnace, 120,000 Btu/hr input - 80% est eff., 1 HP blower motor; with evap coil in duct	furnace rm	York Fraser Johnston furnace PBKM-L016N120C, Serial #: EKCM480731; evaporator GSUA0485A (R22 refrig), Serial #: EFC5224477 with 1 HP blower motor	Natural Gas / Electric blower	Offices	1993	0%
Cooling	1 outside condenser (split unit for office evaporator) - est. eff is 10 SEER	outside and back of offices	York HBMC-F0485A, Serial #: EECM219418	Electric	Offices	1993	0%
Heating / Cooling	1 furnace, 75,000 Btu/hr input - 80% est eff., 1/2 HP blower motor; with evap coil in duct	mezzanine furnace rm	Lennox furnace 61604-75-5, Serial #: 5887F21258; evaporator C16-21-1ff (R22 refrig), Serial #: 5188A63138	Natural Gas / Electric blower	Locker Rm / Break Rm	1987	0%
Cooling	1 outside condenser (split unit for mezzanine evaporator) - est. eff is 13 SEER	outside and back of offices	Gibson - Nordyne JS3BA-024KA, Serial #: JSD030402438	Electric	Locker Rm / Break Rm	2005	70%
Heating	5 garage 150,000 BTUH ceiling IR heaters - convection htg, est combustion eff >95%	garage ceiling	Gordon Ray BTH-150A	Natural Gas	Garage	1978	0%
Heating	2,200 Watt electric ceiling mounted heater, 1/4 amp fan	generator shed	Qmark MUH0321 by Marley Eng Prod	Electric	generator shed	2003	50%
Domestic Hot Water	1 electric DHW heater, 50 gal storage, 3,000 kW upper coil, 3,000 kW lower coil, Energy Star rating is 4825 kWh/yr (on a scale 4,622-4,879)	mezzanine level	A O Smith ProMax ECL 50 200 200, Serial #: MO7A127187	Electric	DPW bldg	2008	80%
Ventilation	1 wall fan, abandoned in place	wall	no nameplate	Electric	Garage	1978	0%
Air Purifiers	2 ceiling units, variable and up to 1,000 cfm, est avg CFM/Watt of 3.1	locker rm, break rm	Microcon MCD-002	Electric	locker rm, break rm	1999	30%
Air Purifiers	7 Airmation units in garage, 3,000 cfm, est avg CFM/Watt of 3.1; 1 small Airtek unit in oil room	garage ceiling, oil / tool room ceiling	Airmation AMARB-302A - Serial #s: AM302069A019-1,2,3,4,5,6,7 & 8; Airtek AT0Q-4012	Electric	Garage, Oil / Tool Rm	1999	30%
Generator	1 Genesys 100 kW/kVA	side shed back of offices	Genesys RDS 1250, Serial #: BLO7B202, 1630 rpm, Hercules engine 20BTDC	Diesel / Electric	DPW bldg	2003	70%
Air Com-pressor	1 air compressor for pneumatic tools	oil / tool storage rm	NAPA system with Baldor M3311T, 7.5HP motor, 1760 rpm	Electric	DPW garage area	2003	70%
Well Pump	1 SP4" submersible well pump at back of bldg	in well outside, back of bldg	Goulds 10SB05422 pump with 1/2HP Franklin motor	Electric	DPW bldg	2003	50%
Lighting	See details - Appendix A	See details - Appendix A	See details - Appendix A	Electric	DPW bldg	varies	on the average 30%

Note: The remaining useful life of a system (in %) is an estimate based on the system date of built and existing conditions derived from visual inspection.

4. ENERGY CONSERVATION MEASURES

Based on the assessment of the Readington DPW, SWA has separated the investment opportunities into three recommended categories:

Capital Improvements - Upgrades not directly associated with energy savings
Operations and Maintenance - Low Cost / No Cost Measures
Energy Conservation Measures - Higher cost upgrades with associated energy savings

Category I Recommendations: Capital Improvements

- Install NEMA Premium motors when replacements are required.

- With next major renovation, replace old metal standing seam roofs with new highly insulated roofs (recommended min. R-30) in an effort to minimize energy loss.

- With next major renovation, add insulation to exposed CMU walls of office building (recommended above R-13) in an effort to minimize energy loss.

- The domestic hot water (DHW) heater has 80% estimated useful operating life left and appears in satisfactory condition. Considerations should be given to replacing it with a high efficiency inline instantaneous condensing type gas fired heater without storage when it has reached the end of its operating life.

Category II Recommendations: Operations and Maintenance

- The emergency generator shed is heated by a ceiling mounted heater. SWA recommends lowering the thermostat set point to slightly above freezing temperature.

- SWA recommends installation of several CO/CO_2 detectors with alarms for the garage, office and break/locker room areas which could automatically power the exhaust fan(s) when concentrations exceed ASHRAE standards.

- Maintain roofs - SWA recommends regular maintenance to verify water is draining correctly.

- Maintain downspouts - Repair/install missing downspouts as needed to prevent water/moisture infiltration and insulation damage.

- Maintain weather stripping/air sealing for doors - Doors and vestibules should be observed annually for deficient weather-stripping and replaced as needed. Maintain/repair garage doors so that they fully close and seal all around.

- Maintain weather air sealing for windows. The perimeter of all window frames should also be regularly inspected and any missing or deteriorated caulked areas should be re-caulked to provide an unbroken seal around the window frames.

- Any other accessible gaps or penetrations in the thermal envelope, such as pipes, should also be sealed with caulk or spray foam. SWA recommends as part of the

maintenance program to seal wall penetrations wherever necessary in order to keep insulation dry and effective and reduce air infiltration.

- Provide water efficient fixtures and controls - Adding controlled on / off timers on all lavatory faucets is a cost-effective way to reduce domestic hot water demand and save water. Building staff can also easily install faucet aerators and / or low-flow fixtures to reduce water consumption. There are many retrofit options, which can be installed now or incorporated as equipment is replaced. Routine maintenance practices that identify and quickly address water leaks are a low-cost way to save water and energy. Retrofitting with more efficient water-consumption fixtures / appliances will save both energy and money through reduced energy consumption for water heating, while also decreasing water / sewer bills.

- Use Energy Star labeled appliances - such as Energy Star refrigerators that should replace older energy inefficient equipment.

- Use smart power electric strips - in conjunction with occupancy sensors to power down computer equipment when left unattended for extended periods of time.

- Create an energy educational program - that teaches how to minimize energy use. The US Department of Energy offers free information for hosting energy efficiency educational programs and plans, for more information please visit: http://www1.eere.energy.gov/education/.

Category III Recommendations: Energy Conservation Measures - Summary table

ECM#	Description of Highly Recommended 0-5 Year Payback ECMs
1	Install Vending Miser
2a , 2b	Building Lighting Upgrades
3	Replace Old Office Air Conditioning Split Unit Condenser
	Description of Recommended 5-10 Year Payback ECMs
2c, 2d, 2e	Building Lighting Upgrades
4	Replace Old Refrigerator with Energy Star Model
5	Install 25 kW Photovoltaic System on Roof
6	Replace Old Locker Room/Break Room Furnace
7	Replace Old Office Area Furnace

ECM#1: *Install Vending Miser*

Description:

The DPW Building has one beverage vending machine located in the main garage bay. Energy vending miser devices are now available for conserving energy with these vending machines and coolers. There isn't a need to purchase new machines to reduce operating costs and greenhouse gas emissions. When equipped with the vending miser devices, refrigerated beverage vending machines use less energy and are comparable in daily energy performance to new ENERGY STAR qualified machines. Vending miser devices incorporate innovative energy-saving technology into small plug-and-play devices that installs in minutes, either on the wall or on the vending machine. Vending miser devices use a Passive Infrared Sensor (PIR) to: Power down the machine when the surrounding area is vacant; Monitor the room's temperature; Automatically repower the cooling system at one- to three-hour intervals, independent of sales; Ensure the product stays cold.

Snack vending miser devices can be used on beverage vending machines to achieve maximum energy savings that result in reduced operating costs and decreased greenhouse gas emissions with existing machines. Beverage vending miser devices also use a PIR to determine if there is anyone within 25 feet of the machine. It waits for 15 minutes of vacancy, then powers down the machine. If a customer approaches the machine while powered down, the beverage vending miser will sense the presence and immediately power up.

Installation cost:

Estimated installed cost: $279 (includes $100 of labor)
Source of cost estimate: www.usatech.com *and established costs*

Economics:

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
1	Install (1) beverage vending machine energy miser	www.usatech.com and established costs	279	0	279	1,456	0.5	0	0.5	0	255	12	3,058	1.1	996	83	91	2,158	2,607

Assumptions: SWA assumes energy savings based modeling calculator found at www.usatech.com or http://www.usatech.com/energy_management/energy_calculator.php

Rebates/financial incentives:

This measure does not qualify for a rebate or other financial incentive at this time.

Options for funding ECM:

This project may benefit from enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation

http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings

ECM# 2a, 2b, 2c, 2d & 2e: *Building Lighting Upgrades*

Description:

On the days of the site visits, SWA completed a lighting inventory of the Readington DPW building (see Appendix A). Energy and maintenance savings are available. SWA recommends replacing T12 lights with magnetic ballasts to T8 lamps with electronic ballast for further energy reduction and increased lamp life. Any incandescent lights should be replaced with compact fluorescent lights (CFL's) which typically operate at a third of the wattage for the same lumen output and longer life. Exit signs were found to be two-bulb incandescent type fixtures. SWA recommends replacing the incandescent exit signs with LED exit signs to reduce wattage with the same lumen output. An LED retrofit kit may be used or the entire exit sign may be replaced economically. All replacements should meet local code requirements, such as shielding for safety hazards.

SWA also recommends installing occupancy sensors in areas that are occupied only part of the day and the payback on savings is justified. Typically, occupancy sensors have an adjustable time delay that shuts down the lights automatically if no motion is detected within a set time period. Motion detection is achieved by measuring optical (passive infrared sensors) or acoustical changes (ultra-sonic sensors) in the field of view. Each are suited for different applications, some motion detectors use a combination of the different technologies and are called dual-technology detectors which benefit from reduced false triggers.

For exterior applications, SWA recommends replacing Metal Halide (MH) lights with pulse-start Metal Halide fixtures. The pulse start lamps produce higher light output both initially and over time, operate more efficiently, produce whiter light, and turn on and re-strike faster. Due to these characteristics, energy savings can be realized via a one-to-one substitution of lower-wattage systems. The labor in all these installations was evaluated using prevailing electrical contractor wages. The Township of Readington may decide to perform this work with in-house resources from its Maintenance Department.

