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April 30, 2010

Local Government Energy Program
Energy Audit Final Report

South River Roads Department Building
South River, NJ 08882

Project Number: LGEA48

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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 Borough of South River municipal buildings. The audit, conducted on January 5, 11 and 12, 2010 included a review of the:

- Human Services Building
- Municipal Building
- Public Library
- Criminal Justice Building
- War Memorial Building
- Roads Department Building
- George Street Firehouse
- Rescue Squad
- Appleby Avenue Firehouse

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

This report addresses the South River Roads Department Building located at 9 Ivan Way, South River, NJ 08882. The current conditions and energy-related information were collected in order to analyze and facilitate the implementation of energy conservation measures for the building.

The South River South River Roads Department Building was built in 1910. The building consists of 11,700 square feet of conditioned space and houses: two garage bays, tool rooms, storage rooms, a kitchen, offices, bathrooms, mechanical rooms, and a workshop for the Water Department. Occupancy for the Roads Department Building varies, with 12 workers in the building at any given time between 5 AM – 3:30 PM, Monday through Friday. The building is also used during non standard hours as necessary under emergency conditions. Access to the building is restricted to authorized personnel only and it is not open to the public.

The goal of this Local Government Energy Audit (LGEA) is to provide sufficient information to the Borough of South River to make decisions regarding the implementation of the most appropriate and most cost effective energy conservation measures for the Roads Department 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 (BPUs) Office of Clean Energy has assigned TRC Energy Services to administer the Program.

EXECUTIVE SUMMARY

The energy audit performed by Steven Winter Associates (SWA) encompasses the South River Roads Department Building located at 9 Ivan Way, South River, NJ 08882. The Roads Department Building is a single-story building with 11,700 square feet of conditioned space and houses: two garage bays, tool rooms, storage rooms, a kitchen, offices, bathrooms, mechanical rooms, and a workshop for the Water Department. The original structure was built in 1910 when the building was used as the municipal light, power and water department.

Based on the field visits performed by the SWA staff on January 12, 2010 and the results of a comprehensive energy analysis, this report describes the site's current conditions and recommendations for improvements. Suggestions for measures related to energy conservation and improved comfort are provided in the scope of work. Energy and resource savings are estimated for each measure that results in a reduction of heating, cooling, and electric usage.

From November 2008 through October 2009 the Roads Department Building consumed 113,828 kWh or $14,798 worth of electricity at an approximate rate of $0.130/kWh and 15,142 therms or $18,284 worth of natural gas at an approximate rate of $1.207/therm. The joint energy consumption for the building, including both electricity and natural gas, was 1,903 MMBtu of energy that cost a total of $33,082.

SWA has entered energy information about the Roads Department Building in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. This building is comprised of non-eligible (Other) space type, and national comparisons are yet unavailable for rating. SWA encourages the Borough of South River to continue entering utility data in *Energy Star Portfolio Manager* in order to track weather normalized source energy use over time. EPA is continually working to expand the available space types.

The Site Energy Use Intensity is 168.0 kBtu/ft^{2}yr compared to the national average of (Other) space type buildings consuming an average of 104.0 kBtu/ft^{2}yr. Implementing this report's recommendations will reduce use by approximately 43.0 kBtu/ft^{2}yr. Due to the nature of its calculation based upon a survey or existing buildings of varying usage the national average for "Other" space types is very subjective and is not an absolute bellwether for gauging performance. Additionally, should the Borough of South River desire to reach this average there are other large scale and financially less advantageous improvements that can be made such as window replacements that would help the building reach this goal.

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

Category I Recommendations: Capital Improvement Measures

- Install an emergency generator for the safety of the workers during power outages
- Select NEMA Premium motors when replacing motors at the end of their useful operating lives
- Installation of new windows to coincide with the next major building renovation.
- To reduce the amount of heat loss through the uninsulated roof and increase the effectiveness of the existing heating system the building should install a layer of R-30 insulation to the interior of the existing wooden roof surface with the next major renovation
- Replace/ repair and maintain broken/ non-closing/ damaged doors

Category II Recommendations: Operations and Maintenance

- Conduct biannual maintenance inspections of the exterior walls
- Insulate domestic hot water heater distribution piping
- Inspect and replace cracked/ ineffective caulk.
- Install/ replace/ maintain weather stripping around all exterior doors and roof hatches
- Maintain / repair garage doors
- Maintain and inspect all roof surfaces on a regular basis
- Maintain downspouts and cap flashing
- Provide weather stripping / air sealing
- Repair / seal wall cracks and penetrations
- Replace/ add/ maintain caulk around door frames and sills
- Replace broken/ deteriorated bricks and re-point cracked mortar joints
- Re-point deteriorated mortar joints
- Provide water efficient fixtures and controls
- Use Energy Star labeled appliances
- Use smart power electric strips
- Create an energy educational program

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

At this time, SWA highly recommends a total of **3** Energy Conservation Measures (ECMs) for the Roads Department Building that are summarized in the following Table 1. The total investment cost for these ECMs without incentives is **$4,122**. SWA estimates a first year savings of **$2,920** with a simple payback **of 1.4 years**. SWA also recommends **6** more ECMs that have a total first year savings of **$1,033** summarized in Table 2. There are also **2** recommended 10 year or greater payback and end of life cycle ECMs with a total first year savings of **$997** that are summarized in Table 3. SWA estimates that implementing these recommended ECMs will reduce the carbon footprint of the Roads Department Building by **39,896 lbs of CO_2**, which is equivalent to removing approximately 3 cars from the roads each year or avoiding the need of 97 trees to absorb the annual CO_2 generated.

There are various incentives available in New Jersey to lower the cost of installing the Energy Conservation Measures (ECMs), like NJ SmartStart program and Direct Install through the New Jersey Office of Clean Energy. These incentive programs can help provide technical assistance for the building in the implementation phase of any energy conservation project. The Borough of South River and 6 other nearby boroughs have a long term contract to purchase electricity as a consortium from the South River Electric Utility and do not pay the Societal Benefit Charges (SBCs) that fund NJCEP programs. Therefore, the Borough of South River is not eligible to receive any equipment incentives for energy conservation under the New Jersey Clean Energy Program (NJCEP) at the present time; however, they are still eligible to participate in the LGEA program through a special exemption. SWA recommends the Borough of South River initiate a dialogue with the Board of Public Utilities (BPU) to gain access to these and other incentives in the future.

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

Table 1 - Highly Recommended 0-5 Year Payback ECMs																		
ECM #	ECM description	Source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
1	Install (12) twelve digital programmable thermostat to control heating units	RS Means, Lit Search	2,400	0	2,400	0	0.0	1,940	16.6	0	2342	25	39,880	1.0	1562	62	98	20,908	22,698
2.1	Install (6) occupancy sensors in lounges, workshops and offices	RS Means, Lit Search	1,320	0	1,320	2,117	0.44	0	0.6	0	275	15	3,238	4.8	145	10	18	1,419	2,900
2.2	Replace (8) halogen bulbs with CFLs	RS Means, Lit Search	402	0	402	2,067	0.43	0	0.6	34	303	5	1,379	1.3	286	57	75	2,613	2,832
	Totals		**4,122**	**0**	**4,122**	**4,184**	**0.87**	**1,940**	**17.8**	**34**	**2,920**	**-**	**44,497**	**1.4**	**-**	**-**	**-**	**-**	**28,430**

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

Table 2 - Recommended 5-10 Year Payback ECMs																		
ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
2.3	Replace (29) T12 fixtures with T8 fixtures	RS Means, Lit Search	6,524	0	6,524	2,227	0.46	0	0.6	394	683	15	8,038	9.6	114	8	4	275	3051
4.1	Replace (1) compact refrigerator with an 2.7 cu ft model in kind	Energy Star purchasing and procurement site, similar projects	99	0	99	95	0.0	0	0.03	0	12	12	121	8.0	23	2	7	24	130
4.2	Replace one (1) garage refrigerator with an 17 cu ft Energy Star model	Energy Star purchasing and procurement site, similar projects	475	0	475	425	0.1	0	0.14	0	55	12	543	8.6	14	1	6	75	582
5.1	Replace one (1) 20,000 BTU/hr Roads Dept Office A/C with 12.0 EER eff. Model	Energy Star purchasing and procurement site, similar projects	305	0	305	288	0.1	0	0.1	0	37	15	441	8.1	45	3	7	68	395
5.3	Replace one (1) 10,000 BTU/hr Lounge A/C with 12.0 EER eff. model	Energy Star purchasing and procurement site, similar projects	185	0	185	144	0.0	0	0.0	0	19	15	220	9.9	19	1	3	1	197
6	Replace (1) old 87% energy factor boiler – 4.5 kW input with a model in kind - 85% eff 15.4 MBH	Energy Star purchasing and procurement site, similar projects	1979	0	1979	2,569	0.0	-103.43	-0.13	0	209	25	3,562	9.5	80	3	4	103	2,309
	Totals		**9,567**	**0**	**9,567**	**5,748**	**0.66**	**-103.43**	**0.74**	**394**	**1033.6**	**-**	**12,925**	**9.3**	**-**	**-**	**-**	**-**	**6,664**

Table 3 - Description of Recommended 10 Year or Greater Payback and End of Life Cycle ECMs																		
ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime 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 (22) Metal Halide fixtures with pulse start MH type	RS Means, Lit Search	17,018	0	17,018	3,447	0.72	0	1.01	542	990	15	11,650	17.2	16	1	-5	-7,163	4,722
5.2	Replace one (1) 4,000 BTU/hr Roads Dept Lounge A/C with 12.0 EER eff. model	Energy Star purchasing and procurement site, similar projects	100	0	100	57.65	0.0	0	0.02	0	7	15	88	13.3	-12	-1	-2	-25	79
	Totals		**17,118**	**0**	**17,118**	**3,505**	**0.7**	**0**	**1**	**542**	**997**	**15**	**67,591**	**17.2**	**342**	**23**	**-5**	**-7,194**	**4,802**

