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January 29, 2010

Local Government Energy Program
Energy Audit Final Report

For

Byram Township DPW Garage
Stanhope, NJ 07828

Project Number: LGEA32

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INTRODUCTION

On October 15th and 28th Steven Winter Associates, Inc. (SWA) performed an energy audit and assessment for the Township of Byram municipal buildings. The audit included a review of the:

- Byram Township Municipal Building
- Byram Township Civic Center
- Byram Township Department of Public Works (DPW) Garage

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

This report addresses the Byram Township DPW Garage located at 10 Mansfield Drive, Stanhope, NJ 07874. 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 single-story Byram DPW Garage building was built in 1964, with renovations / additions circa 1985. The building houses an office for the DPW supervisor, trucks / machinery and repair shop, parts storage and 2 large truck bays; one holds 7 trucks, the other 6 trucks. The building consists of 10,650 square feet of conditioned space. The Byram DPW Garage building is occupied on weekdays by approximately 11 employees and staff (2 in the building at any one time) from 7:00 AM - 3:30 PM.

The goal of this Local Government Energy Audit (LGEA) is to provide sufficient information to the Township of Byram to make decisions regarding the implementation of the most appropriate and most cost effective energy conservation measures for the Byram Municipal building. SWA was informed that the Township of Byram is registered with Sustainable Jersey.

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. 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 Byram DPW Garage building located at 10 Mansfield Drive, Stanhope, NJ 07874. The Byram DPW Garage building is a single-story building with a floor area of 10,650 square feet. The original structure was built in 1964, with renovations / additions circa 1985.

Based on the field visits performed by the SWA staff on October 15th and 28th 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 October 2008 and September 2009 the Byram DPW Garage building consumed 60,920 kWh or $10,459 worth of electricity at an approximate rate of $0.172/kWh and 3,000 gallons or $5,289 worth of fuel oil #2 at an approximate rate of $1.763/gal. The joint energy consumption for the building, including both electricity and fuel oil #2, was 625 MMBtu of energy that cost a total of $15,748.

SWA has entered energy information about the Byram DPW Garage building in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. This (vehicle repair / service building) facility is comprised of non-eligible (Other) space type. SWA encourages the Township of Byram 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 Site Energy Use Intensity is 61 kBtu/ft^{2}yr compared to the national average of township vehicle repair / service building consuming 77 kBtu/ft^{2}yr. Implementing this report's recommendations will reduce use by approximately 18.7 kBtu/ft^{2}yr, which when implemented would make the building energy consumption much better than the national average. There may be energy procurement opportunities for the Byram DPW Garage building to reduce annual electric utility costs, which are $1,321 higher, when compared to the average estimated NJ commercial utility rates.

Based on the assessment of the Byram Municipal building, 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 CO / CO_2 detectors with alarms for the garage and office as a safety feature
- Replace overhead garage doors with new insulated units that maintain garage heat inside the building
- Select NEMA Premium motors when replacing motors at the end of their useful operating lives

Category II Recommendations: Operations and Maintenance

- Apply for a NJ state permit to burn approximately 1,000 gals / year of waste oil (mixed with fuel oil #2)
- Maintain / repair garage doors so that they fully close and are sealed all around
- Insulate and plug all penetrations. Insulate the exterior walls by adhering / attaching 2" polyiso boards to the interior CMU. This work can be done during the next major renovation.
- Maintain roofs and verify water is draining correctly
- Maintain downspouts - repair / install missing downspouts as needed
- Provide weather stripping / air sealing

- Repair / seal wall cracks and penetrations
- 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 **1** Energy Conservation Measure (ECM) for the Byram DPW Garage building that is summarized in the following Table 1. The total investment cost for this ECM with incentives is **$160**. SWA estimates a first year savings of **$53** with a simple payback of **3 years**. SWA estimates that implementing the highly recommended ECMs will reduce the carbon footprint of the Byram DPW Garage building by **356 lbs of CO_2/year**. SWA also recommends **2** ECMs with a total first year savings of **$44,703** that is summarized in Table 2.

There are various incentives that the Township of Byram could apply for that could also help lower the cost of installing the ECMs, such as enroll in the NJ SmartStart 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, to be rolled out soon, could also assist to cover 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 two tables summarize the proposed Energy Conservation Measures (ECM) and their economic relevance.

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	gallons fuel oil, 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 energy 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
1.1	replace (4) incandescent and halogen lamps with CFLs	RS Means, Lit Search, NJ Clean Energy Program	160	none at this time	160	260	0.1	0	0.02	9	53	5	267	3.0	67	13	20	83	356
	TOTALS		**160**	**0**	**160**	**260**	**0.1**	**0**	**0.02**	**9**	**53**	**-**	**267**	**3.0**	**-**	**-**	**-**	**83**	**356**

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	gallons fuel oil, 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 energy 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
2	install 50 kW PV rooftop system (with $1/W INCENTIVE and $600/1MWh SREC)	similar projects	375,000	50,000	325,000	56,721	50.0	0	18.2	0	43,356	25	747,900	7.5	130	5	11	236,531	77,708
1.2	replace (26) old style Metal Halide lamps with pulse start Metal Halide lamps	RS Means, Lit Search, NJ Clean Energy Program	14,820	650	14,170	6,961	2.9	0	0.5	150	1,347	15	20,209	10.5	43	3	5	1,684	9,537
	TOTALS		**389,820**	**50,650**	**339,170**	**63,682**	**52.9**	**0**	**18.7**	**150**	**44,703**	**-**	**768,110**	**7.6**	**-**	**-**	**-**	**238,215**	**87,244**

1. HISTORIC ENERGY CONSUMPTION

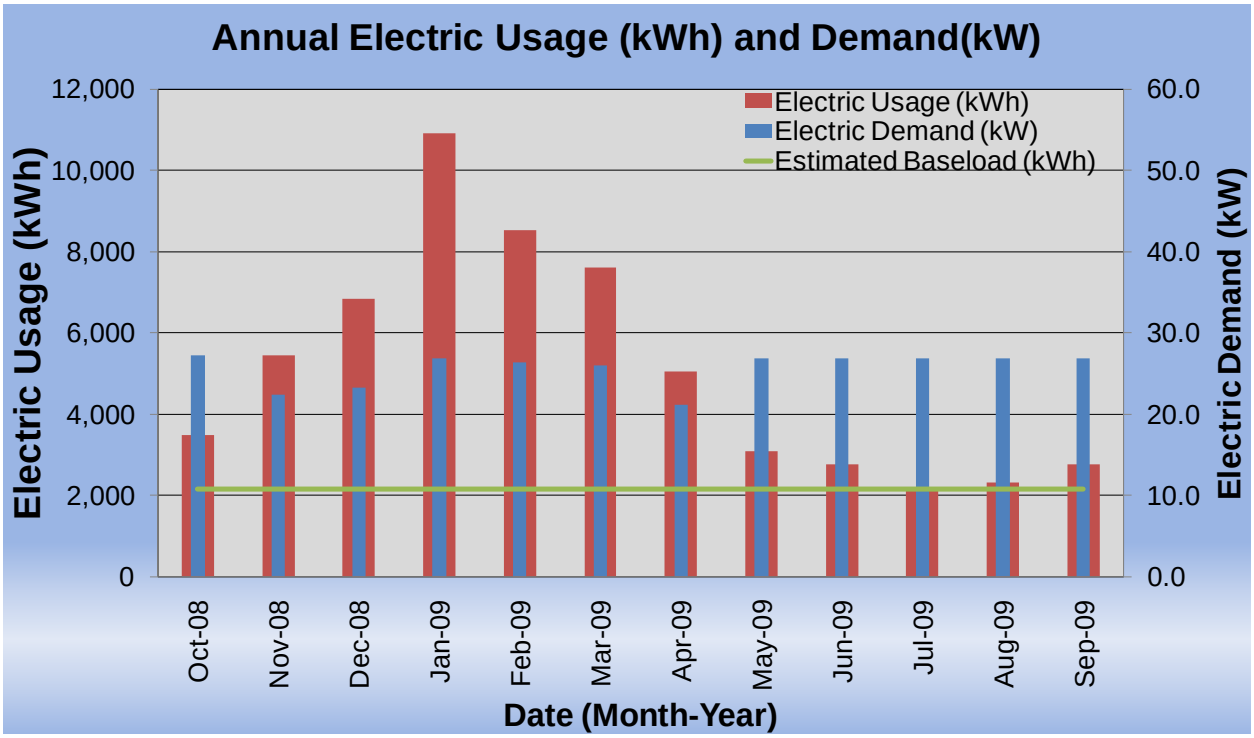
1.1. Energy usage and cost analysis

SWA analyzed utility bills from October 2007 through October 2009 that were received from the utility companies supplying the Byram Township DPW Garage with electric and fuel oil #2.