Economics (Some of the options considered with incentives):
Estimated installed cost: $29,265 (includes $19,721 of labor)
Source of cost estimate: RS *Means; Published and established costs*

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	est. energy & operating 1st year cost savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO2 reduced, lbs/yr
2a	Replace (2) incandescent with CFLs	RS Means, Lit Search	150	0	150	55	0.0	0	0.0	70	80	5	398	1.9	165	33	45	206	98
2b	Install (3) occupancy sensors in office bathroom, rear hall, and lunchroom	RS Means, Lit Search	660	60	600	700	0.3	0	0.2	0	123	12	1,470	4.9	145	12	17	586	1,253
2c	replace (9) incandescent Exit sign fixtures with LED Exit sign type	RS Means, Lit Search	1,665	0	1,665	1,364	0.5	0	0.4	26	265	15	3,974	6.3	139	9	14	1,408	2,442
2d	Replace (103) T12 fixtures throughout the bldg with new T8 fixtures	RS Means, Lit Search	22,145	1,545	20,600	10,735	3.8	0	3.3	455	2,334	15	35,004	8.8	70	5	7	6,647	19,221
2e	Replace (10) exterior Metal Halide fixtures with pulse start MH type	RS Means, Lit Search	6,500	250	6,250	3,013	1.1	0	0.9	160	687	15	10,309	9.1	65	4	7	1,780	5,395
	TOTALS		31,120	1,855	29,265	15,867	5.7	0	5	711	3,488	-	51,156	8.39	-	-	-	-	28,410

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA also assumed an aggregated 18 hrs/yr to replace aging burnt out lamps vs. newly installed.

Rebates/financial incentives:

- *NJ Clean Energy - Metal Halide with pulse start ($25 per fixture) - Maximum incentive amount is $250.*
- *NJ Clean Energy - Wall Mounted occupancy sensors ($20 per control) - Maximum incentive amount is $60.*
- *NJ Clean Energy - T8 lamps with electronic ballast in existing facilities ($15 per fixture, depending on quantity and lamps) Maximum incentive amount is $3,090.*

Options for funding the Lighting ECM: *This project may benefit from enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation. http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings*

ECM#3: Replace Old Office *Air Conditioning Split Unit Condenser*

Description:

Currently, the DPW office space is air conditioned by a 5 ton split unit with a York outdoor condenser, 1993 vintage and operating beyond its expected service life of 15 years. This condenser unit is an older model of low efficiency and SWA recommends that it should be replaced with an updated 5 ton condenser 16 Seer R410A (after checking thoroughly compatibility with the associated condensing furnace and evaporative coil) or equivalent. The replacement should be Energy Star rated. The condenser installation should include but not limited to: 16 SEER rated compressor or higher, line-set, unit pad, digital programmable thermostat, mechanical and electrical inspections, disposal of existing equipment and a minimum of one year labor warranty and five year equipment warranty.

Installation cost:

Estimated installed cost: $2,960 (includes $759 in labor)
Source of cost estimate: Similar projects

Economics:

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
3a	Replace (1) old office condenser - 5 Ton - SEER 10.0 in kind	Similar projects	2,100	0	2,100	318	0.1	0	0.1	200	256	15	3,835	8.2	83	6	9	880	569
3b	Incremental difference to replace (1) old office condenser - 5 Ton - SEER is 10.0 with new condenser - SEER 16	Similar projects	1,320	460	860	2,266	0.8	0	0.7	0	397	15	5,948	2.2	592	39	46	3,688	4,057
3 (a+b)	Replace (1) old office condenser - 5 Ton - SEER is 10.0 with new condenser - SEER 16	Energy Star purchasing and procurement site, similar projects	3,420	460	2,960	2,584	0.9	0	0.8	200	652	15	9,782	4.5	230	15	21	4,568	4,626

Assumptions: SWA assumed electrical loads calculated using modeling and by conducting the billing analysis. In order to estimate savings for this measure, SWA assumed in the model an energy reduction based on the difference in efficiencies of existing vs. the proposed equipment, some efficiency degradation of the old condenser performance and a 1,007 hrs of cooling operation based on weather data for the Township of Readington. SWA also assumed that the existing unit requires additional annual repairs vs. a new.

Rebates/financial incentives:

- *NJ Clean Energy – Unitary HVAC / Split System, <5.4 tons ($92 per ton) - Maximum incentive amount is $460.*

Options for funding the Lighting ECM: *This project may benefit from enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.*

http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings

ECM#4: *Replace Old Refrigerator with Energy Star Model*

Description:
SWA observed an older refrigerator in the Lunch Room. Appliances, such as refrigerators, that are over 10-12 years of age should be replaced with newer efficient models with the Energy Star label. SWA recommends the replacement of the existing refrigerator which is operating at the end of its useful life with a more modern, ENERGY STAR®, energy efficient appliance. Besides saving energy, the replacement will also keep the kitchen area cooler. When compared to the average electrical consumption of older equipment, Energy Star equipment results in large savings. Energy Star equipment is rated a minimum 20% more efficient than models that meet the federal minimum standard. Look for the Energy Star label when replacing appliances and equipment, including: window air conditioners, refrigerators, printers, computers, copy machines, etc. More information can be found in the "Products" section of the Energy Star website at: http://www.energystar.gov.

Installation cost:
Estimated installed cost: $750 (includes $70 labor)
Source of cost estimate: *Energy Star purchasing and procurement site, similar projects, Manufacturer and Store established costs*

Economics:

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
4a	replace (1) old kitchen refrigerator with an 18 cu ft model in kind	Energy Star purchasing and procurement site, similar projects	700	0	700	50	0.0	0	0.0	50	59	12	705	11.9	1	0	0	-118	90
4b	incremental difference to replace (1) old kitchen refrigerator with an 18 cu ft Energy Star model	Energy Star purchasing and procurement site, similar projects	50	0	50	300	0.1	0	0.1	0	53	12	630	1.0	1160	97	105	452	537
4 (a+b)	replace one (1) old kitchen refrigerator with an 18 cu ft Energy Star model	Energy Star purchasing and procurement site, similar projects	750	0	750	350	0.1	0	0.1	50	111	12	1,335	6.7	78	7	10	334	627

Assumptions: SWA calculated the savings for this measure using measurements taken the day of the field visit and using the billing analysis. SWA assumed one annual call to a refrigeration contractor to perform minor repairs on old refrigerators.

Rebates/financial incentives:

NJ Clean Energy - There are not any incentives at this time offered by the state of NJ for this energy conservation measure.

Options for funding the Lighting ECM:

This project may benefit from enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.

http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings

ECM#5: *Install 25 kW PV system*

Description:

Currently, the Readington DPW building does not use any renewable energy systems. Renewable energy systems such as photovoltaic panels can be mounted on the building south facing roof and can offset a portion of the purchased electricity for the building. Power stations generally have two separate electrical charges: usage and demand. Usage is the amount of electricity in kilowatt-hours that a building uses from month to month. Demand is the amount of electrical power that a building uses at any given instance in a month period. During the summer periods, when electric demand at a power station is high due to the amount of air conditioners, lights, equipment, etc. being used within the region, demand charges go up to offset the utility's cost to provide enough electricity at that given time. Photovoltaic systems not only offset the amount of electricity use by a building, but also reduce the building's electrical demand, resulting in a higher cost savings as well. SWA presents below the economics, and recommends at this time that Township of Readington further review installing a 25 kW PV system to offset electrical demand and reduce the annual net electric consumption for the building, and review guaranteed incentives from NJ rebates to justify the investment. The Township of Readington may consider applying for a grant and / or engage a PV generator / leaser who would install the PV system and then sell the power at a reduced rate. JCP&L provides the ability to buy SRECs at $600 / MWh or best market offer.

The size of the system was determined using the amount of roof surface area as a limiting factor, as well as the facilities annual base load. A PV system could be installed on a portion of the sloped roof that faces South. A commercial multi-crystalline 123 watt panel (17.2 volts, 7.16 amps) has 10.7 square feet of surface area (11.51 watts per square foot). A 25 kW system needs approximately 200 panels which would take up 2,174 square feet. SWA recommends first replacing the existing roof, which is at the end of its useful life prior to installing solar PV panels.

Installation cost:

Estimated installed cost: $150,000 (labor included at $3.5/Watt, totaling $75,000).
Source of cost estimate: Similar projects

Economics (with incentives):

ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
Install 25 kW Solar Photovoltaic system	Similar Projects	175,000	25,000	150,000	29,500	25	0	9.1	0	22,563	25	390,063	6.6	2	0	13	138,247	52,820

Assumptions: SWA estimated the cost and savings of the system based on past PV projects. SWA projected physical dimensions based on a typical Polycrystalline Solar Panel (123 Watts, Model ND-123UJF). PV systems are sized based on Watts and physical dimensions for an array will differ with the efficiency of a given solar panel (W/sq ft).

Rebates/financial incentives:

NJ Clean Energy - Renewable Energy Incentive Program, Incentive based on $1.00 / watt Solar PV application for systems 50kW or less. Incentive amount for this application is $25,000 for the Readington DPW.

http://www.njcleanenergy.com/renewable-energy/programs/renewable-energy-incentive-program

NJ Clean Energy - Solar Renewable Energy Certificate Program. Each time a solar electric system generates 1000kWh (1MWh) of electricity, a SREC is issued which can then be sold or traded separately from the power. The buildings must also become net-metered in order to earn SRECs as well as sell power back to the electric grid. A total of $17,400 / year, based on $600/SREC, has been incorporated in the above costs for the panels however it requires proof of performance, application approval and negotiations with the utility.

Options for funding ECM:

This project may benefit from enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation. http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings

ECM#6: *Replace Old Locker Room/Break Room Furnace*

Description:

The locker room/break room furnace was installed in 1987 and operating beyond its estimated useful life. The coils are of an older design and may be partly fouled. The blower motor is standard rather than NEMA premium efficiency. The ductwork appears to be acoustically insulated on the inside and should be checked for insulation integrity. SWA recommends continuation of furnace routine maintenance, such as lubrication, air filter changes and customary inspections. SWA recommends that the furnace be replaced with an Energy Star condensing furnace of 93% Annual Fuel Utilization Efficiency (AFUE) rating. The heat capacity of the furnace should match the capacity of the furnace it is replacing. Any brittle insulation inside the ducts should be removed and the ducts thoroughly vacuumed out. Then, new insulation and jacketing should be applied to the outside of all the ducts. This re-insulation work is labor intensive and expensive. New evaporator coils are to be added to the furnace discharge ducts for cooling the re-circulating air with R22 refrigerant or R-410A if the matching split condenser is replaced at the same time.

