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February 21st, 2010

**Local Government Energy Program
Energy Audit Report**

For

***Denville Township
Denville Municipal Complex
1 Saint Mary's Place
Denville, NJ 07834***

Project Number: LGEA08



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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 Denville Township buildings. The audit included a review of the Municipal building as well as the Main Street Fire House. The buildings are located in Denville, NJ. A separate energy audit report is issued for each of the referenced buildings.

This report addresses the Denville Municipal Complex building located at 1 Saint Mary's Place, Denville, NJ. The current conditions and energy-related information were collected in order to analyze and suggest the implementation of building improvements and energy conservation measures.

The Denville Municipal Complex building, located at 1 Saint Mary's Place, was built in 2006-2007 and houses several offices as well as a court room. The Municipal Complex building is physically attached to the Denville Police Department. The Police Department is also served by the heating plant located within the Municipal Complex building as well as shares an electric meter. The Police Department was not part of the scope of work through the LGEA program but for purposes of the audit, has been taken into account in order to estimate electricity usage and heating loads as well as determine a benchmark score. The Denville Municipal Complex consists of approximately 28,000 square feet of conditioned space with occupancy of approximately 45 employees. The building is operated regularly from 8am to 4pm, Monday through Friday with occasional night time use for Court and meetings.

The goal of this Local Government Energy Audit (LGEA) is to provide sufficient information to Denville Township to make decisions regarding the implementation of the most appropriate and most cost effective energy conservation measures for the 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. 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 (BPU's) Office of Clean Energy has assigned TRC Energy Services to administer the Program.

- Section 1 and section 2 of the report cover a description and analysis of the building existing conditions.
- Section 3 provides a detail inventory of major electrical and mechanical systems in the building.
- Sections 4 through 7 provide a description of our recommendations.
- Appendices include further details and information supporting our recommendations.

EXECUTIVE SUMMARY

The energy audit performed by Steven Winter Associates (SWA) encompasses the Denville Municipal Complex building located at 1 Saint Mary's Place, Denville, NJ. The building is a two-story building with attic and a total floor area of 28,000 square feet. The original structure was built in 2006-2007 and has not undergone any major renovations or additions.

Based on the field visits performed by the SWA staff on May 14th, 15th, 28th and 29th, 2009 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.

Existing conditions

From September 2007 through September 2008, the period of analysis for this audit, the building consumed 675,600 kWh or \$105,430 worth of electricity at an approximate rate of \$0.156/kWh and 20,416 therms or \$29,260 worth of natural gas at an approximate rate of \$1.43 per therm. The joint energy consumption for the building, including both electricity and fossil fuel, was 4,347 MMBtus of energy that cost a total of \$134,690.

SWA has entered energy information about the Municipal Complex building in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. The building was benchmarked as an office building since a majority of the space is used for offices. Also, since the building shares an electric meter with the Police Department, the total area of the benchmarked building includes the area of the Police Department. The benchmark score also takes into consideration the electric meter that includes the Police Department but only the natural gas meter for the Municipal Complex building. The building received an Energy Star performance rating of 29 which is low compared to the national average of 50. The score is artificially low since the building shares an electric meter with the Police Department. SWA encourages the Denville Township to continue entering utility data in *Energy Star Portfolio Manager* in order to track weather normalized source energy use over time.

The Site Energy Use Intensity is 114.4 kBtu/ft²yr compared to the national average of an office building consuming 75 kBtu/ft²yr.

Recommendations

Implementing this report's recommendations will reduce use by approximately 11.3 kBtu/ft²yr, which would decrease the building's energy use intensity to 103.1 kBtu/ft²yr.

The Municipal Complex building is only three years old and therefore most HVAC equipment as well as lighting has been installed according to recent building codes. Equipment was observed in age-appropriate condition and has a majority of the remaining useful lifetime left. The Police Department is located next to and attached to the Northwest side of the Municipal building. Since these buildings share an electric meter, major electric loads such as lighting have been incorporated into the report. The Police Department also shares a common heating plant with the Municipal Complex building. In Appendix C, SWA has included a mechanical inventory list of equipment for the Police Department.

Based on the assessment of the 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

- Check window warranty/Install interior storm windows

Category II Recommendations: Operations and Maintenance

- Maintain roofs
- Provide weather stripping / air sealing
- Provide water efficient fixtures and controls
- Use Energy Star labeled appliances

Category III Recommendations: Energy Conservation Measures

At this time, SWA highly recommends a total of **4** Energy Conservation Measures (ECMs) for the Municipal Complex building that is summarized in the following Table 1. The total investment cost for these ECMs with incentives is **\$5,850**. SWA estimates a first year savings of **\$3,110** with a simple payback of **1.9 years**. SWA also recommends **3** ECMs with a 5-10 year payback that is summarized in Table 2 and no End of Life Cycle ECMs.

The implementation of all the recommended ECMs would reduce the building electric usage by 125,606 kWh annually, or 19% of the building's current electric consumption. Due to the age of the building and the recent installation of a new heating plant, there are no recommended measures that reduce gas usage. SWA estimates that implementing these ECMs will reduce the carbon footprint of the Municipal Complex building by **224,898 lbs of CO₂**, which is equivalent to removing approximately 17 cars from the roads each year or avoiding the need of 542 trees to absorb the annual CO₂ produced. SWA also recommends that Denville Township contacts third party energy suppliers in order to negotiate a lower electricity rate. Comparing the current electric rate to average utility rates of similar type buildings in New Jersey, it may be possible to save up to \$0.006/kWh, which would have equated to \$4,054 for the past 12 months.

There are various incentives that Denville Township could apply for that could also help lower the cost of installing the ECMs. SWA recommends that the Denville Township apply for the NJ SmartStart program through the New Jersey Office of Clean Energy. This incentive 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 three 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	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 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	Police Department - 6 new CFL installations	RS Means, lit search	120	0	120	1,051	0.2	0	0.1	30	194	7	1,199	0.6	899.5	128.5	161.4	1,079	1,882
2	Municipal - 21 new CFL installations	RS Means, lit search	930	0	930	5,243	1.1	0	0.5	15	833	7	5,150	1.1	453.8	64.8	88.5	4,220	9,388
3	Municipal - 8 new occupancy sensors	RS Means, lit search	1,760	160	1,600	5,195	1.1	0	0.5	0	810	12	7,971	2.0	398.2	33.2	50.3	6,371	9,302
4	Police Department - 16 new occupancy sensors	RS Means, lit search	3,520	320	3,200	8,158	1.7	0	0.7	0	1,273	12	12,518	2.5	291.2	24.3	39.0	9,318	14,607
	TOTALS	-	6,330	480	5,850	19,647	4.1	0	1.8	45	3,110	-	26,839	1.9	-	-	-	20,989	35,178

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 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
5	New Oil Free Centrifugal Compressor	Vendor	75,000	0	75,000	93,750	32.8	0	8.4	0	14,625	15	172,093	5.1	129.5	8.6	17.8	97,093	167,859
6	Install 5 kW PV system	Similar Projects	35,000	5,000	30,000	5,902	5.0	0	0.5	0	3,921	25	66,775	7.7	122.6	4.9	10.6	20,982	10,568
7	Police Department - 50 new T8 installations	RS Means, lit search	10,750	1,500	9,250	6,307	1.3	0	0.6	150	1,134	15	13,343	8.2	44.2	2.9	8.8	4,093	11,293
	TOTALS		120,750	6,500	114,250	105,959	39.1	0	9.5	150	19,680	-	252,211	5.8	-	-	-	122,168	189,720

Table 3 - Recommended End of Life Cycle 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 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
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	TOTALS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note: For more details on End of Life Cycle ECMs and associated incremental cost for high efficiency equipment and performance see Section 4.

1. HISTORIC ENERGY CONSUMPTION

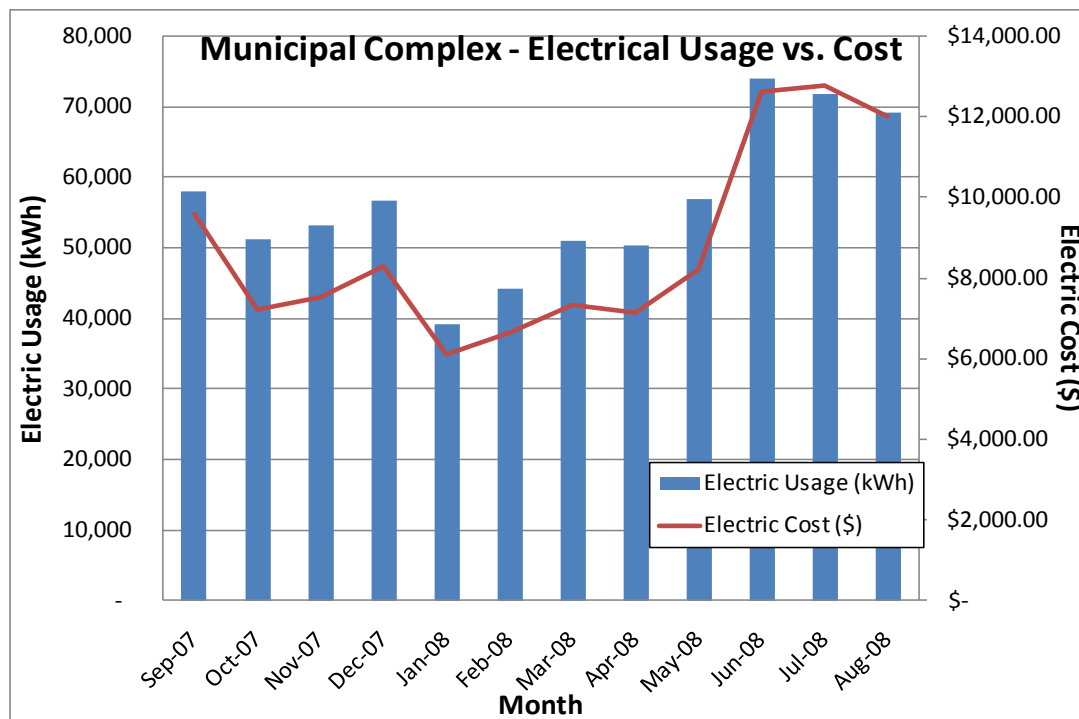
1.1. Energy usage, load profiles and cost analysis

SWA analyzed utility bills from **September 2007 through September 2008** (period of analysis) that were received from the utility companies supplying the Municipal Complex building with electric and natural gas.

Electricity - The Municipal Complex building buys electricity from JCP&L at **an average rate of \$0.156/kWh** based on 12 months of utility bills from September 2007 to September 2008. The Municipal Complex building purchased **approximately 675,600 kWh or \$105,430 worth of electricity** in the previous year. The Municipal Complex building is currently charged for demand (kW) which has been factored into each monthly bill. The main electric meter serves both the Municipal Complex building as well as the Police Department.