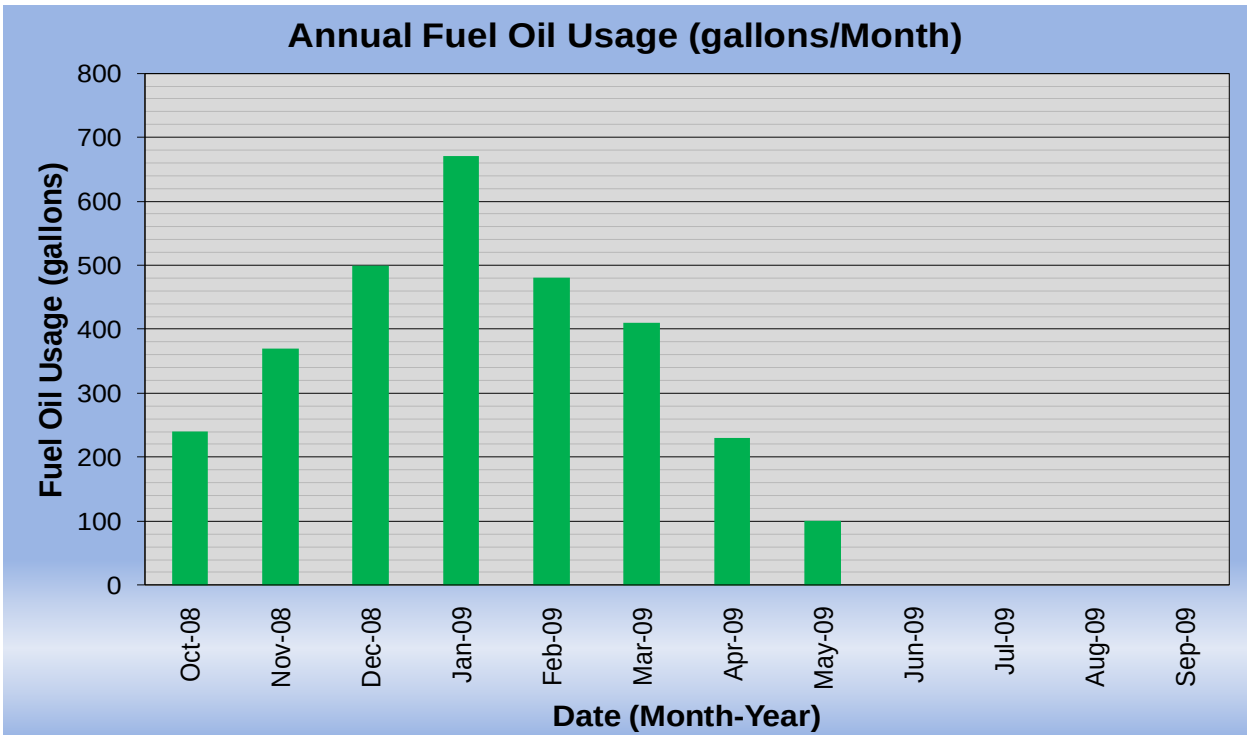
Electricity - The Byram Township DPW Garage is currently served by one electric meter. The Byram DPW Garage building currently buys electricity from JCP&L at **an average rate of $0.172/kWh** based on 12 months of utility bills from October 2008 and September 2009. The Byram DPW Garage building purchased **approximately 60,920 kWh or $10,459 worth of electricity** in the previous year. The average monthly demand was 26 kW.

Fuel oil #2 - The Byram Township DPW Garage is currently heated with fuel oil #2. The Byram Township DPW Garage currently buys fuel oil #2 from Finch Fuel Oil Co. at **an average aggregated rate of $1.763/gal** based on 12 months of utility bills for October 2008 and September 2009. The Byram Township DPW Garage purchased **approximately 3,000 gallons or $5,289 worth of fuel oil #2** in the previous year.

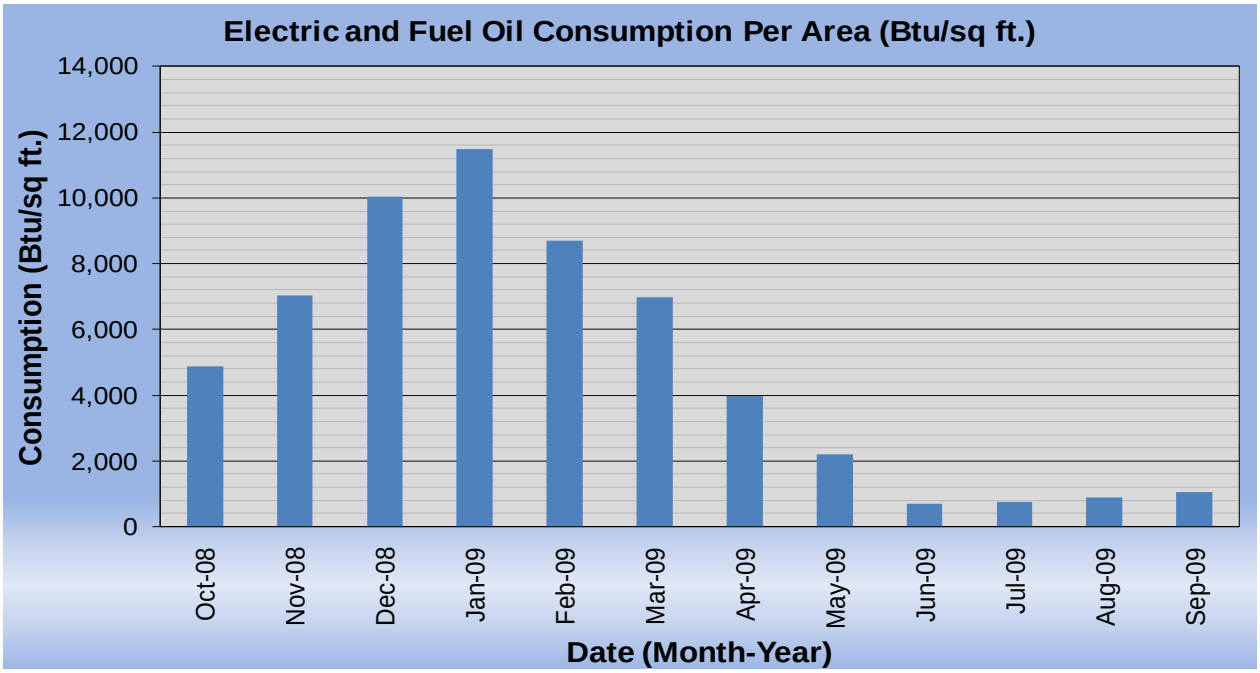
The following chart shows electricity use for the Byram DPW Garage building based on utility bills for the 12 month period of October 2008 and September 2009.



The following chart shows the fuel oil #2 consumption for the Byram DPW Garage building based on fuel oil #2 bills for the 12 month period of October 2008 and September 2009.

