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June 28, 2010

Local Government Energy Program
Energy Audit Report

Township of Livingston

Pump House, Booster Station, Sewer Station
Livingston, NJ 07039

Project Number: LGEA50

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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 Township of Livingston. The audit included a review of the following buildings located in the Township of Livingston for which separate energy audit reports are issued for each of the following referenced buildings:

- Municipal Court
- Main Fire Station
- Northfield Fire Department
- Circle Fire Station
- Township Garage
- Livingston Free Public Library
- Senior & Community Center
- Water Department
- Monmouth Court Community Center
- Well House No. 3, Building 1
- Well House No. 3, Building 2
- Well House No. 4
- Well House No. 9
- Well House No. 11
- Okner Field Concession Building
- Storage Shed
- Northland Pool and Recreation Center
- Sewage Treatment Plant
- Animal Shelter
- Pump House
- Booster Station
- Sewer Station

This report addresses the Pump House, Booster Station and Sewer Station in Livingston, 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 Pump House located at 415 South Orange Avenue was opened in 1999. It is a single-story; free standing building with approximately 500 square feet of conditioned space.

The Booster Station located at 55 North Hillside Avenue was opened in 1956. It is a single story free standing building with approximately 360 square feet of conditioned space.

The Sewer Station located at 297 Eisenhower Parkway was opened in the 1950's. It is a single story free standing building with approximately 130 square feet of conditioned space.

The buildings are used exclusively to house mechanical equipment and serve no other purpose. While the equipment inside all of the buildings operates all day every day the facilities themselves are unoccupied except for approximately 1 hour per day when an employee of the Water Department will inspect and maintain the existing equipment and perform testing.

The goal of this Local Government Energy Audit (LGEA) is to provide sufficient information to the Township of Livingston 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 5 provide a description of our recommendations.
- Appendices include further details and information supporting our recommendations.

EXECUTIVE SUMMARY

The Pump House located at 415 South Orange Avenue was opened in 1999. It is a single story free standing building with approximately 500 square feet of conditioned space.

The Booster Station located at 55 North Hillside Avenue was opened in 1956. It is a single story free standing building with approximately 360 square feet of conditioned space.

The Sewer Station located at 297 Eisenhower Parkway was opened in the 1950's. It is a single story free standing building with approximately 130 square feet of conditioned space.

The buildings are used exclusively to house mechanical equipment and serve no other purpose. While the equipment inside all of the buildings operates all day every day the facilities themselves are unoccupied except for approximately 1 hour per day when an employee of the Water Department will inspect and maintain the existing equipment and perform testing.

Based on the field visit performed by the SWA staff on January 26, 2010 and the results of a comprehensive energy analysis, this report describes the site's current conditions and recommendations for improvements. Suggestions for measures related to energy conservation and improved comfort are provided in the scope of work. Energy and resource savings are estimated for each measure that results in a reduction of heating, cooling, and electric usage.

Pump House:

From January 2009 through December 2009, the period of analysis for this audit, the building consumed 75,557 kWh or $13,229 worth of electricity at an approximate rate of $0.175/kWh. The energy consumption for the building was 258 MMBTUs.

SWA has entered energy information about the pump house in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. Currently, the building is not eligible to receive a performance rating because it is classified as an "other" space type which means that it is still ineligible for Energy Star. SWA encourages the Township of Livingston 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 515.6 kBtu/sq ft yr compared to the national average of an "other" building consuming 104.0 kBtu/sq ft yr. The extremely high intensity is a result of this building housing numerous pieces of process equipment that are not present in the average commercial building.

Booster Station:

From March 2008 through February 2009, the period of analysis for this audit, the building consumed 66,535 kWh or $11,231 worth of electricity at an approximate rate of $0.169/kWh. The energy consumption for the building was 227 MMBTUs.

SWA has entered energy information about the booster station in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. Currently, the building is not eligible to receive a performance rating because it is classified as an "other" space type which means that it is still ineligible for Energy Star. SWA encourages the Township of Livingston 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 660.1 kBtu/sq ft yr compared to the national average of a pump house consuming 104.0 kBtu/sq ft yr. The extremely high intensity is a result of this building housing numerous pieces of process equipment that are not present in the average commercial building.

Sewer Station:

From January 2009 through December 2009, the period of analysis for this audit, the building consumed 36,946 kWh or $6,250 worth of electricity at an approximate rate of $0.169/kWh. The energy consumption for the building was 126 MMBTUs.

SWA has entered energy information about the sewer station in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. Currently, the building is not eligible to receive a performance rating because it is classified as an "other" space type which means that it is still ineligible for Energy Star. SWA encourages the Township of Livingston 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 252.1 kBtu/sq ft yr compared to the national average of an "other" building consuming 104.0 kBtu/sq ft yr. The extremely high intensity is a result of this building housing numerous pieces of process equipment that are not present in the average commercial building.

Recommendations

The booster and sewer station are both over fifty years old, most HVAC equipment has exceeded their recommended useful life cycle and additionally much of the lighting is inefficient. In Appendix C, SWA has included a mechanical inventory list of equipment for the three buildings. 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:

Pump House:

Category I Recommendations: - Capital Improvements

- Install baffles and extend ceiling insulation.
- Apply epoxy to exposed concrete floor.
- Install premium motors when replacements are required.

Category II Recommendations: - Operations and Maintenance

- Maintain roofs
- Maintain downspouts
- Provide weather-stripping and air sealing
- Repair/seal wall cracks and penetrations

Booster Station:

Category I Recommendations: - Capital Improvements

- Remove and replace brick veneer with EIFS and 1" rigid insulation.
- Provide R-30 ceiling insulation.
- Replace roof with 25 year fiberglass shingles over 30# felt.
- Install gutters and downspouts to keep water away from the building façade and base..
- Replace gable vents.
- Repair crack at the base of the building.
- Replace windows
- Replace door with insulated metal door.
- Replace electric unit heater
- Replace exhaust fan
- Install premium motors when replacements are required

Category II Recommendations: - Operations and Maintenance

- Maintain roofs
- Maintain downspouts
- Provide weather-stripping and air sealing
- Repair/seal wall cracks and penetrations

Sewer Station:

Category I Recommendations: - Capital Improvements

- Cover building with EIFS and 1" rigid insulation.
- Install a layer of rigid roof insulation below a new EPDM membrane.
- Replace windows
- Replace door with insulated metal door.
- Replace tank-type water heater with instantaneous water heater
- Replace duct from roof fan to sewer pit
- Install premium motors when replacements are required.

Category II Recommendations: - Operations and Maintenance

- Maintain roofs
- Maintain downspouts
- Provide weather-stripping and air sealing
- Repair/seal wall cracks and penetrations

Category III Recommendations: Energy Conservation Measures

At this time, SWA recommends a total of **6** Energy Conservation Measures (ECMs) for the three buildings as summarized in the following Tables 1 and 2. The total investment cost for these ECMs with incentives is **$7,514**. SWA estimates a first year savings of **$1,248** with a simple payback of **6.1 years**.

The implementation of all the recommended ECMs would reduce the building electric usage by 6,119 kWh annually. SWA estimates that implementing these ECMs will reduce the carbon footprint of the Pump House by **8,382lbs of CO_2**, which is equivalent to removing approximately 1 cars from the roads each year or avoiding the need of 23 trees to absorb the annual CO_2 produced. SWA also recommends that Township of Livingston 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 $0.020/kWh in pump house and $0.014 in the other buildings.

There are various incentives that Township of Livingston could apply for that could also help lower the cost of installing the ECMs. SWA recommends that the Township of Livingston 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 could also assist to cover up to 80% of the capital investment.

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

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	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
2.2	Replace (1) incandescent fixture with CFL	50	0	50	175	0.0	0	1.7	4	35	5	173	1.4	245	49	63	108	240
3	Replace (1) incandescent fixture with CFL	50	0	50	175	0.0	0	1.7	4	35	5	173	1.4	245	49	63	108	240
	TOTALS	**100**	**0**	**100**	**350**	**0.0**	**0**	**3.4**	**8**	**70**	**-**	**346**	**1.4**	**-**	**-**	**-**	**216**	**480**

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	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
1	Replace (3) metal halide fixtures with PSMH	1,395	75	1,320	473	0.1	0	3.2	145	228	15	3,417	5.8	159	11	15	1,360	648
2.1	Replace (1) metal halide fixture with PSMH	675	25	650	158	0.0	0	1.5	48	76	15	1,139	8.6	75%	5%	8	243	216
4.1	replace (2) 25 Hp Booster Pump motors with Premium Efficiency	3,200	260	2,940	3,504	0.7	0	33.2	0	592	20	11,844	5.0	303	15	20	5,870	4,800
4.2	replace (2) 5 Hp submersible pump motors with Premium Efficiency	1,010	120	890	755	0.2	0	5.2	0	128	20	2,552	7.0	187	9	13	1,008	1,034
4.3	replace (2) 10 Hp Submersible Sewage Pump Motors with Premium Efficiency	1,564	200	1,364	879	0.2	0	6.0	0	154	20	3,077	8.9	126	6	9	925	1,204
	TOTALS	**7,844**	**680**	**7,164**	**5,769**	**1.2**	**0**	**49.1**	**193**	**1,178**	**-**	**22,029**	**6.1**	**-**	**-**	**-**	**9,406**	**7,902**

1. HISTORIC ENERGY CONSUMPTION

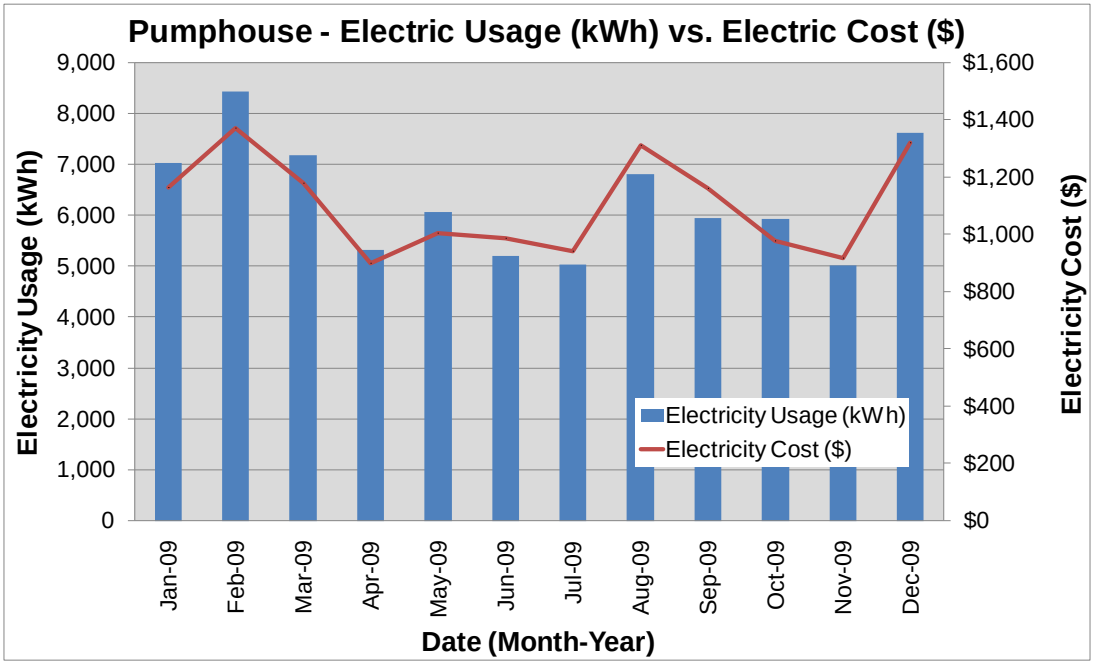
1.1. Energy usage, load profiles and cost analysis

Pump House

SWA analyzed utility bills for the Pump House for the 24 months from January 2008 to December 2009 with an analysis period between **January 2009 and December 2009**.