1. HISTORIC ENERGY CONSUMPTION

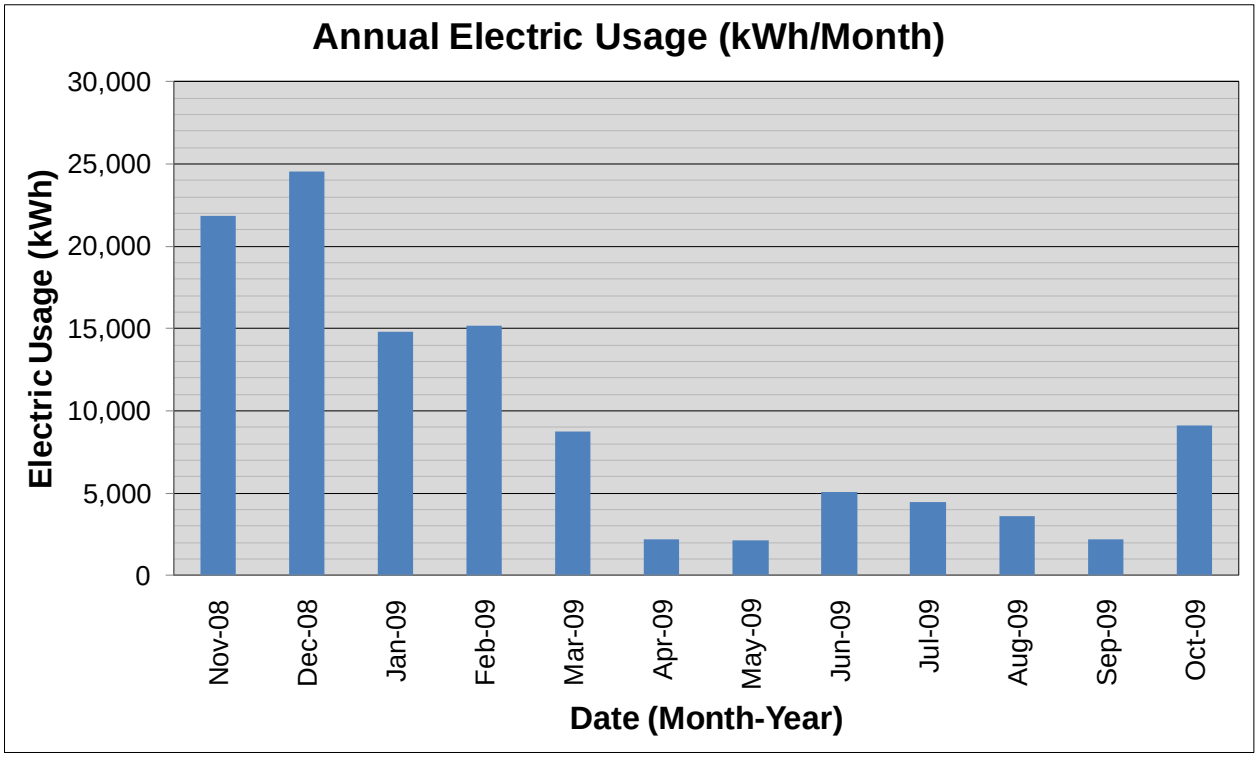
1.1. Energy Usage and Cost Analysis

SWA analyzed utility bills from November 2007 through October 2009 that were received from the utility companies supplying the South River Roads Department Building with electric and natural gas.

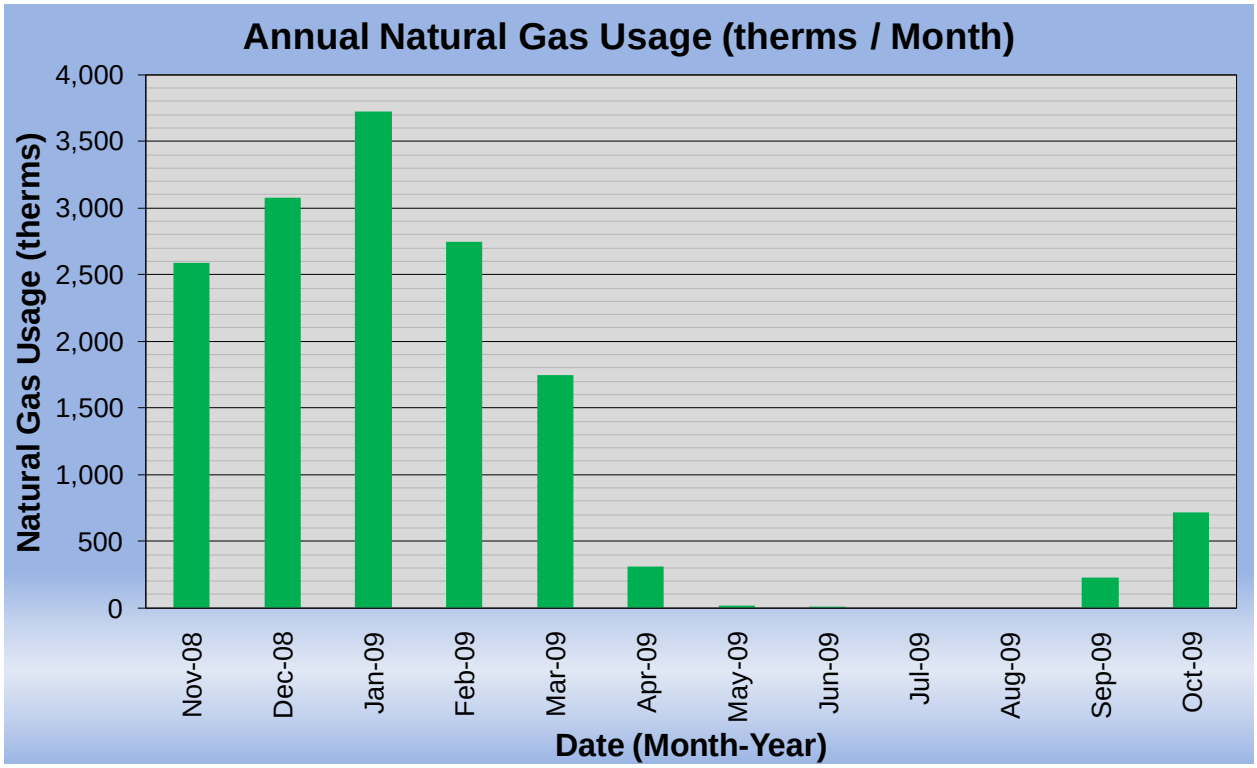
Electricity - The South River Roads Department Building is currently served by one electric meter. The Roads Department Building currently buys electricity from South River Electric Utility at **an average rate of $0.130/kWh** based on 12 months of utility estimates from November 2008 through October 2009. The Roads Department Building purchased **approximately 113,828 kWh or $14,798 worth of electricity** in the previous year. The average monthly demand is unavailable.

Natural gas - The South River Roads Department Building is currently served by one meter for natural gas. The South River Roads Department Building currently buys natural gas from PSE&G at **an average aggregated rate of $1.207/therm** based on 12 months of utility bills for November 2008 through October 2009. The South River Roads Department Building purchased **approximately 15,142 therms or $18,284 worth of natural gas** in the previous year at a very competitive rate.

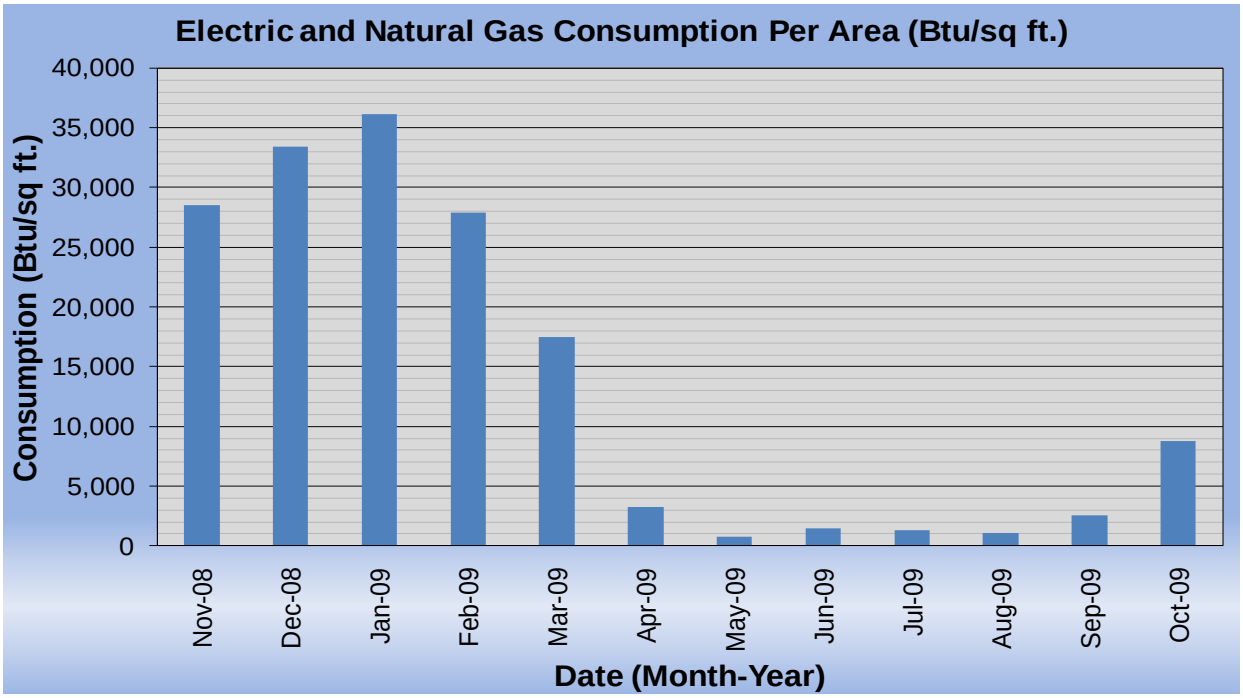
The following chart shows electricity consumption for the Roads Department Building based on electric bills for the 12 month period of November 2008 through October 2009.



The following chart shows the natural gas consumption for the Roads Department Building based on natural gas bills for the 12 month period of November 2008 through October 2009.

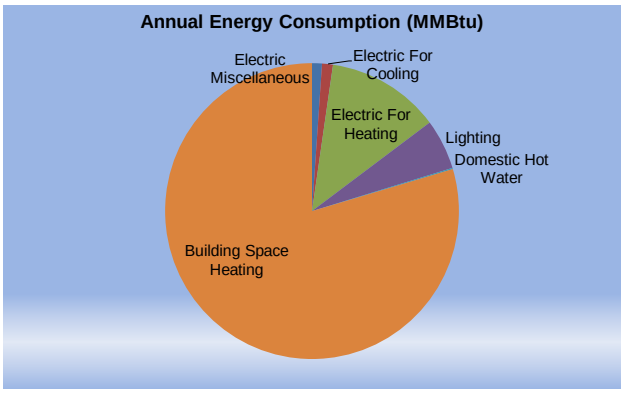


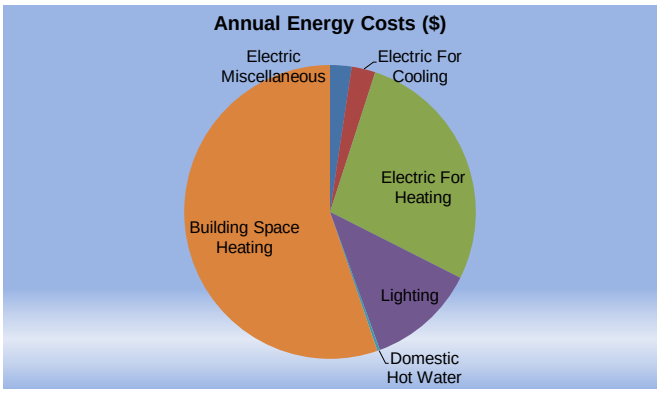
The following chart shows combined natural gas and electric consumption in Btu/sq ft for the Roads Department Building based on estimates and utility bills for the 12 month period of November 2008 through October 2009.