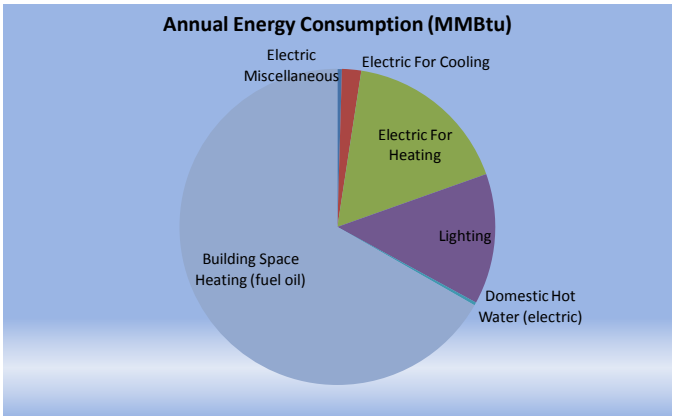


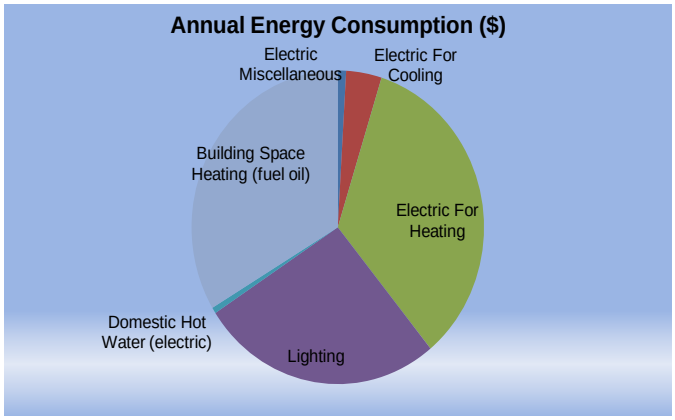
The following chart shows combined fuel oil #2 and electric consumption in Btu/sq ft for the Byram DPW Garage building based on utility bills for the 12 month period of October 2008 and September 2009.



The following table and chart pies show energy use for the Byram DPW Garage building based on utility bills for the 12 month period of October 2008 and September 2009. Note electrical cost at $50/MMBtu of energy is more than 4 times as expensive to use as fuel oil #2 at $13/MMBtu.

2009 Annual Energy Consumption / Costs					
	MMBtu	**% MMBtu**	**$**	**% $**	**$/MMBtu**
Electric Miscellaneous	3	0%	$144	1%	50
Electric For Cooling	12	2%	$618	4%	50
Electric For Heating	107	17%	$5,391	34%	50
Lighting	84	13%	$4,208	27%	50
Domestic Hot Water (Electric)	2	0%	$98	1%	50
Building Space Heating	417	67%	$5,289	34%	13
Totals	625	100%	$15,748	100%	25
Total Electric Usage	208	33%	$10,459	66%	50
Total Fuel Oil Usage	417	67%	$5,289	34%	13
Totals	625	100%	$15,748	100%	25





1.2. Utility rate

The Byram DPW Garage building currently purchases electricity from JCP&L at a general service market rate for electricity use (kWh) with a separate (kW) demand charge. The Byram DPW Garage building currently pays an average rate of approximately $0.172/kWh based on the 12 months of utility bills of October 2008 and September 2009.

The Byram DPW Garage building currently purchases fuel oil #2 supply from the Finch Fuel Oil Co. at a general delivered market rate for fuel oil #2 (gallons). Finch Fuel Oil Co. also acts as the delivery company. There is one 2,000 gal fuel oil tank that provides fuel oil #2 to the Byram DPW Garage building currently. The average aggregated rate (supply and delivery) for the fuel oil #2 is approximately $1.763/gal based on 12 months of utility bills for October 2008 and September 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 and tank level readings.

1.3. Energy benchmarking

SWA has entered energy information about the Byram DPW Garage building in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. This (vehicle repair / service building) facility is comprised of non-eligible (Other) space type. Vehicle repair / service building space or "Other" can be 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 Byram Garage building is not eligible to receive a national energy performance rating at this time.

The Site Energy Use Intensity is 61 kBtu/sq ft yr compared to the national average of a township vehicle repair / service building consuming 77 kBtu/sq ft yr. Implementing this report's highly recommended Energy Conservations Measures (ECMs) will reduce use by approximately 0.02 kBtu/sqft yr, with an additional 18.7 kBtu/sq ft yr from the recommended ECMs, which when implemented would make the building energy consumption much better than the national average.

Per the LGEA program requirements, SWA has assisted the Township of Byram to create an *Energy Star Portfolio Manager* account and share the Byram DPW Garage 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 Byram (user name of "byramtwp" with a password of "byramtwp") and TRC Energy Services (user name of TRC-LGEA).

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Township of Byram - Municipal Garage

Building ID: 1938475
For 12-month Period Ending: September 30, 2009[1]
Date SEP becomes ineligible: N/A
Date SEP Generated: December 08, 2009

Facility
Township of Byram - Municipal Garage
10 Mansfield Drive
Stanhope, NJ 07874

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 1964
Gross Floor Area (ft²): 10,650

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

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	206,151
Fuel Oil (No. 2) (kBtu)	443,810
Natural Gas - (kBtu)[4]	0
Total Energy (kBtu)	649,961

Energy Intensity[5]

Site (kBtu/ft²/yr)	61
Source (kBtu/ft²/yr)	107

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	64

Electric Distribution Utility
FirstEnergy - Jersey Central Power & Lt Co

National Average Comparison

National Average Site EUI	77
National Average Source EUI	150
% Difference from National Average Source EUI	-29%
Building Type	Service (Vehicle Repair/Service, Postal Service)

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 regional variation 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 single-story Byram DPW Garage building was built in 1964, with renovations / additions (of the back truck bays) circa 1985. The building houses an office for the DPW supervisor, trucks / machinery and repair shop, parts storage and 2 large truck bays; one holds 7 trucks, the other 6 trucks. The building has one sink and is without bathrooms (located in an adjacent building). The building consists of 10,650 square feet of conditioned space.

2.2. Building occupancy profiles

Occupancy for the entire Byram DPW Garage building is approximately 11 employees and staff (2 in the building at any one time) from 7:00 AM - 3:30 PM, or 40-50 hrs per week depending on workload.

2.3. Building envelope

2.3.1.Exterior Walls

The exterior envelope wall consists of a steel frame structure with CMU (Concrete Masonry Unit) or metal panel infill. The metal panel façade over metal studs were found to be in good condition. CMU parts of the walls showed some signs of deterioration caused by moisture, especially on the wood casings. The field auditors also discovered a rough spot of broken masonry around a window opening as well as water damage and cracked bricks by the transition from CMU to the metal panel.

Signs of deterioration of the wood casings and a masonry rough spot were found

SWA recommends filling-in the masonry rough spot to prevent moisture or water penetration into wall cavity. Further investigation should be done to determine the cause of the steel lintel deterioration. To eliminate surface water problems and enhance the architectural appeal, the exposed CMU could be finished with metal panels to match the already installed. There wasn't any wall insulation detected during the site visit. SWA recommends insulating the exterior walls of the structure by adhering / attaching 2" polyiso boards (Polyisocyanurate) to the interior CMU or stud face.

2.3.2.Roof

The originally flat roof was replaced with a gable type in 2002. 6-8" of insulation was also installed then and found to be in good condition. Asphalt shingles are in age appropriate condition without signs or reports of leaking. Insulation levels were determined to be appropriate, given the building's use and hours of operation.

2.3.3.Base

The building's base is a 4" concrete slab-on grade with a perimeter footing and without stem walls. No water seepage through the slab or other issues related to thermal performance were detected.

2.3.4.Windows

In 2004, the single pane windows were replaced with double glazed vinyl type windows. The windows are primarily operable double hung units and tight air seals. There wasn't any low-e coating detected, but otherwise, windows were found to be in good condition.

The window air conditioning unit was inspected and found to be in need of proper gasketing and air sealing.

Window air conditioning unit found without proper seals and gaskets

SWA recommends that the opening around the window air conditioning unit be upgraded with airtight gaskets / sealing for optimal performance.

2.3.5.Exterior doors

The new vinyl office door, installed in 2009 is in good condition. The insulated over-head type doors for the garage bays showed signs of wear and tear. Other doors were found to have worn or missing weather stripping.

Door showing worn weather stripping and over-head type door without a base gasket

SWA recommends new insulated garage doors to help reduce winter heating costs, given the extensive use of overhead doors during winter months.

2.3.6. Building air tightness

In addition to the above mentioned recommendations SWA suggests air sealing, caulking and / or insulating around all plumbing, electrical, HVAC and structural envelope penetrations. This should include bottom and top plates, recessed light fixtures, electrical boxes and window sleeved air conditioner units.

The air tightness of buildings helps to maximize other implemented energy measures and investments and minimizes long term maintenance and repair cost.