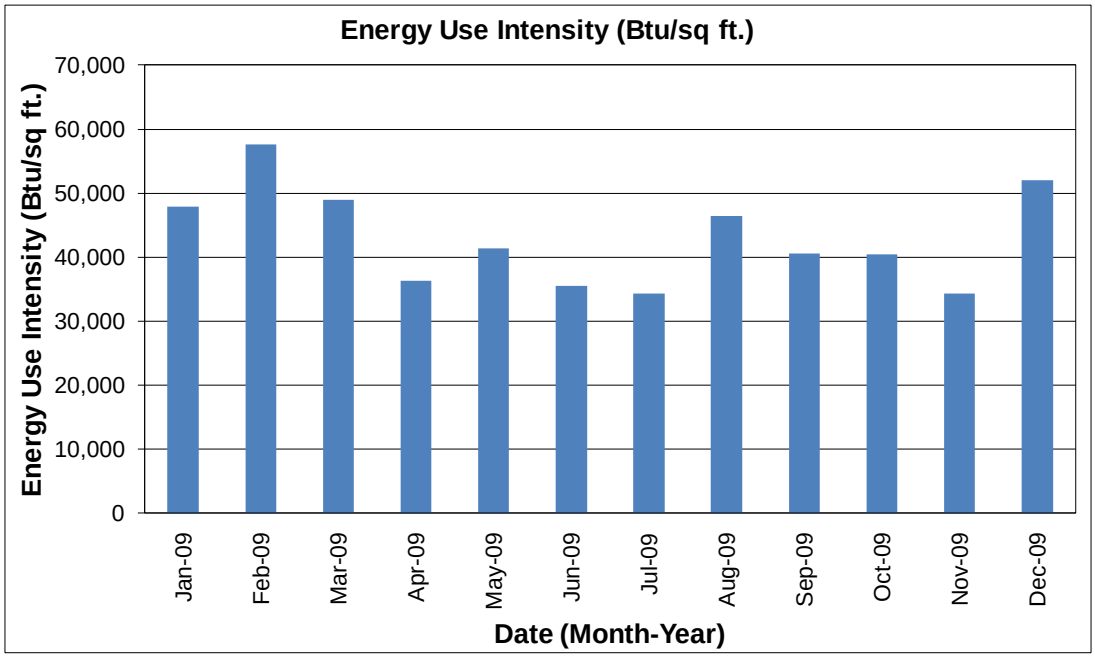
Electricity - The Pump House buys electricity from JCP&L at **an average rate of $0.175/kWh** based on 12 months of utility bills from **January 2009 through December 2009**. The building purchased **approximately 75,557 kWh or $13,229 worth of electricity** during the analysis period and is currently charged for demand (kW) which has been factored into each monthly bill. The building had an average monthly demand of **34.5 kW** and an annual peak demand of **36.4 kW**.

The following chart shows electricity use versus cost for the Pump House based on utility bills for the 12 month period of January 2009 to December 2009.



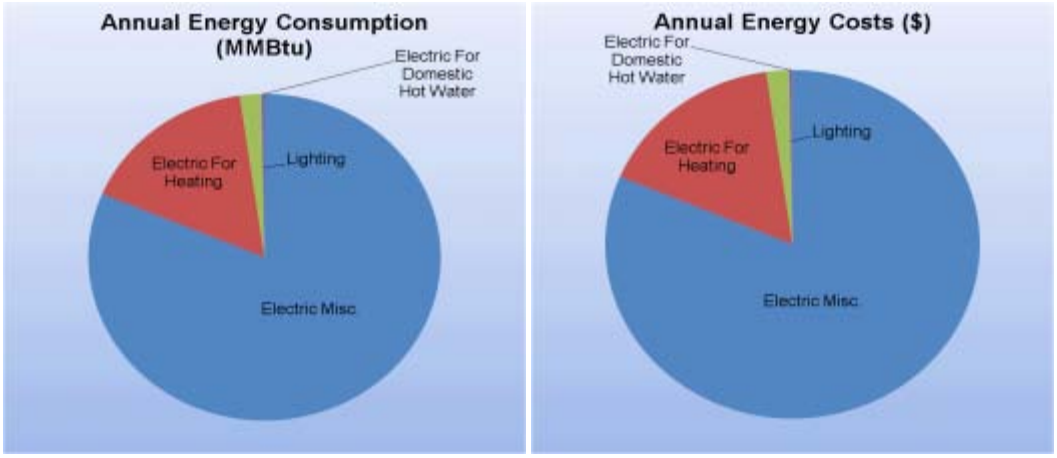
Electricity use follows a trend that is expected for this building with usage peaking during the winter due to the electric heating equipment. The cost of electricity fluctuates as expected with usage peaking in the summer during the time of highest usage.

The following chart shows electric consumption in Btu/sq ft for the Pump House based on utility bills for the 12 month period of January 2009 to December 2009.



The following table and chart pies show energy use for the Pump House based on utility bills for the 12 month period of January 2009 to December 2009.

2009 Annual Energy Consumption / Costs					
	MMBtu	% MMBtu	$	% $	$/MMBtu
Electric Miscellaneous	210	81%	$10,761	81%	51
Electric For Heating	42	16%	$2,168	16%	51
Lighting	5	2%	$262	2%	51
Electric For Domestic Hot Water	1	0%	$37	0%	51
Totals	258	100%	$13,229	100%	

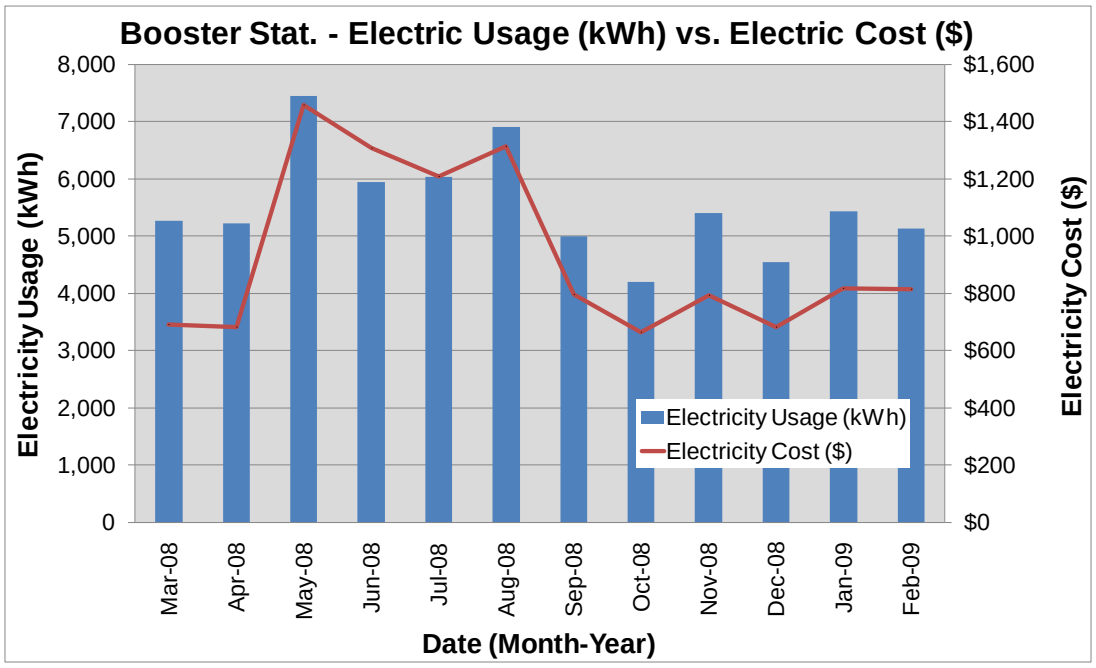


Booster Station

SWA analyzed utility bills for the Booster Station for the 24 months between March 2007 to February 2009 with an analysis period between **March 2008 and February 2009**.

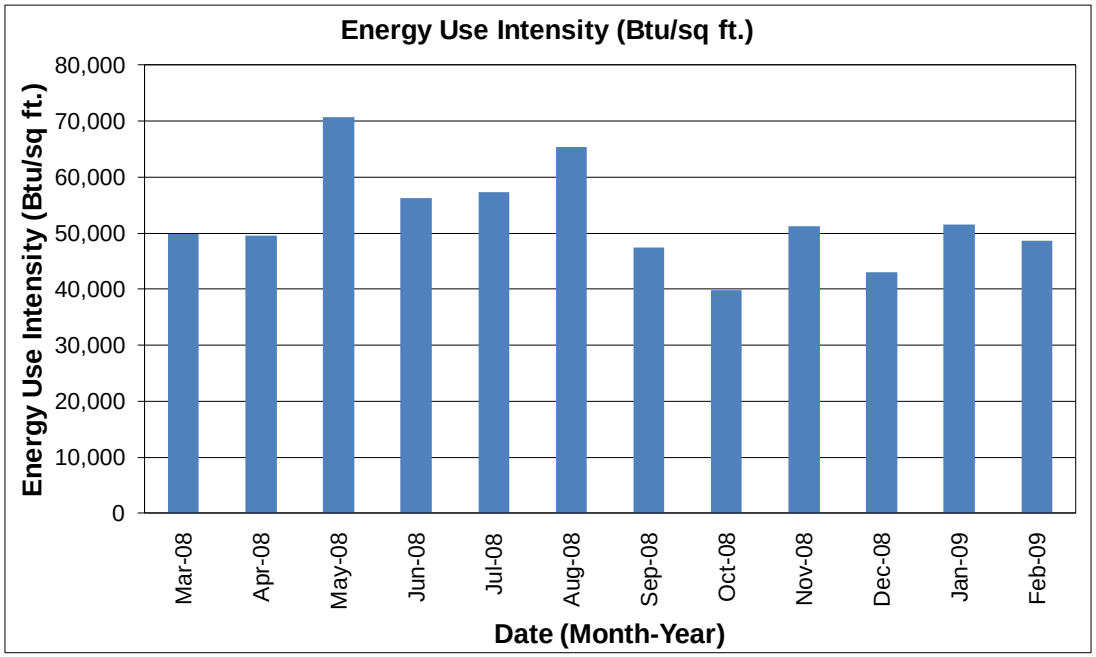
Electricity - The Booster Station buys electricity from PSE&G at **an average rate of $0.169/kWh** based on 12 months of utility bills from **March 2008 through February 2009**. The building purchased **approximately 66,535 kWh or $11,231 worth of electricity** during the analysis period and is currently charged for demand (kW) which has been factored into each monthly bill. The building had an average monthly demand of **22.3 kW** and an annual peak demand of **34 kW**.