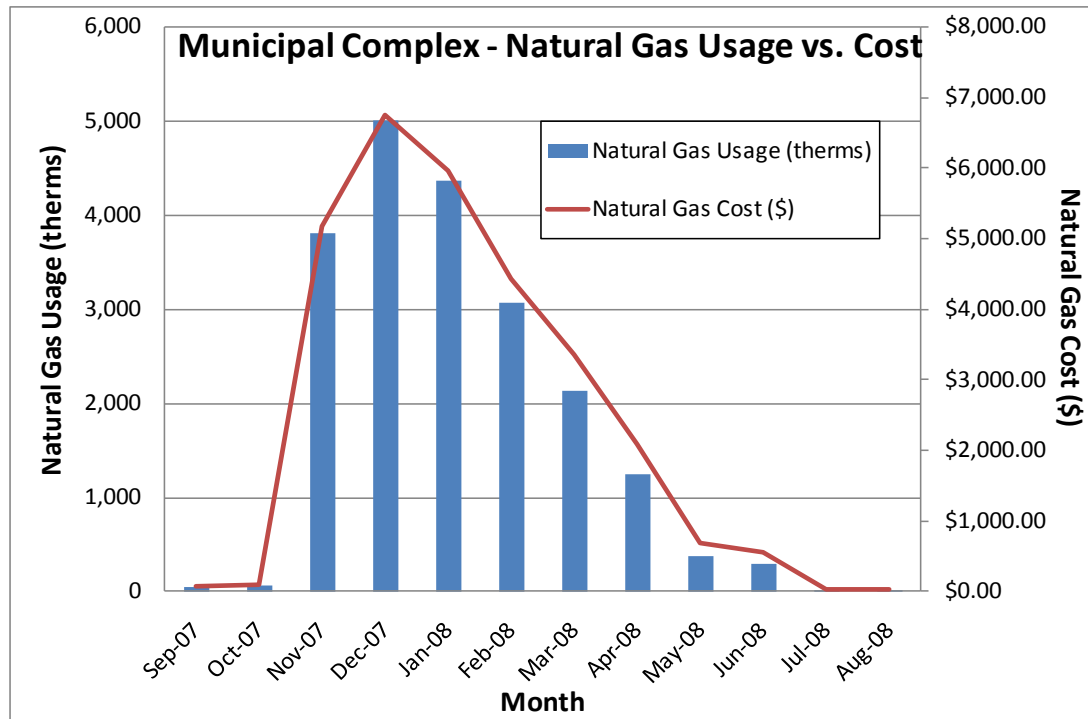
Natural gas - The Municipal Complex building is currently served by one meter for natural gas. The Municipal Complex building currently buys natural gas from New Jersey Natural Gas (NJNG) at **an average aggregated rate of \$1.43/therm** based on 12 months of utility bills for September 2007 to September 2008. The Municipal Complex building purchased **approximately 20,416 therms or \$29,260 worth of natural gas** in the previous year.

The following chart shows electricity use versus cost for the Municipal Complex building based on utility bills for the 12 month period of September 2007 to September 2008.



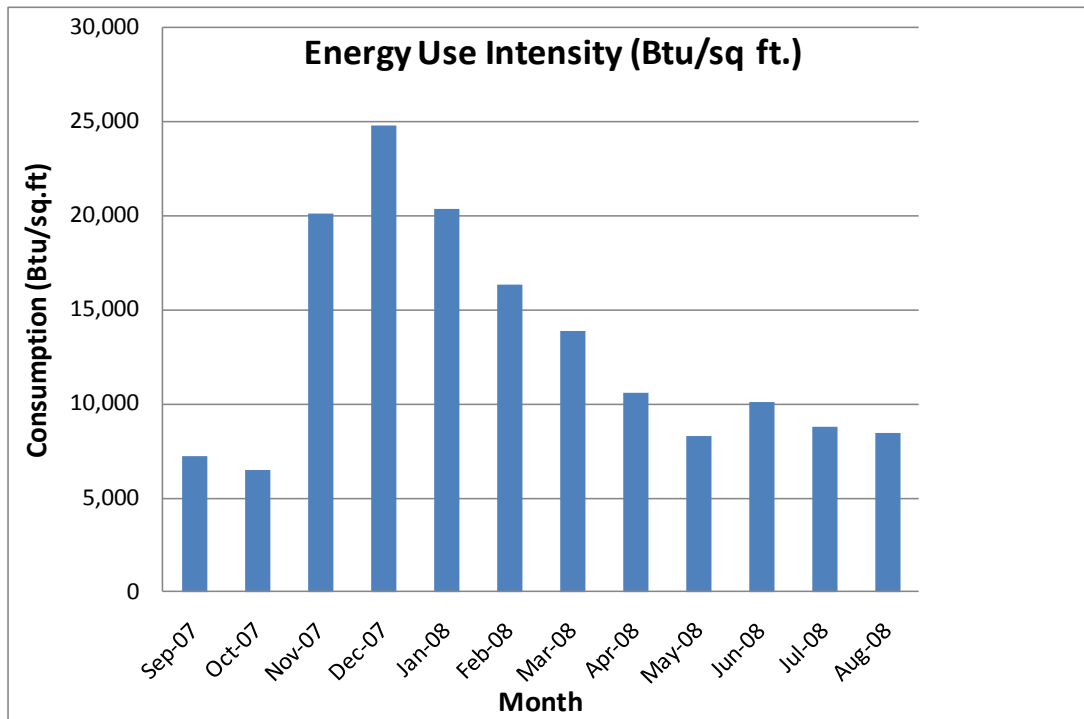
Electricity use follows a trend as expected; peaking during the summer months when air conditioning units are used most and decreases during the winter. The cost of electricity fluctuates as expected with usage.

The following is a chart of the natural gas annual load profile for the building versus natural gas costs, peaking in the coldest months of the year and a chart showing natural gas consumption following the “heating degree days” curve.



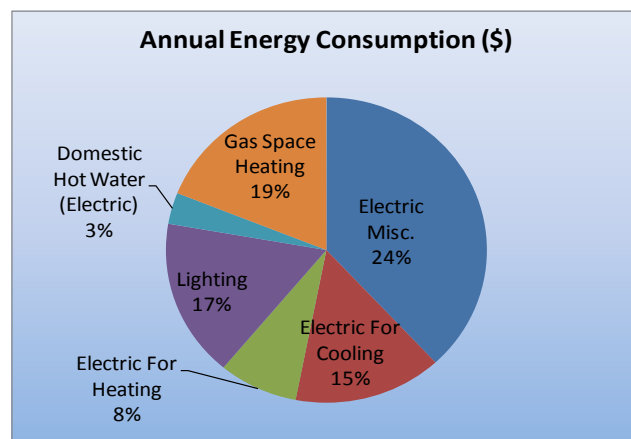
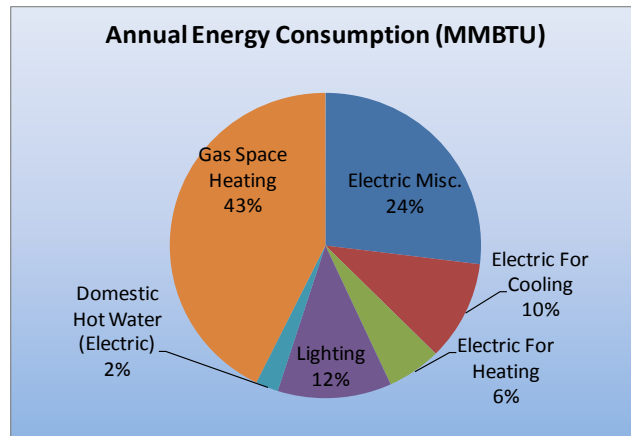
In the above chart, the natural gas use follows a heating trend as expected. During the summer it is clear that the natural gas use is very minimal which reflects that heat is not being used and the domestic hot water (DHW) load is minimal.

The following chart shows combined natural gas and electric consumption in Btu/sq ft for the Municipal Complex building based on utility bills for the 12 month period of September 2007 to September 2008.



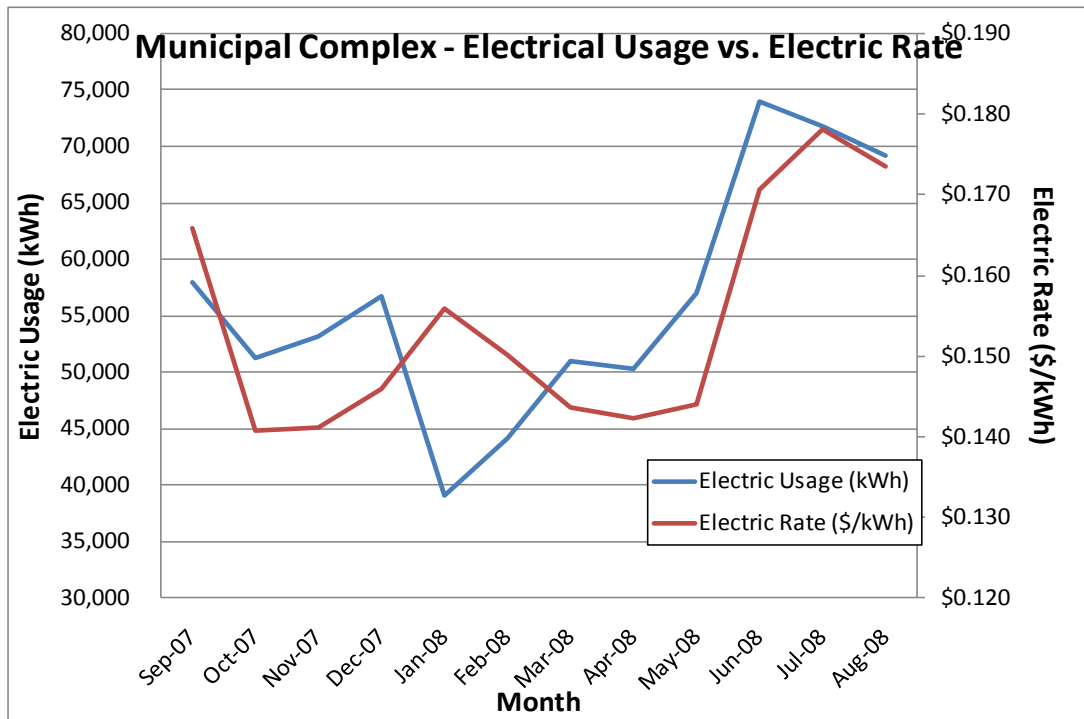
The following table and chart pies show energy use for the Municipal Complex building based on utility bills for the 12 month period of September 2007 to September 2008. The Annual Energy Consumption chart includes energy usage associated with the Police Department since it is not separately metered from the Municipal Complex. Note electrical cost at \$45.7/MMBtu of energy is more than 3 times as expensive to use as natural gas at \$14.3/MMBtu.

2008 Annual Energy Consumption / Costs					
	MMBtu	% MMBtu	\$	% \$	\$/MMBtu
Electric Miscellaneous	1172	27%	\$53,560	44%	45.7
Electric For Cooling	458	11%	\$20,931	17%	45.7
Electric For Heating	245	6%	\$11,197	13%	45.7
Lighting	514	12%	\$23,490	6%	45.7
Domestic Hot Water (Electric)	102	2%	\$4,661	2%	45.7
Gas Space Heating	1856	43%	\$26,541	18%	14.3
Totals	4,347	100%	\$140,380	100%	-
Total Electric Usage	2305	53%	\$105,430	78%	45.7
Total Gas Usage	2042	47%	\$29,260	22%	14.3
Totals	4,347	100%	\$134,690	100%	-



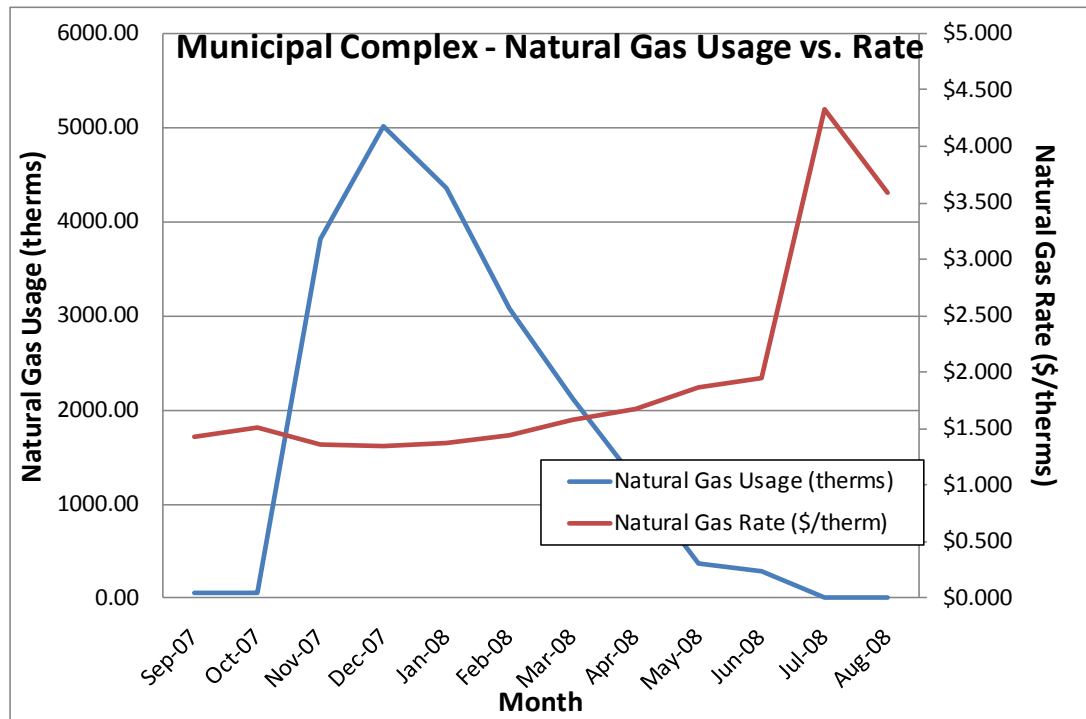
1.2. Utility rate analysis

The Municipal Complex building currently purchases electricity from JCP&L at a general service market rate for electricity use (kWh) including a separate (kW) demand charge that is factored into each monthly bill. The Municipal Complex building currently pays an average rate of approximately \$0.156/kWh based on the 12 months of utility bills of September 2007 to September 2008. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year. The electric rate does not show large fluctuations throughout the year and therefore appears to be the appropriate rate for the building.