2.4. HVAC Systems

The Byram Township DPW Garage is heated by two oil fired hot air furnaces with cooling and ventilation provided by cross drafts via open doors and windows.

2.4.1. Heating

The Garage workspace and truck bay heating is provided by a Quaker oil fired hot air furnace and distribution ductwork. The furnace was installed in 2003 and has 70% expected life still left on it.

The Garage office and the mechanics bay (next to it) heating are provided by a COX HO300 oil fired hot air furnace and distribution ductwork. The furnace was installed in 2008 and has 95% expected life still left on it.

Programmable thermostats with lock boxes control temperature settings for the two zones.

2.4.2. Cooling

The Byram Township DPW Garage building does not have cooling systems, except for a small window air conditioner sleeved into the supervisor's office wall.

2.4.3. Ventilation

The Byram Garage building ventilation is achieved by natural cross draft ventilation via open doors and windows. SWA recommends installation of CO / CO_2 detectors with alarms for the garage and office as a safety feature.

2.4.4. Domestic Hot Water

The domestic hot water (DHW) for the Byram DPW Garage sink (located next to the office) is provided by a Whirlpool electric heater with 6 gal storage and one 1,650 Watt electric coil. This heater has 77% estimated useful operating life left and appears in satisfactory condition.

2.5. Electrical systems

2.5.1. Lighting

Interior Lighting - The Byram DPW Garage building currently consists of T12, T8 and CFL fluorescent fixtures, metal halide and halogen lamps for the work spaces. Based on measurements of lighting levels for each space, there are not any vastly over-illuminated areas. SWA recommends replacing T12 fixtures and magnetic ballasts with T8 fixtures and electronic ballasts if cost justified and replacing incandescent and halogen lamps with CFLs. SWA recommends replacing the Metal Halide lamps with pulse start Metal Halide lamps. Pulse-start metal halide (MH) lamps offer the advantages of standard (probe-start) MH lamps, but minimize the disadvantages. They 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 one-to-one substitution of lower-wattage systems, or by taking advantage of higher light output and reducing the number of fixtures required in the space. 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 LED type.

Exterior Lighting - The exterior lighting surveyed during the building audit was found to be a mix of CFL and Metal Halide fixtures. SWA recommends, as with the interior, replacing the Metal Halide lamps with pulse start Metal Halide lamps. Exterior lighting is controlled by timers. SWA is not recommending at this time any upgrades to the exterior timers.

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.

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. fridges, coffee makers, televisions, etc) be plugged in to power strips and turned off each evening just as the lights are turned off. The Byram Township DPW Garage computer is NOT programmed for the power save mode, to shut down after a period of time that it has not been used.

2.5.3. Elevators

The Byram Township DPW Garage is a single-story building without elevators.

2.5.4. Others electrical systems

Except for a 100 kVA emergency back-up[generator, there are not currently any other significant energy impacting electrical systems installed at the Byram DPW Garage.

3. EQUIPMENT LIST

Inventory

Building System	Description	Location	Model #	Fuel	Space Served	Year Equip Installed	Estimated Remaining Useful Life %
heating	hot air furnace for mechanics bay and office	above office	COX HO300 - 300 Mbtu/h, 2.5 gph Beckett "AFG" oil burner; S/N K130095	Fuel Oil #2	DPW office and mechanics bay	2008	95%
heating	hot air furnace for truck bays	back of truck bays	Quaker NH0C250AK01 - 250 Mbtu/h; S/N Not available	Fuel Oil #2	DPW truck bays	2003	70%
DHW	6 gal domestic hot water heater	on top of metal closet next to office	Whirlpool, E1F6US017V, 1650 Watt lower element; S/N 0827J402124	Electric	office sink	2006	77%
generator	100 kVA	on the side of bldg	Kohler with John Deere engine 100ROZJ; S/N CD6059T428495	Diesel	DPW	2003	70%
oil tank	2,000 gal	outside bldg	Highland tank	Fuel Oil #2	DPW	2007	92%
lighting	See details - Appendix A	building	-	Electric	DPW	varies	varies, average 20%

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 Byram Township DPW Garage, SWA has separated the investment opportunities into three recommended categories:

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

Category I Recommendations: Capital Improvements

- Install CO / CO_2 detectors with alarms for the garage and office as a safety feature.

- Replace overhead garage doors with new insulated units that can properly close, seal and maintain garage heat inside the building. Based on similar projects, the installed estimated cost of an insulted truck door is $20,000.

- Install premium motors when replacements are required - Select NEMA Premium motors when replacing motors that have reached the end of their useful operating lives.

Category II Recommendations: Operations and Maintenance

- Apply for a NJ state permit to burn approximately 1,000 gals / year of waste oil (mixed with fuel oil #2) in the garage furnace rather than pay a hauler approximately $3,000 / year to remove it from site and dispose.

- Maintain / repair garage doors so that they fully close and are sealed all around.

- SWA recommends insulating the exterior walls of the structure by adhering / attaching 2" polyiso boards (Polyisocyanurate) to the interior CMU or stud face as funding becomes available. Especially, re-insulate the cinderblock block face of the building to prevent heat loss. This work can be done in several phases during the next major renovation.

- 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.

- Provide weather stripping / air sealing - SWA observed that exterior door weather-stripping in places was beginning to deteriorate. Doors and vestibules should be observed annually for deficient weather-stripping and replaced as needed. The perimeter of all window frames should also be regularly inspected and any missing or deteriorated caulking should be re-caulked to provide an unbroken seal around the window frames. Any other accessible gaps or penetrations in the thermal envelope penetrations should also be sealed with caulk or spray foam.

- Repair / seal wall cracks and penetrations - SWA recommends as part of the maintenance program to install proper flashing and seal wall penetrations wherever necessary in order to keep insulation dry and effective.

- 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 their 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
1.1 & 1.2	replace incandescent and halogen lamps with CFLs and Metal Halide with pulse Metal Halide fixtures
	Description of Recommended 5-10 Year Payback ECMs
2	install 50 kW PV rooftop system

ECM#1: *Building Lighting Upgrades*

Description:

On the days of the site visits, SWA completed a lighting inventory of the Byram DPW Garage building (see Appendix A). SWA recommends replacing T12 fixtures and magnetic ballasts with T8 fixtures and electronic ballasts if it is cost justified and replacing incandescent and halogen lamps with CFLs. SWA recommends replacing the Metal Halide lamps with pulse start Metal Halide lamps. Pulse-start metal halide (MH) lamps offer the advantages of standard (probe-start) MH lamps, but minimize the disadvantages. They 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 one-to-one substitution of lower-wattage systems, or by taking advantage of higher light output and reducing the number of fixtures required in the space. The labor in all these installations was evaluated using prevailing electrical contractor wages. The Township of Byram may decide to perform this work with in-house resources from its Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor, to obtain savings.

Installation cost:

Estimated installed cost: $15,410 (includes $10,000 of labor)
Source of cost estimate: RS *Means; Published and established costs, NJ Clean Energy Program;*

Economics (Some of the options considered with incentives):

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	gallons fuel oil, 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 energy 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
1.1	replace (4) incandescent and halogen lamps with CFLs	RS Means, Lit Search, NJ Clean Energy Program	160	none at this time	160	260	0.1	0	0.0	9	53	5	267	3.0	67	13	20	83	356
1.2	replace (26) old style Metal Halide lamps with pulse start Metal Halide lamps	RS Means, Lit Search, NJ Clean Energy Program	14,820	650	14,170	6,961	2.9	0	0.5	150	1,347	15	20,209	10.5	43	3	5	1,684	9,537
consider-ed, not proposed	replace (6) T12 with T8 fixtures	RS Means, Lit Search, NJ Clean Energy Program	1,260	180	1,080	347	0.1	0	0.0	9	68	15	1,027	15.8	<0	0	<0	<0	475
	TOTALS		**16,240**	**830**	**15,410**	**7,568**	**3.2**	**0**	**0.5**	**168**	**1,469**	**-**	**21,503**	**10.5**	**-**	**-**	**-**	**1,492**	**10,368**

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 2.5 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 $650.*
- *NJ Clean Energy - T5 and T8 lamps with electronic ballast in existing facilities ($10-30 per fixture, depending on quantity and lamps) Maximum incentive amount is $180.*

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#2: *Install 50 kW PV system*

Description:

Currently, the Byram DPW Garage building does not use any renewable energy systems. Renewable energy systems such as photovoltaic panels, can be mounted on the building roofs, 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 Byram further review installing a 50 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 Byram DPW Garage building is not eligible for a 30% federal tax credit. Instead, the Township of Byram 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.