The following chart shows electricity use versus cost for the Booster Station based on utility bills for the 12 month period of January 2009 to December 2009.



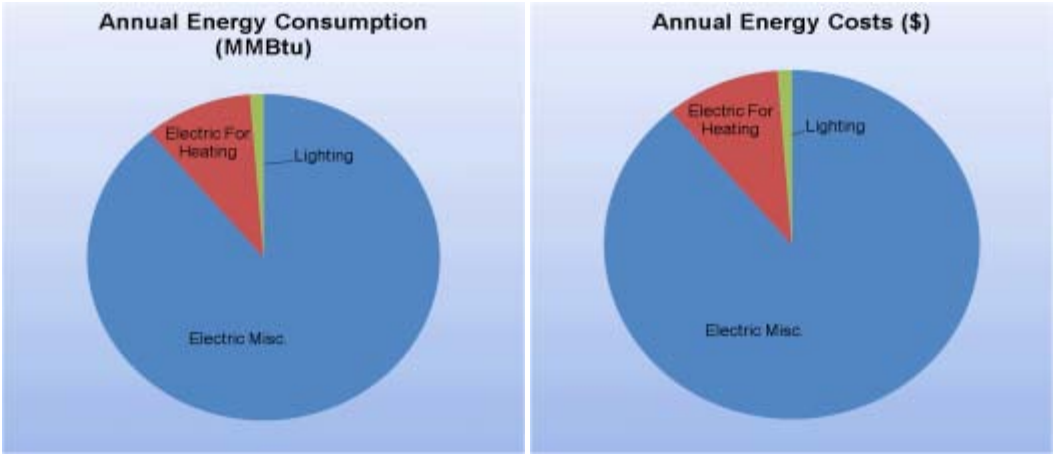
Electricity use follows a trend that is expected for this building with usage never peaking during the winter due to the electric heating equipment. The cost of electricity fluctuates as expected with usage peaking in the summer during the time of highest usage.

The following chart shows electric consumption in Btu/sq ft for the Booster Station based on utility bills for the 12 month period of January 2009 to December 2009.



The following table and chart pies show energy use for the Booster Station based on utility bills for the 12 month period of January 2009 to December 2009.

March 2008 - February 2009 Annual Energy Consumption / Costs					
	MMBtu	% MMBtu	$	% $	$/MMBtu
Electric Miscellaneous	202	89%	$9,981	89%	49
Electric For Heating	23	10%	$1,113	10%	49
Lighting	3	1%	$137	1%	49
Totals	227	100%	$11,231	100%	

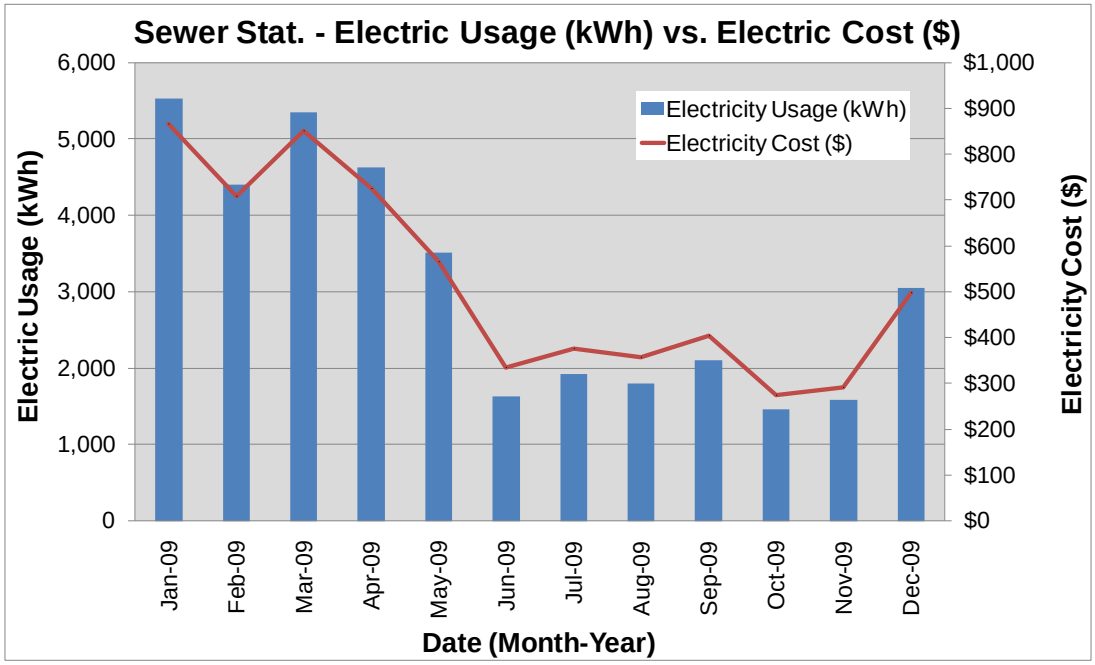


Sewer Station

SWA analyzed utility bills for the Sewer Station for the 24 months between January 2008 to December 2009 with an analysis period between **January 2009 and December 2009**.

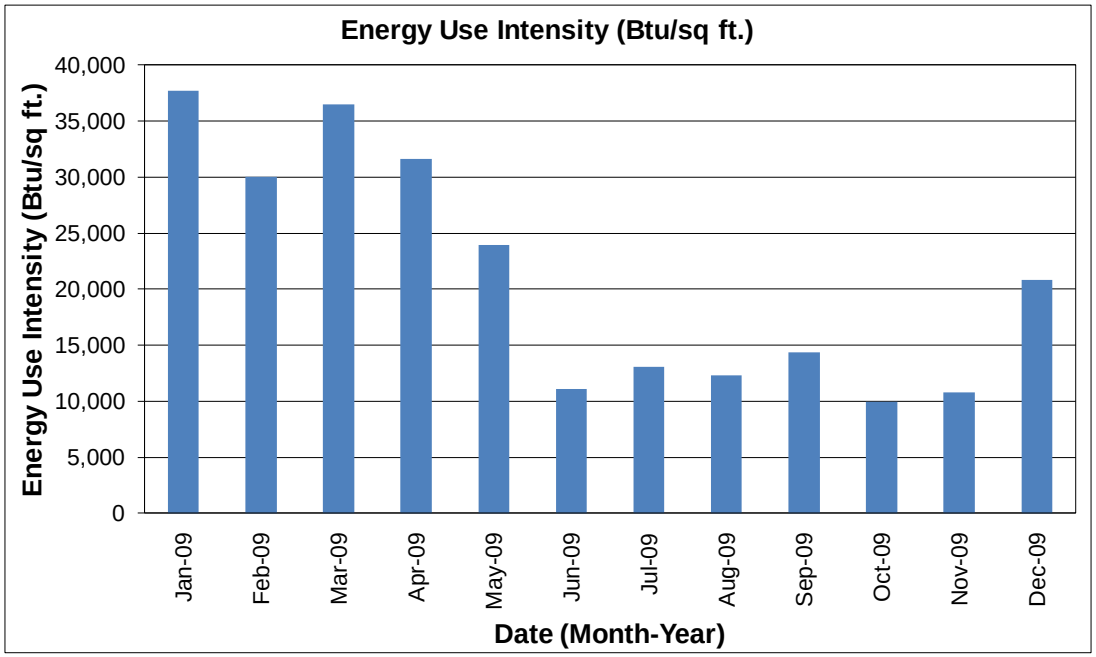
Electricity - The Sewer Station buys electricity from JCP&L at **an average rate of $0.169/kWh** based on 12 months of utility bills from **January 2009 through December 2009**. The building purchased **approximately 36,946 kWh or $6,250 worth of electricity** during the analysis period and is currently charged for demand (kW) which has been factored into each monthly bill. The building had an average monthly demand of **11.7 kW**.

The following chart shows electricity use versus cost for the Sewer Station based on utility bills for the 12 month period of January 2009 to December 2009.



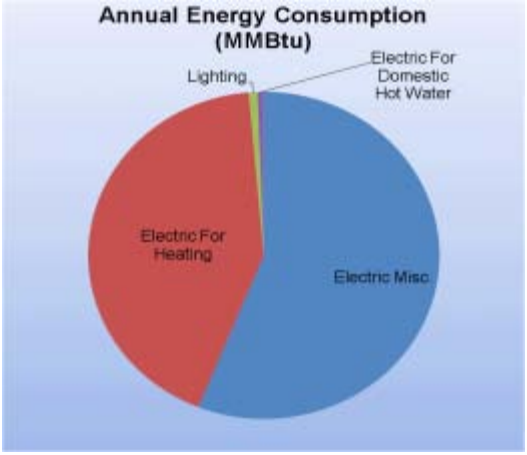
Electricity use follows a trend that is expected for this building with usage peaking during the winter due to the electric heating equipment. The cost of electricity fluctuates as expected with usage peaking in the summer during the time of highest usage.

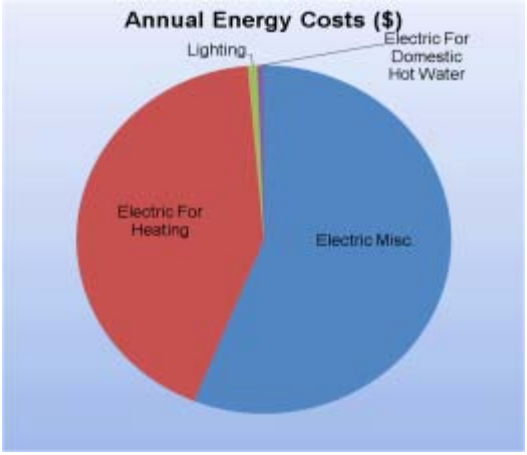
The following chart shows electric consumption in Btu/sq ft for the Sewer Station based on utility bills for the 12 month period of January 2009 to December 2009.



The following table and chart pies show energy use for the Sewer Station based on utility bills for the 12 month period of January 2009 to December 2009.