The Municipal Complex building currently purchases natural gas supply from the NJNG at a general service market rate for natural gas (therms). There is one gas meter that provides natural gas service to the Municipal Complex building currently. The average aggregated rate (supply and transport) for the meter is approximately \$1.43/therm based on 12 months of utility bills for September 2007 to September 2008. The suppliers' general service rate for natural gas charges a market-rate price based on use and the Municipal Complex 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 boilers. The high gas price per therm fluctuations in the summer may be due to high energy costs that occurred in 2008 and low use caps for the non-heating months. Thus the building pays for fixed costs such as meter reading charges during the summer months.

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 Municipal Complex building in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. The building was benchmarked as an office building since a majority of the space is used for offices. Also, since the building shares an electric meter with the Police Department, the total area of the benchmarked building includes the area of the Police Department. The benchmark score also takes into consideration the electric meter that includes the Police Department but only the natural gas meter for the Municipal Complex building. The building received an Energy Star performance rating of 29 which is low compared to the national average of 50. The score is artificially low since the building shares an electric meter with the Police Department. SWA encourages the Denville Township to continue entering utility data in *Energy Star Portfolio Manager* in order to track weather normalized source energy use over time.

The Site Energy Use Intensity is 114.4 kBtu/sq ft yr compared to the national average of an Office building consuming 75 kBtu/sq ft yr. Implementing this report's highly recommended Energy Conservations Measures (ECMs) will reduce use by approximately 1.8 kBtu/sqft yr, with an additional 9.5 kBtu/sq ft yr from the recommended ECMs and 0.0 kBtu/sq ft yr from the recommended End of Life Cycle ECMs.

Per the LGEA program requirements, SWA has assisted Denville to create an *Energy Star Portfolio Manager* account and has shared the Municipal building facility information to allow future data to be added and tracked using the benchmarking tool. SWA is sharing this Portfolio Manager Site information with TRC Energy Services. As per requirements, the account information is provided below:

Username: DenvilleTownship
 Password: DENVILLE

Also, below is a performance rating that is generated based on historical energy consumption from the Portfolio Manager Benchmarking tool.

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE Denville Municipal Building

Building ID: 1944836
For 12-month Period Ending: August 31, 2008¹
Date SEP becomes ineligible: N/A

Date SEP Generated: December 01, 2009

Facility
Denville Municipal Building
2 Saint Mary's Place
Denville, NJ 07834

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 2006
Gross Floor Area (ft²): 38,000

Energy Performance Rating² (1-100) 29

Site Energy Use Summary³

Electricity - Grid Purchase(kBtu)	2,305,147
Natural Gas (kBtu) ⁴	2,041,621
Total Energy (kBtu)	4,346,768

Energy Intensity⁵

Site (kBtu/ft ² /yr)	114
Source (kBtu/ft ² /yr)	259

Emissions (based on site energy use)

Greenhouse Gas Emissions (MtCO ₂ e/year)	460
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Electric Distribution Utility

Jersey Central Power & Lt Co

National Average Comparison

National Average Site EUI	91
National Average Source EUI	206
% Difference from National Average Source EUI	26%
Building Type	Office

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.

Meets Industry Standards⁶ for Indoor Environmental Conditions:

Ventilation for Acceptable Indoor Air Quality	N/A
Acceptable Thermal Environmental Conditions	N/A
Adequate Illumination	N/A

Certifying Professional
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 52 for ventilation for acceptable indoor air quality, ASHRAE Standard 55 for thermal comfort, and IESNA Lighting Handbook for lighting quality.

The government estimates the average time needed to fill out this form is 5 hours (includes the time for entering energy data, PE facility inspection, and notarizing the SEP) and welcomes suggestions for reducing this level of effort. Send comments (referencing OMB control number) to the Director, Collection Strategies Division, U.S., EPA (282271), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460.

EPA Form 5900-16

2. FACILITY AND SYSTEMS DESCRIPTION

2.1. Building Characteristics

The Municipal Complex building was built in 2006-2007 and currently houses the Denville Municipal offices and Denville Municipal Court. The building is two-stories with attic space and a total floor area of 28,000 square feet. The Denville Police Department is attached to the building and shares a common electric meter as well as heating plant. The Court comprises approximately 2,500 square feet of the conditioned space.

2.2. Building occupancy profiles

There are approximately 45 full time employees in the Municipal Complex at any given time but occupancy can increase when Court is in session or during meetings and special events. The building is operated regularly from 8am to 4pm, Monday through Friday with occasional night time use for Court and other meetings.

2.3. Building envelope

2.3.1.Exterior Walls

The exterior walls of the Municipal Complex consist of CMU blocks with a red faced brick façade. Since the complex was built three years ago, recent energy codes would have a required minimum level of insulation in the exterior walls. There are no improvements to the exterior walls that would provide a significant improvement in building performance.

Overall, exterior and interior wall finishes of the envelope were found to be in age-appropriate, good condition with no major signs of water or air leakage.

2.3.2.Roof

The roof of the Municipal Complex is mostly pitched with sections of flat or low sloped roof. The court house roof is rounded. The surface of the roof is black EPDM rubber that is well insulated. The metal roof at the pitched section is in excellent condition. Again, given the age of the building, there are no improvements to the roof assembly or insulation that would provide a significant improvement to the building performance.

2.3.3.Base

The building's base is 6" concrete slab-on-grade. There were no reported problems with water penetration or moisture. The building code in effect at the time of construction required insulation either at the perimeter of the foundation walls or under the slab.

2.3.4.Windows

The existing windows of the Municipal Complex building are aluminum frame units with dual glazing. These windows were purchased for the building since they were high performance-rated windows. These windows are equipped with a thermal break that is supposed to prevent heat transfer across the frame of the window. Interviews with Municipal staff and the Facilities manager indicate that the windows have not been performing as expected. Due to seasonal conditions at the time of the site visit, SWA could not review the reported comfort concerns directly. Measurements taken by the

facilities manager when the outside temperature was below 30°F have found that the window glass is consistently 10°F warmer than outside air temperature. Similarly, measurements of the aluminum frame temperature have also been found to be lower than expected.

The temperature differential may be due to the lack of a thermal break in the windows. The thermal break is typically provided by a polypropylene gasket that isolates the interior aluminum frame from the exterior frame and prevents the frame from conducting heat through the aluminum frame to the outside. The existence of a thermal break could not be verified during the site inspection.

SWA has reviewed the specifications for the installed windows and they appear to have a thermal break. SWA recommends contacting the manufacturer in order to determine if deficient windows have been installed. If it is determined that the window does include a thermal break, the window installer should be contacted to review potential installation issues. SWA was not able to identify a thermal break in the window based on visual inspection. There may be repairs that can be addressed under the installation warranty.

Installation of new windows would not be economically viable. There are interior and exterior retrofit strategies that may provide increased comfort for building occupants. IN areas with the greatest comfort complaints, one alternative may be the installation of an interior storm window system. In some cases, these systems have been found to reduce drafts and minimize radiation from cold surfaces. Although there may be a minimal amount of energy savings, it is difficult to verify the rate energy performance of site-built assemblies. As a result, interior storm windows will address comfort concerns and not necessarily energy concerns. Selection of the appropriate alternative should be made with consideration to comfort, durability, window functionality and aesthetics.

As a best practice, SWA recommends that all windows be inspected at least once a year. Any gaps, cracks, or damage to weather-stripping or caulking should be repaired or replaced, as needed, to minimize energy loss around those openings. Building staff should also verify that windows open and close properly and repair, as needed.



Typical Window installation

2.3.5.Exterior doors

The exterior doors are insulated metal with double-glazed glass panes. The exterior doors are in excellent condition and virtually all of the weather-stripping is still intact. If not properly maintained, exterior doors can become major sources of heat loss and infiltration. As a best practice, SWA recommends checking the weather-stripping of each door on a regular basis and replacing any broken seals immediately. This will help optimize comfort and energy performance.



2.3.6. Building air tightness

Based on a visual inspection, the building was observed to be relatively well-sealed considering the age and intended use of the building. As a best practice, weather-stripping on doors and windows should be checked every 6 months for deficiencies and replaced as they fail.

2.4. HVAC Systems

The Municipal Complex building is served by one main heating plant that consists of 3 Mestek Hydrotherm direct vent boilers. These boilers were replaced in the past year due to deficiencies with the original installed boilers. The heating plant also provides heating for the Denville Police Department which is attached to the Municipal Complex building. The cooling system consists of an electric Trane chiller that serves only the Municipal Complex area.

2.4.1. Heating

The heating system includes three Mestek Hydrotherm direct vent boilers with a combined output of 1,110 MBtuh and a nameplate efficiency of 92.7%. The building is only 3 years old; however the Denville facilities manager reported ongoing performance concerns with the original heating system that was installed. Within the past year, the three Mestek Hydrotherm boilers were installed, replacing the original system. The heating plant also contains two pumps that contain 10 HP Baldor SuperE high efficiency motors that serve as circulating pumps for the heating system. One of these pumps sends hot waters throughout the Municipal Complex while the other serves the Police Department located next door.

The heating hot water loop serves one main air handler located in the attic of the Municipal Complex building that sends forced hot air to VAV boxes located throughout the building. In addition, the hot water loop also provides hot water to baseboard heaters in the Court Room and Council Chambers. Each room contains a programmable thermostat to control the temperatures. It appears that the heating system is currently set to modulate with outdoor temperature as well as setback at night. At the time of the audit, there were no major complaints with the new heating plant or existing distribution system.

2.4.2. Cooling

All areas of the Municipal Complex building are cooled using a central Trane 83.7 kW, 80 ton air-cooled, electric chiller. The central chiller sends around chilled water, via two pumps that contain 10

HP Baldor SuperE high efficiency motors that serve as circulating pumps. The chiller provides the same air handling unit used for heating with chilled water for cooling. The air handler also uses VAV boxes to distribute cooled air throughout the building. Unlike the heating system however, the chiller serves only the Municipal Complex building and not the Police Department. The chiller was operating on the day of the audit and was observed in good operating condition. The chiller is in excellent condition but its performance can be improved by upgrading the compressors to a new and more efficient technology.

Cooling in the computer areas is provided by a separate EMI 28,000 Btuh DX split-system. This DX split-system has a SEER value of 13.0 and was observed to be in excellent condition.

2.4.3.Ventilation

As mentioned above, a majority of the building is provided conditioned air from the heating/cooling plant via a large air handler. This air handler receives a mix of outside and return air, tempers it based on set points and provides forced air throughout the building via VAV boxes.

In addition to the air handling unit, there are 10 exhaust fans that help rid the building of stale air and also help induce fresh air into the building. These rooftop exhaust fans were observed to all be working with no major maintenance issues.

2.4.4.Domestic Hot Water

There is one Bradford-White Hydrojet electric water heater with a 65 gallon capacity and 18 gallon/hour recovery. This domestic hot water heater was observed to be appropriately sized and in good condition. This electric hot water heater serves only sinks located within the Municipal Complex building. There have been no reports of domestic hot water problems within the building.