The following table and chart pies show energy use for the Roads Department Building based on utility bills for the 12 month period of November 2008 through October 2009. Note electrical cost at $38/MMBtu of energy is more than 3 times as expensive to use as natural gas at $12/MMBtu.

Nov 08 - Oct 09 Annual Energy Consumption / Costs					
	MMBtu	% MMBtu	$	% $	$/MMBtu
Electric Miscellaneous	14	1%	$552	2%	38
Electric For Cooling	23	1%	$870	3%	38
Electric For Heating	238	12%	$9,061	27%	38
Lighting	105	5%	$3,982	12%	38
Domestic Hot Water (Electric)	8.77	0.46%	$334	1%	38
Building Space Heating	1,514	80%	$18,284	55%	12
Totals	1,903	100%	$33,082	100%	17
Total Electric Usage	388	20%	$14,798	45%	38
Total Gas Usage	1,514	80%	$18,284	55%	12
Totals	1,903	100%	$33,082	100%	17





1.2. Utility Rate

The Roads Department Building currently purchases electricity from South River Electric Utility at a general service market rate for electricity use (kWh) with a separate (kW) demand charge. The Roads Department Building currently pays an average rate of approximately $0.130/kWh based on the 12 months estimates of November 2008 through October 2009.

The Roads Department Building currently purchases natural gas supply from the PSE&G at a competitive general service market rate for natural gas (therms). PSE&G also acts as the transport company. There is one gas meter that provides natural gas service to the Roads Department Building currently. The average aggregated rate (supply and transport) for the meter is approximately $1.207/therm based on 12 months of utility bills for November 2008 through October 2009. Some of the minor unusual utility fluctuations that showed up for a couple of months on the utility bills may be due to adjustments between estimated and actual meter readings.

1.3. Energy Benchmarking

SWA has entered energy information about the Roads Department Building in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. This building is comprised of non-eligible (Other) space type. "Other" can be used to classify a facility or a portion of a facility where the primary activity does not fall into any of the available space types. Consequently, the Roads Department Building is not eligible to receive a national energy performance rating at this time however *Portfolio Manager* provides a preliminary kBtu/sq ft yr comparison.

The Site Energy Use Intensity is 168.0 kBtu/ft2yr compared to the national average of (Other) space type buildings consuming an average of 104.0 kBtu/ft^2yr. Implementing this report's recommendations will reduce use by approximately 43.0 kBtu/ft^2yr. Due to the nature of its calculation based upon a survey or existing buildings of varying usage the national average for "Other" space types is very subjective and is not an absolute bellwether for gauging performance. Additionally, should the Borough of South River desire to reach this average there are other large scale and financially less advantageous improvements that can be made such as window replacements that would help the building reach this goal.

Per the LGEA program requirements, SWA has assisted the Borough of South River to create an *Energy Star Portfolio Manager* account and share the Roads Department Building facilities information to allow future data to be added and tracked using the benchmarking tool. SWA has shared this Portfolio Manager Site information with the Borough of South River (user name of "sriverboro" with a password of "sriverboro") and TRC Energy Services (user name of TRC-LGEA).

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Borough of South River - Roads Department

Building ID: 2019268
For 12-month Period Ending: October 31, 2009[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: February 18, 2010

Facility
Borough of South River - Roads Department
410 Whitehead Avenue
South River, NJ 08882

Facility Owner
Borough of South River
48 Washington Street
South River, NJ 08882

Primary Contact for this Facility
Richard Dudas
48 Washington Street
South River, NJ 08882

Year Built: 1950
Gross Floor Area (ft²): 11,700

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

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	397,551
Natural Gas (kBtu)[4]	1,566,742
Total Energy (kBtu)	1,964,293

Energy Intensity[5]

Site (kBtu/ft²/yr)	168
Source (kBtu/ft²/yr)	254

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	144

Electric Distribution Utility
Borough of South River

National Average Comparison

National Average Site EUI	104
National Average Source EUI	213
% Difference from National Average Source EUI	19%
Building Type	Other

Stamp of Certifying Professional

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

Certifying Professional
N/A

Meets Industry Standards[6] **for Indoor Environmental Conditions:**

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

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

EPA Form 5900-16

2. FACILITY AND SYSTEMS DESCRIPTION

2.1. Building Characteristics

The single story (slab on grade), 11,700 square feet South River Roads Department Building was originally constructed in 1910. It houses various mechanical spaces, garage bays, tool rooms, storage rooms, a kitchen, offices, bathrooms, and a workshop for the Water Department.

North Façade

South Façade

East Façade

West Façade

2.2. Building Occupancy Profiles

Occupancy for the Roads Department Building varies, with 12 workers in the building at any given time between 5 AM – 3:30 PM, Monday through Friday. The building is also used during non standard hours as necessary under emergency conditions. Access to the building is restricted to authorized personnel only and it is not open to the public.

2.3. Building envelope

Due to unfavorable weather conditions (min. 20 deg F delta-T in/ outside & no/ low wind) no exterior envelope infrared (IR) images were taken during the field audit. Thermal imaging/ infrared (IR) technology helps to identify energy compromising problem areas in a non-invasive way.

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 and thermal analysis, as far as accessibility and weather conditions allowed at the time of the field audit.

2.3.1. Exterior Walls

The exterior walls are typical throughout the Roads Department. The exterior wall surface was observed to be 12" or 16" thick red and brown masonry brick. There were no observed layers of insulation or materials besides the brick. There are also numerous pipe conduits and electrical line remnants from when the building used to be home to the local department of power and lighting that are enhancing the displacement and caulking problems with the masonry units.

Note: Wall insulation levels could visually be verified in the field by non-destructive methods.

During the field audit exterior and interior wall surfaces were inspected. They were found/ reported to be in overall acceptable/ age appropriate condition with some signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues detected on all facades.

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

Damaged exterior wall finishes with cracked/ aged caulk and cracked/ deteriorated bricks and mortar joints and uncontrolled roof water run-off due to defective/ clogged gutters and downspouts

In light of the exterior wall conditions mentioned above SWA has the following recommendation, which may be described, quantified and categorized further in the *Executive Summary*:

- Replace broken/ deteriorated bricks and re-point cracked mortar joints.
- Inspect and replace cracked/ ineffective caulk.
- Apply appropriate air-sealing strategies around all exterior wall penetrations (including electrical, plumbing and HVAC).
- Install/ repair and maintain gutters, downspouts and downspout deflectors to minimize uncontrolled roof water run-off causing exterior wall damage.
- Re-point deteriorated mortar joints soon to prevent possible water/ moisture penetration into cavity walls.
- At a minimum, conduct biannual maintenance inspections to inspect the exterior walls with a focus on cracks and pointing of the masonry, degraded caulking, and locating sources of water and air leakage.

2.3.2. Roof

The building's roof is predominantly a low-pitch gable type over a wood structure with an asphalt shingle finish. No roof insulation was visually observed or apparent from the audit, or reported from consultations with building staff or existing building plans. It is not known when the last roof replacement occurred.

During the field audit roofs, related flashing, gutters and downspouts were inspected. They were found/ reported to be in overall acceptable/ age appropriate condition with only a few signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues mostly detected on sloped roof areas. While there are no major apparent problems with the roof its

does show signs of advanced age as it seems to be approaching the end of its life cycle. Given the current conditions it can be expected that problems with the roof will increase in the coming years and that the roof has between five to ten years of effective usage remaining.

The following specific roof construction was identified:

Examples of asphalt shingle roofing found throughout the entire facility

In light of the exterior wall conditions mentioned above SWA has the following recommendations which may be described, quantified and categorized further in the *Executive Summary*:

- Insulate original and uninsulated roof and ceiling sections. SWA suggests applying spray foam and/ or rigid foam board insulation (R-30 min.) under and/ or on top of the wooden structure.

- Maintain and inspect all roof surfaces on a regular basis with a focus on the drainage, penetrations, flashing and seams of the roof.

2.3.3. Base

The building's base is composed of a slab-on-grade floor with a perimeter foundation and no detectable slab edge/ perimeter insulation.

Slab/ perimeter insulation levels could not be verified in the field or on construction plans and are based upon similar wall types and time of construction.

The building's base and its perimeter were inspected. Judging from signs of uncontrolled moisture or water presence and other energy compromising issues, overall the base was found/ reported to be in good/ age appropriate condition with no signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues neither visible on the interior nor exterior. This is standard for this type of structure.

SWA does not recommend any additional insulation as it would not be cost effective.

2.3.4. Windows

The building contains basically two different types of windows.

- 15 fixed type windows with a non-insulated aluminum frame, clear tempered single glazing safety glass and no interior or exterior shading devices. The windows are located throughout the building and many have been installed for over twenty years or longer.
- Double-hung type windows with a non-insulated aluminum frame clear double glazing and interior shading devices. The windows are located throughout the building and were recently installed within the last ten years.

There are also small glass panels inside of the garage doors and a transom unit above one of the outer doors. Windows, shading devices, sills, related flashing and caulking were inspected from the exterior and interior as far as accessibility allowed. Based on signs of moisture, air-leakage and other energy compromising issues, overall the windows were found and/or reported to be in acceptable/ age appropriate condition and while they are thermally ineffective they show no signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

The following are examples of the typical windows installed throughout the building:

In light of the exterior wall conditions mentioned above, SWA has the following recommendation, which may be described, quantified and categorized further in the *Executive Summary*:

- Installation of new windows would not be economically viable, but as a best practice SWA recommends that all windows be inspected at least once a year with a focus on tight air seals, caulking, weather-stripping and frame damage.

2.3.5. Exterior doors

The building contains several different types of exterior doors.

- Solid metal type exterior doors. They are located throughout the building and were recently installed. Some of the existing metal doors were observed to be obstructed at the frame and do not close properly.
- Wood type exterior doors. They are located throughout the building and were observed to have damaged frames.
- Paneled metal overhead type exterior doors. They are located throughout the building at the entrances to all of the garage bays along with glass panels and some contain separate metal doors installed inside of them.

All exterior doors, thresholds, related flashing, caulking and weather-stripping were inspected. Based on signs of moisture, air-leakage and other energy compromising issues, overall the doors were found/ reported to be in acceptable/ age appropriate condition with some signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

The following specific are examples of the typical exterior doors:

Examples of typical doors and damaged/ warped/ aged door frame, obstructed metal doors, and missing and worn weather stripping

In light of the exterior wall conditions mentioned above SWA has the following recommendations, which may be described, quantified and categorized further in the *Executive Summary*:

- Replace/ repair and maintain broken/ non-closing/ damaged door units.
- Install/ replace/ maintain weather stripping around all exterior doors and roof hatches.
- Replace/ add/ maintain caulk around door frames and sills.

2.3.6. Building Air Tightness

Overall the field auditors found the building not to be adequately air-tight with numerous areas, as described in more detail earlier in this section.

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

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

2.4. HVAC Systems

The Roads Department Building heating is provided for the garage portion of the building by ceiling suspended natural gas fired infrared heaters, Roads Department office by wall mounted electric perimeter heating and the two lounges by wall mounted electric heaters. Cooling for some of the rooms is provided by through the window air conditioners; however, most of the building including the garage bays is not cooled. Domestic Hot Water is provided by an electrical storage hot water heater.