2009 Annual Energy Consumption / Costs					
	MMBtu	% MMBtu	$	% $	$/MMBtu
Electric Miscellaneous	71	56%	$3,506	56%	49
Electric For Heating	54	43%	$2,658	43%	49
Lighting	1	1%	$50	1%	49
Electric For Domestic Hot	1	1%	$36	1%	49
Totals	127	100%	$6,250	100%	

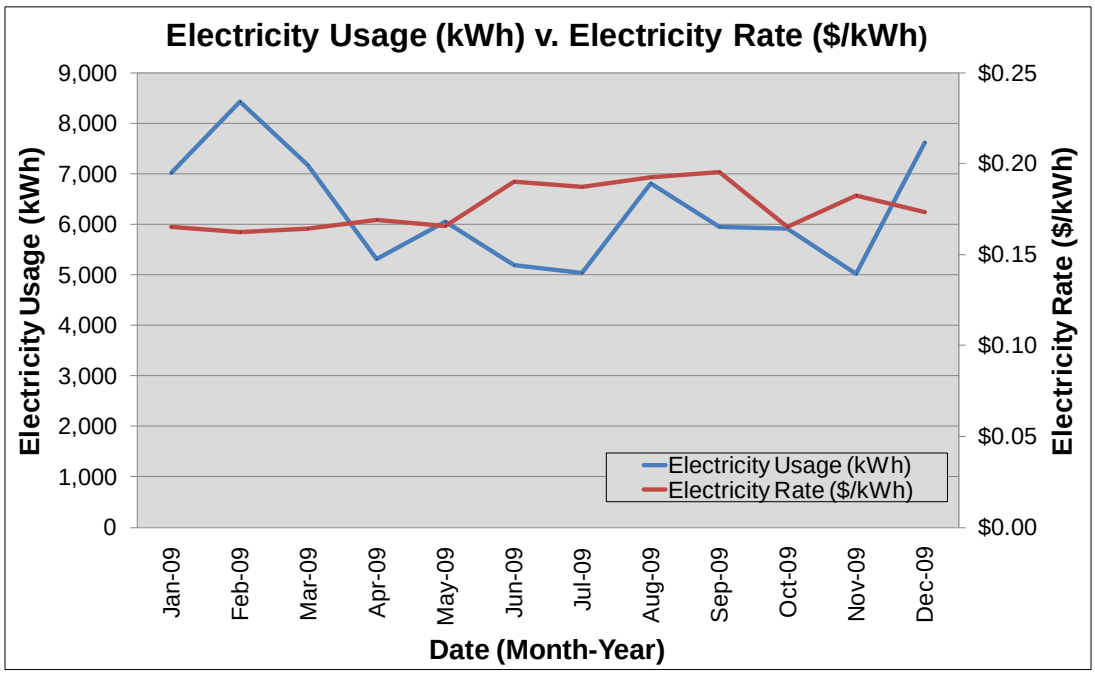




1.2. Utility Rate Analysis

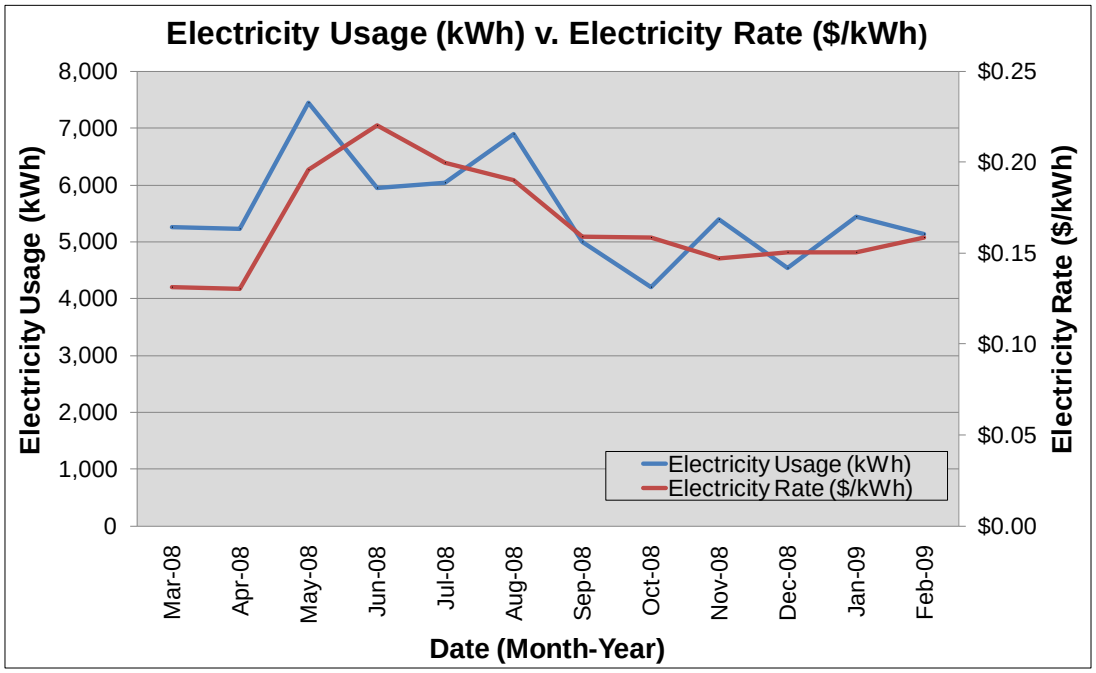
Pump House

The Pump House 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 Pump House currently pays an average rate of approximately $0.175/kWh based on the 12 months of utility bills of January 2009 to December 2009. 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 except for an anticipated rise in the summer time. Based on these observations this appears to be the appropriate rate for the building.



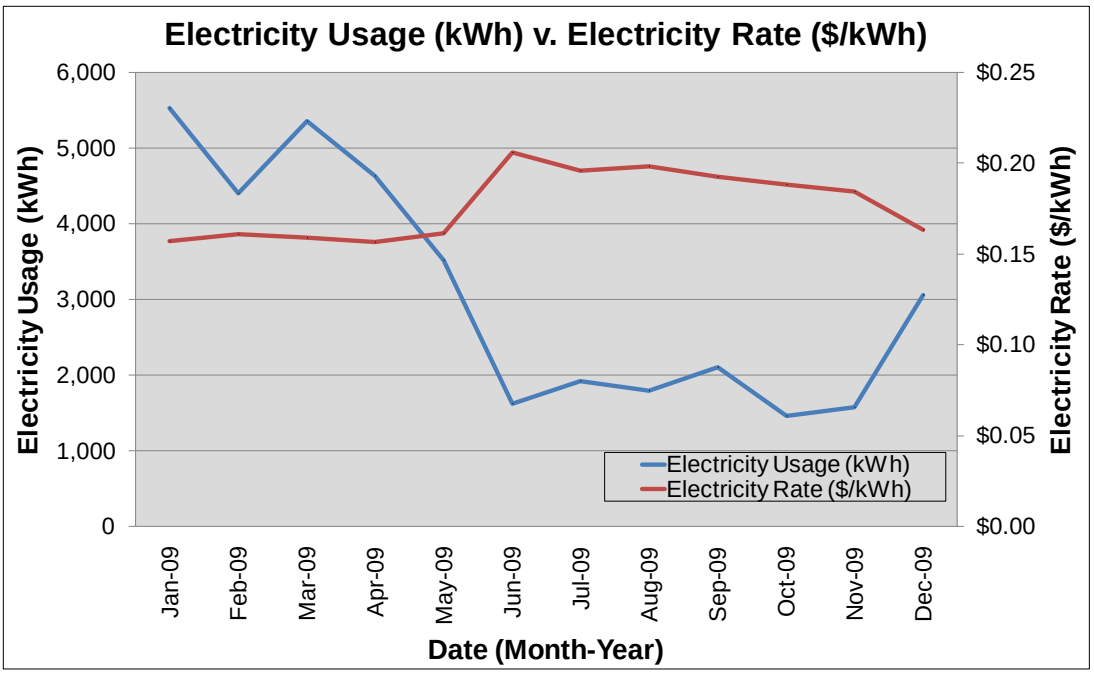
Booster Station

The Booster Station currently purchases electricity from PSE&G at a general service market rate for electricity use (kWh) including a separate (kW) demand charge that is factored into each monthly bill. The Booster Station currently pays an average rate of approximately $0.169/kWh based on the 12 months of utility bills of March 2008 to February 2009. 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 except for an anticipated rise in the summer time. Based on these observations this appears to be the appropriate rate for the building.



Sewer Station

The Sewer Station 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 Sewer Station currently pays an average rate of approximately $0.169/kWh based on the 12 months of utility bills of January 2009 to December 2009. 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 except for an anticipated rise in the summer time. Based on these observations this appears to be the appropriate rate for the building.



1.3. Energy benchmarking

Pump House

SWA has entered energy information about the pump house in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. Currently, the building is not eligible to receive a performance rating because it is classified as an "other" space type which means that it is still ineligible for Energy Star. SWA encourages the Township of Livingston 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 515.6 kBtu/sq ft yr compared to the national average of an "other" building consuming 104 kBtu/sq ft yr. Implementing this report's recommended Energy Conservations Measures (ECMs) will reduce use by approximately 27.1 kBtu/ sq ft yr, which would decrease the building's energy use intensity to 488.5 kBtu/sq ft yr. The extremely high intensity is a result of this building housing numerous pieces of process equipment that are not present in the average commercial building.

Per the LGEA program requirements, SWA has assisted the Township of Livingston to create an *Energy Star Portfolio Manager* account and has shared the 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:

[redacted]

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

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Township of Livingston - Pump House

Building ID: 2025837
For 12-month Period Ending: December 31, 2009[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: March 23, 2010

Facility	Facility Owner	Primary Contact for this Facility
Township of Livingston - Pump House 415 South Orange Avenue Livingston, NJ 07039	Township of Livingston 357 South Livingston Avenue Livingston, NJ 07039	Richard Calbi 357 South Livingston Avenue Livingston, NJ 07039

Year Built: 1999
Gross Floor Area (ft²): 500

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

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	257,800
Natural Gas - (kBtu)[4]	0
Total Energy (kBtu)	257,800
Energy Intensity[5]	
Site (kBtu/ft²/yr)	516
Source (kBtu/ft²/yr)	1722
Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	39
Electric Distribution Utility	
FirstEnergy - Jersey Central Power & Lt Co	
National Average Comparison	
National Average Site EUI	104
National Average Source EUI	213
% Difference from National Average Source EUI	709%
Building Type	Other

Stamp of Certifying Professional

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

Certifying Professional
N/A

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

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

EPA Form 5900-16

Booster Station

SWA has entered energy information about the booster station in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. Currently, the building is not eligible to receive a performance rating because it is classified as an "other" space type which means that it is still ineligible for Energy Star. SWA encourages the Township of Livingston 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 660.1 kBtu/sq ft yr compared to the national average of a pump house consuming 104 kBtu/sq ft yr. Implementing this report's recommended Energy Conservations Measures (ECMs) will reduce use by approximately 10.3 kBtu/ sq ft yr, which would decrease the building's energy use intensity to 649.8 kBtu/sq ft yr. The extremely high intensity is a result of this building housing numerous pieces of process equipment that are not present in the average commercial building.