2.5. Electrical systems

2.5.1.Lighting

Interior Lighting – The Municipal Complex building is three years old and therefore contains mostly efficient lighting. A majority of the building uses 4' T8 fixtures with electronic ballasts. There are some areas that use either incandescent bulbs or halogen, depending on area. SWA observed opportunities to replace 11 (in addition to 10 exterior lights) existing halogen or incandescent bulbs with newer, lower wattage CFL screw-in bulbs. SWA also recommends installing 8 occupancy sensors throughout the building to limit the amount of runtime of certain fixtures. See attached lighting schedule in Appendix A for a complete lighting inventory throughout the building and estimated power consumption.

The Denville Municipal Complex building also shares an electric meter with the next door Police Department. The Police Department was not included in the scope of work, however SWA performed a lighting analysis of the Police Department building as well since the lighting was observed to be old and inefficient, contributing a large base load to the Municipal Complex electric meter. Many of the Police Department lighting fixtures consisted of older T12 fluorescent fixtures with magnetic ballasts. There was also an opportunity to install 16 occupancy sensors to reduce the runtime of certain fixtures within the Police Department. See attached lighting schedule in Appendix A for a complete lighting inventory 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 were found to be mostly 250W metal halide fixtures. SWA recommends replacing these metal halide fixtures with screw-type 150W CFLs. There were 10 exterior lights total that should be upgraded.

2.5.2.Appliances

SWA performed a basic survey of appliances installed at the Denville Municipal Complex building and has determined that it would not be cost-effective to replace any appliances at this time due to the age of the building. 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>.

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 in meeting areas use approximately 3-5 watts of electricity when turned off. SWA recommends all computers and all appliances (i.e. refrigerators, coffee makers, televisions, etc) be plugged in to power strips and turned off each evening just as the lights are turned off. The Municipal Complex building computers are generally 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 Municipal Complex building does not have any installed elevators.

2.5.4.Process and others electrical systems

There are currently three dry-type transformers installed in the building to step down all incoming electric supply to a voltage that is used by the building. These transformers vary in size and include 150 kVA, 112.5 kVA and 100 kVA units. Recent federal guidelines have increased the efficiency of all transformers. Based on transformer specifications, these transformers comply with newer federal guidelines and would not be cost-effective to upgrade at this point in time.

3. EQUIPMENT LIST

Inventory

Building System	Description	Physical Location	Make/ Model	Fuel	Space served	Estimated Remaining useful life %
Controls	Trane Tracer Summit Building Management System	Boiler room; top floor	Trane Tracer Summit	Electricity	Municipal building and Police Department	95%
Heating	Boiler #1: Mestek Hydrotherm direct vent boiler, 399,000 Btuh input, 369,873 Btuh output	Boiler room; top floor	Mestek Hydrotherm boiler, Model #GX 400, Serial #39550	Natural Gas	Municipal building and Police Department	95%
Heating	Boiler #2: Mestek Hydrotherm direct vent boiler, 399,000 Btuh input, 369,873 Btuh output	Boiler room; top floor	Mestek Hydrotherm boiler, Model #GX 400, Serial #39459	Natural Gas	Municipal building and Police Department	95%
Heating	Boiler #3: Mestek Hydrotherm direct vent boiler, 399,000 Btuh input, 369,873 Btuh output	Boiler room; top floor	Mestek Hydrotherm boiler, Model #GX 400, Serial #39543	Natural Gas	Municipal building and Police Department	95%
Heating	Heating Pump #1: Baldor SuperE motor, 1770 RPM, 10 HP, Nema Nom. Efficiency 91.7%, 80% Power Factor	Boiler room; top floor	Baldor SuperE motor, Cat. #EM3313T, Spec. #37F614T853	Electricity	Municipal building and Police Department	95%
Heating	Heating Pump #2: Baldor SuperE motor, 1770 RPM, 10 HP, Nema Nom. Efficiency 91.7%, 80% Power Factor	Boiler room; top floor	Baldor SuperE motor, Cat. #EM3313T, Spec. #37F614T853	Electricity	Municipal building and Police Department	95%
Heating	FT-A Versa-Line radiator 1832 MBH, Fin Tube Radiator/Baseboard	Council Chambers	Versa-Line	-	Council	80%
Cooling	CH-1 Trane Series R Chiller 83.7kW, 212.9 GPM, 19.6 ft dP	Rooftop; Upper roof	Trane RTAA080	Electricity	Municipal building only	88%
Cooling	Chilled Water Pump #1: Baldor SuperE motor, 10 HP, 1760 RPM, Nema Nom. Efficiency 91.7%, 80% Power Factor	Boiler room; top floor	Baldor SuperE motor, Cat. #EM3313T, Spec. #37F614Y568	Electricity	Municipal building only	95%
Cooling	Chilled Water Pump #2: Baldor SuperE motor, 10 HP, 1760 RPM, Nema Nom. Efficiency 91.7%, 80% Power Factor	Boiler room; top floor	Baldor SuperE motor, Cat. #EM3313T, Spec. #37F614Y568	Electricity	Municipal building only	95%
Heating/Cooling	AH-2: Trane M-series Climate Changer air handler, (2) 30 HP motors, (2) VFDs	Attic space; top floor	Trane M-Series Climate Changer air handler, Model #MCCB040UA0D0UA, Serial #K06H91184	Electricity	Municipal building only	88%
Cooling	Enviromaster International Inc. condensing unit, 28,000 Btuh capacity, SEER 13.0, EER 12.3, R-22	Rooftop: upper roof near chiller	Enviromaster International Inc. condensing unit, Model #S1CA8000D00, Serial #1-06-G-8658-26	Electricity	Serves server room in municipal building	88%
Ventilation	EF-5: Fantech TurboFlow exhaust fan, 1 ph, 60 Hz, 1/10 HP, 1550 RPM, 09/05, Tag #F06J1, not running during audit	Rooftop: upper roof near chiller	Fantech TurboFlow, Model #RED06, Serial #63852	Electricity	Toilets	70%
Ventilation	EF-4: Fantech TurboFlow exhaust fan, 1 ph, 60 Hz, 1/10 HP, 1550 RPM, 09/05, Tag #F06J1, running during audit	Rooftop: upper roof center	Fantech TurboFlow, Model #RED06, Serial #63857	Electricity	Toilets	70%
Ventilation	EF-3: Fantech TurboFlow exhaust fan, 1 ph, 60 Hz, 1/10 HP, 1550 RPM, 05/06, Tag #F08J1, running during audit	Rooftop: east side of upper roof	Fantech TurboFlow, Model #RED06, Serial #10956	Electricity	Toilets	70%

Ventilation	Fantech TurboFlow cannister-shaped exhaust fan, 1 ph, 60 Hz, 1/3 HP, 1750 RPM, 06/06, no tag #, running during audit	Rooftop: west side of lower roof	Fantech TurboFlow, Model #TBD9, Serial #703406	Electricity	Attic Storage	70%
Ventilation	Fantech TurboFlow exhaust fan, 1 ph, 60 Hz, 1/10 HP, 1550 RPM, 09/05, Tag #F06J1, not running during audit	Rooftop: west side of lower roof	Fantech TurboFlow, Model #RED06, Serial #63871	Electricity	Toilets	70%
Ventilation	Fantech TurboFlow exhaust fan, 1 ph, 60 Hz, 1/10 HP, 1550 RPM, 05/06, Tag #F08J1, running during audit	Rooftop: center side of lower roof	Fantech TurboFlow, Model #RED08, Serial #10915	Electricity	Toilets	70%
Ventilation	EF-6: Fantech TurboFlow exhaust fan, 1 ph, 60 Hz, 1/12 HP, 1050 RPM, 05/06, Tag #F08H1, serial # could not be read, running with lots of noise and vibration during audit	Rooftop: east side of lower roof	Fantech TurboFlow, Model #RED08, Serial #XX	Electricity	Toilets	70%
Ventilation	EF-2: Fantech TurboFlow exhaust fan, 1 ph, 60 Hz, 1/10 HP, 1550 RPM, 09/05, Tag #F06J1, serial # could not be read, not running during audit	Rooftop: center side of lower roof	Fantech TurboFlow, Model #RED06, Serial #XX	Electricity	Toilets	70%
Ventilation	RF-1, Trane Module Return Fan 4800 CFM, 1386 RPM, 3Ph, 60 Hz, 3 HP	Rooftop: center/east of lower roof, adjacent to court room	Trane Module	Electricity	AH-1	70%
Ventilation	RF- 2, Trane Module Return Fan 17,500 CFM, 1110 RPM, 3Ph, 60 Hz, 15 HP	Rooftop: center/east of lower roof, adjacent to court room	Trane Module	Electricity	AH-2	70%
Distribution System	Variable Air Volume Air System	1st and 2nd floors	VSWF	-	1st & 2nd Floors	
Domestic Hot Water	Bradford-White Hydrojet electric water heater, 65 gallon capacity, 208V, 4933 kWh/year according to Energy Star label, Upper element: 4500 Watts, Lower element: 4500 Watts, 18 GPH recovery	Municipal building DHW storage closet	Bradford-White Hydrojet, Model #LD65R33B090, Serial #DB8787943	Electricity	Municipal building only	80%
Electric Transformers	T-7: Square D Watchdog transformer, Sorgel - 3 phase general purpose transformer, 150 kVA, 4.1% Imp., Class AA	Attic space: top floor	Square D Watchdog transformer, Cat. #150T3HBCU47DB, Serial #21137223-018	Electricity	Municipal building only	93%
Electric Transformers	T-6: Square D Watchdog transformer, Sorgel - 3 phase general purpose transformer, 112.5 kVA, 2.4% IZ, Class AA	Attic space: top floor	Square D Watchdog transformer, Cat. #112T151HBCUCT, Serial #21137223-020	Electricity	Municipal building only	93%
Electric Transformers	T-A: Square D Watchdog transformer, Sorgel - single phase general purpose transformer, 100 kVA, 3.7% IZ, Class AA	Attic space: top floor	Square D Watchdog transformer, Cat. #100S2629 HBCU 47DB, Serial #21137223-019	Electricity	Municipal building only	93%
Lighting	See details appendix A	-	-	-	-	-

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 Municipal Complex building, 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

- Check window warranty/Install interior storm windows – There are currently many comfort and energy performance complaints with the window. The Facilities manager for the building has observed low window frame/glass temperatures when the outside temperature is low. It is not possible to tell if a thermal break has been installed as per specifications or if there is an installation defect with the windows. SWA recommends to first contact the window manufacturer to alert them of the problem. The window manufacturer should be able to send a field representative to check for a thermal break. If a thermal break has been installed inside of the windows, as per specification then the window installer should be contacted. If a thermal break has been installed, an installation defect may be allowing cold air to breach the thermal barrier for each window. As a last resort, if windows are manufactured and installed as per specifications, interior storm windows may be installed. There are kits available that essentially upgrade the quality of the window and can be installed on the interior surface. SWA recommends interior storm windows as a last result due to the installed cost. Before interior storm windows are installed, Denville Township should contact the window manufacturer and installer to evaluate whether there is a problem that can be fixed and whether that problem is covered under warranty.

Category II Recommendations: Operations and Maintenance

- Maintain roofs - SWA recommends regular maintenance to verify water is draining correctly.
- Provide weather stripping / air sealing – SWA observed that all windows and doors had proper weather-stripping and air sealing due to their age. As a best practice, SWA recommends that each window and door is inspected twice per year for deficiencies. Any time that a seal has been compromised, building maintenance staff should repair and replace the seal immediately to ensure that thermal barriers are not breached.
- 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.

Category III Recommendations: Energy Conservation Measures

Summary table

ECM#	Description of Highly Recommended 0-5 Year Payback ECMs
1	Police Department – 6 new CFL installations
2	Municipal – 21 new CFL installations
3	Municipal – 8 new occupancy sensors
4	Police Department – 16 new occupancy sensors
	Description of Recommended 5-10 Year Payback ECMs
5	New Oil Free centrifugal compressor
6	Install 5 kW PV system
7	Police Department – 50 new T8 installations
	Description of Recommended End of Life Cycle ECMs
-	-

ECM#1: Police Department – 6 new CFL installations

Description:

The Police Department building is not part of the scope of work, however the Police Department and Municipal Complex share as an electric meter. Since the buildings share an electric meter, reducing the lighting load of the Police Department can help improve the Energy Star Performance Score of the Municipal Complex building.