2.4.1. Heating

The garage portion of the building is heated via eight (8) ceiling suspended natural gas infrared heaters that are directly vented through the roof of the building. There is a ninth heater present and it is no longer operational / has been disconnected but not removed. Of those eight units, five (5) are installed in the main garage bay and the other three (3) installed in the auxiliary garage, Water Department workshop and corridor leading to the main garage bay. Each unit is capable of 100 MBH input and is installed with a two sided metal reflector. The units have various installation dates but are all around 12 years old and have approximately 20% left of there expected service life of 15 years.

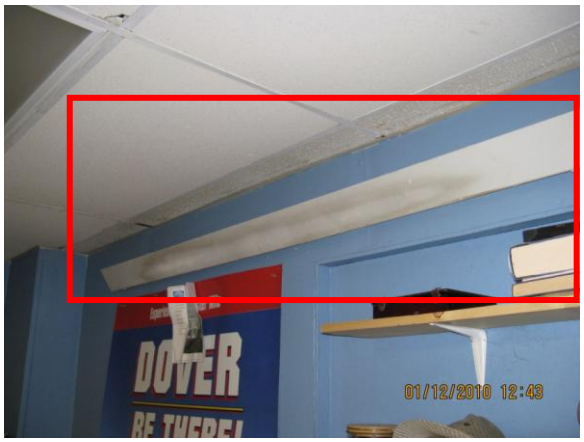
There were no complaints about the ability of the heating system to provide adequate comfort to the building occupants and the existing equipment seems to be in good working condition. Infrared heaters are ideal for garage applications due to the advantages of radiant heating in a large open space like a garage, and their high efficiency.

Typical Infrared Heaters

Each of the two lounge areas are heated by their own separate electric space heaters. Due to the small areas that they serve convective heaters are ideal for areas of continuous occupancy that require heating of indoor air. SWA also recommends the installation of programmable thermostats to control these units in place of the existing control knobs on the units as they will reduce overheating which will increase thermal comfort and optimize the operating schedule of the units.

Existing Electrical Space Heaters

In the lounge of the Roads Department office in the southern corner of the building there are sections of electrical perimeter heating with ceramic reflectors mounted on the upper portion of the walls near the ceiling tiles. Due to the small areas that they serve, convective heaters are ideal for areas of continuous occupancy that require heating of indoor air. SWA also recommends the installation of programmable thermostats to control these units as they will reduce overheating which will increase thermal comfort and optimize the operating schedule of the units.



Existing Perimeter Electrical Heating

2.4.2. Cooling

The Roads Department Building cooling is provided by two through the window air conditioning units and one through the wall air conditioner units, one of which is installed in an interior wall separating a lounge area from the main garage bay. There manufacturers are Panasonic and Emerson and they serve the western lounge and the separate Roads Department office in the southern corner of the building. These are relatively old units, around ten years old that are at or approaching the end of their operating life.

Air Conditioner Mounted In an Interior Wall

Existing Air Conditioning Units

SWA recommends replacement with high efficiency Energy Star rated units and that the replacement for through the wall unit installed in the interior wall be installed with exterior exposure. They could be better sealed in the windows to prevent expensive conditioned air from escaping to the outside.

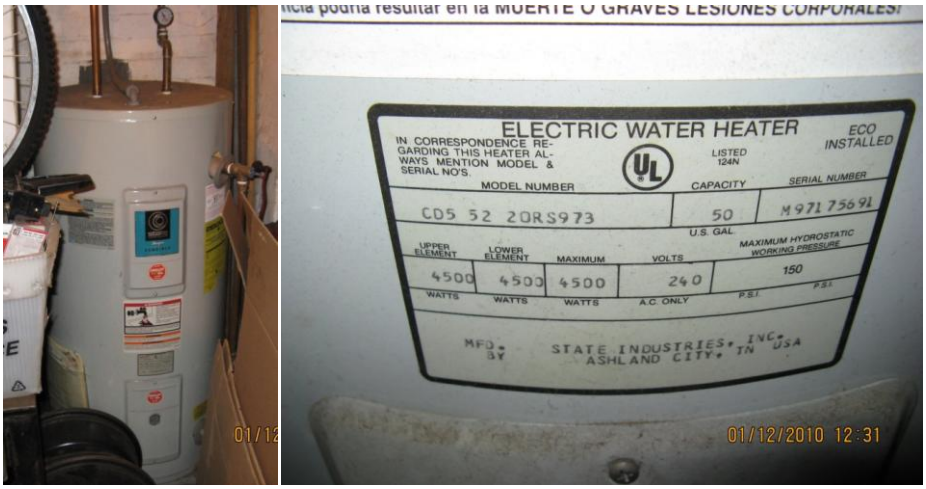
2.4.3. Ventilation

The various spaces of the building are ventilated by infiltration air, natural ventilation that occurs with the opening of the garage bay doors, and the air conditioning units that serve the lounges and roads department offices. There are also existing rooftop exhaust fans in the main garage bay however, they are no longer operational but do contribute to building infiltration. While it would not be economical to remove these units at the current time, their removal should occur in coordination with any future roofing work to sections near or including the fans.

Rooftop exhaust fans to be removed in coordination with future roofing work.

2.4.4. Domestic Hot Water

The domestic hot water (DHW) for the Roads Department Building is provided by an electrical water heater with a storage capacity of 50 gallons and 4.5 kW of maximum element power. This unit has an energy factor of 0.87, an estimated Energy Guide annual usage of 5,006 kWh and was installed in September of 1997. SWA recommends that when the unit reaches the end of its operating life it should be replaced with a high efficiency gas fired, Energy Star, non-condensing type unit. SWA also recommends biannual inspections of the unit given the tendency of electrical units to rust out the bottom of their tanks after approximately ten years of service.



Domestic Hot Water Heater and Nameplate

2.5. Electrical Systems

2.5.1. Lighting

Interior Lighting - The Roads Department Building currently consists of mostly inefficient lighting with T12 fluorescent fixtures with magnetic ballasts, and high bay metal halide fixtures. Based on measurements of lighting levels for each space, there are not any vastly

over-illuminated areas. SWA recommends replacing the following inefficient fixtures with more energy efficient types: T12 lamps should be replaced with T8 electronically ballasted lamps and metal halides should be replaced with pulse start metal halide fixtures. SWA recommends installing 6 occupancy sensors in areas that are occupied only part of the day and payback on savings are justified, such as the lounge areas, workshops and roads department office in the southern corner of the building. Typically, occupancy sensors have an adjustable time delay that shuts down the lights automatically if no motion is detected within a set time period. Advance micro-phonic lighting sensors include sound detection as a mean to control lighting operation. See attached lighting schedule in Appendix A for a complete inventory of lighting throughout the building and estimated power consumption.

Exit Lights - Exit signs were found to be efficient LED type.

Exterior Lighting - The exterior lighting surveyed during the building audit was found to be a mix of Metal Halide lamp fixtures, halogen fixtures and high pressure sodium fixtures. Exterior lighting is controlled by timers. SWA recommends replacing the Metal Halide lamps with pulse start Metal Halide lamps, halogens with CFL's and high pressure sodium fixtures with pulse start metal halides. Pulse-start metal halide (MH) lamps offer the advantages of standard (probe-start) MH lamps, but minimize the disadvantages. They produce higher light output both initially and over time, operate more efficiently, produce whiter light, and turn on and re-strike faster. SWA is not recommending at this time any upgrades to the exterior timers.

2.5.2. Appliances and Process

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

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

2.5.3. Elevators

The Roads Department Building is a single-story building without an elevator.

2.5.4. Others Electrical Systems

There are not currently any other significant energy impacting electrical systems installed at the Roads Department Building.

3. EQUIPMENT LIST

Inventory

Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Heating	(5) Infrared Heaters, 100 MBH input, ~95% eff	Main Garage Bay	Roberts Gordon Inc., GordonRay BH-100 series	Natural Gas	Main Garage Bay	1998	20%
Heating	(1) Infrared Heaters, 100 MBH input, ~95% eff	Water Dept. Workshop	Roberts Gordon Inc., GordonRay BH-100 series	Natural Gas	Water Dept. Workshop	1998	20%
Heating	(1) Infrared Heaters, 100 MBH input, ~95% eff	Auxiliary Garage	Roberts Gordon Inc., GordonRay BH-100 series	Natural Gas	Auxiliary Garage	1998	20%
Heating	(1) Infrared Heaters, 100 MBH input, ~95% eff	Hallway	Roberts Gordon Inc., GordonRay BH-100 series	Natural Gas	Hallway	1998	20%
Cooling	1 wall AC unit, 20,000 Btu/hr - 9.0 EER eff.	Roads Dept. Office	Emerson, Quiet Kool, Serial #: 5757198	Electric	Roads Dept. Office	1996	90%
Cooling	1 wall AC unit, 4,000 Btu/hr – 9.0 EER eff.	Roads Dept. Lounge	Panasonic, CW-40G	Electric	Roads Dept. Lounge	1996	90%
Cooling	1 wall AC unit, 10,000 Btu/hr - 9.0 EER eff.	Lounge	Emerson, Quiet Kool,	Electric	Roads Dept. Office	1996	90%
Domestic Hot Water	1 hot water heater, 4.5kW, 50 gal - energy factor of at 0.87	Auxiliary Garage	State Industries – CDS-52-20RS973; Serial #: M97175691	Natural Gas	Roads Department Bldg	1997	13%
Air Compressor	(1) 5HP air compressor unit	Mechanical Closet	Curtis, Baldor motor N3218T, 1,750 RPM, 13.8/6.9 amp, 230/460 Volts	Electric	Main Garage Bay	2000	30%
Lighting	See details - Appendix A	See details - Appendix A	See details - Appendix A	Electric	Roads Department Bldg	See details- Appendix A	50%

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 South River Roads Department Building, SWA has separated the investment opportunities into three recommended categories:

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

Category I Recommendations: Capital Improvements

- SWA recommends that the Roads Department install a building emergency generator that would support the safety of the workers during power outages.

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

- Install new windows energy efficient ENERGY STAR qualified windows to coincide with the next major building renovation.

- Replace/ repair and maintain broken/ non-closing/ damaged door units.

- Currently the South River Roads Department is predominantly a low-pitch gable type over a wood structure with an asphalt shingle finish. No roof insulation was visually observed or apparent from the audit, or reported from consultations with building staff or existing building plans. To reduce the amount of heat loss through the uninsulated roof and increase the effectiveness of the existing heating system the building should install a layer of R-30 insulation to the interior of the existing wooden roof surface. A typical installation would entail the use of rigid insulation boards such as polyisocyanurate installed along the existing roofing members between the roof joists. The estimated cost of installation is $5.5 per SF. When modeled in eQuest this saves approximately 2,717 therms per year or $3,729 annually and is a reduction of 23.2 kBtu/ft^{2}yr with a simple payback of 19.6 years.

Category II Recommendations: Operations and Maintenance

- Conduct biannual maintenance inspections to inspect the exterior walls with a focus on cracks and pointing of the masonry, degraded caulking, and locating sources of water and air leakage.