SWA recommends replacement with a two-stage furnace, which is like having two furnaces in one. On the coldest days, the furnace operates in the high-stage mode at 100% capacity. But on most days, the furnace comfortably conserves energy by operating in the low-stage mode at just 70% capacity. The two-stage gas valve runs quietly on the low stage 90% of the time, producing just 25% of the normal high-fire sound, while significantly reducing energy consumption. A central furnace control orchestrates the various functions of the furnace with digital accuracy. Functions like the blower and inducer motor are monitored for proper operation, increasing safety and reliability. SWA also recommends features like the corrosion-resistant, aluminized steel tubular heat exchanger with stainless-steel recuperative coil which will provide many years of trouble-free service. Plus, a furnace heavy-gauge, reinforced and insulated steel cabinet. The high-efficiency combustion process allows venting with 2 - 4 inch PVC without the need for a traditional chimney flue. And because it can be direct-vented to the outside, fresh air can be used for combustion. The fuel stingy auto-ignition system eliminates the old-fashioned standing pilot for greater ignition dependability without the wasted energy.

Installation cost:

Estimated installed cost: $2,500 (includes $700 of labor)
Source of cost estimate: Manufacturer's data and similar projects

Economics:

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
6a	replace (1) old 80% eff locker rm / break rm furnace - 75 MBH input with a model in kind	Energy Star purchasing and procurement site, similar projects	2,000	0	2,000	39	0.0	21	0.2	110	141	15	2,117	14.2	6	0	1	-329	302
6b	incremental difference to replace (1) old 80% eff locker rm / break rm furnace with a condensing model - 93% eff	Energy Star purchasing and procurement site, similar projects	900	400	500	170	0.1	91	0.9	0	135	15	2,022	3.7	304	20	26	1,053	1,311
6 (a+b)	replace (1) old 80% eff locker rm / break rm furnace with a condensing Energy Star model - 93% eff	Energy Star purchasing and procurement site, similar projects	2,900	400	2,500	209	0.1	112	1.1	110	276	15	4,139	9.1	66	4	7	724	1,613

Assumptions: SWA assumed electrical/gas loads calculated using modeling and by conducting the billing analysis. In order to estimate savings for this measure, SWA assumed in the model an energy reduction based on the difference in efficiencies of existing

vs. the proposed equipment and a 2,340 hrs of heating operation based on weather data for the Township of Readington. SWA also assumed that the existing unit requires additional annual repairs vs. a new.

Rebates/financial incentives:

- *NJ Clean Energy - Gas Furnace, 92% or greater AFUE, electronic commutated motor ($400 per furnace) - Maximum incentive amount is $800.*

Options for funding the Lighting ECM: *This project may benefit from enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.*

http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings

ECM#7: *Replace Old Office Area Furnace*

Description:

The office area furnace was installed in 1993 and has experienced several breakdowns in the last few heating seasons, besides operating beyond its estimated useful life. The coils are of an older design and may be partly fouled. The blower motor is standard rather than NEMA premium efficiency. The ductwork appears to be acoustically insulated on the inside and should be checked for insulation integrity. SWA recommends continuation of furnace routine maintenance, such as lubrication, air filter changes and customary inspections. SWA recommends that the furnace be replaced with an Energy Star condensing furnace of 93% Annual Fuel Utilization Efficiency (AFUE) rating. The heat capacity of the furnace should match the capacity of the furnace it is replacing. New evaporator coils are to be added to the furnace discharge ducts for cooling the re-circulating air with R22 refrigerant or R-410A if the matching split condenser is replaced at the same time.

SWA recommends replacement with a two-stage furnace, which is like having two furnaces in one. On the coldest days, the furnace operates in the high-stage mode at 100% capacity. But on most days, the furnace comfortably conserves energy by operating in the low-stage mode at just 70% capacity. The two-stage gas valve runs quietly on the low stage 90% of the time, producing just 25% of the normal high-fire sound, while significantly reducing energy consumption. A central furnace control orchestrates the various functions of the furnace with digital accuracy. Functions like the blower and inducer motor are monitored for proper operation, increasing safety and reliability. SWA also recommends features like the corrosion-resistant, aluminized steel tubular heat exchanger with stainless-steel recuperative coil which will provide many years of trouble-free service. Plus, a furnace heavy-gauge, reinforced and insulated steel cabinet. The high-efficiency combustion process allows venting with 2 - 4 inch PVC without the need for a traditional chimney flue. And because it can be direct-vented to the outside, fresh air can be used for combustion. The fuel stingy auto-ignition system eliminates the old-fashioned standing pilot for greater ignition dependability without the wasted energy.

Installation cost:

Estimated installed cost: $3,360 (includes $913 of labor)
Source of cost estimate: Manufacturer's data and similar projects

Economics:

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
7a	replace (1) old 80% eff office furnace - 120 MBH input with a model in kind	Energy Star purchasing and procurement site, similar projects	2,410	0	2,410	52	0.0	26	0.2	110	149	15	2,232	16.2	-7	0	-1	-639	378
7b	incremental difference to replace (1) old 80% eff office furnace with a condensing model - 93% eff	Energy Star purchasing and procurement site, similar projects	1,350	400	950	170	0.1	112	1.1	0	158	15	2,374	6.0	150	10	14	884	1,535
7 (a+b)	replace (1) old 80% eff office furnace with a condensing Energy Star model - 93% eff	Energy Star purchasing and procurement site, similar projects	3,760	400	3,360	223	0.1	137	1.3	110	307	15	4,606	10.9	37	2	4	245	1,913

Assumptions: SWA assumed electrical/gas loads calculated using modeling and by conducting the billing analysis. In order to estimate savings for this measure, SWA assumed in the model an energy reduction based on the difference in efficiencies of existing vs. the proposed equipment and a 2,340 hrs of heating operation based on weather data for the Township of Readington. SWA also assumed that the existing unit requires additional annual repairs vs. a new.

Rebates/financial incentives:

- *NJ Clean Energy - Gas Furnace, 92% or greater AFUE, electronic commutated motor ($400 per furnace) - Maximum incentive amount is $800.*

Options for funding the Lighting ECM: *This project may benefit from enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.*

http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings

5. RENEWABLE AND DISTRIBUTED ENERGY MEASURES

5.1 Existing systems

There aren't currently any existing renewable energy systems.

5.2 Wind

There aren't any recommendations for this renewable energy source at this time due to lack of necessary wind conditions in this region.

5.3 Solar Photovoltaic

Pleases see the above recommended ECM#5.

5.4 Solar Thermal Collectors

Solar thermal collectors are not cost effective for this building and would not be recommended due to the insufficient and not constant use of domestic hot water throughout the building to justify the expenditure.

5.5 Combined Heat and Power

CHP is not applicable for this building because of absence of a major cooling system and insufficient domestic hot water use.

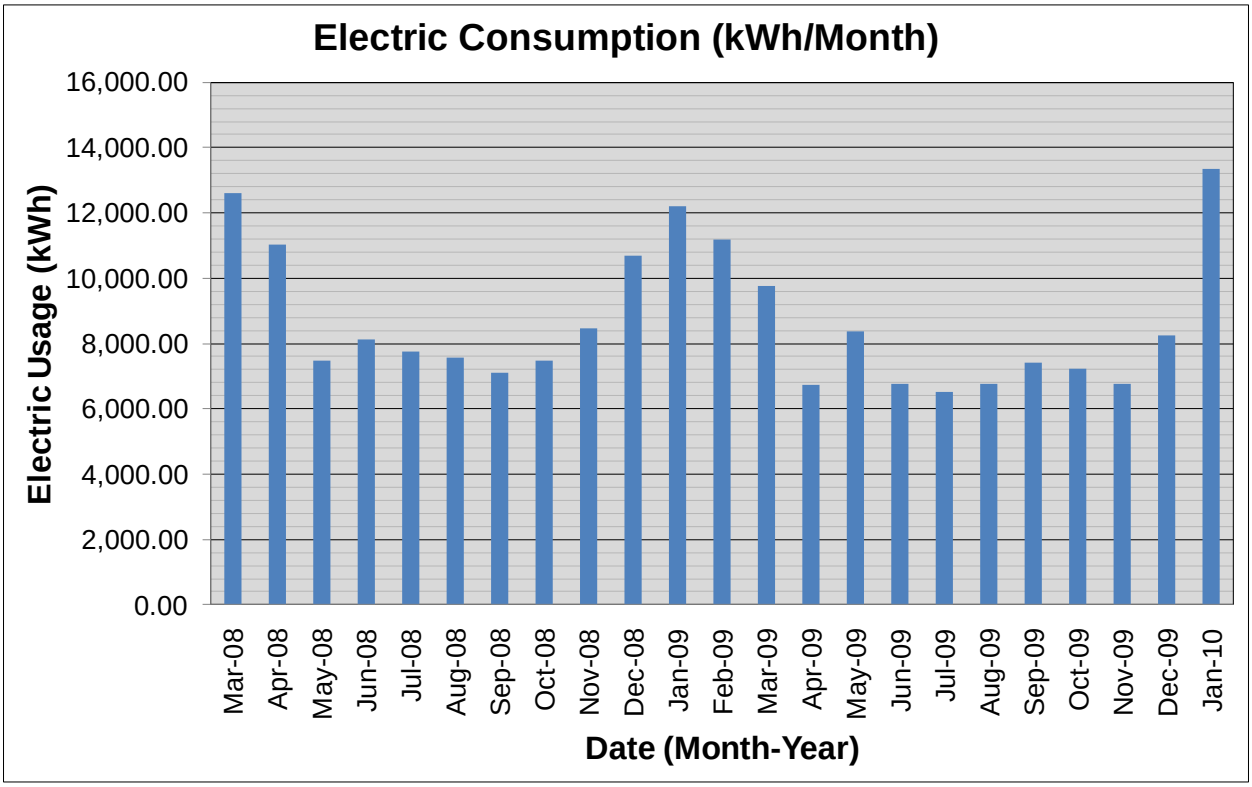
5.6 Geothermal

Geothermal is not applicable for this building because it would not be cost effective, since it would require replacement of the existing HVAC system, of which major components still have as a whole a number of useful operating years.