Per the LGEA program requirements, SWA has assisted the Township of Livingston to create an *Energy Star Portfolio Manager* account and has shared the 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:

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

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Township of Livingston - Booster Station

Building ID: 2051180
For 12-month Period Ending: February 28, 2009[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: March 23, 2010

Facility	Facility Owner	Primary Contact for this Facility
Township of Livingston - Booster Station 55 North Hillside Avenue Livingston, NJ 07039	Township of Livingston 357 South Livingston Avenue Livingston, NJ 07039	Richard Calbi 357 South Livingston Avenue Livingston, NJ 07039

Year Built: 1956
Gross Floor Area (ft²): 360

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

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	237,619
Natural Gas - (kBtu)[4]	0
Total Energy (kBtu)	237,619
Energy Intensity[5]	
Site (kBtu/ft²/yr)	660
Source (kBtu/ft²/yr)	2205
Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	36
Electric Distribution Utility	
Public Service Elec & Gas Co	
National Average Comparison	
National Average Site EUI	104
National Average Source EUI	213
% Difference from National Average Source EUI	935%
Building Type	Other

Stamp of Certifying Professional

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

Certifying Professional
N/A

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

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

EPA Form 5900-16

Sewer Station

SWA has entered energy information about the sewer station in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. Currently, the building is not eligible to receive a performance rating because it is classified as an "other" space type which means that it is still ineligible for Energy Star. SWA encourages the Township of Livingston 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 252.1 kBtu/sq ft yr compared to the national average of an "other" building consuming 104 kBtu/sq ft yr. Implementing this report's recommended Energy Conservations Measures (ECMs) will reduce use by approximately 27.1 kBtu/ sq ft yr, which would decrease the building's energy use intensity to 225 kBtu/sq ft yr. The extremely high intensity is a result of this building housing numerous pieces of process equipment that are not present in the average commercial building.

Per the LGEA program requirements, SWA has assisted the Township of Livingston to create an *Energy Star Portfolio Manager* account and has shared the 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:

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

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Township of Livingston - Sewer Station

Building ID: 2051201
For 12-month Period Ending: December 31, 2009[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: March 23, 2010

Facility	Facility Owner	Primary Contact for this Facility
Township of Livingston - Sewer Station 297 Eisenhower Parkway Livingston, NJ 07039	Township of Livingston 357 South Livingston Avenue Livingston, NJ 07039	Richard Calbi 357 South Livingston Avenue Livingston, NJ 07039

Year Built: 1956
Gross Floor Area (ft²): 500

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

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	126,060
Natural Gas - (kBtu)[4]	0
Total Energy (kBtu)	126,060
Energy Intensity[5]	
Site (kBtu/ft²/yr)	252
Source (kBtu/ft²/yr)	842
Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	19
Electric Distribution Utility	
FirstEnergy - Jersey Central Power & Lt Co	
National Average Comparison	
National Average Site EUI	104
National Average Source EUI	213
% Difference from National Average Source EUI	295%
Building Type	Other

Stamp of Certifying Professional

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

Certifying Professional
N/A

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

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

EPA Form 5900-16

2. FACILITY AND SYSTEMS DESCRIPTION

2.1. Building Characteristics

Pump House

The pump house single story building is 500 gross square feet. It is the most recently constructed Water Department building. This slab-on-grade structure also houses the emergency generator. The exterior is rough face block with an interior wythe of acoustical CMU. The roof is a gabled structure with asphalt roof shingles.

Orientation: South Elevation – Entrance door side
North Elevation – Rear opposite entrance
East Elevation – Right side (when facing entrance)
West Elevation – Left side (when facing entrance)

Sewer Station

The sewer station is a single story, slab-on-grade, brick structure of 130 gross square feet is over 60 years old. The building was built as a pump station and is composed of a poured-in-place reinforced concrete shed roof, double wythe un-insulated brick wall and an 8" thick concrete slab.

Orientation: Southeast Elevation – Entrance door side
Northwest Elevation – Rear opposite entrance
Northeast Elevation – Right side(when facing entrance)
Southwest Elevation – Left side (when facing entrance)

Booster Station

The booster station is a single story building of approximately 360 gross square feet is a slab on grade structure. The exterior walls of the building have been cosmetically upgraded with the addition of a thin brick veneer. No other upgrades have been undertaken.

Orientation: East Elevation – Faces Hillside Ave. with entrance door
West Elevation – Building rear (opposite entrance side)
North Elevation –Right side (when facing entrance)
South elevation – Left side (when facing entrance)

2.2. Building Occupancy Profiles

These buildings operate 24 hours per day, 7 days per week and 52 weeks per year. The facilities are essentially unoccupied except for approximately 1 hour per day when a member of the Water Department will inspect and maintain equipment and perform some testing. Occupancy may be for longer in the case of a power outage or emergency condition.

2.3. Building Envelope

General Note: All findings and recommendations on the exterior envelope (base, walls, roofs, doors and windows) are based on the energy auditors' experience and expertise, on construction document reviews (if available) and on detailed visual analysis, as far as accessibility and weather conditions allowed at the time of the field audit.

2.3.1. Exterior Walls

Pump House

The exterior wall construction of the building is conventional cavity wall using rough face 8"x16" block on the exterior wythe and 8"x16" acoustical block on the interior wythe of the generator room. Visual observation of the cavity was not possible but based on the age and condition of the building it is assumed that 1" rigid board cavity wall insulation was installed. The walls are in excellent condition.

East elevation

Booster Station

The exterior envelope consists of a thin brick veneer adhered to the stucco substrate that was originally applied to the concrete masonry unit (CMU) walls. The building is un-insulated. Thermal images of the building were taken at all four corners where cracking has occurred through the veneer. The images indicate that rain water has been leaking through the cracks behind the veneer and is forcing the veneer to delaminate from the substrate.

It is recommended that the thin brick veneer and substrate be removed and replaced with a suitable material over 1" rigid insulation board. Exterior materials for consideration would include External Insulation Finishing System (EIFS), horizontal siding, or vertical standing seam metal siding.



Severe Cracks Through Veneer (Left); Typical Vertical Crack (Right)

Sewer Station

The exterior walls of the building are constructed of double wythe brick without insulation. The exterior wythe of brick is in excellent condition. The interior wythe of brick has pealing paint which should be refinished.


Southwest Corner at Ceiling

It is recommended that exterior cladding material be applied. Select from EIFS, horizontal siding, or vertical standing seam vertical siding.

2.3.2. Roof

Pump House

The roof of the building is asphalt roof shingles over plywood roof sheathing and wood roof trusses 24" O.C. The roof is in excellent condition. Eave and gable vent are provided. R-30 fiberglass batt ceiling installation is installed properly. However, there are no baffles installed between the trusses at the ceiling plane to permit ventilation from the eaves to reach the gable vents. It is recommended that baffles be installed and the

ceiling insulation be extended out to touch the baffle. Gutters and downspouts are installed properly.

Booster Station

The roof of the building consists of asphalt roof shingles over plywood sheathing. The gable frame roof is supported on wood roof rafters 16" O.C. The shingles have deteriorated beyond their useful life and moss is growing on the face. Water damage was noticed on the ceiling in the N/W corner indicating a roof leak. The building is without gutters and downspouts. No insulation was present above the ceiling.

Deteriorated Roof Shingles

SWA recommends that the roof shingles be removed and replaced with new 25 yr. fiberglass roof shingles over 30# roofing felts. Gutters and downspouts should be added to the north and south faces of the building. R-30 ceiling insulation should be added and replace gable vents replaced at the east and west ends.

Sewer Station

There is damage to the north corner of the concrete roof, with reinforcing bars exposed. There are no gutters or downspouts installed. The roof is coated with a liquid membrane. An EPDM membrane over rigid roof insulation should be installed to protect the concrete from deteriorating and create an improved thermal envelope.

Damage at the North Corner of the Roof

2.3.3. Base

Pump House

The slab-on-grade building has an exposed concrete floor. Epoxy should be installed to protect the slab. There are no other significant issues with the base.

Booster Station

The building's base is a 4" concrete slab on grade. The edge of the slab is un-insulated and significant deterioration has occurred below the entrance door threshold. Grading around the building is sufficient to direct rainwater away from the building. The epoxy floor covering is in good condition. There is a crack at the base of the south wall which should be repaired with epoxy filler.

Cracked base at south wall

SWA recommends that the threshold of the door be repaired and a metal door threshold be placed over the lip to prevent damage.

Sewer Station

There was no observable deterioration detected at the base of the building. The door threshold is approximately 8" above grade to prevent surface rain water from entering the building. The epoxy flooring material is in satisfactory condition.

2.3.4. Windows

Pump House

The windows on the south face of the building are for appearance only and the CMU back-up wall blocks the opening. There is damage to one of the window lites which should be repaired.

Booster Station

The windows are single-glazed industrial type single hung without thermal break. It is recommended that fixed-sash replacement windows be installed with aluminum thermal break frames and double-glazed window lites.

Window at North Wall

Sewer Station

The windows are single hung industrial steel frame single glazed. They should be replaced with fixed sash aluminum frame windows with a thermal break, double glazed.

2.3.5. Exterior doors

Pump House

The exterior doors are metal panel faced insulated doors, in a metal frame with weather-stripping. There are no significant issues with the doors

Booster Station

The exterior steel door is un-insulated and not sufficiently weather-stripped. Thermal images taken indicate sufficient infiltration of cold air leaking at the base and jambs of the door and frame.

Door Threshold

The door should be removed and replaced with an insulated steel faced door and weather-stripping added to the steel frame. A proper metal threshold would prevent damage to the slab edge.

Sewer Station

The exterior door is an un-insulated steel door, without weather-stripping. There is a louvered panel in the door that was taped over on the inside with a piece of cardboard. Replacing the door and frame with an insulated steel door, without louver, with weather-stripping will prevent heat loss through the door.

2.3.6. Building air-tightness

Pump House

There are no significant air tightness issues presently. Periodic maintenance over the next few years may require additional caulking and sealants around wall penetrations. But currently this is not necessary.

Booster Station

Based on the visual inspection of the exterior and interior it was determined that there is a pipe protruding through the south wall that is not connected to equipment and is not sealed on the outside. There is currently a cloth stuffed in the open end. The pipe should be removed when the exterior wall materials are replaced. There is water damage to the ceiling that needs to be corrected after the roof is replaced. The epoxy flooring is in good condition and the interior CMU wall surfaces are in good condition. Generally replace all caulking and sealants around all penetrations, door and window frames. There is a crack at the joint between the wall and base at the south wall that should be sealed with epoxy.

Sewer Station

There is a gravity vent through the N/W wall which is sealed from the inside with cardboard. The vent should be removed or if left in place an insulated panel should be constructed to seal the vent during winter months. The interior walls are painted but pealing in prevalent. Re-painting, caulking and sealing around windows, door and wall penetrations is recommended.

2.4. HVAC Systems

2.4.1. General

Pump House

The Crown Court Pump Station is a small structure with two (2) rooms, a generator room and a pump control room. The station serves two (2) raw sewage pumps and a grinder, which were not visible inside the facility. The structure is heated and ventilated but does not contain a mechanical cooling system. The ventilation system provides heat rejection for the two rooms.

Booster Station

The Hillside Avenue Booster Station is a small structure that houses two booster pumps serving the township's domestic water system. The structure is heated and ventilated but does not contain a mechanical cooling system. The ventilation system provides heat rejection for protection of the pumps and pump controls during the cooling season. There is a natural gas service at the building that is connected to a small emergency generator.

Sewer Station

The Beaufort Sewer Station is a small structure that houses two sewage pumps serving the township's sanitary sewer system. The structure is heated and ventilated but does not contain a mechanical cooling system. The ventilation system provides heat rejection for protection of the pumps and pump controls during the cooling season. There is also a natural ventilation system for the sewage pit. There is a small diesel emergency generator at the building

2.4.2. Heating

Pump House

The building is heated by a pair of electric unit heaters, one in each room. The heaters are mounted on a wall bracket. The heaters are in very good condition and can be retained. The Township could see operating cost savings by replacing these heaters with gas-fired heaters, but there is no natural gas service at the facility so the cost of this measure could not be justified by the potential energy savings.