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

- Domestic hot water distribution piping insulation - Insulate un-insulated hot water piping to efficiently deliver heat where required and provide personnel protection.

- Inspect and replace cracked/ ineffective caulk.

- Install/ replace/ maintain weather stripping around all exterior doors and roof hatches.

- Maintain roofs - SWA recommends regular maintenance and inspections of all roof surfaces on a regular basis with a focus on the drainage, penetrations, flashing and seams of the roof.

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

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

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

- Replace broken/ deteriorated bricks and re-point cracked mortar joints to prevent possible water/ moisture penetration into cavity walls.

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

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

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

Category III Recommendations: Energy Conservation Measures - Summary Table

ECM#	Description of Highly Recommended 0-5 Year Payback ECMs
1	Install programmable thermostats to control heating systems
2.1 & 2.2	Install occupancy sensors and replace halogen lamps with a CFLs
	Description of Recommended 5-10 Year Payback ECMs
2.4	Replace T12 with T8 fixtures
4	Replace old refrigerator with Energy Star type model
5	Replace Existing Air Conditioners with an Energy Star Model
	Description of Recommended 10 Year or Greater Payback and End of Life Cycle ECMs
3	Replace Metal Halide with pulse start Metal Halide fixtures
6	Replace hot water heater with gas fired non-condensing hot water heater
	Description of Renewable ECMs
7	Install a 5 kW solar PV rooftop system

ECM#1: Install programmable thermostats to control heating systems

Description:

On the days of the site visit, SWA completed a mechanical inventory of the Roads Department Building. There was a combination of ceiling mounted infrared heating units, electric space heaters and perimeter electric heating. These heating units were controlled by either manufacturer provided control knobs or a manual thermostat. By replacing these control units with digital programmable thermostats we can increase thermal comfort while decreasing energy waste due to excessive usage. Savings were modeled in E-Quest with a four degree temperature setpoint reduction during unoccupied hours and two degree temperature setpoint reduction during the occupied hours.

Installation cost:

Estimated installed cost: $2,400 (this includes $1,500 in labor cost)
Source of cost estimate: RS *Means; Published and established costs*

Economics:

ECM #	ECM description	Source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
1	Install (12) twelve digital programmable thermostat to control heating units	RS Means, Lit Search	2,400	0	2,400	0	0.0	1,940	16.6	0	2342	25	39,880	1.0	1562	62	98	20,908	22,698

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

Rebates/financial incentives: *NJ Clean Energy - There aren't any incentives at this time offered by the state of NJ for this energy conservation measure.*

Options for Funding ECM:

This project may benefit from applying for a grant from the State of New Jersey - American Recovery and Reinvestment Act Energy Efficiency and Conservation Block Grant (EECBG) Program to offset a portion of the cost of implementation.
http://www.state.nj.us/recovery/infrastructure/eecbg_program_criteria.html

ECM#2: *Building Lighting Upgrades*

Description:

On the days of the site visits, SWA completed a lighting inventory of the Roads Department Building (see Appendix A).

The Roads Department Building currently consists of mostly inefficient lighting with T12 fluorescent fixtures with magnetic ballasts, and high bay metal halide fixtures. Based on measurements of lighting levels for each space, there are not any vastly over-illuminated areas. SWA recommends replacing the following inefficient fixtures with more energy efficient types: T12 lamps should be replaced with T8 electronically ballasted lamps and metal halides should be replaced with pulse start metal halide fixtures. SWA recommends installing 6 occupancy sensors in areas that are occupied only part of the day and payback on savings are justified, such as the lounge areas, workshops and roads department office in the southern corner of the building. Typically, occupancy sensors have an adjustable time delay that shuts down the lights automatically if no motion is detected within a set time period. Advance micro-phonic lighting sensors include sound detection as a mean to control lighting operation. See attached lighting schedule in Appendix A for a complete inventory of lighting throughout the building and estimated power consumption. The exterior lighting surveyed during the building audit was found to be a mix of Metal Halide lamp fixtures, halogen fixtures and high pressure sodium fixtures. Exterior lighting is controlled by timers. SWA recommends replacing the Metal Halide lamps with pulse start Metal Halide lamps, halogens with CFL's and high pressure sodium fixtures with pulse start metal halides. Pulse-start metal halide (MH) lamps offer the advantages of standard (probe-start) MH lamps, but minimize the disadvantages. They produce higher light output both initially and over time, operate more efficiently, produce whiter light, and turn on and re-strike faster. SWA is not recommending at this time any upgrades to the exterior timers. The labor in all these installations was evaluated using prevailing electrical contractor wages. The Borough of South River 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.

Installation cost:

Estimated installed cost: $8,246 (this includes $2,612 in labor cost)
Source of cost estimate: RS *Means; Published and established costs*

Economics:

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime 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	install (6) occupancy sensors in lounges, workshops and offices	RS Means , Lit Search	1,320	0	1,320	2,117	0.44	0	0.6	0	275	15	3,238	4.8	145	10	18	1,419	2,900
2.2	Replace (8) halogen bulbs with CFLs	RS Means , Lit Search	402	0	402	2,067	0.43	N/A	0.6	34	303	5	1,379	1.3	286	57	75	2,613	2,832
2.4	Replace (29) T12 fixtures with T8 fixtures	RS Means , Lit Search	6,524	0	6,524	2,227	0.46	0	0.6	394	683	15	8,038	9.6	114	8	4	275	3051
	Totals		**8,246**	**0**	**8,246**	**6,411**	**1**	**0**	**2**	**428**	**1,261**	**-**	**12,655**	**6.5**	**-**	**-**	**-**	**4,307**	**8,783**

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA also assumed an aggregated 10% failure rate in addition to the standard life cycle.

Rebates / Financial Incentives:
NJ Clean Energy - There aren't any incentives at this time offered by the state of NJ for this energy conservation measure.

Options for Funding ECM:
This project may benefit from applying for a grant from the State of New Jersey - American Recovery and Reinvestment Act Energy Efficiency and Conservation Block Grant (EECBG) Program to offset a portion of the cost of implementation.

http://www.state.nj.us/recovery/infrastructure/eecbg_program_criteria.html

ECM#3: *Replace Metal Halide with Pulse Start Metal Halide Fixtures*

Description:

On the days of the site visits, SWA completed a lighting inventory of the Roads Department Building (see Appendix A).

The Roads Department Building currently utilizes inefficient lighting in the form of high bay and exterior metal halide fixtures. Based on measurements of lighting levels for each space, there are not any vastly over-illuminated areas. SWA recommends replacing them with pulse start metal halide fixtures. Pulse-start metal halide (MH) lamps offer the advantages of standard (probe-start) MH lamps, but minimize the disadvantages. They produce higher light output both initially and over time, operate more efficiently, produce whiter light, and turn on and re-strike faster. The labor in all these installations was evaluated using prevailing electrical contractor wages. The Borough of South River 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. While they are not the most cost effective measure they do provide a large amount of energy savings for just a lighting replacement and they are the natural replacement option for any malfunctioning metal halide fixture.

Installation cost:

Estimated installed cost: $17,018 (this includes $5,393 in labor cost)
Source of cost estimate: RS *Means; Published and established costs*

Economics:

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime 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 (22) Metal Halide fixtures with pulse start MH type	RS Means, Lit Search	17,018	0	17,018	3,447	0.72	0	1.0	542	990	15	11,650	17.2	16	1	-5	-7,163	4,722

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA also assumed an aggregated 10% failure rate in addition to the standard life cycle.

Rebates / Financial Incentives:

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

Options for Funding ECM:

This project may benefit from applying for a grant from the State of New Jersey - American Recovery and Reinvestment Act Energy Efficiency and Conservation Block Grant (EECBG) Program to offset a portion of the cost of implementation.

http://www.state.nj.us/recovery/infrastructure/eecbg_program_criteria.html

ECM#3: *Replace Old Refrigerator with an Energy Star Model*

Description:

On the day of the site visit, SWA observed that there were two old refrigerators a 2.7 cu. ft. model and 17 cu. ft. model in the garage bay area which were not Energy Star rated (using approximately 254 and 773 kWh/yr each). Appliances, such as refrigerators, that are over 10 years of age should be replaced with newer efficient models with the Energy Star label. Two of the four refrigerators at the Roads Department building, the Sanyo and General Electric models fall under this criteria and should be replaced. SWA recommends the replacement of the existing GE refrigerator in the garage with a 17 cu. ft. top freezer refrigerator ENERGY STAR®, or equivalent and the Sanyo refrigerator with a 2.7 cf. ft. ENERGY STAR® model or equivalent. Besides saving energy, the replacement will also keep the kitchen and other areas cooler. When compared to the average electrical consumption of older equipment, Energy Star equipment results in large savings. Look for the Energy Star label when replacing appliances and equipment, including: window air conditioners, refrigerators, printers, computers, copy machines, etc. More information can be found in the "Products" section of the Energy Star website at: http://www.energystar.gov.

Installation cost:

Estimated installed cost: $574 (includes $75 of labor)
Source of cost estimate: *Manufacturer and Store established costs*

Economics:

ECM #	ECM description	Source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
4.1	Replace (1) compact refrigerator with an 2.7 cu ft model in kind	Energy Star purchasing and procurement site, similar projects	99	0	99	95	0.0	0	0.03	0	12	12	121	8.0	23	2	7	24	130
4.2	Replace one (1) garage refrigerator with an 17 cu ft Energy Star model	Energy Star purchasing and procurement site, similar projects	475	0	475	425	0.1	0	0.14	0	55	12	543	8.6	14	1	6	75	582
	Totals		**574**	**0**	**574**	**520**	**0.1**	**0**	**0.2**	**0**	**67**	**-**	**664**	**8.5**	**-**	**-**	**-**	**-**	**712**

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

Rebates/financial incentives: *NJ Clean Energy - There aren't any incentives at this time offered by the state of NJ for this energy conservation measure.*

Options for Funding ECM:

This project may benefit from applying for a grant from the State of New Jersey - American Recovery and Reinvestment Act Energy Efficiency and Conservation Block Grant (EECBG) Program to offset a portion of the cost of implementation.

http://www.state.nj.us/recovery/infrastructure/eecbg_program_criteria.html

ECM#5: *Replace Existing Air Conditioners with an Energy Star Model*

Description:

On the day of the site visit, SWA observed that there were three old air conditioners in the building, two of which were in the separate roads department office and another in the smaller lounge area which was not Energy Star rated. Appliances, such as air conditioners, that are over 10 years of age should be replaced with newer efficient models with the Energy Star label. Besides saving energy through the efficiency of the units they also come equipped with more accurate controls and will reduce infiltration losses if installed properly as compared to the current installations which are substandard. When compared to the average electrical consumption of older equipment, Energy Star equipment results in large savings and more information can be found in the "Products" section of the Energy Star website at: http://www.energystar.gov.