The Police Department currently contains six 65W incandescent bulbs located in the Dispatch area. SWA recommends that these screw-type incandescent bulbs are replaced with 44W CFL screw-type bulbs. In addition, there will be operating cost savings associated with each bulb since CFLs have a longer rated lifetime than incandescent bulbs. See Appendix A for complete lighting schedule and analysis.

Installation cost:

Estimated installed cost: \$120

Source of cost estimate: RS Means; Published 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 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	Police Department - 6 new CFL installations	RS Means, lit search	120	0	120	1,051	0.2	0	0.1	30	194	7	1,199	0.6	899.5	128.5	161.4	1,079	1,882

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA assumes operation cost savings based on avoided bulb replacement when upgrading to lighting that consists of longer rated burn hours.

Rebates / financial incentives:

There are currently no incentives for this measure 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#2: Municipal Building – 21 new CFL installations

Description:

The Municipal Complex building currently contains 11 interior fixtures that contain a mix of incandescent and halogen bulbs as well as 10 exterior fixtures that contain 250W metal halide bulbs. SWA recommends that all 21 of these fixtures are replaced with screw-type CFL bulbs that provide the same quality of light but reduces the amount of power consumed. In addition, there will be operating cost savings associated with each light fixture since newer technology bulbs have a longer rated lifetime than existing bulbs. See Appendix A for complete lighting schedule and analysis.

Installation cost:

Estimated installed cost: \$930

Source of cost estimate: RS Means; Published 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 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	Municipal - 21 new CFL installations	RS Means, lit search	930	0	930	5,243	1.1	0	0.5	15	833	7	5,150	1.1	453.8	64.8	88.5	4,220	9,388

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA assumes operation cost savings based on avoided bulb replacement when upgrading to lighting that consists of longer rated burn hours.

Rebates / financial incentives:

There are currently no incentives for this measure 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#3: Municipal Building – 8 new occupancy sensors

Description:

Based on field observations, there are 8 areas within the Municipal Complex building that would benefit from occupancy sensors. SWA recommends that these 8 areas are upgraded to occupancy sensors in order to reduce the amount of runtime based on occupancy schedules. See Appendix A for complete lighting schedule and analysis.

Installation cost:

Estimated installed cost: \$1,600

Source of cost estimate: RS Means; Published 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 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
3	Municipal - 8 new occupancy sensors	RS Means, lit search	1,760	160	1,600	5,195	1.1	0	0.5	0	810	12	7,971	2.0	398.2	33.2	50.3	6,371	9,302

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA assumes amount of reduced hours based on field observations.

Rebates / financial incentives:

NJ Clean Energy Prescriptive Lighting Controls – Wall-mounted occupancy sensors (\$20 per control)

Maximum incentive amount is \$160.

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#4: Police Department – 16 new occupancy sensors

Description:

The Police Department building is not part of the scope of work, however the Police Department and Municipal Complex share as an electric meter. Since the buildings share an electric meter, reducing the lighting load of the Police Department can help improve the Energy Star Performance Score of the Municipal Complex building.

Based on field observations, there are 16 areas within the Police Department building that would benefit from occupancy sensors. SWA recommends that these 16 areas are upgraded to occupancy sensors in order to reduce the amount of runtime based on occupancy schedules. See Appendix A for complete lighting schedule and analysis.

Installation cost:

Estimated installed cost: \$3,200

Source of cost estimate: RS Means; Published 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 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
4	Police Department - 16 new occupancy sensors	RS Means, lit search	3,520	320	3,200	8,158	1.7	0	0.7	0	1,273	12	12,518	2.5	291.2	24.3	39.0	9,318	14,607

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA assumes amount of reduced hours based on field observations.

Rebates / financial incentives:

NJ Clean Energy Prescriptive Lighting Controls – Wall-mounted occupancy sensors (\$20 per control)

Maximum incentive amount is \$320.

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#5: New Oil Free Centrifugal Compressor

Description:

SWA recommends replacing the two existing 40-ton compressors with one 90 ton oil-free, magnetic bearing centrifugal compressor that has an integrated part-load value (IPLV) of approximately .55 kW per ton. The existing screw-type compressors on the Trane chiller are rated at about .96 kW per ton IPLV. Since the chiller rarely has to run at 100% load, increases in part load efficiency are crucial to operating performance. The magnetic bearings are a significant improvement over traditional roller bearing that must be lubricated with oil. In the oil free compressor, the compressor shaft is actually levitated and rotated on a magnetic cushion. In addition to the improved efficiency and energy cost savings, there would also be maintenance savings due to not needing oil management and the elimination of problems caused by oil contamination in the refrigerant. SWA assumes that the improvements in efficiency and reduced maintenance will compensate for the loss of redundancy that will result from replacing the two traditional compressors with the one larger oil-free unit.

Installation cost:

Estimated installed cost: \$75,000

Source of cost estimate: Vendor

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 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
5	New Oil Free Centrifugal Compressor	Vendor	75,000	0	75,000	93,750	32.8	0	8.4	0	14,625	15	172,093	5.1	129.5	8.6	17.8	97,093	167,859

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis.

Rebates / financial incentives:

There are currently no incentives for this measure 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#6: *Install 5kW PV system*

Description:

Currently, the Municipal Complex 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 Denville Township further review installing a 5kW 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 Municipal Complex building is not eligible for a 30% federal tax credit. Instead, Denville Township 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 a few locations for a 5kW PV installation on the building roofs and away from shade. 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 5kW system needs approximately 41 panels which would take up 435 square feet. The installation of a renewable Solar Photovoltaic power generating system could serve as a good educational tool and exhibit for the community.

Installation cost:

Estimated installed cost: \$30,000

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	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 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
6	Install 5 kW PV system	Similar Projects	35,000	5,000	30,000	5,902	5.0	0	0.5	0	3,921	25	66,775	7.7	122.6	4.9	10.6	20,982	10,568

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. Incentive amount for this application is \$5,000.

<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. \$3,600 has been incorporated in the above costs; 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#7: Police Department – 50 new T8 installations

Description:

The Police Department building is not part of the scope of work, however the Police Department and Municipal Complex share as an electric meter. Since the buildings share an electric meter, reducing the lighting load of the Police Department can help improve the Energy Star Performance Score of the Municipal Complex building.

The Police Department currently contains 50 inefficient T12 fluorescent fixtures with magnetic ballasts. SWA recommends replacing each one of these T12 fixtures with equivalent T8 fluorescent fixtures with electronic ballasts. Typically, T8 fluorescent fixtures with electronic ballasts use 30% less energy than equivalent T12 fixtures with magnetic ballasts. In addition, there will be operating cost savings associated with each bulb since CFLs have a longer rated lifetime than incandescent bulbs. See Appendix A for complete lighting schedule and analysis.

Installation cost:

Estimated installed cost: \$10,750

Source of cost estimate: RS Means; Published 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 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
7	Police Department - 50 new T8 installations	RS Means, lit search	10,750	1,500	9,250	6,307	1.3	0	0.6	150	1,134	15	13,343	8.2	44.2	2.9	8.8	4,093	11,293

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA assumes operation cost savings based on avoided bulb replacement when upgrading to lighting that consists of longer rated burn hours.

Rebates / financial incentives:

NJ Clean Energy Prescriptive Lighting – T-5 and T8 lamps with electronic ballast in existing facilities (\$10-30 per fixture, depending on quantity of lamps)

Maximum incentive amount is \$1,500. .

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

A Wind system is not applicable for this building because the area does not have winds of sufficient velocity to justify installing a wind turbine system.

5.3. Solar Photovoltaic

Please see the above recommended ECM#7.

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 the existing HVAC system and insufficient domestic hot water use.

5.6. Geothermal

Geothermal is not applicable for this building because current HVAC equipment is new.

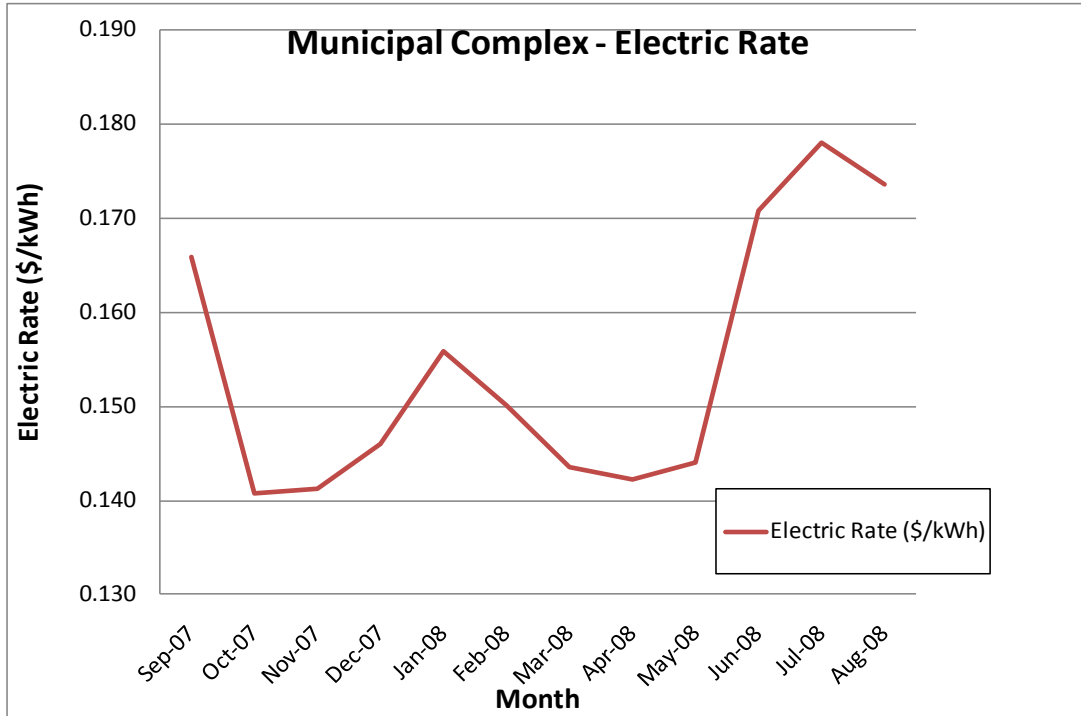
6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

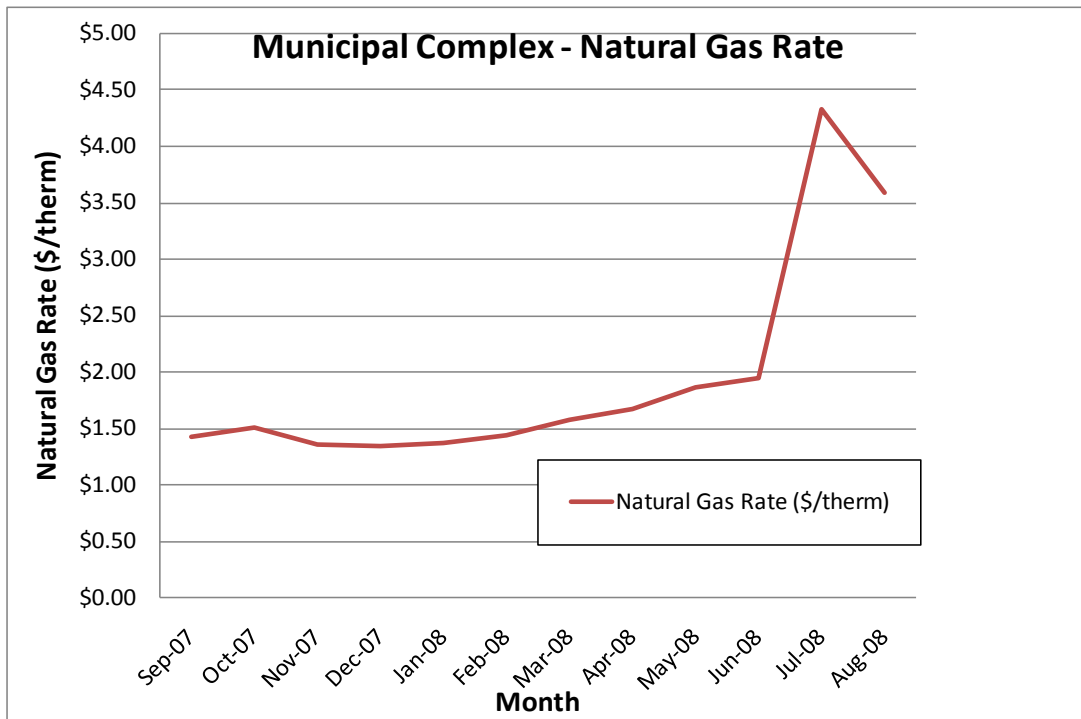
6.1. Energy Purchasing

The Municipal Complex building receives natural gas via one incoming meter. New Jersey Natural Gas supplies gas to the building. There is not an 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 also purchased via one incoming meter directly for the Municipal Complex building from JCP&L without an ESCO. The electric meter serves both the Municipal Complex building as well as the connected Police Department. SWA analyzed the utility rate for natural gas and electricity supply over an extended period. Electric bill analysis shows fluctuations of 27% over the most recent 12 month period. Natural gas bill analysis shows fluctuations up to 44% 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 escalating energy costs in 2008.