Electric Unit Heater in Pump Control Room

Booster Station

The building is heated by a small electric unit heater that is mounted from the ceiling. The unit heater is controlled by a wall-mounted thermostat located on the same wall as the pump control switchgear, opposite the front door. No nameplate was observed on the heater but based on its size, it is estimated to be rated in the 3kW to 5 kW range. The unit heater is relatively new and is in very good condition.

Electric Unit Heater to Left of Vertical Pipe and Window Louver to Right

The Township could save on operating costs by replacing the electric unit heater with a new high efficiency gas-fired unit heater and serving it by tapping into the natural gas service. However, the cost of this measure cannot be justified by the associated energy savings.

Sewer Station

The building is heated by a small electric unit heater that is suspended from the ceiling. No nameplate was observed on the heater but based on its size, it is estimated to be rated at approximately 3kW. The unit heater is relatively new and is in very good condition.

2.4.3. Cooling

Pump House

The building does not contain any mechanical cooling systems.

Booster Station

The building does not contain any mechanical cooling systems. Heat rejection for the pumps and pump control panels and switchgear is provided by a roof-mounted exhaust fan with makeup air provided via a window-mounted louver. The fan is controlled by a thermostat that is mounted on the front of the pump control panel.

Sewer Station

The building does not contain any mechanical cooling systems. Heat rejection for the pumps is provided by a wall-mounted exhaust fan. The fan is controlled by a thermostat that is mounted on the front of the fan.

2.4.4. Ventilation

Pump House

Ventilation for the space is provided by two (2) wall-mounted exhaust fans, one in each room, with makeup air provided to each via a wall-mounted louver (two (2) louvers total).

Wall-Mounted Exhaust Fans

Booster Station

Ventilation for the space is provided by a roof-mounted exhaust fan with makeup air provided via a window-mounted louver. The fan is controlled by a thermostat that is mounted on the front of the pump control panel. The louver and fan are original to the building and are in fair condition.

Rooftop Exhaust Fan

Sewer Station

Ventilation for the space is provided by a wall-mounted exhaust fan.

Wall-Mounted Exhaust Fan

2.4.5. Domestic Hot Water

Pump House

There is a small electric instantaneous heater domestic hot water heater inside the building that serves a janitor's sink. This heater is in relatively good condition and can be retained for use.

Booster Station

There is no domestic hot water system inside the building.

Sewer Station

There is a small 6-gallon tank type electric domestic hot water heater inside the building that serves a small sink. This heater is beyond its service life. Based on the assumed infrequent use of the sink, energy can be saved by replacing the tank type water heater with an instantaneous heater to avoid standby heat losses from the heater tank.

Domestic Water Heater

2.5. Electrical systems

2.5.1. Lighting

Pump House

Interior Lighting – The lighting in the generator room consists of four (4) 4 ft long fluorescent fixtures that each utilize an electronic ballast and two (2) T8 lamps. The lighting in the control room consists of three (3) 4 ft long fluorescent fixtures that each utilize an electronic ballast and two (2) T8 lamps.

Exit Lights – There are no exit lights in the facility.

Exterior Lighting – The exterior lighting consists of three (3) metal halide fixtures one mounted over the entry door to the control room, one mounted above the entry door to the generator room and one mounted above the generator room intake louver. These fixtures are in good condition. SWA does not recommend replacement at this time.

Exterior Metal Halide Wallpack Light Fixture

Booster Station

Interior Lighting – The lighting consists of two (2) 8 ft long fluorescent fixtures that each utilize a magnetic ballast and two (2) T12 lamps. SWA recommends replacing these fixtures with more efficient T8 lamp fixtures.

Suspended Fluorescent Light Fixture

Exit Lights – There are no exit lights in the facility.

Exterior Lighting – The exterior lighting consists of one (1) incandescent fixture directly above the front door and one (1) metal halide above the front door and at the roof peak. SWA recommends that he incandescent lamp is replaced with a compact fluorescent lamp to achieve energy savings.

Metal Halide and Incandescent Fixtures Above Front Door

Sewer Station

Interior Lighting – The lighting consists of one (1) 4 ft long fluorescent fixture that utilizes a magnetic ballast and two (2) T12 lamps.

Fluorescent Light Fixture

Exit Lights – There are no exit lights in the facility.

Exterior Lighting – The exterior lighting consists of one (1) incandescent fixture beside the entry door. SWA recommends that he incandescent lamp is replaced with a compact fluorescent lamp to achieve energy savings.

2.5.2. Appliances

SWA performed a basic survey of appliances installed at all three buildings and observed no other appliances besides the pumps mentioned in the proceeding process and electrical system section.

2.5.3. Elevators

None of the buildings have any elevators installed on the premises.

2.5.4. Process and others electrical systems

Pump House

There are two (2) sanitary lift pumps at this location that are below ground. The control panels for these pumps are housed by this building. The pumps were manufactured in 1999 but their condition could not be observed. The pumps operate in a lead-lag fashion with only one pump operating at any one time. It was reported by the Water Department personnel that each pump operates for approximately 30 hours per week, depending on demand. For the purposes of calculating energy conservation measures, SWA will assume an average operating time of 1,550 hours per year.

Controls for One of the Sewage Pumps

Booster Station

There are two (2) domestic water system booster pumps housed in this building. The pumps are end-suction type and are each rated for 25 HP. The pumps operate in a lead-lag fashion with only one pump operating at any one time. It was reported by the Water Department personnel that one pump operates from 5 to 15 hours per day, depending on demand. For the purposes of calculating energy conservation measures, SWA will assume an average operating time of 10 hours per day.

Domestic Booster Pumps

Sewer Station

There are two (2) sanitary lift pumps housed by this building. The pumps were manufactured in 1996 and the motors were rehabilitated in 2006 and are in relatively good condition. The pumps operate in a lead-lag fashion with only one pump operating at any one time. It was reported by the Sewer Department personnel that each pump operates from 40-50 hours per week, depending on demand. For the purposes of calculating energy conservation measures, SWA will assume an operating time of 2,350 hours per year.

Sewage Pump Motors

3. EQUIPMENT LIST – Inventory

Pump House

Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Heating	Electric Unit Heater	Pump House	Trane M# UHEC053DACA 480V 5KW	Electric	Pump House	1999	15%
Heating	Electric Unit Heater	Pump House	Trane M# UHEC033DACA 480V 3KW	Electric	Pump House	1999	15%
Ventilation	(2) Sidewall Exhaust Fans	Pump House	Greenheck (nameplate inaccessible) Approx. 2 HP ea.	Electric	Pump House	1999	45%
Domestic Hot Water	Wall-mounted Insta-hot Heater	Pump House	EEMAX 3.5KW	Electric	Pump House	1999	45%
Sanitary	(2) Raw Sewage Pumps	Pump House	(nameplate inaccessible)	Electric	Pump House	1999	45%
Electric	Generator	Pump House	Onan M# 60DGCB-1220 S# F000113662 60KW	Diesel	Pump House	1999	65%
Lighting	See details - Appendix A	Pump House	-	Electric	Building		

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.

Booster Station

Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Domestic Water /Process	(2) End Suction Booster Pumps	Booster Station	Peerless Pumps No Nameplate 25 HP each	Electric	Township Domestic Water System	1990	0-10%
Heating	Electric Unit Heater	Booster Station	Dayton No Nameplate Estimated 3 kW	Electric	Booster Station	2000	50%
Ventilation	Rooftop Exhaust Fan	Booster Station	No Nameplate Estimated 1/2 HP	Electric	Booster Station	1990	0-10%
Emergency Power	Natural Gas Generator	Booster Station	DMT Corporation M# DMT-65GH2 S#93581-1 65 kW	Natural Gas	Booster Station	Early 1980s	10-20%
Lighting	See details - Appendix A	Booster Station	-	Electric	Booster Station	Est. 1990	0%

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.

Sewer Station

Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Heating	Electric Unit heater	Sewer Station	Dayton M# 4E169D +/- 3KW	Electric	Sewer Station	2006	70%
Sewage Treatment	(2) Sewage Pumps	Sewer Station	Gorman Rupp 5HP ea.	Electric	Sewer Station	2006	80%
Sewage Treatment	(2) Submersible Sewage Pumps	Sewer Station		Electric	Sewer Station	2006	80%
Domestic Hot Water	Electric Water Heater	Sewer Station	Rheem Vanguard M# 1PZ81 S# VG902217615 120V 1ph 2KW 6 gal.	Electric	Sewer Station	2006	70%
Heating	Electric Unit heater	Sewer Station	Dayton M# 4HZ356	Electric	Sewer Station	2006	70%
Electric	Generator	On grade adjacent to Sewer Station	Generac M# 9111040100 S# 2096110 25 KW	Diesel	Sewer Station	2006	85-90%
Ventilation	Sidewall Exhaust Fan	Sewer Station	Dayton M# 4HZ356	Electric	Sewer Station	2006	80%
Lighting	See details - Appendix A	Sewer Station	-	Electric	Building		

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 Administration 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

Pump House

Category I Recommendations: - Capital Improvements

- Install baffles and extend ceiling insulation. The estimated cost for this upgrade is $500.00.
- Apply epoxy to exposed concrete floor. The estimated cost for this upgrade is $4,500.00.
- Install premium motors when replacements are required - Select NEMA Premium motors when replacing motors that have reached the end of their useful operating lives.

Category II Recommendations: - Operations and Maintenance

- Maintain roofs – SWA recommends regular maintenance to verify that the rainwater is draining correctly.
- Maintain downspouts – Repair/install missing/disconnected/damaged downspouts as needed to prevent water/moisture infiltration and infiltration damage.
- Provide weather-stripping and air sealing – Doors should be observed annually for deficient weather-stripping and replaced as needed. Perimeter of all window frames should also be regularly inspected and any missing or deteriorated caulking should be re-caulked to provide an unbroken seal around the window frames. Any other accessible gaps or penetrations in the thermal envelope penetrations should be sealed with caulk or spray foam.
- Repair/seal wall cracks and penetrations – SWA recommends as part of the maintenance program to install weep holes, install proper flashing, correct masonry efflorescence and seal wall cracks and penetrations wherever necessary in order to keep insulation dry and effective.

Category III Recommendations: Energy Conservation Measures

ECM#	Description of Recommended 5-10 Year Payback ECMs
1	Replace (3) metal halide fixtures with PSMH
4.3	Replace (2) 10 Hp Submersible Sewage Pump Motors with Premium Efficiency

Booster Station

- Remove and replace brick veneer with EIFS and 1" rigid insulation. The estimated cost for this upgrade is $9,500.00.

- Provide R-30 ceiling insulation. The estimated cost for this upgrade is $500.00.

- Replace roof with 25 year fiberglass shingles over 30# felt. The estimated cost for this upgrade is $2,750.00.

- Install gutters and downspouts to keep water away from the building façade and base. The estimated cost for this upgrade is $700.00.

- Replace gable vents. The estimated cost for this upgrade is $1,750.00

- Repair crack at the base of the building. The estimated cost for this upgrade is $550.00.