There are many possible locations for a 50 kW PV installation on the building roofs and away from shade. A commercial multi-crystalline 230 Watts panel (37.0 volts, 8.24 amps) has 17.5 square feet of surface area (13.1 Watts per square foot). A 50 kW system needs approximately 217 panels, which would take up 3,804 square feet. The installation of a renewable Solar Photovoltaic power generating system could also serve as a good educational tool and exhibit for the community.

Installation cost:

Estimated installed cost: $325,000 (includes $162,500 of labor)
Source of cost estimate: Similar projects

Economics (with incentives):

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	gallons fuel oil, 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 energy 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
2	install 50 kW PV rooftop system (with $1/W INCENTIVE and $600/1MWh SREC)	similar projects	375,000	50,000	325,000	56,721	50.0	0	18.2	0	43,356	25	747,900	7.5	130	5	11	236,531	77,708

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 (230 Watts, model #ND-U230C1). 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 $50,000 for the Byram DPW Garage.

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 $33,600 / year has been incorporated in the above costs for the Township of Byram, 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

5. RENEWABLE AND DISTRIBUTED ENERGY MEASURES

5.1. Existing systems

There aren't currently any existing renewable energy systems.

5.2. Wind

Description:

Low wind velocities in the area do not make this site favorable for a Wind System installation.

5.3. Solar Photovoltaic

Pleases see the above recommended ECM#2.

5.4. Solar Thermal Collectors

Description:

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

Description:

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

5.6. Geothermal

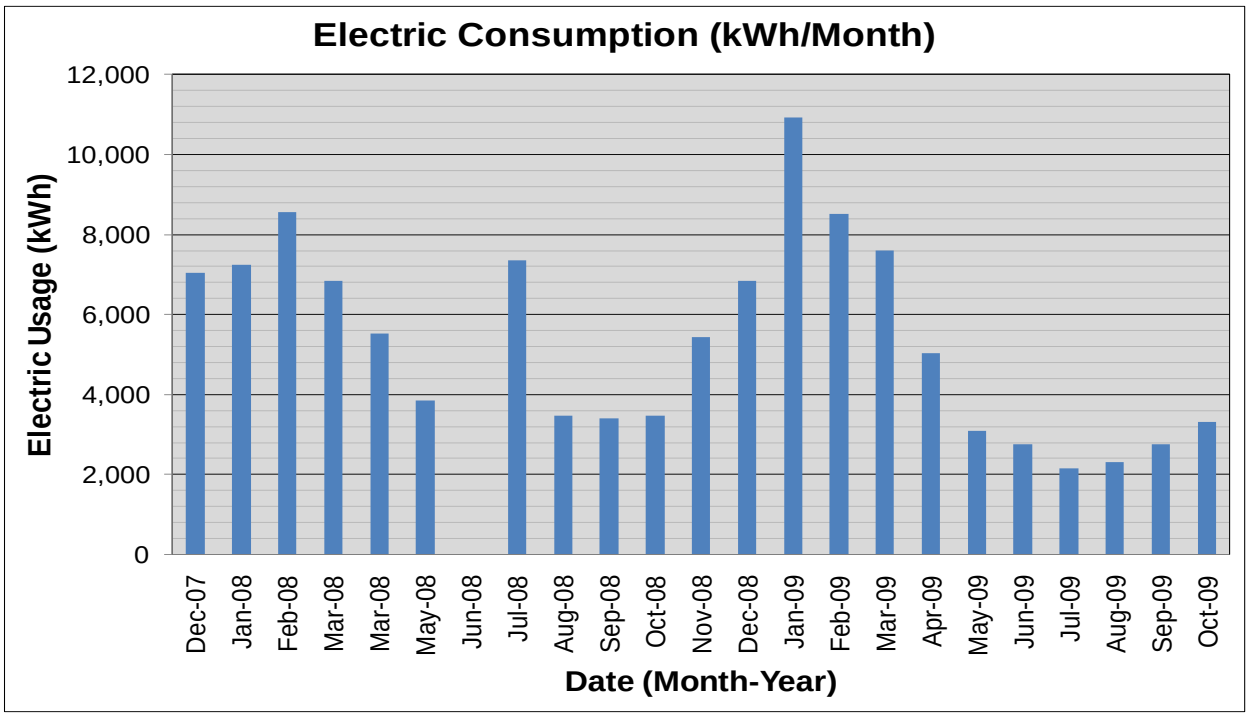
Description:

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.

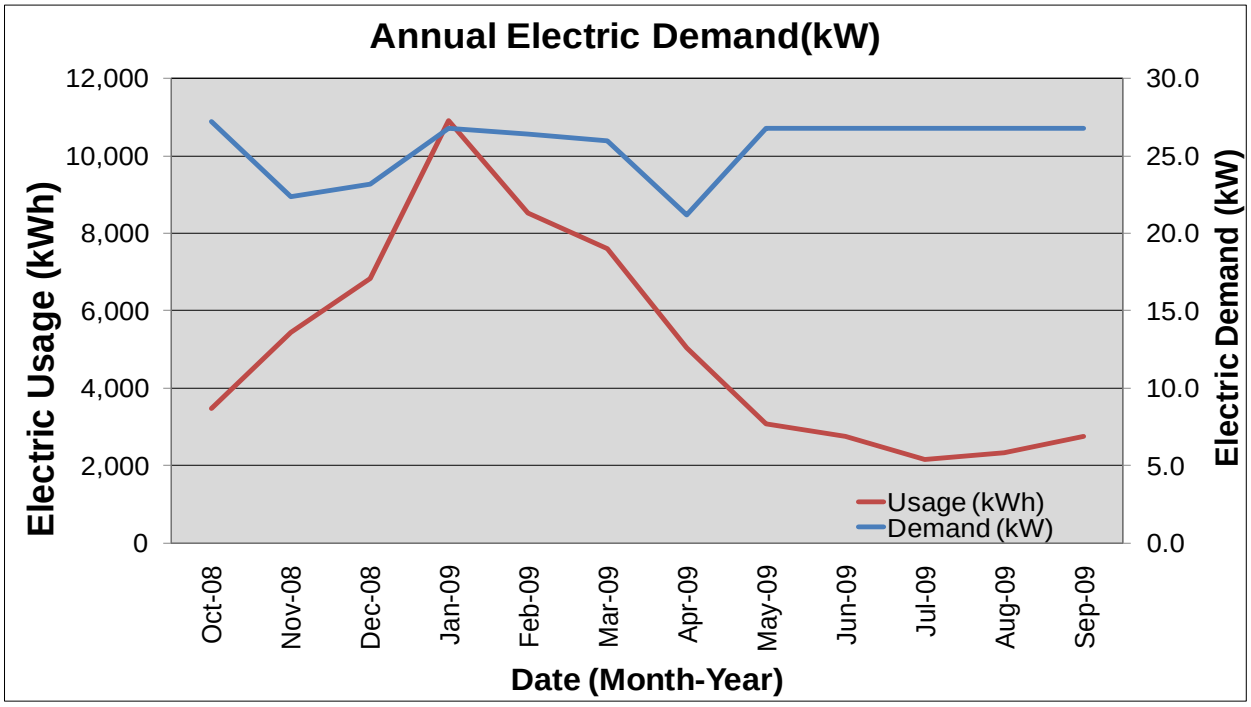
6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