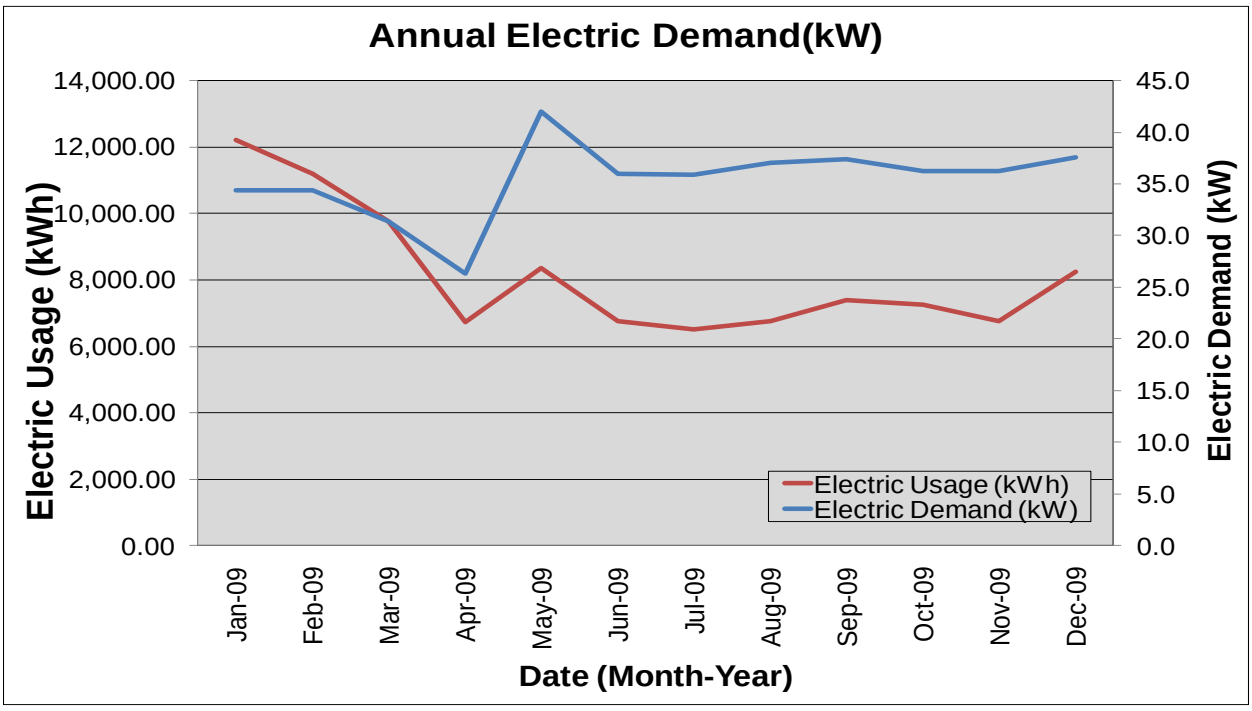
6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

6.1 Load profiles

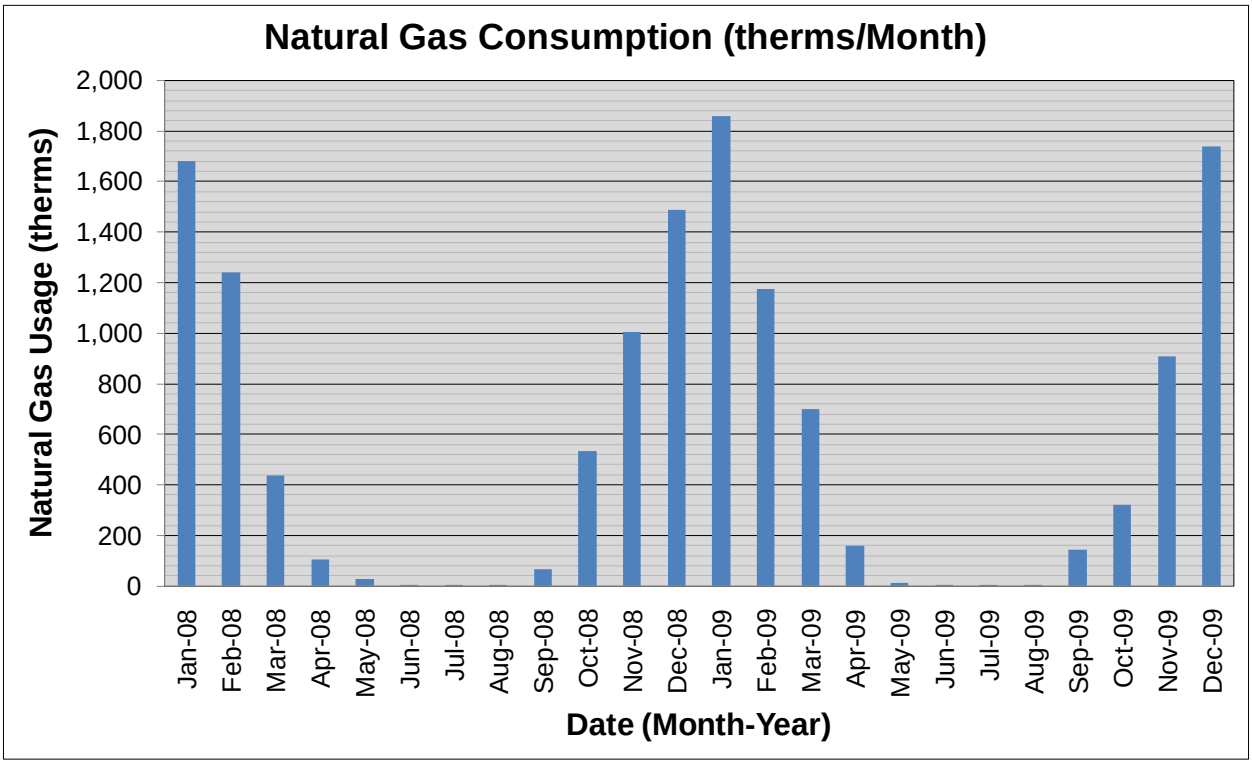
The following chart shows the electric load profile for the Readington DPW.

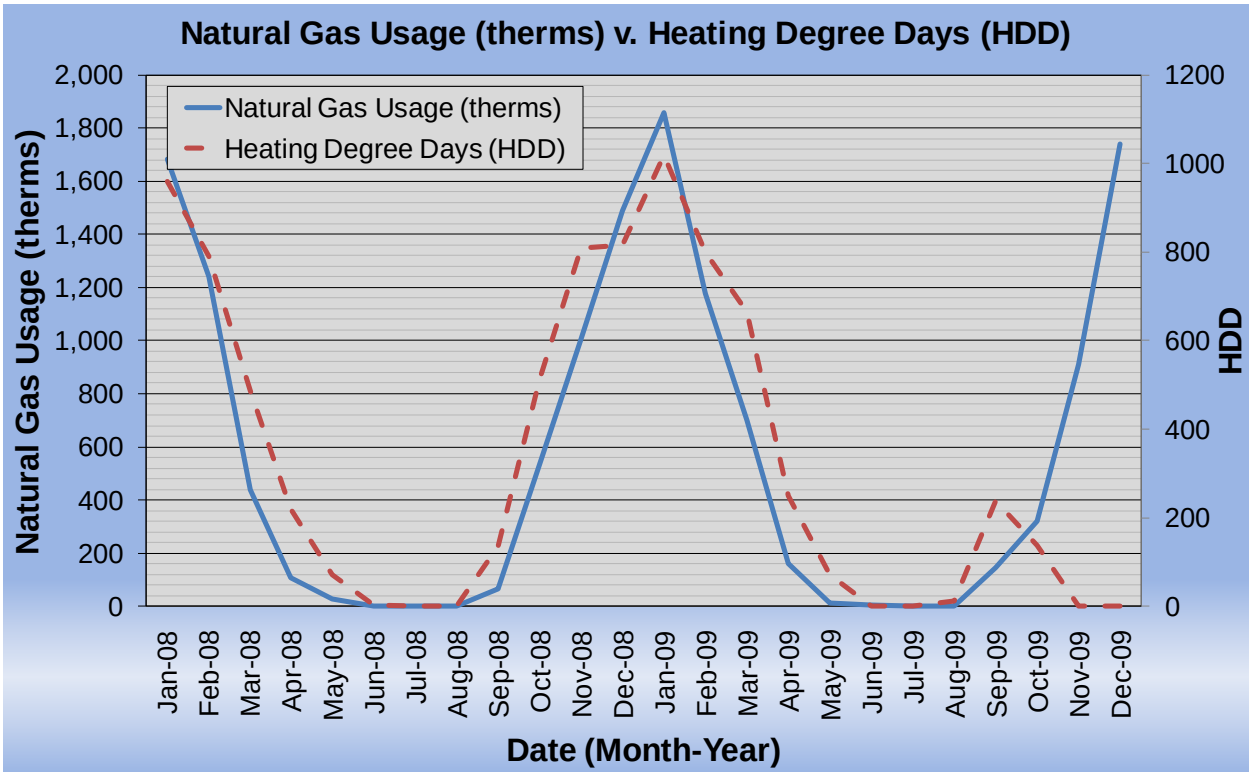


Some minor unusual electric fluctuations shown may be due to adjustments between estimated and actual meter readings. Also, note on the following chart how the electrical demand peaks (except for a few unusual fluctuation anomalies) follow the electrical consumption and are a steady draw. The one electric meter includes usage by many lights outside the DPW garage building. The monthly usage rates stay fairly steady and pick up in the winter when more lighting hours are used.