Currently, New Jersey commercial buildings of similar type pay \$0.150/kWh for electricity and \$1.55/therm for natural gas. Currently, the electricity rate for Municipal Complex building is \$.156/kWh, which means there is a potential cost savings of \$4,054 per year. The current natural gas rate for the Municipal Complex building is \$1.43/therm which is better than the average natural gas cost. A large

cost savings potential for electricity exists, however this involves contacting third party suppliers and negotiating utility rates. SWA recommends that Denville Township further explore opportunities of purchasing electricity from third party energy suppliers in order to reduce rate fluctuation and ultimately reduce the annual cost of energy for the Municipal Complex building. Appendix B contains a complete list of third party energy suppliers for the Denville Township service area. Denville Township 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 ESCOs and of improving the pricing structures. This sort of activity is happening in many parts of the country and in New Jersey.





6.2. Energy Procurement strategies

Also, the Municipal Complex building would not be eligible for enrollment in a Demand Response Program, because there isn't the capability at this time 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.

7. METHOD OF ANALYSIS

7.1. Assumptions and tools

Energy modeling tool: Established / standard industry assumptions, DOE 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

Municipal Building

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	Court Room	Screw	N	CFL	18	1	32	S	4	261	2	578	639	N/A	Screw	CFL	E	S	18	1	32	4	261	2	578	639	0	0	0
2	1	Court Room	Uplight	N	HID	16	1	100	S	4	261	28	1,628	2,138	N/A	Uplight	HID	E	S	16	1	100	4	261	28	1,628	2,138	0	0	0
3	1	Court Room	Exit sign	E	LED Exit	2	1	5	S	24	365	1	11	105	N/A	Exit sign	LED Exit	None	S	2	1	5	24	365	1	11	105	0	0	0
4	1	Court Room	Screw	N	Inc	2	1	20	S	4	261	0	40	42	CFL	Screw	CFL	None	S	2	1	7	4	261	0	13	14	28	0	28
5	1	Vestibule	Screw	N	CFL	6	1	32	S	8	261	2	194	426	N/A	Screw	CFL	None	S	6	1	32	8	261	2	194	426	0	0	0
6	1	Vestibule	HID	N	Hal	4	1	100	S	8	261	28	428	1,069	CFL	HID	CFL	None	S	4	1	33	8	261	28	161	512	557	0	557
7	1	Vestibule	Exit sign	N	LED Exit	1	1	5	S	24	365	1	6	53	N/A	Exit sign	LED Exit	None	S	1	1	5	24	365	1	6	53	0	0	0
8	1	Council / Muni Clerk	Parabolic	E	4T8	2	3	32	OS	8	261	4	196	418	N/A	Parabolic	4T8	None	OS	2	3	32	8	261	4	196	418	0	0	0
9	1	Conference Room	Screw	N	Inc	3	1	40	S	8	261	0	120	251	CFL	Screw	CFL	None	S	3	1	13	8	261	0	40	84	167	0	167
10	1	Conference Room	Screw	N	CFL	10	1	26	S	8	261	1	261	564	N/A	Screw	CFL	None	S	10	1	26	8	261	1	261	564	0	0	0
11	1	Small Staff Area	Screw	N	CFL	2	1	26	OS	8	261	1	53	113	N/A	Screw	CFL	None	OS	2	1	26	8	261	1	53	113	0	0	0
12	1	Large Office	Screw	N	CFL	10	1	26	S	8	261	1	261	564	N/A	Screw	CFL	None	S	10	1	26	8	261	1	261	564	0	0	0
13	1	Large Office	Screw	N	Inc	2	1	40	S	8	261	0	80	167	CFL	Screw	CFL	None	S	2	1	13	8	261	0	27	56	111	0	111
14	1	Mayor Aid	Recessed	E	4T8	3	3	32	OS	8	261	4	292	626	N/A	Recessed	4T8	None	OS	3	3	32	8	261	4	292	626	0	0	0
15	1	Mayor Aid Desks	Recessed	E	2T8	2	1	16	S	8	261	1	33	71	N/A	Recessed	2T8	None	S	2	1	16	8	261	1	33	71	0	0	0
16	1	Rest Room	Recessed	E	4T8	1	1	32	OS	8	261	2	34	71	N/A	Recessed	4T8	None	OS	1	1	32	8	261	2	34	71	0	0	0
17	1	Finance Office 1	Screw	N	CFL	6	1	26	S	8	261	1	157	338	N/A	Screw	CFL	None	S	6	1	26	8	261	1	157	338	0	0	0
18	1	Finance Office 2	Recessed	E	4T8	2	3	32	S	8	261	4	196	418	N/A	Recessed	4T8	None	S	2	3	32	8	261	4	196	418	0	0	0
19	1	Finance Office 3	Recessed	E	4T8	2	3	32	S	8	261	4	196	418	N/A	Recessed	4T8	None	S	2	3	32	8	261	4	196	418	0	0	0
20	1	Office 2 Desk Lights	Recessed	E	2T8	2	1	16	S	8	261	1	33	71	N/A	Recessed	2T8	None	S	2	1	16	8	261	1	33	71	0	0	0
21	1	Finance Office 3	Recessed	E	4T8	2	3	32	S	8	261	4	196	418	N/A	Recessed	4T8	None	S	2	3	32	8	261	4	196	418	0	0	0
22	1	Office 3 Desk Lights	Recessed	E	4T8	2	1	32	S	8	261	2	66	142	N/A	Recessed	4T8	None	S	2	1	32	8	261	2	66	142	0	0	0
23	1	Finance Office 3	Recessed	E	4T8	2	3	32	S	8	261	4	196	418	N/A	Recessed	4T8	None	S	2	3	32	8	261	4	196	418	0	0	0
24	1	Finance Office 3	Recessed	E	4T8	2	1	32	S	8	261	2	66	142	N/A	Recessed	4T8	None	S	2	1	32	8	261	2	66	142	0	0	0
25	1	Finance Office 4	Recessed	E	4T8	2	3	32	S	8	261	4	196	418	N/A	Recessed	4T8	None	S	2	3	32	8	261	4	196	418	0	0	0
26	1	Finance Office 4	Recessed	E	2T8	2	1	16	S	8	261	1	33	71	N/A	Recessed	2T8	None	S	2	1	16	8	261	1	33	71	0	0	0
27	1	Mail Room	Recessed	E	4T8	3	3	32	S	8	261	4	292	626	N/A	Recessed	4T8	None	S	3	3	32	8	261	4	292	626	0	0	0
28	1	Shipping	Recessed	E	4T8	5	2	32	S	8	261	3	323	699	N/A	Recessed	4T8	None	S	5	2	32	8	261	3	323	699	0	0	0
29	1	Corridor / Landing	Recessed	E	4T8	4	1	32	S	8	261	2	130	284	N/A	Recessed	4T8	None	S	4	1	32	8	261	2	130	284	0	0	0
30	1	Office	Recessed	E	4T8	2	3	32	OS	8	261	4	196	418	N/A	Recessed	4T8	None	OS	2	3	32	8	261	4	196	418	0	0	0
31	1	John's Shop Office	Recessed	E	4T8	2	3	32	OS	8	261	4	196	418	N/A	Recessed	4T8	None	OS	2	3	32	8	261	4	196	418	0	0	0
32	1	Small Corridor	Recessed	E	4T8	2	3	32	S	8	261	4	196	418	N/A	Recessed	4T8	None	S	2	3	32	8	261	4	196	418	0	0	0
33	1	Lunch Room	Recessed	E	4T8	6	2	32	S	8	261	3	387	839	N/A	Recessed	4T8	None	S	6	2	32	8	261	3	387	839	0	0	0
34	1	Rest Rooms	Recessed	E	4T8	2	1	32	OS	8	261	2	66	142	N/A	Recessed	4T8	None	OS	2	1	32	8	261	2	66	142	0	0	0
35	1	Finance Cubicles	Recessed	E	4T8	18	3	32	S	8	261	4	1,732	3,758	C	Recessed	4T8	None	OS	18	3	32	6	261	4	1,732	2,819	0	940	940
36	1	Finance Cubicle Desks	Recessed	E	4T8	14	1	32	S	8	261	2	450	994	N/A	Recessed	4T8	None	S	14	1	32	8	261	2	450	994	0	0	0
37	1	Small Meeting Room	Recessed	E	4T8	1	3	32	OS	8	261	4	100	209	N/A	Recessed	4T8	None	OS	1	3	32	8	261	4	100	209	0	0	0
38	1	Corridor at other Side	Screw	N	CFL	6	1	26	S	8	261	1	157	338	N/A	Screw	CFL	None	S	6	1	26	8	261	1	157	338	0	0	0
39	1	Storage	Parabolic	E	4T8	2	2	32	OS	2	261	3	131	70	N/A	Parabolic	4T8	None	OS	2	2	32	2	261	3	131	70	0	0	0
40	1	Office	Recessed	E	4T8	2	3	32	S	8	261	4	196	418	N/A	Recessed	4T8	None	S	2	3	32	8	261	4	196	418	0	0	0
41	1	Office 22	Recessed	E	4T8	3	3	32	S	8	261	4	292	626	N/A	Recessed	4T8	None	S	3	3	32	8	261	4	292	626	0	0	0
42	1	Community Room	Recessed	E	4T8	8	2	32	S	8	261	3	515	1,119	C	Recessed	4T8	None	OS	8	2	32	6	261	3	515	839	0	280	280
43	1	Kitchen	Recessed	E	4T8	1	2	32	OS	8	261	3	67	140	N/A	Recessed	4T8	None	OS	1	2	32	8	261	3	67	140	0	0	0