6.1. Load profiles

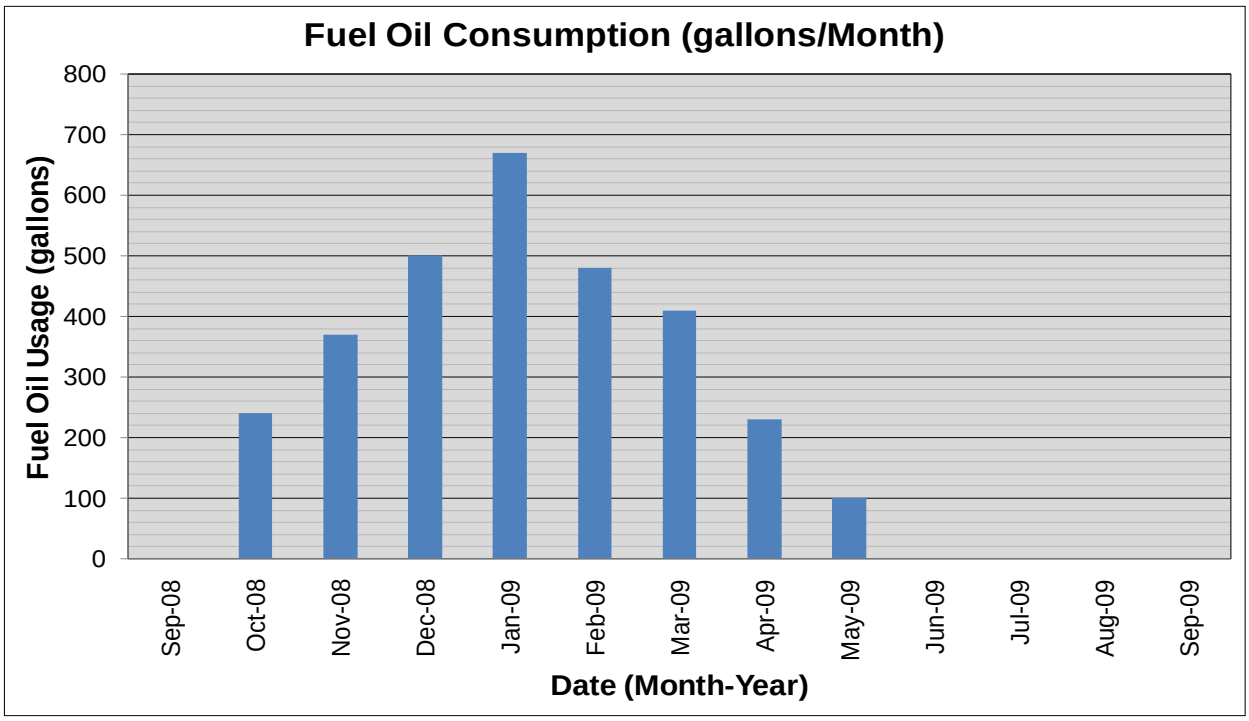
The following are charts that show the annual electric and fuel oil #2 load profiles for the Byram Township DPW Garage.

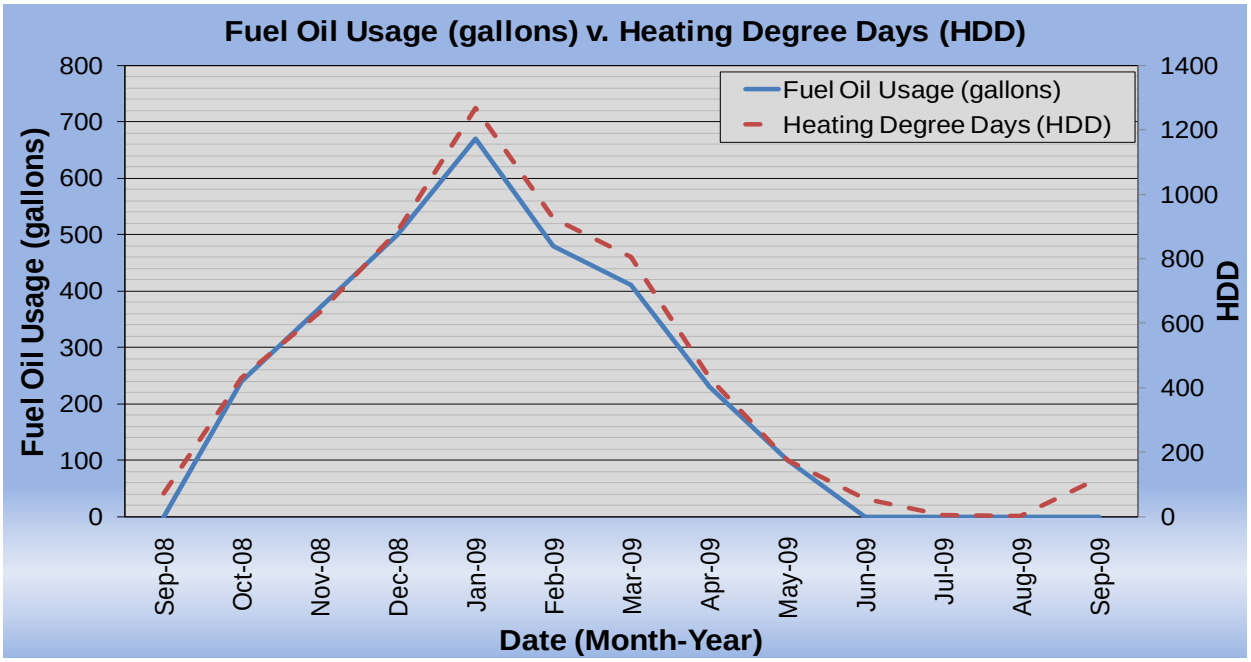


Some minor unusual electric fluctuations shown may be due to adjustments between estimated and actual meter readings. Also, note on the following chart how the electrical Demand peaks (except for a few unusual fluctuation anomalies) follow the electrical consumption and are a steady draw.



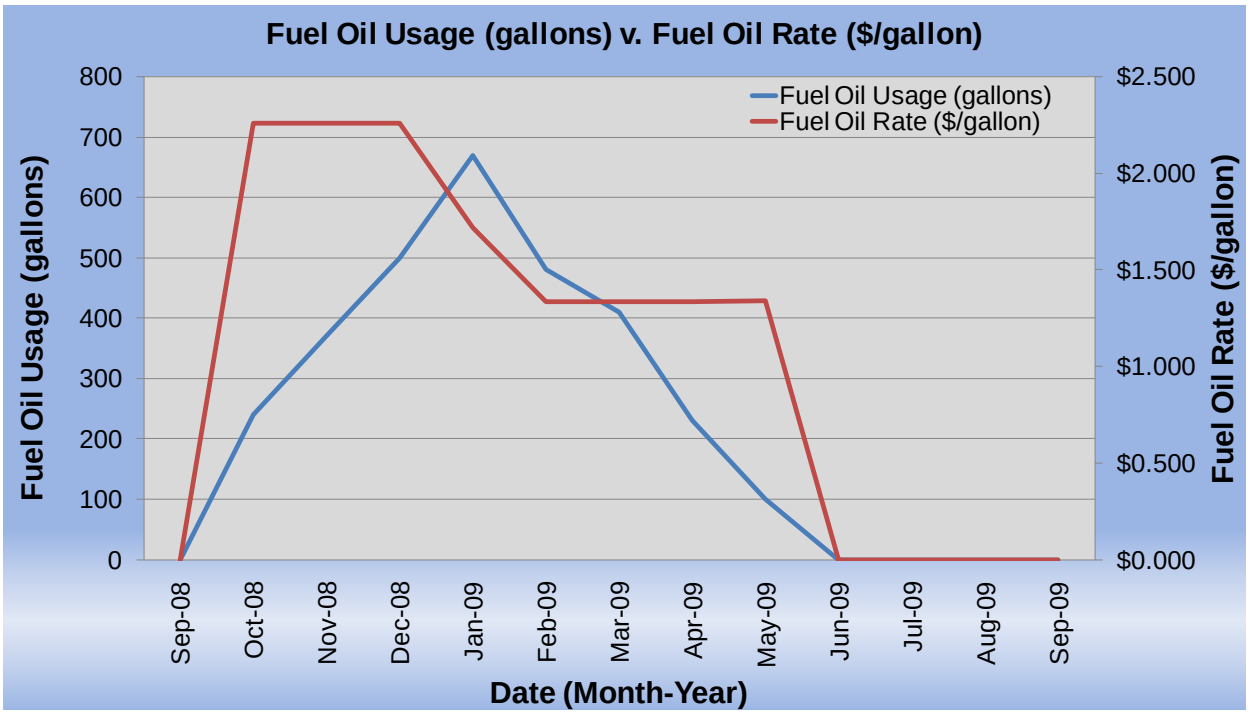
The following is a chart of the fuel oil #2 annual load profile for the building, peaking in the coldest months of the year and a chart showing fuel oil #2 consumption following the "heating degree days" curve. Some of the bills have more than one month estimated and combined charges.