- Replace windows - SWA evaluated, as part of a capital improvement plan replacing the windows (3 single-pane) with newer fixed aluminum frame models with thermal breaks, dual glazing and a low-e rating. Proper flashing and caulking should be performed upon installation of the new windows. The estimated cost for this upgrade is $1,350.00. Window replacement rebates and tax incentives are available only for residential buildings at this time.

- Replace door with insulated metal door. The estimated cost for this upgrade is $1,350.00.

- Replace electric unit heater – the heater is near the end of it expected service life, although it is in relatively good condition and appears to be operating properly. The Township could realize some savings in operating costs by replacing the heater with a gas-fired heater and running the gas service from the same service that serves the emergency generator. This measure would not result in energy savings. However, this measure has a payback of greater than 10 years. This measure can be deferred if necessary.

- Replace exhaust fan – The rooftop exhaust fan is beyond its expected life and should be replaced with a fan utilizing a premium efficiency motor. Replacement will yield negligible energy savings since the fan is fractional horsepower. In addition, there is no NJ Clean Energy rebate available for single phase motors.

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

Category II Recommendations: - Operations and Maintenance

- Maintain roofs – SWA recommends regular maintenance to verify that the rainwater is draining correctly.

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

- Provide weather-stripping and air sealing – Doors should be observed annually for deficient weather-stripping and replaced as needed. Perimeter of all window frames should also be regularly inspected and any missing or deteriorated caulking should be re-caulked to provide an unbroken seal around the window frames. Any other accessible gaps or penetrations in the thermal envelope penetrations should be sealed with caulk or spray foam.

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

Category III Recommendations: Energy Conservation Measures

ECM#	Description of Highly Recommended 0-5 Year Payback ECMs
2.2	Replace (1) incandescent fixture with CFL
	Description of Recommended 5-10 Year Payback ECMs
2.1	Replace (1) metal halide fixture with PSMH
4.1	replace (2) 25 Hp Booster Pump motors with Premium Efficiency

Sewer Station

- Cover building with EIFS and 1" rigid insulation. The estimated cost for this upgrade is $4,000.00.

- Install a layer of rigid roof insulation below a new EPDM membrane. The estimated cost for this upgrade is $2,000.00.

- Replace windows - SWA evaluated, as part of a capital improvement plan replacing the windows (2 single-pane) on the Deep Well Building with newer fixed aluminum frame models with thermal breaks, dual glazing and a low-e rating. Proper flashing and caulking should be performed upon installation of the new windows. The estimated cost for this upgrade is $2,500, based on similar projects. Window replacement rebates and tax incentives are available only for residential buildings at this time.

- Replace door with insulated metal door. The estimated cost for this upgrade is $1,300.00.

- Replace tank-type water heater with instantaneous water heater – Based on the infrequent use of domestic water at this facility, energy savings can be realized by

producing domestic hot water upon demand and avoiding tank standby losses associated with tank-type water heaters. The estimated cost for this upgrade is $600.00.

- Replace duct from roof fan to sewer pit – The ductwork leading from the roof fan to the sewer pit has corroded, leaving a large hole. Replace ductwork in kind or with fiberglass duct that is more resistant to the corrosive nature of the exhaust air. The estimated cost for this upgrade is $800.00.

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

Category II Recommendations: - Operations and Maintenance

- Maintain roofs – SWA recommends regular maintenance to verify that the rainwater is draining correctly.

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

- Provide weather-stripping and air sealing – Doors should be observed annually for deficient weather-stripping and replaced as needed. Perimeter of all window frames should also be regularly inspected and any missing or deteriorated caulking should be re-caulked to provide an unbroken seal around the window frames. Any other accessible gaps or penetrations in the thermal envelope penetrations should be sealed with caulk or spray foam.

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

Category III Recommendations: Energy Conservation Measures

ECM#	Description of Highly Recommended 0-5 Year Payback ECMs
1.1	Replace (1) incandescent fixture with CFL
	Description of Recommended 5-10 Year Payback ECMs
4.2	Replace (2) 5 Hp submersible pump motors with Premium Efficiency

ECM#1: *Lighting Upgrades – Pump House*

Description:

On the day of the site visit, SWA completed a lighting inventory of the Crown Court Pump Station (see Appendix A). The existing lighting consists of 4' T12 fluorescent fixtures with magnetic ballasts and exterior metal halide fixtures. Due to the low amount of occupied hours of the pump house the typical installation of T8 electronically ballasted fixtures in place of the T12 fixtures is not recommended due to insufficient savings leaving the pulse start metal halide installations in place of the existing metal halides as SWA's only recommendation. The labor in all these installations was evaluated using prevailing electrical contractor wages. The Township of Livingston may decide to perform this work with in-house resources from its Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor to obtain savings.

Installation cost:

Estimated installed cost: $1,395 (Includes $537 in labor costs)
Source of cost estimate: *RS Means; Published and established costs, NJ Clean Energy Program*

Economics (with incentives):

ECM #	ECM description	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	Replace (3) metal halide fixtures with PSMH	1,395	75	1,320	473	0.1	N/A	3.2	145	228	15	3,417	5.8	159	11	15	1,360	648

Assumptions: SWA calculated the savings for this measure using measurements taken the day of the site visits and using the billing analysis. SWA also assumed an aggregated 1 hr/yr to replace aging burnt out lamps vs. newly installed.

Rebates/financial incentives:

NJ Clean Energy – $25 per PSMH fixture

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: *Lighting Upgrades – Booster Station*

Description:

On the day of the site visit, SWA completed a lighting inventory of the Booster Station (see Appendix A). The existing lighting consists of 8' T12 fluorescent fixtures with magnetic ballasts, incandescent and exterior metal halide fixtures. Due to the low amount of occupied hours of the pump house the typical installation of T8 electronically ballasted fixtures in place of the T12 fixtures is not recommended due to insufficient savings leaving the CFL installation in place of the incandescent and pulse start metal halide installation in place of the existing metal halides as SWA's only recommendations. The labor in all these installations was evaluated using prevailing electrical contractor wages. The Township of Livingston may decide to perform this work with in-house resources from its Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor to obtain savings.

Installation cost:

Estimated installed cost: $725 (Includes $205 in labor costs)
Source of cost estimate: *RS Means; Published and established costs, NJ Clean Energy Program*

Economics (with incentives):

ECM #	ECM description	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
2.1	Replace (1) metal halide fixture with PSMH	675	25	650	158	0.0	N/A	1.5	48	76	15	1,139	8.6	75%	5%	8	243	216
2.2	Replace (1) incandescent fixture with CFL	50	0	50	175	0.0	N/A	1.7	4	35	5	173	1.4	245	49	63	108	240

Assumptions: SWA calculated the savings for this measure using measurements taken the day of the site visits and using the billing analysis. SWA also assumed an aggregated 1 hr/yr to replace aging burnt out lamps vs. newly installed.

Rebates/financial incentives:

NJ Clean Energy – $25 per PSMH fixture

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: *Lighting Upgrades – Sewer Station*

Description:

On the day of the site visit, SWA completed a lighting inventory of the Sewer Station (see Appendix A). The existing lighting consists of 4' T12 fluorescent fixtures with magnetic ballasts and incandescent fixtures. Due to the low amount of occupied hours of the pump house the typical installation of T8 electronically ballasted fixtures in place of the T12 fixtures is not recommended due to insufficient savings leaving the CFL installation in place of the existing incandescent as SWA's only recommendation. The labor in all these installations was evaluated using prevailing electrical contractor wages. The Township of Livingston may decide to perform this work with in-house resources from its Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor to obtain savings.

Installation cost:

Estimated installed cost: $50 (Includes $28 in labor costs)
Source of cost estimate: *RS Means; Published and established costs, NJ Clean Energy Program*

Economics (with incentives):

ECM #	ECM description	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	Replace (1) incandescent fixture with CFL	50	0	50	175	0.0	N/A	1.7	4	35	5	173	1.4	245	49	63	108	240

Assumptions: SWA calculated the savings for this measure using measurements taken the day of the site visits and using the billing analysis. SWA also assumed an aggregated 1 hr/yr to replace aging burnt out lamps vs. newly installed and that CFL replacements would include a total fixture replacement not just a bulb replacement.

Rebates/financial incentives:

NJ Clean Energy – No incentives are available for this building

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: *Install Premium Efficiency Motors on Pumps*

Description:

The Hillside Avenue Booster Station contains two (2) booster pumps that service the domestic water distribution system for the Township. The Beaufort Sewer Station contains two (2) submersible sewage pumps. The Crown Court Pump Station contains two (2) submersible raw sewage pumps. The following is a summary of the pumps in these facilities that are a part of this study:

Hillside Avenue Booster Station

- (2) 25 HP Booster Pumps

Beaufort Sewer Station

- (2) 5 HP Submersible Sewage Pumps

Crown Court Pump Station

- (2) Submersible Sewage Pumps – Nameplate Inaccessible – assumed 10 HP

The pump motors are standard efficiency. The Township of Livingston will realize energy savings by utilizing premium efficiency motors for these pumps.

Installation cost:

Estimated installed cost: $5,775 (Includes $2,310 in labor)
Source of cost estimate: Similar projects and DOE Motor Master International selection & savings analysis

Economics (with incentives):

Hillside Avenue Booster Station

ECM #	ECM description	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
4.1	replace (2) 25 Hp Booster Pump motors with Premium Efficiency	3,200	260	2,940	3,504	0.7	0	33.2	0	592	20	11,844	5.0	303	15	20	5,870	4,800

Beaufort Sewer Station

ECM #	ECM description	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
4.2	replace (2) 5 Hp submersible pump motors with Premium Efficiency	1,010	120	890	755	0.2	0	5.2	0	128	20	2,552	7.0	187	9	13	1,008	1,034

Crown Court Pump Station

ECM #	ECM description	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
4.3	replace (2) 10 Hp Submersible Sewage Pump Motors with Premium Efficiency	1,564	200	1,364	879	0.2	0	6.0	0	154	20	3,077	8.9	126	6	9	925	1,204

Assumptions: SWA calculated the savings for this measure using nameplate data taken and using the billing analysis. The DOE Motor Master International selection and calculator was based on information from Water Department and Sewer Department personnel. Based on personnel interviews, one of the Hillside Avenue Booster Station pumps operate from 5-15 hours per day. Based on this information, SWA estimated that one of the pumps operates for approximately 3,650 hours per year. The Beaufort Sewer Station pumps are assumed to operate from 40-50 hours per week, or 2,350 hours per year. The Crown Court Pump House pumps are assumed to operate for 30 hours per week, or 1,550 hours per year.

Rebates/financial incentives:

NJ Clean Energy – Premium three-phase motors ($45-$700 per motor)
Maximum incentive amount is $580.

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 Systems

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

Solar photovoltaics are not recommended due to the small sizes of these buildings and shadowing from surrounding foliage.

5.4. Solar Thermal Collectors

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

5.5. Combined Heat and Power

CHP is not applicable for this building because of insufficient domestic water use.