44	1	Court Administration	Recessed	E	4T8	10	3	32	S	8	261	4	964	2,088	C	Recessed	4T8	None	OS	10	3	32	6	261	4	964	1,566	0	522	522
45	1	Court Admin Desks	Parabolic	E	2T8	5	1	16	S	8	261	1	81	177	N/A	Parabolic	2T8	None	S	5	1	16	8	261	1	81	177	0	0	0
46	1	CA Side Corridor	Screw	N	CFL	3	1	26	S	8	261	1	79	169	N/A	Screw	CFL	None	S	3	1	26	8	261	1	79	169	0	0	0
47	1	Closet	Recessed	E	4T8	2	2	32	S	2	261	3	131	70	N/A	Recessed	4T8	None	S	2	2	32	2	261	3	131	70	0	0	0
48	1	Mens Room	Screw	N	CFL	1	1	26	OS	8	261	1	27	56	N/A	Screw	CFL	None	OS	1	1	26	8	261	1	27	56	0	0	0
49	1	Mens Room	Recessed	E	4T8	2	1	32	OS	8	261	2	66	142	N/A	Recessed	4T8	None	OS	2	1	32	8	261	2	66	142	0	0	0
50	1	Mens Room	Recessed	E	4T8	1	1	32	OS	8	261	2	34	71	N/A	Recessed	4T8	None	OS	1	1	32	8	261	2	34	71	0	0	0
51	1	Recreation -Ofc. 1	Recessed	E	4T8	2	3	32	OS	8	261	4	196	418	N/A	Recessed	4T8	None	OS	2	3	32	8	261	4	196	418	0	0	0
52	1	Rec. - Desk Lights	Recessed	E	4T8	4	1	32	S	8	261	2	130	284	N/A	Recessed	4T8	None	S	4	1	32	8	261	2	130	284	0	0	0
53	1	Council / Muni Clerk	Screw	N	CFL	6	1	26	S	8	261	1	157	338	N/A	Screw	CFL	None	S	6	1	26	8	261	1	157	338	0	0	0
54	1	Recreation	Recessed	E	4T8	6	3	32	S	8	261	4	580	1,253	C	Recessed	4T8	None	OS	6	3	32	6	261	4	580	940	0	313	313
55	1	Admin., Mayor Hall	Recessed	E	4T8	3	3	32	S	8	261	4	292	626	N/A	Recessed	4T8	None	S	3	3	32	8	261	4	292	626	0	0	0
56	1	Admin., Mayor Hall	Screw	N	CFL	9	1	26	S	8	261	1	235	507	N/A	Screw	CFL	None	S	9	1	26	8	261	1	235	507	0	0	0
57	1	Admin Office	Recessed	E	4T8	3	3	32	OS	8	261	4	292	626	N/A	Recessed	4T8	None	OS	3	3	32	8	261	4	292	626	0	0	0
58	1	Main Corridor	Screw	N	CFL	27	1	26	S	8	261	1	703	1,522	N/A	Screw	CFL	None	S	27	1	26	8	261	1	703	1,522	0	0	0
59	1	Court Lobby	Screw	N	CFL	6	1	32	S	8	261	2	194	426	N/A	Screw	CFL	None	S	6	1	32	8	261	2	194	426	0	0	0
60	1	Office - court clerk	Recessed	E	4T8	10	3	32	S	8	261	4	964	2,088	C	Recessed	4T8	None	OS	10	3	32	6	261	4	964	1,566	0	522	522
61	1	Office	Recessed	E	4T8	2	2	32	S	8	261	3	131	280	N/A	Recessed	4T8	None	S	2	2	32	8	261	3	131	280	0	0	0
62	1	Bathroom Women	Recessed	E	4T8	5	1	32	OS	24	261	2	162	1,065	N/A	Recessed	4T8	None	OS	5	1	32	24	261	2	162	1,065	0	0	0
63	1	Bathroom Women	Screw	N	CFL	3	1	32	OS	24	261	2	98	639	N/A	Screw	CFL	None	OS	3	1	32	24	261	2	98	639	0	0	0
64	1	Bathroom Men	Screw	N	CFL	3	1	32	OS	24	261	2	98	639	N/A	Screw	CFL	None	OS	3	1	32	24	261	2	98	639	0	0	0
65	1	Bathroom Men	Recessed	E	4T8	3	1	32	OS	24	261	2	98	639	N/A	Recessed	4T8	None	OS	3	1	32	24	261	2	98	639	0	0	0
66	1	Hallway	Recessed	E	4T8	10	1	32	OS	24	261	2	322	2,130	N/A	Recessed	4T8	None	OS	10	1	32	24	261	2	322	2,130	0	0	0
67	1	Hallway	Screw	N	CFL	2	1	32	OS	24	261	2	66	426	N/A	Screw	CFL	None	OS	2	1	32	24	261	2	66	426	0	0	0
68	1	Janitor's Closet	Screw	N	CFL	2	1	32	S	2	261	2	66	35	N/A	Screw	CFL	None	S	2	1	32	2	261	2	66	35	0	0	0
69	1	rec office	Recessed	E	4T8	2	3	32	S	8	261	4	196	418	N/A	Recessed	4T8	None	S	2	3	32	8	261	4	196	418	0	0	0
70	1	Kitchen - comm room	Recessed	E	4T8	1	2	32	S	8	261	3	67	140	N/A	Recessed	4T8	None	S	1	2	32	8	261	3	67	140	0	0	0
71	1	Common Room	Screw	N	CFL	24	1	32	S	8	261	2	770	1,704	C	Screw	CFL	None	OS	24	1	32	6	261	2	770	1,278	0	426	426
72	1	Common Room	Exit sign	N	LED Exit	3	1	5	S	24	365	1	16	158	N/A	Exit sign	LED Exit	None	S	3	1	5	24	365	1	16	158	0	0	0
73	1	Janitor's Closet	Recessed	E	4T8	2	2	32	S	2	261	3	131	70	N/A	Recessed	4T8	None	S	2	2	32	2	261	3	131	70	0	0	0
74	1	Common Room	Exit sign	N	LED Exit	3	2	5	S	24	365	1	31	289	N/A	Exit sign	LED Exit	None	S	3	2	5	24	365	1	31	289	0	0	0
75	2	Main Corridor	Screw	N	CFL	8	1	26	S	8	261	1	209	451	N/A	Screw	CFL	None	S	8	1	26	8	261	1	209	451	0	0	0
76	2	Conference Room	Screw	N	CFL	6	1	26	OS	8	261	1	157	338	N/A	Screw	CFL	None	OS	6	1	26	8	261	1	157	338	0	0	0
77	2	Construction Office	Recessed	E	4T8	2	3	32	S	8	261	4	196	418	N/A	Recessed	4T8	None	S	2	3	32	8	261	4	196	418	0	0	0
78	2	Code Enforce Ofc. 2	Recessed	E	4T8	2	3	32	S	8	261	4	196	418	N/A	Recessed	4T8	None	S	2	3	32	8	261	4	196	418	0	0	0
79	2	Code Cubicles	Recessed	E	4T8	34	3	32	S	8	261	4	3,268	7,099	C	Recessed	4T8	None	OS	34	3	32	6	261	4	3,268	5,324	0	1,775	1,775
80	2	Staff Area	Recessed	E	4T8	1	3	32	OS	8	261	4	100	209	N/A	Recessed	4T8	None	OS	1	3	32	8	261	4	100	209	0	0	0
81	2	Code Enforcement	Recessed	E	4T8	2	1	32	OS	8	261	2	66	142	N/A	Recessed	4T8	None	OS	2	1	32	8	261	2	66	142	0	0	0
82	2	Copy / Printing	Recessed	E	4T8	3	3	32	S	8	261	4	292	626	N/A	Recessed	4T8	None	S	3	3	32	8	261	4	292	626	0	0	0
83	2	Large Filing	Recessed	E	4T8	3	3	32	S	8	261	4	292	626	N/A	Recessed	4T8	None	S	3	3	32	8	261	4	292	626	0	0	0
84	2	Small Filing	Recessed	E	4T8	4	2	32	OS	8	261	3	259	560	N/A	Recessed	4T8	None	OS	4	2	32	8	261	3	259	560	0	0	0
85	2	Code - Desk Lights	Recessed	E	2T8	22	1	16	S	8	261	1	353	781	N/A	Recessed	2T8	None	S	22	1	16	8	261	1	353	781	0	0	0
86	2	Counter	Screw	N	CFL	10	1	26	S	8	261	1	261	564	N/A	Screw	CFL	None	S	10	1	26	8	261	1	261	564	0	0	0
87	2	Soc. Svcs Office	Recessed	E	4T8	4	3	32	OS	8	261	4	388	835	N/A	Recessed	4T8	None	OS	4	3	32	8	261	4	388	835	0	0	0
88	2	Health Office	Recessed	E	4T8	2	3	32	OS	8	261	4	196	418	N/A	Recessed	4T8	None	OS	2	3	32	8	261	4	196	418	0	0	0
89	2	Rest Room	Recessed	E	4T8	1	1	32	OS	8	261	1	33	69	N/A	Recessed	4T8	None	OS	1	1	32	8	261	1	33	69	0	0	0
90	2	Soc. Svcs Office	Recessed	E	4T8	4	3	32	S	8	261	4	388	835	N/A	Recessed	4T8	None	S	4	3	32	8	261	4	388	835	0	0	0
91	2	Health Cubicles	Recessed	E	4T8	8	3	32	S	8	261	4	772	1,670	C	Recessed	4T8	None	OS	8	3	32	6	261	4	772	1,253	0	418	418
92	2	Health Desk Lights	Recessed	E	2T8	8	1	16	S	8	261	1	129	284	N/A	Recessed	2T8	None	S	8	1	16	8	261	1	129	284	0	0	0
93	2	Health Counter	Screw	N</																										