6.2. Tariff analysis

Currently, fuel oil #2 is supplied and delivered to the Byram DPW Garage building by the Finch Fuel Oil Co. Fuel oil is provided by the Finch Fuel Oil Co. at a general service rate. Typically, the fuel oil #2 prices increase during the heating months when fuel oil #2 is used by boilers and furnaces. A recommended strategy is to fill up oil tanks (or commit to buying seasonal quantities ahead of time) during the summer when fuel oil prices are typically lower than during winter months.

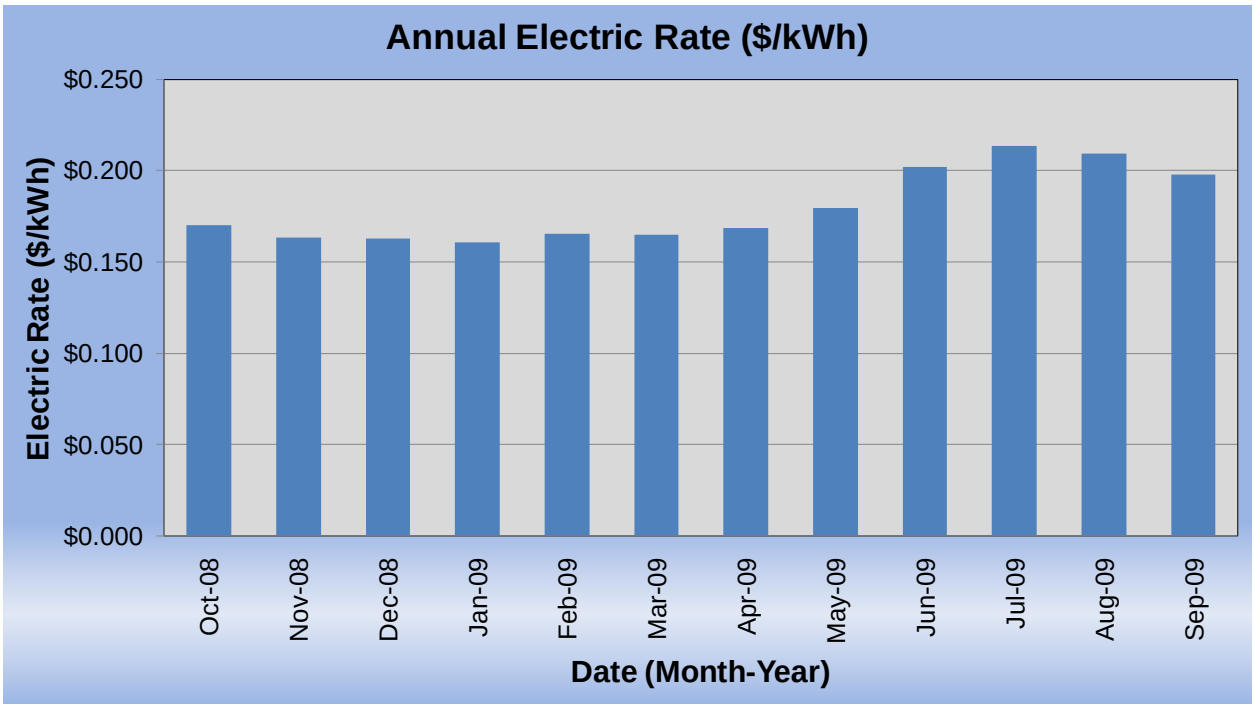


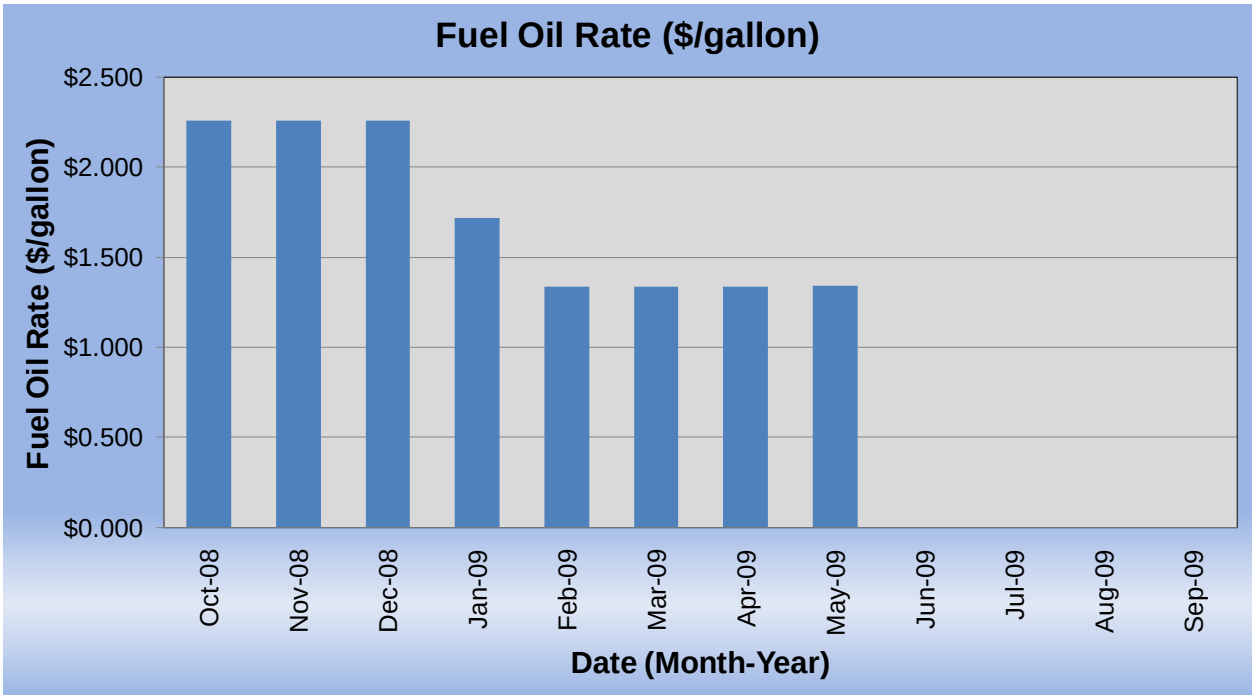
The Byram DPW Garage building is direct-metered and currently purchases electricity from JCP&L at a general service rate. The general service rate for electric charges are market-rate based on use and the Byram DPW Garage building billing does show a breakdown of demand costs. Demand prices are reflected 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 the HVAC condensing units and air handlers.

6.3. Energy Procurement strategies

SWA recommends that the Township of Byram evaluate engaging an ESCO for the energy procurement 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 Byram DPW Garage building from JCP&L without an ESCO. SWA analyzed the rates for fuel oil #2 and electricity supply over an extended period. Electric bill analysis shows fluctuations up to 25% over the most recent 12 month period. Fuel oil #2 bill analysis shows fluctuations up to 57% over the most recent 12 month period. Some of these fluctuations may have been caused by adjustments between estimated and actual meter and tank level readings, others may be due to unusual high and recent escalating energy costs. The average estimated NJ commercial electric utility rate is $0.150/kWh. The Byram DPW Garage building annual electric utility cost is $1,321 higher, when compared to the average estimated NJ commercial utility rates. SWA recommends that the Township of Byram further explore opportunities of purchasing both fuel oil #2 and electricity from ESCOs in order to reduce rate fluctuation and ultimately reduce the annual cost of energy for the Byram DPW Garage. Appendix B contains a complete list of third party energy suppliers for the Byram Township service area. The Township of Byram may want to consider partnering with other school districts, municipalities, townships and communities to aggregate a substantial electric and fuel oil #2 usage for better leveraging in negotiations with 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 Byram DPW Garage 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. Demand Response could be an option in the future when the Township of Byram may install a large enough back-up emergency generator. The following charts show the Byram DPW Garage building monthly spending per unit of energy in 2009.