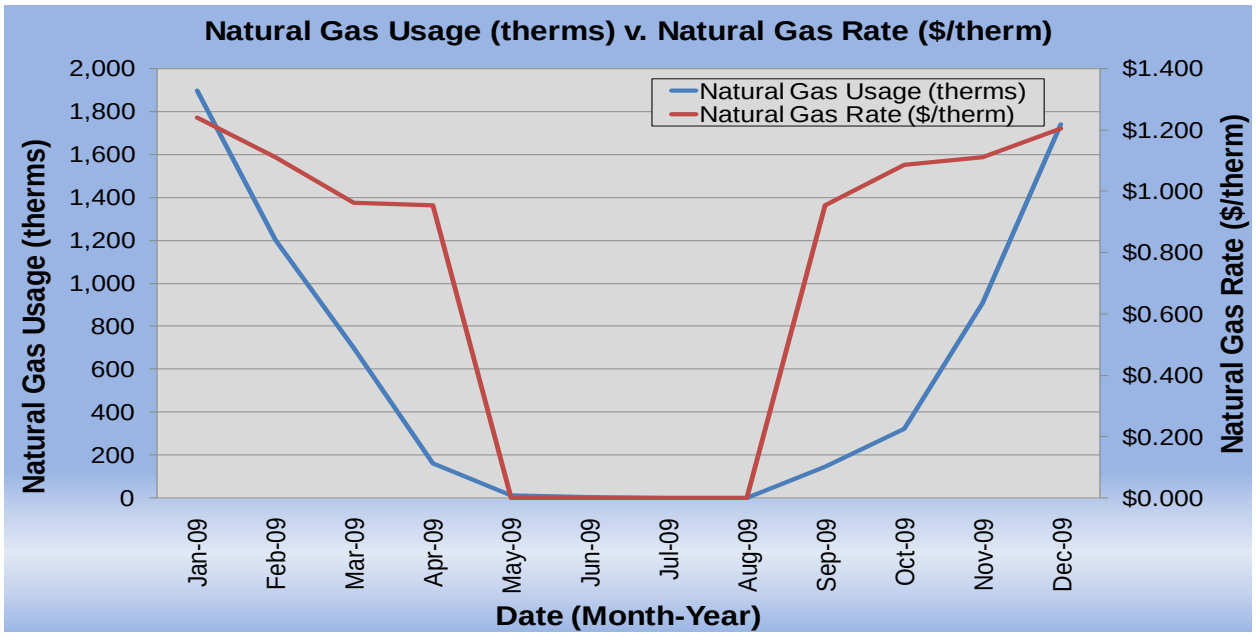
The following is a chart of the natural gas annual load profile for the building, peaking in the coldest months of the year and a chart showing natural gas consumption following the “heating degree days” curve. Some utility bills have more than one month estimated and combined.



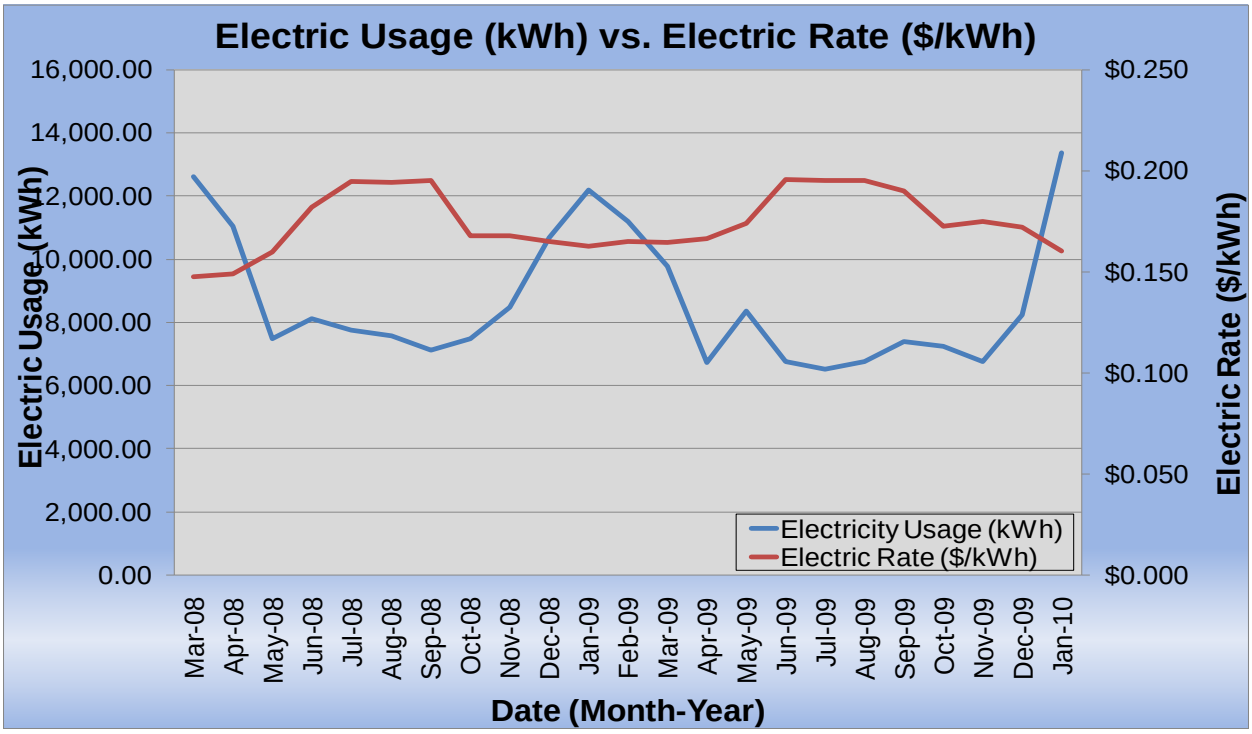


6.2 Tariff analysis

Currently, natural gas is provided to the Readington DPW via one gas meter with the PSE&G acting as the supply and also the transport company. Gas is provided by the PSE&G at a general service rate. The suppliers' general service rate for natural gas charges a market-rate price based on use and the Readington DPW building billing does not breakdown demand costs for all periods. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year. Typically, the natural gas prices increase during the heating months when natural gas is used by the hot water boiler units. The high gas price per therm fluctuations in the summer may be due to high energy costs that recently occurred and low use caps for the non-heating months as seen in June and July. Thus the building pays for fixed costs such as meter reading charges during the summer months. Therefore the summer months are excluded from the following chart. Below is a chart to display the rate fluctuations.



The Readington DPW building is direct-metered and currently purchases electricity from JCP&L at a general service rate. The general service rate for electric charges are market-rate based on use and the Readington DPW building billing does not track a breakdown of demand costs. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year. Typically, the electricity prices increase during the cooling months when electricity is used by air conditioning systems. Outliers during peak cooling months were normalized as to not skew the chart scale. Electric rate peaks during winter months, such as December can be due to peak charges in the evening when lighting is needed for more hours than during the summer.