Installation cost:

Estimated installed cost: $530 (includes $80 of labor)
Source of cost estimate: *Manufacturer and Store established costs*

Economics:

ECM #	ECM description	Source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
5.1	Replace one (1) 20,000 BTU/hr Roads Dept Office A/C with 12.0 EER eff. model	Energy Star purchasing and procurement site, similar projects	305	0	305	288.2	0.1	0	0.08	0	37	15	441	8.1	45	3	7	68	395
5.2	Replace one (1) 4,000 BTU/hr Roads Dept Lounge A/C with 12.0 EER eff. model	Energy Star purchasing and procurement site, similar projects	100	0	100	57.7	0.0	0	0.02	0	7	15	88	13.3	-12	-1	-2	-25	79
5.3	Replace one (1) 10,000 BTU/hr Lounge A/C with 12.0 EER eff. model	Energy Star purchasing and procurement site, similar projects	185	0	185	144.1	0.0	0	0.04	0	19	15	220	9.9	19	1	3	1	197
	Totals		590	0	590	490	0	0	0.1	0	64	15	750	9.3	27	2	4	44	671

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

Rebates/financial incentives: *NJ Clean Energy - There aren't any incentives at this time offered by the state of NJ for this energy conservation measure.*

Options for Funding ECM:

This project may benefit from applying for a grant from the State of New Jersey - American Recovery and Reinvestment Act Energy Efficiency and Conservation Block Grant (EECBG) Program to offset a portion of the cost of implementation.

http://www.state.nj.us/recovery/infrastructure/eecbg_program_criteria.html

ECM#6: *Replace Hot Water Heater with Gas Fired Non-Condensing Hot Water Heater*

Description:

The existing hot water is approaching its expected service life and should be replaced within the next two years to avoid catastrophic failure. An upgrade to Energy Star non-condensing hot water heater of 85% Annual Fuel Utilization Efficiency (AFUE) rating cannot be justified by energy savings alone. However, replacement is strongly recommended along with upgrades to other portions of the heating system. The new high efficiency unit should have comparable storage capacity of 50 gallons and a compact design for easy retrofit installation, with sectional aluminum block and ASME relief valve.

Installation cost:

Estimated installed cost: $1,979 (includes $429 of labor)
Source of cost estimate: RS Means, manufacturer's data and similar projects

Economics:

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
6	Replace (1) old 87% energy factor boiler – 4.5 kW input with a model in kind - 85% eff 15.4 MBH	Energy Star purchasing and procurement site, similar projects	1979	0	1979	2,569	0.0	-103.43	-0.13	0	209	25	3,562	9.5	80	3	4	103	2,309

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

Rebates/financial incentives: *NJ Clean Energy - There aren't any incentives at this time offered by the state of NJ for this energy conservation measure.*

Options for Funding ECM:

This project may benefit from applying for a grant from the State of New Jersey - American Recovery and Reinvestment Act Energy Efficiency and Conservation Block Grant (EECBG) Program to offset a portion of the cost of implementation.
http://www.state.nj.us/recovery/infrastructure/eecbg_program_criteria.html

ECM#7: *Install a 5 kW PV System*

Description:

Currently the Roads Department building does not use any renewable energy systems. Renewable energy systems such as photovoltaic panels, can be mounted on the building roofs, and can offset a portion of the purchased electricity for the building. Power stations generally have two separate electrical charges: usage and demand. Usage is the amount of electricity in kilowatt-hours that a building uses from month to month. Demand is the amount of electrical power that a building uses at any given instance in a month period. During the summer periods, when electric demand at a power station is high due to the amount of air conditioners, lights, equipment, etc… being used within the region, demand charges go up to offset the utility's cost to provide enough electricity at that given time. Photovoltaic systems not only offset the amount of electricity use by a building, but also reduce the building's electrical demand, resulting in a higher cost savings as well. The Borough of South River may want to review installing a 5 kW PV system to offset electrical demand and reduce the annual net electric consumption for the Roads Department building. The Roads Department building is not eligible for a 30% federal tax credit. The Roads Department building may want to consider applying for a grant and / or engage a PV generator / leaser who would install the PV system and then sell the power at a reduced rate. Typically, a major utility provides the ability to buy SREC's at $600/MWh or best market offer. However, this option is not available from the local utility. See below for more information.

Considering the available square footage of the Roads Department building roof at this time, it would be possible to install a 5 kW PV system. However, considering the facts that:

- the solar PV system should be limited in size to below the minimum electrical demand since the utility will not buy back excess power generated by the system
- the solar PV system installation cost should be limited to allow for available grant money to considerably shorten the payback period

SWA has considered the system size stated above. Should the Roads Department decide to increase the air conditioned spaces, the minimum demand would increase over the historical data cited in this analysis, and therefore further study into expanding the proposed system would be recommended.

There are many possible locations for a 5 kW PV installation on the building roofs. A commercial crystalline 230 watt panel has 17.5 square feet of surface area (13.1 watts per square foot). A 5 kW system needs approximately 22 panels which would take up 380 square feet. The installation of a renewable Solar Photovoltaic power generating system could serve as a good educational tool and exhibit for the community.

Installation cost:

Estimated installed cost: $37,500 (includes $15,000 of labor)
Source of cost estimate: Similar Projects

Economics (<u>without</u> NJ EECBG Grant):

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
7	Install a 5 kW Solar Photovoltaic system	Similar Projects	37,500	0	37,500	5,902	5.0	0	2.7	0	767	25	19,182	48.9	0	0	-5	-23,675	10,568

Assumptions: SWA estimated the cost and savings of the system based on past PV projects. SWA projected physical dimensions based on a typical Polycrystalline Solar Panel (230 Watts, model #ND-U230C1). PV systems are sized based on Watts and physical dimensions for an array will differ with the efficiency of a given solar panel (W/sq ft).

Rebates/financial incentives:

NJ Clean Energy rebates are not available since the South River Utility is part of an energy consortium that does not pay the Societal Benefits Charge that funds these rebates.

NJ Clean Energy - Solar Renewable Energy Certificate Program. Each time a solar electric system generates 1,000kWh (1MWh) of electricity, a SREC is issued which can then be sold or traded separately from the power. The buildings must also become net-metered in order to earn SRECs as well as sell power back to the electric grid. An estimated SREC value of $3,000 could be realized with a traditional solar PV system setup. However, since net metering is not available from the local utility, savings in the form of SRECs were NOT incorporated into the above analysis.

Options for funding ECM:

This project may benefit from applying for a grant from the State of New Jersey Energy Efficiency and Conservation Block Grant (EECBG) Program to offset a portion of the cost of implementation.
http://www.state.nj.us/recovery/infrastructure/eecbg_program_criteria.html

5. RENEWABLE AND DISTRIBUTED ENERGY MEASURES

5.1. Existing systems

There aren't currently any existing renewable energy systems.

5.2. Wind

Description:

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

Description:

A Solar PV System is not applicable because of insufficient financial incentives and a simple payback greater than 40 years. See ECM#7.

5.4. Solar Thermal Collectors

Description:

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

5.5. Combined Heat and Power

Description:

CHP is not applicable for this building because of a few small cooling systems and insufficient domestic hot water use.

5.6. Geothermal

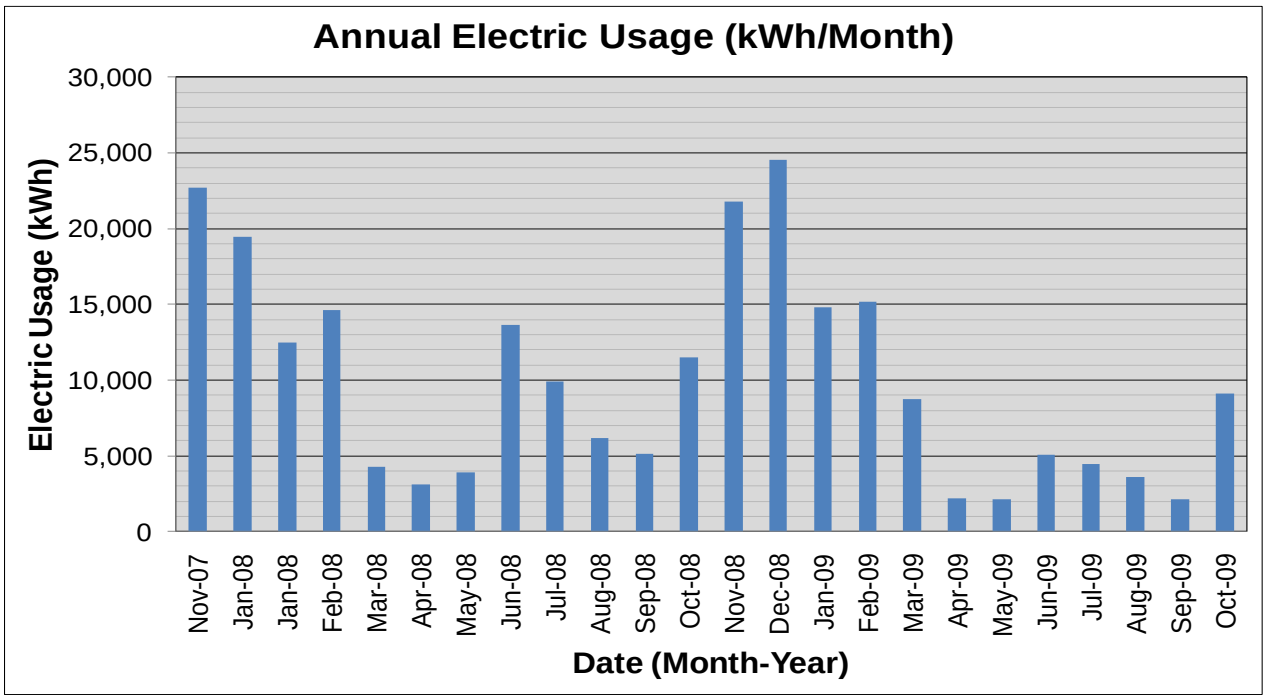
Description:

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

6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

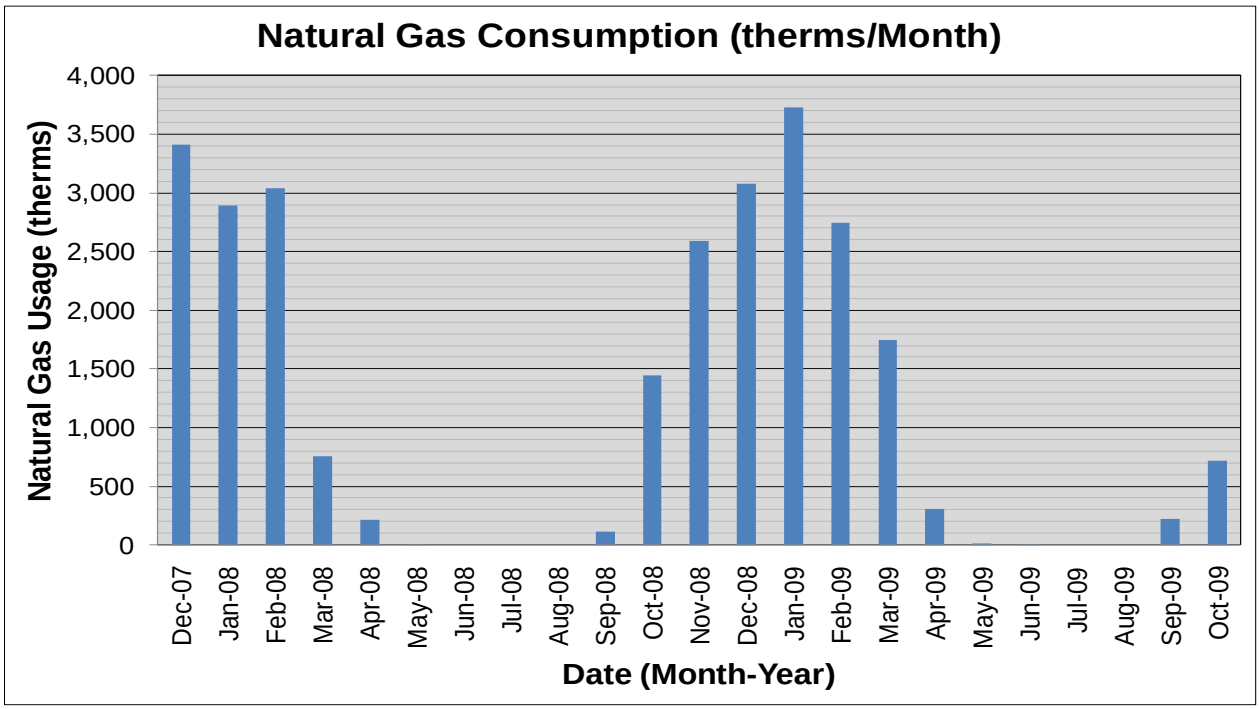
6.1. Load Profiles

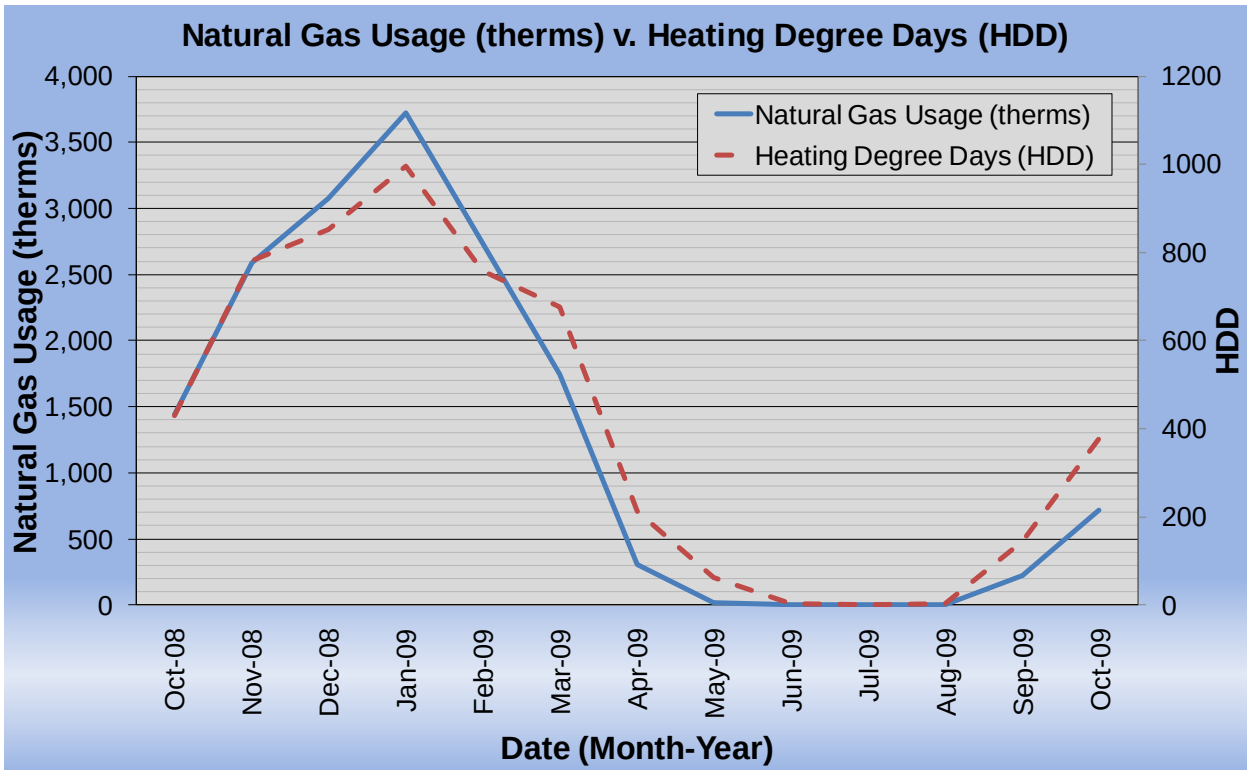
The following are charts that show the annual electric and natural gas load profiles for the South River Roads Department Building. For annual electric and natural gas usage please also see Section 1. Historic Energy Consumption.



Some minor unusual electric fluctuations shown may be due to adjustments between estimated and actual meter readings.

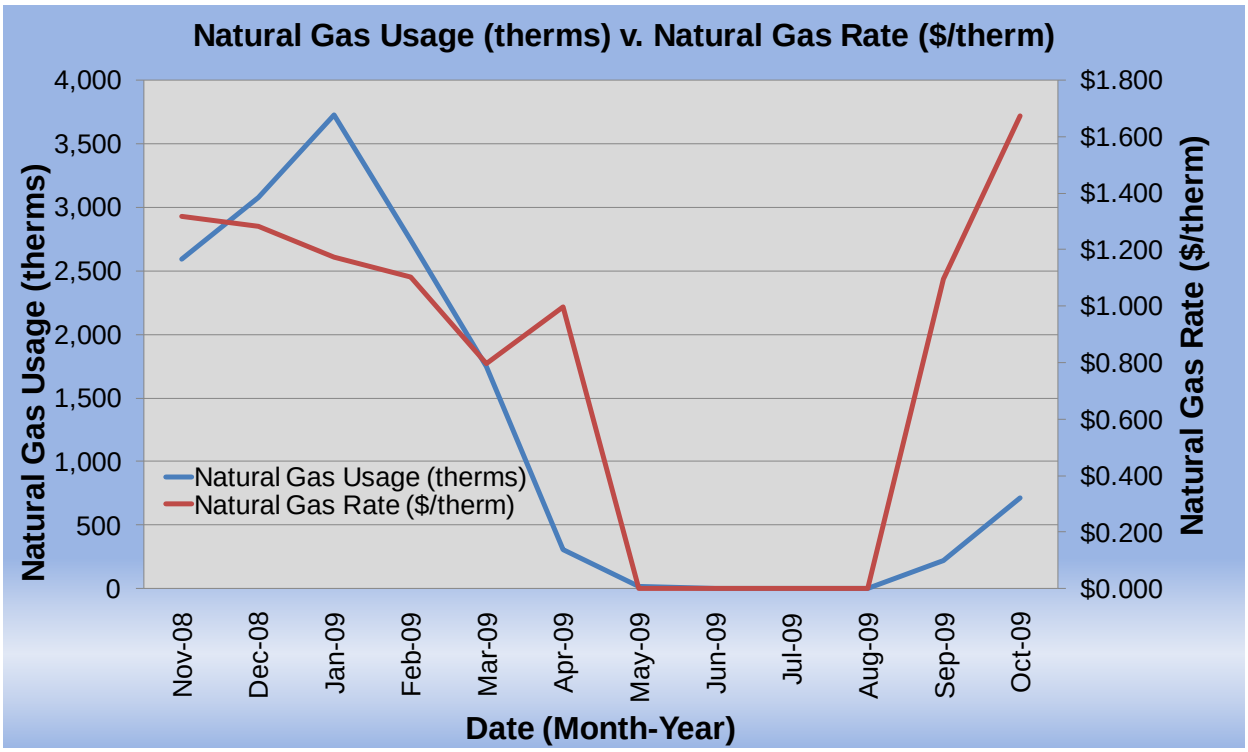
The following is a chart of the natural gas load profile for the building, peaking in the coldest months of the year and a chart showing natural gas consumption following the “heating degree days” curve. Some utility bills have more than one month estimated and combined.





6.2. Tariff Analysis

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



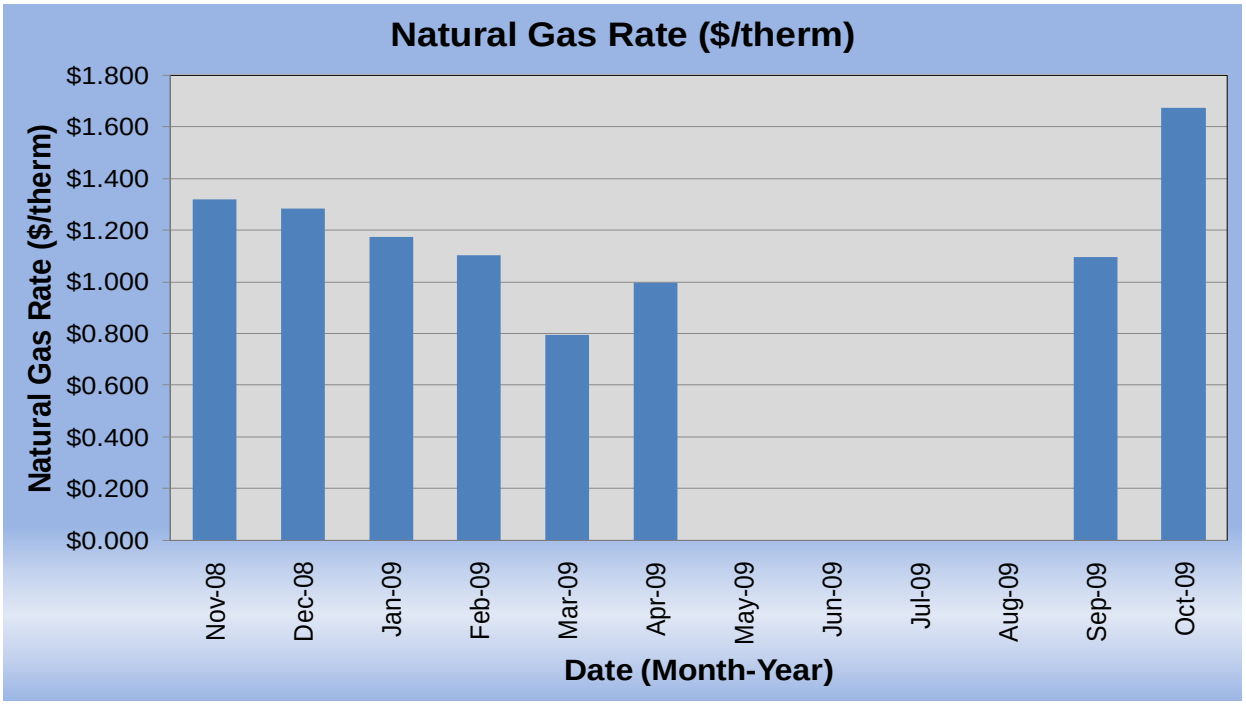
The Roads Department Building is direct-metered and currently purchases electricity from the South River Electric Utility at a general service rate. The general service rate for electric charges is market-rate based on use and the Roads Department Building does not track a breakdown of demand costs. Demand prices are generally reflected in the utility bills and can be verified by observing the price fluctuations throughout the year. Typically, the electricity prices increase during the cooling months when electricity is used by the HVAC condensing units and air handlers.