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	GF	Office	Parabolic	M	4'T12	3	2	40	S	8	261	15	255	595	T8	Parabolic	4'T8	E	S	3	2	32	8	261	6	198	438	157	0	157
2	GF	Mechanical Rm	Screw-in	N	Inc	1	1	40	S	2	261	0	40	21	CFL	Screw-in	CFL	N	S	1	1	15	2	261	0	15	8	13	0	13
3	GF	Garage	HID	N	MH	6	1	400	S	5	261	100	2,500	3,915	PSMH	HID	PSMH	N	S	6	1	275	5	261	59	1,709	2,615	1,300	0	1,300
4	GF	Garage	Exit Sign	N	LED	1	1	5	S	24	365	1	6	53	N/A	Exit Sign	LED	N	S	1	1	5	24	365	1	6	53	0	0	0
5	2	Office	Parabolic	M	4'T12	1	2	40	S	8	261	15	95	198	T8	Parabolic	4'T8	E	S	1	2	32	8	261	6	70	146	52	0	52
6	2	Office	Parabolic	M	4'T8	1	2	32	S	8	261	6	70	146	N/A	Parabolic	4'T8	N	S	1	2	32	8	261	6	70	146	0	0	0
7	2	Office	Screw-in	N	CFL	1	2	32	S	8	261	0	64	134	N/A	Screw-in	CFL	N	S	1	2	32	8	261	0	64	134	0	0	0
8	GF	Garage 2	HID	N	MH	5	1	400	S	5	261	100	2,100	3,263	PSMH	HID	PSMH	N	S	5	1	275	5	261	59	1,434	2,179	1,083	0	1,083
9	GF	Garage 2	HID	N	Hal	2	1	70	S	5	261	18	158	230	CFL	Screw-in	CFL	N	S	2	1	25	5	261	0	50	65	164	0	164
10	GF	Garage 2	Exit Sign	N	LED	1	1	5	S	24	365	1	6	53	N/A	Exit Sign	LED	N	S	1	1	5	24	365	1	6	53	0	0	0
11	GF	Garage 2	HID	N	Hal	1	1	70	S	5	261	18	88	115	CFL	Screw-in	CFL	N	S	1	1	25	5	261	0	25	33	82	0	82
12	GF	Garage 2	Parabolic	E	8'T12	2	2	80	S	5	261	24	344	480	T8	Parabolic	8'T8	E	S	2	2	59	5	261	13	249	342	138	0	138
13	GF	Garage 3 rear	HID	E	MH	9	1	400	S	5	261	100	3,700	5,873	PSMH	HID	PSMH	E	S	9	1	275	5	261	59	2,534	3,923	1,950	0	1,950
14	GF	Garage 3 rear	Exit Sign	E	LED	2	1	5	S	24	365	1	11	105	N/A	Exit Sign	LED	E	S	2	1	5	24	365	1	11	105	0	0	0
15	Ext	Exterior	Exterior	E	MH	6	1	250	T	12	365	63	1,563	8,226	PSMH	Exterior	PSMH	E	T	6	1	175	12	365	38	1,088	5,598	2,628	0	2,628
16	Ext	Exterior	Exterior	E	CFL	11	1	23	T	12	365	0	253	1,108	N/A	Exterior	CFL	E	T	11	1	23	12	365	0	253	1,108	0	0	0
Totals:						53	21					462	11,253	24,513						53	21				249	7,782	16,945	7,567	0	7,567

Proposed Lighting Summary Table			
Total Surface Area (SF)	10,650		
Average Power Cost ($/kWh)	0.172		
Total Exterior Lighting	**Existing**	**Proposed**	**Savings**
Exterior Annual Consumption (kWh)	9,334	6,706	**2,628**
Exterior Power (watts)	1,816	1,341	**475**
Total Interior Lighting	**Existing**	**Proposed**	**Savings**
Annual Consumption (kWh)	15,179	10,240	**4,939**
Lighting Power (watts)	9,437	6,441	**2,996**
Lighting Power Density (watts/SF)	0.89	0.60	**0.28**
Estimated Cost of Fixture Replacement ($)	15,410		
Estimated Cost of Controls Improvements ($)	0		
Total Consumption Cost Savings ($)	**1,469**		

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.** 1135 Mountain Avenue Murray Hill, NJ 011374 (800) 247-2644 www.boc.com	**Commerce Energy, Inc.** 4400 Route 9 South, Suite 100 Freehold, NJ 07728 (800) 556-84113 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 0113113 (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	**Strategic Energy, LLC** 55 Madison Avenue, Suite 400 Morristown, NJ 011360 (888) 925-9115, www.sel.com
Liberty Power Holdings, LLC Park 80 West, Plaza II, Suite 200 Saddle Brook, NJ 07663 (866) 769-31139 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 080113 (856) 273-9995 www.ugienergyservices.com	**American Powernet Management, LP** 437 North Grove St. Berlin, NJ 08009 (800) 437-7872 www.hess.com	**ConEdison Solutions** Cherry Tree, Corporate Center 1135 State Highway 38 Cherry Hill, NJ 08002 (888) 625-0955 www.conedsolutions.com
Credit Suisse, (USA) Inc. 700 College Road East Princeton, NJ 08450 212-1138-3124 www.creditsuisse.com	**Sprague Energy Corp.** 12 Ridge Road Chatham Township NJ 011328 (800) 225-1560 www.spragueenergy.com	

Appendix C

Glossary and Method of Calculations

Glossary of ECM Terms

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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.

Calculation References

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

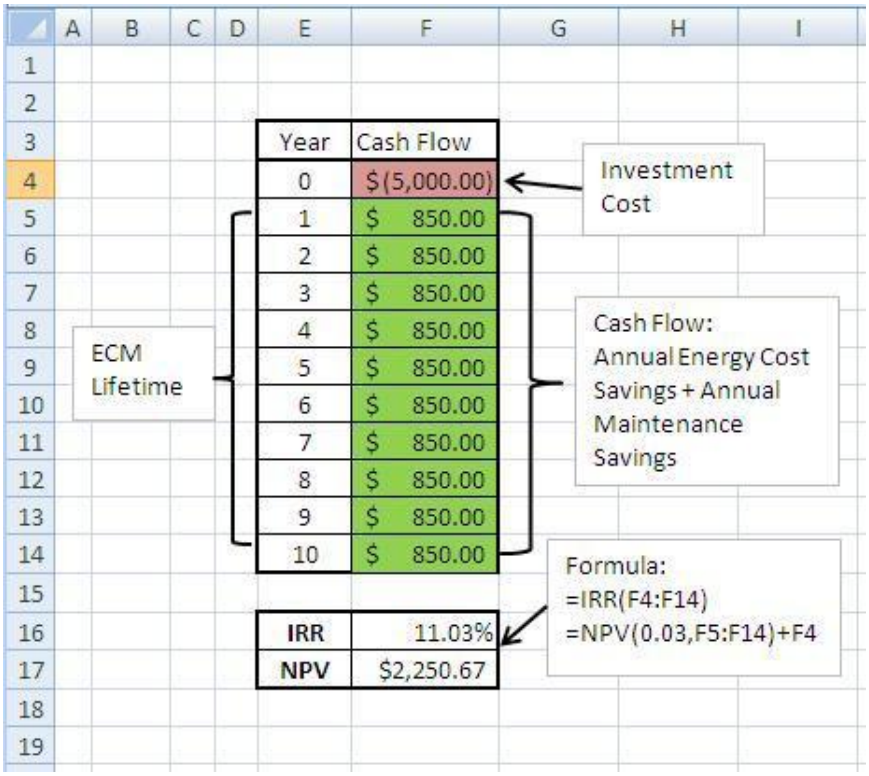
Note: The lifetime operating cost savings are all avoided operating, maintenance, and / or component replacement costs over the lifetime of the ECM. This can be the sum of any annual operating savings, recurring or bulk (i.e. one-time repairs) maintenance savings, or the savings that comes from avoiding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

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

It is easiest to calculate the NPV and IRR using a spreadsheet program like Excel.

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:



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.

NJCEP C & I Lifetimes

Measure	Measure Life
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