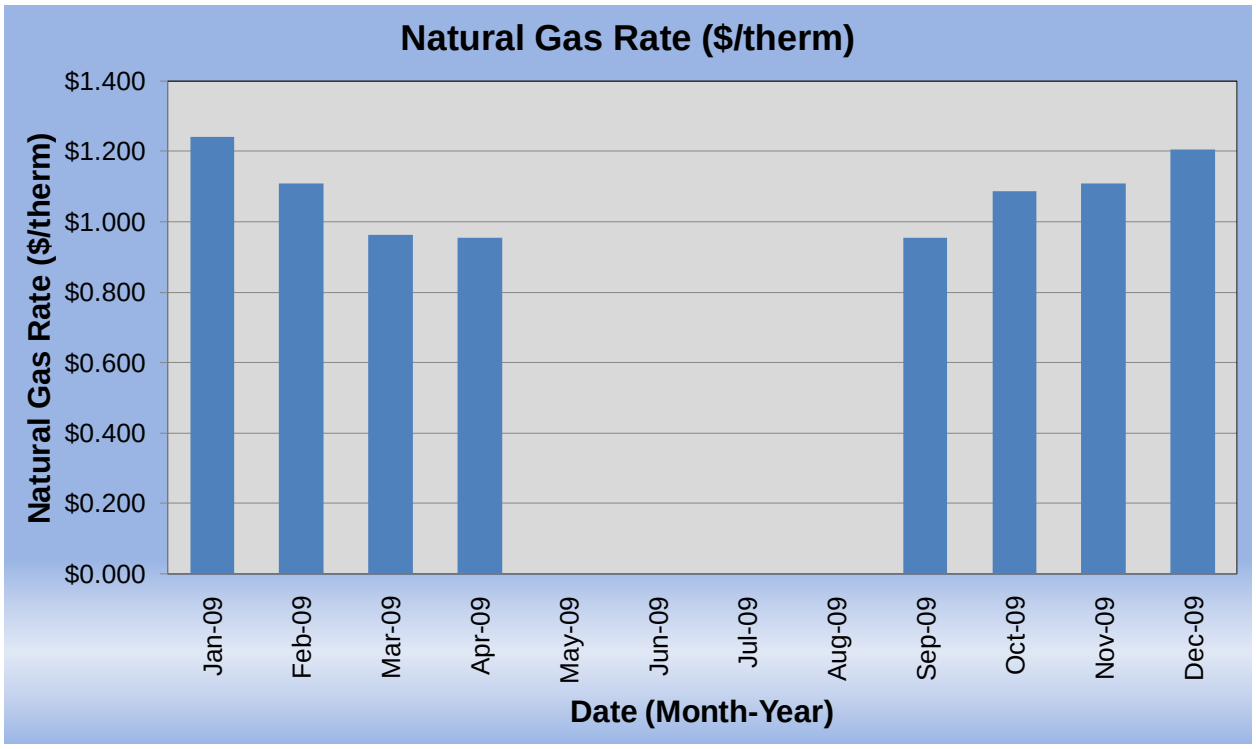


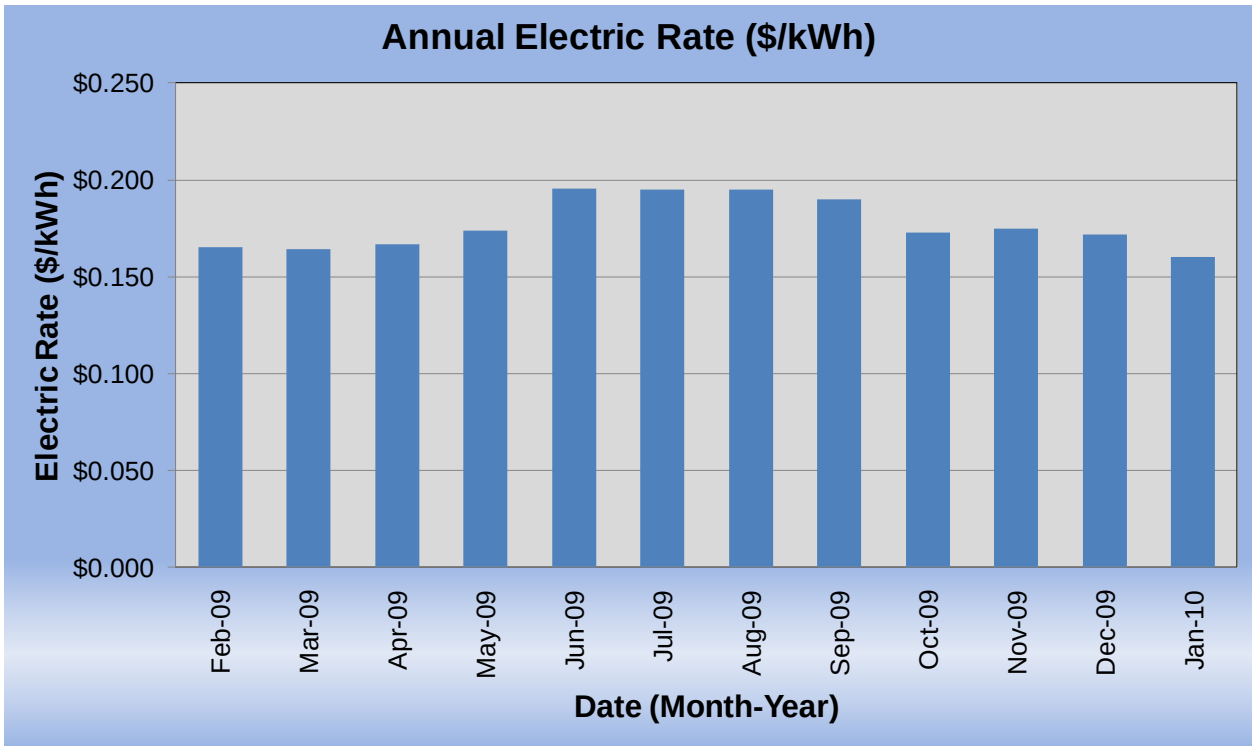
6.3 Energy Procurement strategies

The Readington DPW building receives natural gas via one incoming meter. The PSE&G supplies the gas and transports it. There is no third party supplier or ESCO engaged in the process. An Energy Services Company (ESCO) is a consultancy group that engages in a performance based contract with a client firm to implement measures which reduce energy consumption and costs in a technically and financially viable manner. Electricity is purchased via one incoming meter directly for the main Readington DPW building from JCP&L without a third party supply or an ESCO. SWA analyzed the utility rate for natural gas and electricity supply over an extended period. Electric bill analysis shows fluctuations up to 17% over the most recent 12 month period. Natural gas bill analysis shows fluctuations up to 30% over the most recent 12 month period. Some of these fluctuations may have been caused by adjustments between estimated and actual meter readings, others may be due to unusual high and recent escalating energy costs.

The average estimated NJ commercial utility rates for electric and gas are $0.150/kWh and $1.550/therm respectively. The Readington DPW Building annual natural gas costs are very competitive. The DPW building annual electric costs are $2,489 higher when compared to the average estimated NJ commercial utility rates. SWA recommends that the Township of Readington further explore opportunities of purchasing both natural gas and electricity from ESCOs in order to reduce rate fluctuation and ultimately reduce the annual cost of energy for the Readington DPW. Appendix B contains a complete list of third party energy suppliers for the Township of Readington service area. The Township of Readington may want to consider partnering with other school districts, municipalities, townships and communities to aggregate a substantial electric and natural gas use for better leveraging in negotiations with third party suppliers or ESCOs and of improving the pricing structures. This sort of activity is happening in many parts of the country and in New Jersey. Also, the Readington DPW building would not be eligible for enrollment in a Demand Response Program, because there isn't the capability at this time (without a large capital investment) to shed a minimum of 150 kW electric demand when requested by the utility during peak demand periods, which is the typical threshold for considering this option

The following charts show the Readington DPW building monthly spending per unit of energy from January 2009 to December 2009.


Natural Gas Rate ($/therm)
Natural Gas Rate ($/therm)
$1.400
$1.200
$1.000
$0.800
$0.600
$0.400
$0.200
$0.000
Jan-09
Feb-09
Mar-09
Apr-09
May-09
Jun-09
Jul-09
Aug-09
Sep-09
Oct-09
Nov-09
Dec-09
Date (Month-Year)


Annual Electric Rate ($/kWh)
Electric Rate ($/kWh)
$0.250
$0.200
$0.150
$0.100
$0.050
$0.000
Feb-09
Mar-09
Apr-09
May-09
Jun-09
Jul-09
Aug-09
Sep-09
Oct-09
Nov-09
Dec-09
Jan-10
Date (Month-Year)

7. METHOD OF ANALYSIS

7.1 Assumptions and tools

Energy modeling tool: established / standard industry assumptions, E-Quest
Cost estimates: RS Means 2009 (Facilities Maintenance & Repair Cost Data)
RS Means 2009 (Building Construction Cost Data)
RS Means 2009 (Mechanical Cost Data)
Published and established specialized equipment material and labor costs
Cost estimates also based on utility bill analysis and prior experience with similar projects

7.2 Disclaimer

This engineering audit was prepared using the most current and accurate fuel consumption data available for the site. The estimates that it projects are intended to help guide the owner toward best energy choices. The costs and savings are subject to fluctuations in weather, variations in quality of maintenance, changes in prices of fuel, materials, and labor, and other factors. Although we cannot guarantee savings or costs, we suggest that you use this report for economic analysis of the building and as a means to estimate future cash flow.

THE RECOMMENDATIONS PRESENTED IN THIS REPORT ARE BASED ON THE RESULTS OF ANALYSIS, INSPECTION, AND PERFORMANCE TESTING OF A SAMPLE OF COMPONENTS OF THE BUILDING SITE. ALTHOUGH CODE-RELATED ISSUES MAY BE NOTED, SWA STAFF HAVE NOT COMPLETED A COMPREHENSIVE EVALUATION FOR CODE-COMPLIANCE OR HEALTH AND SAFETY ISSUES. THE OWNER(S) AND MANAGER(S) OF THE BUILDING(S) CONTAINED IN THIS REPORT ARE REMINDED THAT ANY IMPROVEMENTS SUGGESTED IN THIS SCOPE OF WORK MUST BE PERFORMED IN ACCORDANCE WITH ALL LOCAL, STATE, AND FEDERAL LAWS AND REGULATIONS THAT APPLY TO SAID WORK. PARTICULAR ATTENTION MUST BE PAID TO ANY WORK WHICH INVOLVES HEATING AND AIR MOVEMENT SYSTEMS, AND ANY WORK WHICH WILL INVOLVE THE DISTURBANCE OF PRODUCTS CONTAINING MOLD, ASBESTOS, OR LEAD.

Appendix A: Lighting Study

Location			Existing Fixture Information												Retrofit Information												Annual Savings		
Marker	Floor	Room Identification	Fixture Type	Ballast	Lamp Type	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Controls	Operational Hours per Day	Operational Days per Year	Ballast Wattage	Total Watts	Energy Use kWh/year	Category	Fixture Type	Lamp Type	Ballast	Controls	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Operational Hours per Day	Operational Days per Year	Ballast Watts	Total Watts	Energy Use kWh/year	Fixture Savings (kWh)	Controls Savings (kWh)	Total Savings (kWh)
1	1	Entrance Hallway (1)	Recessed	M	4'T12	1	2	40	S	9	260	15	95	222	T8	Recessed	4'T8	E	S	1	2	32	9	260	6	70	164	59	0	59
2	1	Office Area (2)	Recessed	M	4'T12	6	2	40	S	9	260	15	570	1,334	T8	Recessed	4'T8	E	S	6	2	32	9	260	6	420	983	351	0	351
3	1	Office Area (3)	Recessed	M	4'T12	5	2	40	S	9	260	15	475	1,112	T8	Recessed	4'T8	E	S	5	2	32	9	260	6	350	819	293	0	293
4	1	Office Area (2)	Exit Sign	N	inc	2	1	20	N	24	365	0	40	350	LEDex	Exit Sign	LED	N	N	2	1	5	24	365	1	12	105	245	0	245
5	1	ear Entrance Hallway	Exit Sign	N	inc	2	1	20	N	24	365	0	40	350	LEDex	Exit Sign	LED	N	N	2	1	5	24	365	1	12	105	245	0	245
6	1	ear Entrance Hallway	Recessed	M	4'T12	3	2	40	S	9	260	15	285	667	T8	Recessed	4'T8	E	OS	3	2	32	7	260	6	210	369	176	123	298
7	1	Office Bathroom (5)	2'U-shape	M	4'T12	2	2	40	S	9	260	15	190	445	T8	2'U-Shape	4'T8	E	OS	2	2	32	7	260	6	140	246	117	82	199
8	1	howers Men/storage (	Recessed	M	4'T12	2	4	40	S	9	260	24	368	861	T8	Recessed	4'T8	E	S	2	4	32	9	260	13	282	660	201	0	201
9	1	Lunch Rm (7)	Recessed	M	4'T12	6	4	40	S	9	260	24	1,104	2,583	T8	Recessed	4'T8	E	OS	6	4	32	7	260	13	846	1485	604	495	1099
10	1	Lunch Rm (7)	Exit Sign	N	inc	1	2	20	N	24	365	0	40	350	LEDex	Exit Sign	LED	N	N	1	1	5	24	365	1	6	53	298	0	298
11	1	Lunch Rm (7)	Exit Sign	N	inc	1	2	20	N	24	365	0	40	350	LEDex	Exit Sign	LED	N	N	1	1	5	24	365	1	6	53	298	0	298
12	1	Truck Bay (8)	Exit Sign	N	inc	1	1	20	N	9	260	0	20	47	LEDex	Exit Sign	LED	N	N	1	1	5	9	260	1	6	14	33	0	33
13	1	Truck Bay (8)	Exit Sign	N	inc	2	1	20	N	24	365	0	40	350	LEDex	Exit Sign	LED	N	N	2	1	5	24	365	1	12	105	245	0	245
14	1	Truck Bay (8)	Parabolic	M	8'T12	63	2	80	S	9	260	24	11,592	27,125	T8	Parabolic	8'T8	E	S	63	2	59	9	260	13	8253	19312	7813	0	7813
15	1	Truck Bay2 (8)	Parabolic	M	8'T12	3	2	80	S	9	260	24	552	1,292	T8	Parabolic	8'T8	E	S	3	2	59	9	260	13	393	920	372	0	372
16	2	Storage Rm (201)	Parabolic	M	8'T12	1	2	80	S	2	260	24	184	96	T8	Parabolic	8'T8	E	S	1	2	59	2	260	13	131	68	28	0	28
17	2	Storage Rm (202)	Parabolic	M	8'T12	1	2	80	S	2	260	24	184	96	T8	Parabolic	8'T8	E	S	1	2	59	2	260	13	131	68	28	0	28
18	2	Mechanical Rm (203)	Screw-in	N	Inc	1	1	60	S	2	260	0	60	31	CFL	Screw-in	CFL	N	S	1	1	20	2	260	0	20	10	21	0	21
19	2	Storage Rm (204)	Parabolic	M	8'T12	2	2	80	S	2	260	24	368	191	T8	Parabolic	8'T8	E	S	2	2	59	2	260	13	262	136	55	0	55
20	2	Storage Rm (205)	Parabolic	M	8'T12	1	2	80	S	2	260	24	184	96	T8	Parabolic	8'T8	E	S	1	2	59	2	260	13	131	68	28	0	28
21	1	Men's Locker Room (9	Recessed	M	4'T12	4	4	40	T	9	260	24	736	1,722	T8	Recessed	4'T8	E	T	4	4	32	9	260	13	564	1320	402	0	402
22	1	Bathroom (10)	Recessed	M	4'T12	2	4	40	OS	9	260	24	368	861	T8	Recessed	4'T8	E	OS	2	4	32	9	260	13	282	660	201	0	201
23	1	Mechanical Rm ()	Parabolic	M	4'T12	1	1	40	S	2	260	12	52	27	T8	Parabolic	4'T8	E	S	1	1	32	2	260	3	35	18	9	0	9
24	1	Mechanical Rm ()	Screw-in	N	Inc	1	1	100	S	2	260	0	100	52	CFL	Screw-in	CFL	N	S	1	1	35	2	260	0	35	18	34	0	34
25	Ext	terior - garage wall lo	Exterior	N	MH	6	1	70	T	12	365	18	528	2,313	PSMH	Exterior	PSMH	N	T	6	1	45	12	365	10	330	1445	867	0	867
26	Ext	erior - garage wall hig	Exterior	N	MH	2	1	400	T	12	365	100	1,000	4,380	PSMH	Exterior	PSMH	N	T	2	1	275	12	365	59	668	2926	1454	0	1454
27	Ext	terior - office wall hig	Exterior	N	MH	2	1	175	T	12	365	44	438	1,918	PSMH	Exterior	PSMH	N	T	2	1	115	12	365	25	280	1226	692	0	692
28	Ext	gas station ()	Exterior	N	MH	2	1	320	S	12	365	81	802	3,513	MH	Exterior	MH	N	S	2	1	320	12	365	81	802	3513	0	0	0
29	Ext	parking lot ()	Exterior	N	MH	7	1	1000	S	4	260	80	7,560	7,862	MH	Exterior	MH	N	S	7	1	1000	4	260	80	7560	7862	0	0	0
30	Ext	ballfield ()	Exterior	N	MH	24	1	1000	S	3	63	80	25,920	4,899	MH	Exterior	MH	N	S	24	1	1000	3	63	80	25920	4899	0	0	0
Totals:						**157**	**55**	**4,125**				**730**	**53,935**	**65,496**						**157**	**53**	**3,514**			**504**	**48,169**	**49,629**	**15,167**	**700**	**15,867**