Note: Bolded items in yellow represent fixtures with proposed improvements

Police Department

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 k/Wh/yr	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 k/Wh/yr	Fixture Savings (k/Wh)	Controls Savings (k/Wh)	Total Savings (k/Wh)
1	1	Mens Locker Rm	Recessed	E	T8 U	1	1	32	S	4	365	4	36	53	N/A	Recessed	T8 U	None	S	1	1	32	4	365	4	36	53	0	0	0
2	1	Mens Locker Rm	Recessed	E	4T8	3	2	32	S	4	365	3	195	293	N/A	Recessed	4T8	None	S	3	2	32	4	365	3	195	293	0	0	0
3	1	Womens Locker Rm	Recessed	E	2T8	2	2	16	S	24	365	3	67	613	N/A	Recessed	2T8	None	S	2	2	16	24	365	3	67	613	0	0	0
4	1	Womens Locker Rm	Recessed	E	T12 U	2	1	38	S	38	365	12	88	1,387	T8	2'U-shape	T8 U	E	OS	2	1	34	28.5	365	4	72	791	333	264	596
5	1	Storage Rm	Recessed	E	4T12	1	3	34	S	2	365	10	112	82	T8	Recessed	4T12	E	S	1	3	34	2	365	10	112	82	0	0	0
6	1	Lunch Rm	Recessed	E	4T12	3	2	34	S	24	365	8	212	1,997	T8	Recessed	4T8	E	OS	3	2	32	18	365	3	195	1,321	237	440	677
7	1	Hallway	Recessed	E	T12 U	4	2	38	S	24	365	14	318	3,154	T8	2'U-shape	T8 U	E	S	4	2	34	24	365	3	275	2,488	666	0	666
8	1	Hallway	Exit sign	N	LED Exit	1	1	5	N	24	365	1	6	53	N/A	Exit sign	LED Exit	None	N	1	1	5	24	365	1	6	53	0	0	0
9	1	Office	Recessed	E	4T12	1	4	34	S	24	365	12	148	1,296	C	Recessed	4T12	None	OS	1	4	34	18	365	12	148	972	0	324	324
10	1	Office	Recessed	E	4T12	4	4	34	S	24	365	12	556	5,186	T8	Recessed	4T8	E	OS	4	4	32	18	365	6	518	3,522	491	1,174	1,664
11	1	Detectives Office	Recessed	E	4T12	4	4	34	S	24	365	12	556	5,186	T8	Recessed	4T8	E	OS	4	4	32	18	365	4	516	3,469	561	1,156	1,717
12	1	Detectives Office	Recessed	E	4T12	2	3	34	S	24	365	10	214	1,962	T8	Recessed	4T8	E	OS	2	3	32	18	365	3	195	1,301	228	434	661
13	1	Detectives Office	Recessed	E	4T12	2	4	34	S	24	365	12	284	2,593	T8	Recessed	4T8	E	OS	2	4	32	18	365	6	262	1,761	245	587	832
14	1	Meeting Rm	Recessed	E	4T12	1	3	34	S	24	365	10	112	981	T8	Recessed	4T8	E	S	1	3	34	24	365	10	112	981	0	0	0
15	1	Meeting Rm	Recessed	E	T12 U	2	2	38	S	24	365	14	166	1,577	T8	2'U-shape	T8 U	E	OS	2	2	34	18	365	3	139	933	333	311	644
16	1	Hallway	Recessed	E	T12 U	7	2	38	S	24	365	14	546	5,519	T8	2'U-shape	T8 U	E	S	7	2	34	24	365	3	479	4,354	1,165	0	1,165
17	1	Hallway	Exit sign	N	LED Exit	2	1	5	S	24	365	1	11	105	N/A	Exit sign	LED Exit	None	S	2	1	5	24	365	1	11	105	0	0	0
18	1	Admin. Office	Recessed	E	4T12	1	3	34	S	8	365	10	112	327	T8	Recessed	4T12	E	S	1	3	34	8	365	10	112	327	0	0	0
19	1	Admin. Office	Recessed	E	4T12	1	4	34	S	8	365	12	148	432	T8	Recessed	4T12	E	S	1	4	34	8	365	12	148	432	0	0	0
20	1	Office - report writing	Recessed	E	4T12	2	3	34	S	8	365	10	214	654	T8	Recessed	4T12	E	S	2	3	34	8	365	10	214	654	0	0	0
21	1	Office - comm center	Recessed	E	4T12	2	2	34	S	24	365	8	144	1,332	C	Recessed	4T12	E	OS	2	2	34	18	365	8	144	999	0	333	333
22	1	Office - comm center	Recessed	E	T12 U	1	2	38	S	24	365	14	90	788	T8	Recessed	T12 U	E	S	1	2	34	24	365	14	82	718	70	0	70
23	1	Office	Recessed	E	T12 U	2	3	38	S	24	365	16	244	2,278	T8	2'U-shape	T8 U	E	OS	2	3	34	18	365	4	208	1,393	420	464	885
24	1	Office dispatch	Screw	N	Inc	6	1	65	S	24	365	0	390	3,416	CFL	Screw	CFL	None	S	6	1	44	24	365	1	265	2,365	1,051	0	1,051
25	1	Office dispatch	Recessed	E	4T12	3	4	34	S	24	365	12	420	3,889	T8	Recessed	4T8	E	S	3	4	32	24	365	6	390	3,522	368	0	368
26	1	Office records	Recessed	E	4T12	6	4	34	S	8	365	12	828	2,593	T8	Recessed	4T8	E	OS	6	4	32	6	365	6	774	1,761	245	587	832
27	1	Office	Recessed	E	4T12	6	2	34	S	8	365	8	416	1,332	C	Recessed	4T12	E	OS	6	2	34	6	365	8	416	999	0	333	333
28	1	Office	Recessed	E	4T12	2	2	34	S	8	365	8	144	444	T8	Recessed	4T12	E	S	2	2	34	8	365	8	144	444	0	0	0
29	1	Staircase	Recessed	E	T12 U	3	2	38	S	24	365	14	242	2,365	T8	2'U-shape	T8 U	E	S	3	2	34	24	365	14	218	2,155	210	0	210
30	1	Staircase	Exit sign	N	LED Exit	1	1	5	S	24	365	1	6	53	N/A	Exit sign	LED Exit	None	S	1	1	5	24	365	1	6	53	0	0	0
31	1	Booking room	Recessed	E	4T12	6	4	34	S	24	365	12	828	7,779	T8	Recessed	4T8	E	S	6	4	32	24	365	6	774	7,043	736	0	736
32	1	Hallway	Exit sign	N	LED Exit	1	1	5	S	24	365	1	6	53	N/A	Exit sign	LED Exit	None	S	1	1	5	24	365	1	6	53	0	0	0
33	1	Hallway	Recessed	E	4T8	4	2	32	S	24	365	8	264	2,523	N/A	Recessed	4T8	None	S	4	2	32	24	365	8	264	2,523	0	0	0
34	1	Hallway	Exit sign	N	LED Exit	2	1	5	S	24	365	1	11	105	N/A	Exit sign	LED Exit	None	S	2	1	5	24	365	1	11	105	0	0	0
35	1	Storage Rm	Recessed	E	4T8	1	3	32	S	2	365	3	99	72	N/A	Recessed	4T8	None	S	1	3	32	2	365	3	99	72	0	0	0
36	1	Hallway	Recessed	E	4T8	12	1	32	S	24	365	2	386	3,574	N/A	Recessed	4T8	None	S	12	1	32	24	365	2	386	3,574	0	0	0
37	1	Office	Recessed	E	4T8	2	3	32	S	24	365	4	196	1,752	C	Recessed	4T8	None	OS	2	3	32	18	365	4	196	1,314	0	438	438
38	1	Office	Recessed	E	4T8	2	3	32	S	24	365	4	196	1,752	C	Recessed	4T8	None	OS	2	3	32	18	365	4	196	1,314	0	438	438
39	1	Office	Recessed	E	4T8	2	3	32	S	24	365	4	196	1,752	C	Recessed	4T8	None	OS	2	3	32	18	365	4	196	1,314	0	438	438
40	1	Office	Recessed	E	4T8	2	3	32	S	24	365	4	196	1,752	C	Recessed	4T8	None	OS	2	3	32	18	365	4	196	1,314	0	438	438
41	1	Hallway	Screw	N	CFL	5	1	26	S	24	365	1	131	1,183	N/A	Screw	CFL	None	S	5	1	26	24	365	1	131	1,183	0	0	0
42	1	Hallway	Exit sign	N	LED Exit	1	1	5	S	24	365	1	6	53	N/A	Exit sign	LED Exit	None	S	1	1	5	24	365	1	6	53	0	0	0
43	1	Storage Rm	Recessed	E	4T8	2	2	32	S	2	365	3	131	98	N/A	Recessed	4T8	None	S	2	2	32	2	365	3	131	98	0	0	0
44	1	Lobby	Recessed	E	4T8	2	3	32	S	24	365	4	196	1,752	N/A	Recessed	4T8	None	S	2	3	32	24	365	4	196	1,752	0	0	0
45	1	Lobby	Screw	N	CFL	6	1	32	S	24	365	2	194	1,787	N/A	Screw	CFL	None	S	6	1	32	24	365	2	194	1,787	0	0	0
Totals:						128	106	1,365	0			331	10,061	77,925						128	106	1,300			229	9,441	62,408	7,358	8,158	15,517
Note: Bolded items in yellow represent fixtures with proposed improvements																														

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

Third Party Electric Suppliers for JCPL Service Territory	Telephone & Web Site
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 300 Madison Avenue Morristown, NJ 07926	(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
Integrus Energy Services, Inc. 99 Wood Ave, South, Suite 802 Iselin, NJ 08830	(877) 763-9977 www.integrusenergy.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	(800) 363-7499 www.libertypowercorp.com
Pepco Energy Services, Inc. 112 Main St. Lebanon, NJ 08833	(800) 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 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) 756-3749 www.southjerseyenergy.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

Third Party Gas Suppliers for NJNG Service Territory	Telephone & Web Site
Cooperative Industries 412-420 Washington Avenue Belleville, NJ 07109	(800) 628-9427 www.cooperativenet.com
Direct Energy Services, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com
Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701	(800) 805-8586 www.gesc.com
UGI Energy Services, Inc. 704 East Main Street, Suite 1 Moorestown, NJ 08057	(856) 273-9995 www.ugienergyservices.com
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com
Intelligent Energy 2050 Center Avenue, Suite 500 Fort Lee, NJ 07024	(800) 724-1880 www.intelligentenergy.org
Metromedia Energy, Inc. 6 Industrial Way Eatontown, NJ 07724	(877) 750-7046 www.metromediaenergy.com
MxEnergy, Inc. 510 Thornall Street, Suite 270 Edison, NJ 08837	(800) 375-1277 www.mxenergy.com
NATGASCO (Mitchell Supreme) 532 Freeman Street Orange, NJ 07050	(800) 840-4427 www.natgasco.com
NJ Gas & Electric 1 Bridge Plaza, Fl. 2 Fort Lee, NJ 07024	(866) 568-0290 www.NewJerseyGasElectric.com
Pepco Energy Services, Inc. 112 Main Street Lebanon, NJ 08833	(800) 363-7499 www.pepco-services.com
PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 www.pplenergyplus.com
South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037	(800) 756-3749 www.southjerseyenergy.com
Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 07928	(800) 225-1560 www.spragueenergy.com
Woodruff Energy 73 Water Street Bridgeton, NJ 08302	(800) 557-1121 www.woodruffenergy.com

Appendix C: Police Department Mechanical Inventory

Building System	Description	Physical Location	Make/ Model	Fuel	Space served	Estimated Remaining useful life %
Heating/Cooling	York Rooftop packaged unit, combination heating and cooling unit, R-22, older unit, not running during audit	Police Department roof, near municipal building	York, Model #DCE036A25EBA, Serial #NMMM125616	Electricity /Natural Gas	Police Department	30%
Heating/Cooling	York Rooftop packaged unit, combination heating and cooling unit, R-22, newer unit, not running during audit but general duty safety switch on side was loud and vibrating	Police Department roof, center of roof	York, Model #D3CE072A25BDA, Serial #N0H6779858	Electricity /Natural Gas	Police Department	60%
Heating/Cooling	York Rooftop packaged unit, combination heating and cooling unit, R-22, older unit, not running during audit	Police Department roof, near athletic fields	York, Model #DCE048A25EBA, Serial #NMMM124940	Electricity /Natural Gas	Police Department	30%
Heating/Cooling	York Rooftop packaged unit, combination heating and cooling unit, R-22, older unit, not running during audit but general duty safety switch on side was loud and vibrating	Police Department roof, near parking lot	York, Model #DCE036A25EBA, Serial #NMMM125617	Electricity /Natural Gas	Police Department	30%
Heating	York central heat pump, smaller unit, R-22, older unit, not running during audit	Police Department roof, near municipal building	York, Model #B1HA024A06B, Serial #NLMM114879	Electricity /Natural Gas	Police Department	30%
Cooling	Fujitsu Halcyon Condensing unit for split AC system, 9,700 Btuh cooling capacity, 115V, 60 Hz, 1ph, 410A refrigerant, not running during audit	Police Department roof, near athletic fields	Fujitsu Halcyon, Model #A0V9CQ, Serial #BCN005372	Electricity	Police Department server room	50%
Cooling	Mitsubishi Electric Mr. Slim Condensing unit for split AC system, R-22, not running during audit	Police Department roof, near athletic fields	Mitsubishi Electric Mr. Slim, Model #MU15TN, Serial #2001353	Electricity	Police Department dispatch room	50%
Ventilation	EF-10: Cook exhaust fan, .125 HP, 200 design CFM, 1550 RPM, 11/2003, not running during audit	Police Department roof, adjacent to Mitsubishi condenser	Cook, Model #90 ACEH 90C15DH, Serial #2145764490-00/0001901	Electricity	Police Department	40%
Ventilation	Two (2) larger exhaust fans, no nameplate data	Police Department roof, near athletic fields	NA	Electricity	Police Department	30%
Ventilation	EF-6: Cook exhaust fan, .125 HP, 80 design CFM, 1550 RPM, 11/2003, not running during audit	Police Department roof, near parking lot	Model #90 ACEL 90C15DL, Serial #2145764490-00/0000701	Electricity	Police Department	40%
Ventilation	One (1) larger exhaust fan, no nameplate data, not running during audit	Police Department roof, center of roof	NA	Electricity	Police Department	30%
Ventilation	One (1) larger exhaust fan, no nameplate data, not running during audit	Police Department roof, near municipal building	NA	Electricity	Police Department	30%
Ventilation	One (1) smaller exhaust fan, no nameplate data, not running during audit	Police Department roof, near parking lot	NA	Electricity	Police Department	30%
Ventilation	EF-1: Cook cannister-shaped exhaust fan, .5 HP, 1900 design CFM, 1725 RPM, 02/2004, not running during audit	Police Department roof, near parking lot	Cook, Model #135 ACE 135C5R, Tag #EF-1 BlueDO 1016-2-MESCO	Electricity	Police Department	50%
Distribution System	Force air ductwork	-	-	-	-	-
Domestic Hot Water	AO Smith Dura-Power electric domestic hot water heater, 119 gallons, 3 elements, 18.0 total kW	Police Department, storage room in hallway near parking lot	AO Smith Dura-Power, Model #DRE 120, Serial #AA81-67751-000	Electricity	All areas of Police Department	50%
Lighting	See details appendix A		-	-	-	-