6.3. Energy Procurement strategies

The Roads Department Building receives natural gas via one incoming meter. PSE&G supplies the gas and transports it. There is not an ESCO engaged in the process. An Energy Services Company (ESCO) is a consultancy group that engages in a performance based contract with a client firm to implement measures which reduce energy consumption and costs in a technically and financially viable manner. Electricity is also purchased via one incoming meter directly for the main Roads Department Building from South River Electricity Company without an ESCO. SWA analyzed the utility rate for natural gas and electricity supply over an extended period. Electric rates were estimated by the Borough of South River over the most recent 12 month period. Natural gas bill analysis shows fluctuations up to 24% over the most recent 12 month period. Some of these fluctuations may have been caused by adjustments between estimated and actual meter readings; others may be due to unusual high and recent escalating energy costs.

The average estimated NJ commercial utility rates for electric and gas are $0.150/kWh and $1.550/therm respectively. The Roads Department Building annual utility costs are competitive, when compared to the average estimated NJ commercial utility rates. SWA recommends that the Borough of South River further explore opportunities of purchasing both natural gas and electricity from ESCOs in order to reduce rate fluctuation and ultimately reduce the annual cost

of energy for the Roads Department Building. Appendix B contains a complete list of third party energy suppliers for the Borough of South River service area. The Borough of South River may want to consider partnering with other school districts, municipalities, boroughs 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. Also, the Roads Department Building would not be eligible for enrollment in a Demand Response Program, because there isn't the capability at this time to shed a minimum of 150 kW electric demand when requested by the utility during peak demand periods, which is the typical threshold for considering this option. The following chart show the Roads Department Building monthly natural gas spending per unit of energy in 2009. Electric rates were estimated by the Borough at a constant rate of $0.130/kWh.



7. METHOD OF ANALYSIS

7.1. Assumptions and tools

Energy modeling tool:	established / standard industry assumptions, E-Quest
Cost estimates:	RS Means 2009 (Facilities Maintenance & Repair Cost Data) RS Means 2009 (Building Construction Cost Data) RS Means 2009 (Mechanical Cost Data) Published & established specialized equipment material & 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 of Borough of South River Roads Department

Location			Existing Fixture Information													Retrofit Information												Annual Savings		
Marker	Floor	Room Identification	Fixture Type	Ballast	Lamp Type	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Controls	Operational Hours per Day	Operational Days per Year	Ballast Wattage	Total Watts	Energy Use 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	Garage Bay #1	HID	N	MH	4	1	150	S	10.0	251	38	752	1,888		PSMH	HID	PSMH	N	S	4	1	100	10.0	251	36	544	1365	522	0	522
2	GF	Garage Bay #1	Parabolic	M	8'T12	4	2	60	S	10.0	251	24	576	1,446		T8	Parabolic	8'T8	E	S	4	2	59	10.0	251	13	524	1315	131	0	131
3	GF	Hallway	Exit Sign	N	LED	2	1	5	N	24.0	365	1	12	105		N/A	Exit Sign	LED	N	N	2	1	5	24.0	365	1	12	105	0	0	0
4	GF	Office	Recessed	M	4'T12	2	4	34	S	10.0	251	24	320	803		T8	Recessed	4'T8	E	OS	2	4	32	7.5	251	13	282	531	272	177	272
5	GF	Office	Exit Sign	N	LED	1	1	5	N	24.0	365	1	6	53		N/A	Exit Sign	LED	N	N	1	1	5	24.0	365	1	6	53	0	0	0
6	GF	Meeting Rm	Recessed	M	4'T12	2	4	34	S	10.0	251	24	320	803		T8	Recessed	4'T8	E	OS	2	4	32	7.5	251	13	282	531	272	177	272
7	GF	Hallway	Parabolic	M	4'T12	1	2	34	S	10.0	251	15	83	208		T8	Parabolic	4'T8	E	S	1	2	32	10.0	251	6	70	176	33	0	33
8	GF	Hallway	Parabolic	M	4'T12	1	2	34	S	10.0	251	15	83	208		T8	Parabolic	4'T8	E	S	1	2	32	10.0	251	6	70	176	33	0	33
9	GF	Hallway	Exit Sign	N	LED	1	1	5	N	24.0	365	1	6	53		N/A	Exit Sign	LED	N	N	1	1	5	24.0	365	1	6	53	0	0	0
10	GF	Meeting Rm	2'U-shape	M	4'T12	4	2	34	S	10.0	251	15	332	833		T8	2'U-Shape	4'T8	E	OS	4	2	32	7.5	251	6	280	527	306	176	306
11	GF	Meeting Rm	Exit Sign	N	LED	1	1	5	N	24.0	365	1	6	53		N/A	Exit Sign	LED	N	N	1	1	5	24.0	365	1	6	53	0	0	0
12	GF	Workshop / Tool Room	Parabolic	M	8'T12	6	4	60	S	10.0	251	40	1,680	4,217		C	Parabolic	8'T8	M	OS	6	4	59	7.5	251	26	1572	2959	1258	986	1258
13	GF	Mechanical Rm	Screw-in	N	Inc	1	1	40	S	2.0	251	0	40	20		N/A	Screw-in	CFL	N	S	1	1	40	2.0	251	0	40	20	0	0	0
14	GF	Garage Bay #2	HID	N	MH	12	1	150	S	10.0	251	38	2,256	5,663		PSMH	HID	PSMH	N	S	12	1	100	10.0	251	36	1632	4096	1566	0	1566
15	GF	Garage Bay #2	Exit Sign	N	LED	1	1	5	N	24.0	365	1	6	53		N/A	Exit Sign	LED	N	N	1	1	5	24.0	365	1	6	53	0	0	0
16	GF	Garage Bay #2	Parabolic	M	4'T12	4	2	34	S	10.0	251	15	332	833		T8	Parabolic	4'T8	E	S	4	2	32	10.0	251	6	280	703	131	0	131
17	GF	Workshop / Tool Room #2	Parabolic	M	4'T12	2	2	34	S	10.0	251	15	166	417		T8	Parabolic	4'T8	E	S	2	2	32	10.0	251	6	140	351	65	0	65
18	GF	Road Dept. Office	Recessed	M	4'T12	2	4	34	S	10.0	251	24	320	803		T8	Recessed	4'T8	E	S	2	4	32	10.0	251	13	282	708	95	0	95
19	GF	Meeting Rm	Recessed	M	4'T12	4	4	34	S	10.0	251	24	640	1,606		T8	Recessed	4'T8	E	OS	4	4	32	7.5	251	13	564	1062	545	354	545
20	GF	Meeting Rm	Exit Sign	N	LED	1	1	5	N	24.0	365	1	6	53		N/A	Exit Sign	LED	N	N	1	1	5	24.0	365	1	6	53	0	0	0
21	GF	Water Dept. Shop Room	Parabolic	M	8'T12	3	2	60	S	10.0	251	24	432	1,084		T8	Parabolic	8'T8	E	OS	3	2	59	7.5	251	13	393	740	344	247	344
22	Ext	Exterior	Exterior	N	Hal	8	1	65	T	12.0	365	16	648	2,838		CFL	Exterior	CFL	N	T	8	1	22	12.0	365	0	176	771	2067	0	2067
23	Ext	Exterior	Exterior	N	MH	2	1	150	T	12.0	365	38	376	1,647		PSMH	Exterior	PSMH	N	T	2	1	100	12.0	365	36	273	1194	453	0	453
24	Ext	Exterior	Exterior	N	MH	4	1	75	T	12.0	365	19	376	1,647		N/A	Exterior	N/A	N	T	4	1	75	12.0	365	19	376	1647	0	0	0
25	Ext	Exterior	Exterior	N	HPS	4	1	150	T	12.0	365	38	752	3,294		PSMH	Exterior	PSMH	N	T	4	1	100	12.0	365	36	545	2388	906	0	906
Totals:						**77**	**47**	**1,296**				**452**	**10,526**	**30,627**							**77**	**47**	**1,032**			**304**	**8,367**	**21,628**	**8,999**	**2,117**	**8,999**

Legend:

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

Appendix B: Third Party Energy Suppliers (ESCOs)

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

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

Appendix C

Glossary and Method of Calculations

Glossary of ECM Terms

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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 measures (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

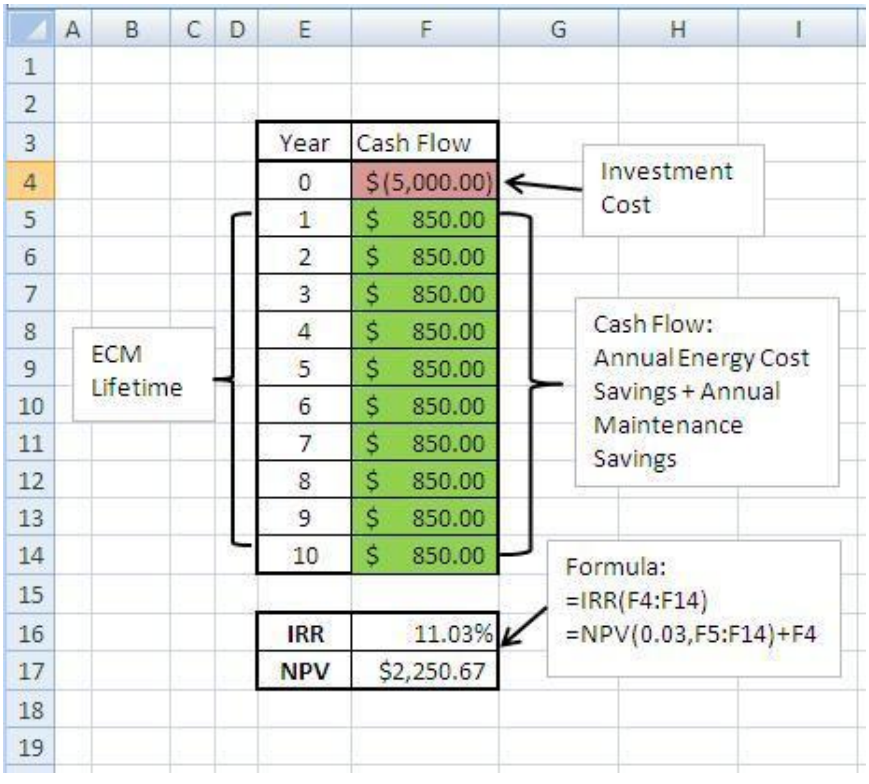
Net ECM Cost = Total ECM Cost – Incentive
LECS = AECS X ECM Lifetime
AOCS = LOCS / ECM Lifetime
LCS = LOCS+LECS

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.

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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