Proposed Lighting Summary Table			
Total Surface Area (SF)	11,036		
Average Power Cost ($/kWh)	0.1750		
Exterior Lighting	**Existing**	**Proposed**	**Savings**
Exterior Annual Consumption (kWh)	24,885	21,872	**3,013**
Exterior Power (watts)	36,248	35,560	**688**
Total Interior Lighting	**Existing**	**Proposed**	**Savings**
Annual Consumption (kWh)	40,611	27,758	**15,867**
Lighting Power (watts)	17,687	12,609	**5,078**
Lighting Power Density (watts/SF)	1.60	1.14	**0.46**
Estimated Cost of Fixture Replacement ($)	27,120		
Estimated Cost of Controls Improvements ($)	600		
Total Consumption Cost Savings ($)	**4,232**		

Legend:

Fixture Type	Lamp Type	Control Type	Ballast Type	Retrofit Category
Exit Sign	LED	N (None)	N/A (None)	N/A (None)
Screw-in	Inc (Incandescent)	S (Switch)	E (Electronic)	T8 (Installl new T8)
Pin	1'T5	OS (Occupancy Sensor)	M (Magnetic)	T5 (Install new T5)
Parabolic	2'T5	T (Timer)		CFL (Install new CFL)
Recessed	3'T5	PC (Photocell)		LEDex (Install new LED Exit)
2'U-shape	4'T5	D (Dimming)		LED (Install new LED)
Circiline	2'T8	DL (Daylight Sensor)		D (Delamping)
Exterior	3'T8	M (Microphonic Sensor)		C (Controls Only)
HID (High Intensity Discharge)	4'T8			
	6'T8			
	8'T8			
	2'T12			
	3'T12			
	4'T12			
	6'T12			
	8'T12			
	CFL (Compact Fluorescent Lightbulb)			
	MR16			
	Halogen			
	MV (Mercury Vapor)			
	MH (Metal Halide)			
	HPS (High Pressure Sodium			
	LPS (Low Pressure Sodium)			

Appendix B: Third Party Energy Suppliers (ESCOs)
http://www.state.nj.us/bpu/commercial/shopping.html

JCP&L ELECTRICAL SERVICE TERRITORY Last Updated: 06/15/09		
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095 (800) 437-7872 www.hess.com	**BOC Energy Services, Inc.** 575 Mountain Avenue Murray Hill, NJ 07974 (800) 247-2644 www.boc.com	**Commerce Energy, Inc.** 4400 Route 9 South, Suite 100 Freehold, NJ 07728 (800) 556-8457 www.commerceenergy.com
Constellation NewEnergy, Inc. 900A Lake Street, Suite 2 Ramsey, NJ 07446 (888) 635-0827 www.newenergy.com	**Direct Energy Services, LLC** 120 Wood Avenue Suite 611 Iselin, NJ 08830 (866) 547-2722 www.directenergy.com	**FirstEnergy Solutions Corp.** 300 Madison Avenue Morristown, NJ 07962 (800) 977-0500 www.fes.com
Glacial Energy of New Jersey, Inc. 207 LaRoche Avenue Harrington Park, NJ 07640 (877) 569-2841 www.glacialenergy.com	**Integrys Energy Services, Inc.** 99 Wood Ave, South, Suite 802 Iselin, NJ 08830 (877) 763-9977 www.integrysenergy.com	**Liberty Power Delaware, LLC** Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663 (866) 769-3799 www.libertypowercorp.com
Liberty Power Holdings, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663 (866) 769-3799 www.libertypowercorp.com	**Pepco Energy Services, Inc.** 112 Main St. Lebanon, NJ 08833 (800) ENERGY-9 (363-7499) www.pepco-services.com	**PPL EnergyPlus, LLC** 811 Church Road Cherry Hill, NJ 08002 (800) 281-2000 www.pplenergyplus.com
Sempra Energy Solutions The Mac-Cali Building 581 Main Street, 8th Floor Woodbridge, NJ 07095 (877) 273-6772 www.semprasolutions.com	**South Jersey Energy Company** One South Jersey Plaza Route 54 Folsom, NJ 08037 (800) 800-756-3749 www.south jerseyenergy.com	**Suez Energy Resources NA, Inc.** 333 Thornall Street 6th Floor Edison, NJ 08837 (888) 644-1014 www.suezenergyresources.com
UGI Energy Services, Inc. 704 East Main Street Suite 1 Moorestown, NJ 08057 (856) 273-9995 www.ugienergyservices.com		

PSE&G NATURAL GAS SERVICE TERRITORY Last Updated: 06/15/09		
Cooperative Industries 412-420 Washington Avenue Belleville, NJ 07109 800-6BUYGAS (6-289427) www.cooperativenet.com	**Direct Energy Services, LLP** 120 Wood Avenue, Suite 611 Iselin, NJ 08830 866-547-2722 www.directenergy.com	**Dominion Retail, Inc.** 395 Highway 170 - Suite 125 Lakewood, NJ 08701 866-275-4240 http://retail.dom.com
Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701 800-805-8586 www.gesc.com	**UGI Energy Services, Inc. d/b/a GASMARK** 704 East Main Street, Suite 1 Moorestown, NJ 080111 856-273-9995 www.ugienergyservices.com	**Great Eastern Energy** 116 Village Riva, Suite 200 Princeton, NJ 08540 888-651-4121 www.greateastern.com
Hess Energy, Inc. One Hess Plaza Woodbridge, NJ 07095 800-437-7872 www.hess.com	**Hudson Energy Services, LLC** 920 Route 17 South Ridgewood, NJ 07450 877- Hudson 9 www.hudsonenergyservices.com	**Intelligent Energy** 2050 Center Avenue, Suite 500 Fort Lee, NJ 07024 800-724-1880 www.intelligentenergy.org
Keil & Sons 1 Bergen Blvd. Fairview, NJ 07002 1-877-Systrum www.systrumenergy@aol.com	**Metromedia Energy, Inc.** 6 Industrial Way Eatontown, NJ 07724 877-750-7046 www.metromediaenergy.com	**Metro Energy Group, LLC** 14 Washington Place Hackensack, NJ 07601 888-111-Metro www.metroenergy.com
MxEnergy, Inc. 510 Thornall Street, Suite 270 Edison, NJ 088327 800-375-1277 www.mxenergy.com	**NATGASCO (Mitchell Supreme)** 1112 Freeman Street Orange, NJ 07050 800-840-4GAS www.natgasco.com	**Pepco Energy Services, Inc.** 112 Main Street Lebanon, NJ 08833 800-363-7499 www.pepco-services.com
PPL EnergyPlus, LLC 811 Church Road - Office 105 Cherry Hill, NJ 08002 800-281-2000 www.pplenergyplus.com	**Sempra Energy Solutions** The Mac-Cali Building 581 Main Street, 8th fl. Woodbridge, NJ 07095 877-273-6772 800-2 SEMPRA www.semprasolutions.com	**South Jersey Energy Company** One South Jersey Plaza, Route 54 Folsom, NJ 08037 800-756-3749 www.sjindustries.com/sje.htm
Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 011128 800-225-1560 www.spragueenergy.com	**Stuyvesant Energy LLC** 10 West Ivy Lane, Suite 4 Englewood, NJ 07631 800-646-64111 www.stuyfuel.com	**Woodruff Energy** 73 Water Street Bridgeton, NJ 08302 800-5111-1121 www.woodruffenergy.com

Appendix C: Glossary and Method of Calculations & Glossary of ECM Terms

Net ECM Cost: The net ECM cost is the cost experienced by the customer, which is typically the total cost (materials + labor) of installing the measure minus any available incentives. Both the total cost and the incentive amounts are expressed in the summary for each ECM.