5.6. Geothermal

Geothermal is not applicable for this building because it would not be cost effective considering the size of the existing HVAC systems

6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

6.1. Energy Purchasing

Pump House

The pump house receives electricity purchased via one incoming meter directly for the pump house from JCP&L without an ESCO. 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. SWA analyzed the utility rate for electricity supply over an extended period. Electric bill analysis shows fluctuations of 22% over the 12 month period between January 2009 and December 2009.

Currently, New Jersey commercial buildings of similar type pay $0.150/kWh for electricity. The electricity rate for the pump house is $0.175/kWh, which means there is a potential cost savings of $1,889 per year. A large cost savings potential for electricity exists, however this involves contacting third party suppliers and negotiating utility rates. SWA recommends that the Township of Livingston 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 Pump

House. Appendix B contains a complete list of third party energy suppliers for the Township of Livingston service area. The Township of Livingston 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.

Booster Station

The booster station receives electricity purchased via one incoming meter directly for the booster station from PSE&G without an ESCO. 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. SWA analyzed the utility rate for electricity supply over an extended period. Electric bill analysis shows fluctuations of 41% over the 12 month period between January 2009 and December 2009.

Currently, New Jersey commercial buildings of similar type pay $0.150/kWh for electricity. The electricity rate for the fire department is $0.169/kWh, which means there is a potential cost savings of $1,264 per year. A large cost savings potential for electricity exists, however this involves contacting third party suppliers and negotiating utility rates. SWA recommends that the Township of Livingston 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 Pump House. Appendix B contains a complete list of third party energy suppliers for the Township of Livingston service area. The Township of Livingston 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.

Sewer Station

The sewer station receives electricity purchased via one incoming meter directly for the sewer station from JCP&L without an ESCO. 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. SWA analyzed the utility rate for electricity supply over an extended period. Electric bill analysis shows fluctuations of 24% over the 12 month period between January 2009 and December 2009.

Currently, New Jersey commercial buildings of similar type pay $0.150/kWh for electricity. The electricity rate for the fire department is $0.169/kWh, which means there is a potential cost savings of $702 per year. A large cost savings potential for electricity exists, however this involves contacting third party suppliers and negotiating utility rates. SWA recommends that the Township of Livingston 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 Pump House. Appendix B contains a complete list of third party energy suppliers for the Township of Livingston service area. The Township of Livingston 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, none of the buildings would 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

Pump House

Location			Existing Fixture Information											Retrofit Information												Annual Savings		
Marker	Floor	Room Identification	Fixture Type	Ballast	Lamp Type	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Controls	Operational Hours per Day	Operational Days per Year	Ballast Wattage	Total Watts	Energy Use kWh/year	Category	Fixture Type	Lamp Type	Ballast	Controls	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Operational Hours per Day	Operational Days per Year	Ballast Watts	Total Watts	Energy Use kWh/year	Fixture Savings (kWh)	Controls Savings (kWh)	Total Savings (kWh)
1	GF	Mechanical Room	Wall Mounted	E	4'T12	4	2	40	Sw	1	365	12	368	134	T8	Wall Mounted	4'T8	E	Sw	4	2	32	1	365	5	276	101	34	0	34
2	GF	Mechanical Room	Wall Mounted	E	4'T12	3	2	40	Sw	1	365	12	276	101	T8	Wall Mounted	4'T8	E	Sw	3	2	32	1	365	5	207	76	25	0	25
3	GF	Exterior	Wall Mounted	S	MH	3	1	75	PC	12	365	21	288	1,261	PSMH	Wall Mounted	PSMH	S	PC	3	1	50	12	365	10	180	788	473	0	473
Totals:						10	5	155				45	932	1,497						10	5	114			20	663	965	532	0	532
Rows Highlighed Yellow Indicate an Energy Conservation Measure is recommended for that space																														

Booster Station

Location			Existing Fixture Information											Retrofit Information												Annual Savings		
Marker	Floor	Room Identification	Fixture Type	Ballast	Lamp Type	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Controls	Operational Hours per Day	Operational Days per Year	Ballast Wattage	Total Watts	Energy Use kWh/year	Category	Fixture Type	Lamp Type	Ballast	Controls	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Operational Hours per Day	Operational Days per Year	Ballast Watts	Total Watts	Energy Use kWh/year	Fixture Savings (kWh)	Controls Savings (kWh)	Total Savings (kWh)
1	GF	Mechanical Room	Ceiling Suspended	E	8'T12	2	2	80	Sw	1	365	20	360	131	T8	Ceiling Suspended	8'T8	E	Sw	2	2	59	1	365	7	250	91	40	0	40
2	GF	Mechanical Room	Wall Mounted	E	Inc	1	1	60	PC	12	365	0	60	263	CFL	Wall Mounted	CFL	E	PC	1	1	20	12	365	0	20	88	175	0	175
3	GF	Exterior	Wall Mounted	S	MH	1	1	75	PC	12	365	21	96	420	PSMH	Wall Mounted	PSMH	S	PC	1	1	50	12	365	10	60	263	158	0	158
Totals:						4	4	215				41	516	815						4	4	129			17	330	442	373	0	373
Rows Highlighed Yellow Indicate an Energy Conservation Measure is recommended for that space																														

Sewer Station

Location			Existing Fixture Information											Retrofit Information												Annual Savings		
Marker	Floor	Room Identification	Fixture Type	Ballast	Lamp Type	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Controls	Operational Hours per Day	Operational Days per Year	Ballast Wattage	Total Watts	Energy Use kWh/year	Category	Fixture Type	Lamp Type	Ballast	Controls	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Operational Hours per Day	Operational Days per Year	Ballast Watts	Total Watts	Energy Use kWh/year	Fixture Savings (kWh)	Controls Savings (kWh)	Total Savings (kWh)
1	GF	Mechanical Room	Wall Mounted	E	4'T12	1	2	40	Sw	1	365	12	92	34	T8	Wall Mounted	4'T8	E	Sw	1	2	32	1	365	9	69	25	8	0	8
2	GF	Exterior	Wall Mounted	E	Inc	1	1	60	Sw	12	365	0	60	263	CFL	Wall Mounted	CFL	E	Sw	1	1	20	12	365	0	20	88	175	0	175

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

Appendix B: Third Party Energy Suppliers (ESCOs)

http://www.state.nj.us/bpu/commercial/shopping.html

Third Party Electric Suppliers for PSEG Service Territory	Telephone & Web Site
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com
American Powernet Management, LP 437 North Grove St. Berlin, NJ 08009	(877) 977-2636 www.americanpowernet.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
ConEdison Solutions 535 State Highway 38 Cherry Hill, NJ 08002	(888) 665-0955 www.conedsolutions.com
Constellation NewEnergy, Inc. 900A Lake Street, Suite 2 Ramsey, NJ 07446	(888) 635-0827 www.newenergy.com
Credit Suisse, (USA) Inc. 700 College Road East Princeton, NJ 08450	(212) 538-3124 www.creditsuisse.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
Metro Energy Group, LLC 14 Washington Place Hackensack, NJ 07601	(888) 536-3876 www.metroenergy.com
Integrys Energy Services, Inc. 99 Wood Ave, South, Suite 802 Iselin, NJ 08830	(877) 763-9977 www.integrysenergy.com
Liberty Power Delaware, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(866) 769-3799 www.libertypowercorp.com
Liberty Power Holdings, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(800) 363-7499 www.libertypowercorp.com
Pepco Energy Services, Inc. 112 Main St. Lebanon, NJ 08833	(800) 363-7499 www.pepco-services.com

Third Party Electric Suppliers for PSEG Service Territory	Telephone & Web Site
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
Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 07928	(800) 225-1560 www.spragueenergy.com
Strategic Energy, LLC 55 Madison Avenue, Suite 400 Morristown, NJ 07960	(888) 925-9115 www.sel.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 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
Integrys Energy Services, Inc. 99 Wood Ave, South, Suite 802	(877) 763-9977 www.integrysenergy.com

Iselin, NJ 08830	
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

Appendix C: Glossary and Method of Calculations

Glossary of ECM Terms

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

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

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

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

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

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

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

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

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

Calculation References

ECM = Energy Conservation Measure
AOCS = Annual Operating Cost Savings
AECS = Annual Energy Cost Savings
LOCS = Lifetime Operating Cost Savings
LECS = Lifetime Energy Cost Savings
LCS = Lifetime Cost Savings

NPV = Net Present Value
IRR = Internal Rate of Return
DR = Discount Rate

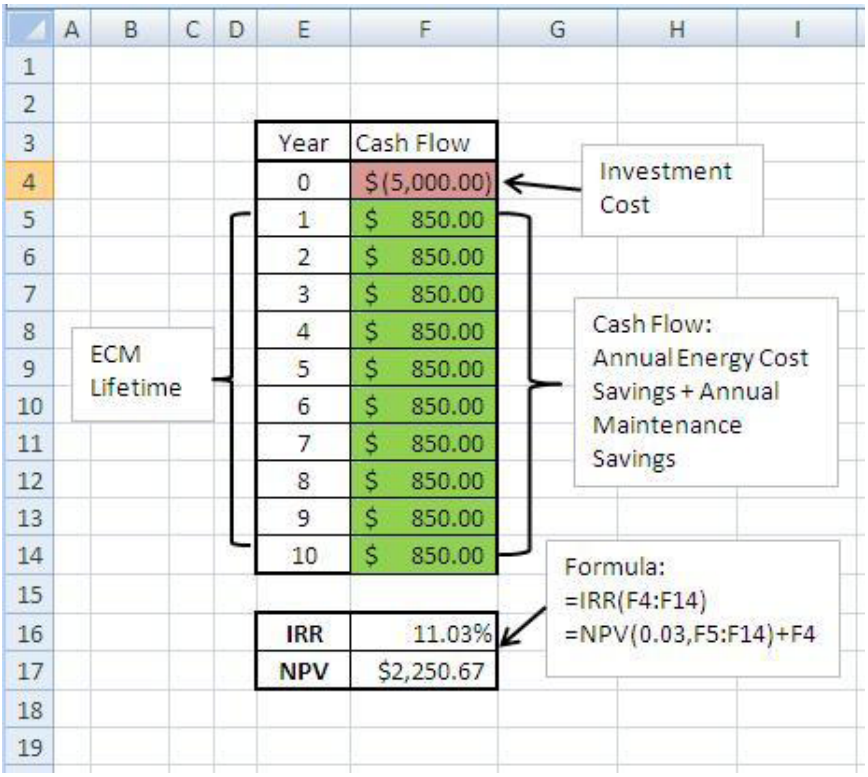
Net ECM Cost = Total ECM Cost – Incentive
LECS = AECS X ECM Lifetime
AOCS = LOCS / ECM Lifetime
LCS = LOCS+LECS

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

Simple Payback = Net ECM Cost / (AECS + AOCS)
Lifetime ROI = (LECS + LOCS – Net ECM Cost) / Net ECM Cost
Annual ROI = (Lifetime ROI / Lifetime) = (AECS + OCS) / Net ECM Cost – 1 / Lifetime
It is easiest to calculate the NPV and IRR using a spreadsheet program like Excel.

Excel NPV and IRR Calculation

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



ECM and Equipment Lifetimes

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

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

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

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

NJCEP C & I Lifetimes

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