Annual Energy Cost Savings (AECS): This value is determined by the audit firm based on the calculated energy savings (kWh or Therm) of each ECM and the calculated energy costs of the building.

Lifetime Energy Cost Savings (LECS): This measure estimates the energy cost savings over the lifetime of the ECM. It can be a simple estimation based on fixed energy costs. If desired, this value can factor in an annual increase in energy costs as long as the source is provided.

Simple Payback: This is a simple measure that displays how long the ECM will take to break-even based on the annual energy and maintenance savings of the measure.

ECM Lifetime: This is included with each ECM so that the owner can see how long the ECM will be in place and whether or not it will exceed the simple payback period. Additional guidance for calculating ECM lifetimes can be found below. This value can come from manufacturer's rated lifetime or warranty, the ASHRAE rated lifetime, or any other valid source.

Operating Cost Savings (OCS): This calculation is an annual operating savings for the ECM. It is the difference in the operating, maintenance, and / or equipment replacement costs of the existing case versus the ECM. In the case where an ECM lifetime will be longer than the existing measure (such as LED lighting versus fluorescent) the operating savings will factor in the cost of replacing the units to match the lifetime of the ECM. In this case or in one where one-time repairs are made, the total replacement / repair sum is averaged over the lifetime of the ECM.

Return on Investment (ROI): The ROI is expresses the percentage return of the investment based on the lifetime cost savings of the ECM. This value can be included as an annual or lifetime value, or both.

Net Present Value (NPV): The NPV calculates the present value of an investment's future cash flows based on the time value of money, which is accounted for by a discount rate (assumes bond rate of 3.2%).

Internal Rate of Return (IRR): The IRR expresses an annual rate that results in a break-even point for the investment. If the owner is currently experiencing a lower return on their capital than the IRR, the project is financially advantageous. This measure also allows the owner to compare ECMs against each other to determine the most appealing choices.

Gas Rate and Electric Rate ($/therm and $/kWh): The gas rate and electric rate used in the financial analysis is the total annual energy cost divided by the total annual energy usage for the 12 month billing period studied. The graphs of the monthly gas and electric rates reflect the total monthly energy costs divided by the monthly usage, and display how the average rate fluctuates throughout the year. The average annual rate is the only rate used in energy savings calculations.

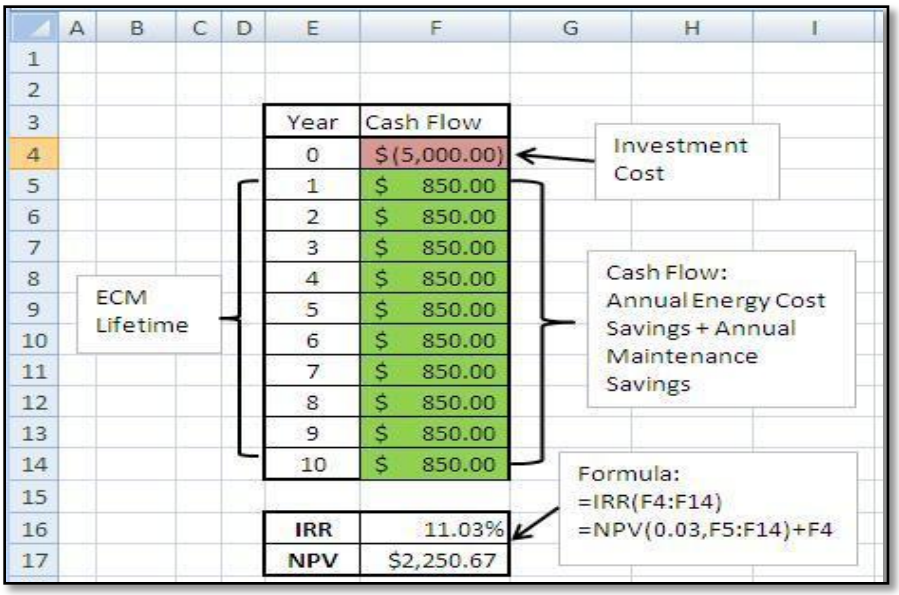
Calculation References

Term	Definition
ECM	Energy Conservation Measure
AOCS	Annual Operating Cost Savings
AECS	Annual Energy Cost Savings
LOCS*	Lifetime Operating Cost Savings
LECS	Lifetime Energy Cost Savings
LCS	Lifetime Cost Savings
NPV	Net Present Value
IRR	Internal Rate of Return
DR	Discount Rate
Net ECM Cost	Total ECM Cost – Incentive
LECS	AECS X ECM Lifetime
AOCS	LOCS / ECM Lifetime
LCS	LOCS+LECS
Simple Payback	Net ECM Cost / (AECS + AOCS)
Lifetime ROI	(LECS + LOCS – Net ECM Cost) / Net ECM Cost
Annual ROI	(Lifetime ROI / Lifetime) = [(AECS + OCS) / Net ECM Cost – (1 / Lifetime)]

* The lifetime operating cost savings are all avoided operating, maintenance, and/or component replacement costs over the lifetime of the ECM. This can be the sum of any annual operating savings, recurring or bulk (i.e. one-time repairs) maintenance savings, or the savings that comes from avoiding equipment replacement needed for the existing measure to meet the lifetime of the ECM (e.g. lighting change outs).

Excel NPV and IRR Calculation

In Excel, function =IRR (values) and =NPV(rate, values) are used to quickly calculate the IRR and NPV of a series of annual cash flows. The investment cost will typically be a negative cash flow at year 0 (total cost - incentive) with years 1 through the lifetime receiving a positive cash flow from the annual energy cost savings and annual maintenance savings. The calculations in the example below are for an ECM that saves $850 annually in energy and maintenance costs (over a 10 year lifetime) and takes $5,000 to purchase and install after incentives:



Solar PV ECM Calculation

There are several components to the calculation:

Costs:	Material of PV system including panels, mounting and net-metering + Labor
Energy Savings:	Reduction of kWh electric cost for life of panel, 25 years
Incentive 1:	NJ Renewable Energy Incentive Program (REIP), for systems of size 50kW or less, $1/Watt incentive subtracted from installation cost
Incentive 2:	Solar Renewable Energy Credits (SRECs) – Market-rate incentive. Calculations assume $600/Megawatt hour consumed per year for a maximum of 15 years; added to annual energy cost savings for a period of 15 years. (Megawatt hour used is rounded to nearest 1,000 kWh)
Assumptions:	A Solar Pathfinder device is used to analyze site shading for the building and determine maximum amount of full load operation based on available sunlight. When the Solar Pathfinder device is not implemented, amount of full load operation based on available sunlight is assumed to be 1,180 hours in New Jersey.

Total lifetime PV energy cost savings =
kWh produced by panel * [$/kWh cost * 25 years + $600/Megawatt hour /1000 * 15 years]

ECM and Equipment Lifetimes

Determining a lifetime for equipment and ECM's can sometimes be difficult. The following table contains a list of lifetimes that the NJCEP uses in its commercial and industrial programs. Other valid sources are also used to determine lifetimes, such as the DOE, ASHRAE, or the manufacturer's warranty.

Lighting is typically the most difficult lifetime to calculate because the fixture, ballast, and bulb can all have different lifetimes. Essentially the ECM analysis will have different operating cost savings (avoided equipment replacement) depending on which lifetime is used.

When the bulb lifetime is used (rated burn hours / annual burn hours), the operating cost savings is just reflecting the theoretical cost of replacing the existing case bulb and ballast over the life of the recommended bulb. Dividing by the bulb lifetime will give an annual operating cost savings.

When a fixture lifetime is used (e.g. 15 years) the operating cost savings reflects the avoided bulb and ballast replacement cost of the existing case over 15 years minus the projected bulb and ballast replacement cost of the proposed case over 15 years. This will give the difference of the equipment replacement costs between the proposed and existing cases and when divided by 15 years will give the annual operating cost savings.

New Jersey Clean Energy Program Commercial & Industrial Lifetimes

Measure	Life Span
Commercial Lighting — New	15
Commercial Lighting — Remodel/Replacement	15
Commercial Custom — New	18
Commercial Chiller Optimization	18
Commercial Unitary HVAC — New - Tier 1	15
Commercial Unitary HVAC — Replacement - Tier 1	15
Commercial Unitary HVAC — New - Tier 2	15
Commercial Unitary HVAC — Replacement Tier 2	15
Commercial Chillers — New	25
Commercial Chillers — Replacement	25
Commercial Small Motors (1-10 HP) — New or Replacement	20
Commercial Medium Motors (11-75 HP) — New or Replacement	20
Commercial Large Motors (76-200 HP) — New or Replacement	20
Commercial VSDs — New	15
Commercial VSDs — Retrofit	15
Commercial Comprehensive New Construction Design	18
Commercial Custom — Replacement	18
Industrial Lighting — New	15
Industrial Lighting — Remodel/Replacement	15
Industrial Unitary HVAC — New - Tier 1	15
Industrial Unitary HVAC — Replacement - Tier 1	15
Industrial Unitary HVAC — New - Tier 2	15
Industrial Unitary HVAC — Replacement Tier 2	15
Industrial Chillers — New	25
Industrial Chillers — Replacement	25
Industrial Small Motors (1-10 HP) — New or Replacement	20
Industrial Medium Motors (11-75 HP) — New or Replacement	20
Industrial Large Motors (76-200 HP) — New or Replacement	20
Industrial VSDs — New	15
Industrial VSDs — Retrofit	15
Industrial Custom — Non-Process	18
Industrial Custom — Process	10
Small Commercial Gas Furnace — New or Replacement	20
Small Commercial Gas Boiler — New or Replacement	20
Small Commercial Gas DHW — New or Replacement	10
C&I Gas Absorption Chiller — New or Replacement	25
C&I Gas Custom — New or Replacement (Engine Driven Chiller)	25
C&I Gas Custom — New or Replacement (Gas Efficiency Measures)	18
O&M savings	3
Compressed Air (GWh participant)	8