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**Local Government Energy Program
Energy Audit Report
FINAL**

***City of Rahway
Senior Citizens Center
Rahway, NJ 07065***

Project Number: LGEA10



TABLE OF CONTENTS

INTRODUCTION3
EXECUTIVE SUMMARY.....4
1. HISTORIC ENERGY CONSUMPTION.....7
1.1. ENERGY USAGE AND COST ANALYSIS.....7
1.2. UTILITY RATE10
1.3. ENERGY BENCHMARKING10
2. FACILITY AND SYSTEMS DESCRIPTION12
2.1. BUILDING CHARACTERISTICS12
2.2. BUILDING OCCUPANCY PROFILES12
2.3. BUILDING ENVELOPE12
2.3.1. EXTERIOR WALLS12
2.3.2. ROOF12
2.3.3. BASE13
2.3.4. WINDOWS13
2.3.5. EXTERIOR DOORS.....13
2.3.6. BUILDING AIR TIGHTNESS.....14
2.4. HVAC SYSTEMS14
2.4.1. HEATING14
2.4.2. COOLING.....14
2.4.3. VENTILATION.....14
2.4.4. DOMESTIC HOT WATER14
2.5. ELECTRICALS SYSTEMS15
2.5.1. LIGHTING.....15
2.5.3. ELEVATORS.....15
2.5.4. OTHER ELECTRICALS SYSTEMS15
3. EQUIPMENT LIST16
4. ENERGY CONSERVATION MEASURES.....17
5. RENEWABLE AND DISTRIBUTED ENERGY MEASURES.....25
5.1. EXISTING SYSTEMS25
5.2. WIND25
5.3. SOLAR PHOTOVOLTAIC.....25
5.4. SOLAR THERMAL COLLECTORS.....25
5.5. COMBINED HEAT AND POWER.....25
5.6. GEOTHERMAL.....25
6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES26
6.1. LOAD PROFILES26
6.2. TARIFF ANALYSIS.....27
6.3. ENERGY PROCUREMENT STRATEGIES.....28
7. METHOD OF ANALYSIS30
7.1. ASSUMPTIONS AND TOOLS.....30
7.2. DISCLAIMER30
APPENDIX A: LIGHTING SURVEY31
APPENDIX B: THIRD PARTY SUPPLIERS (ESCOs).....32
APPENDIX C: INCENTIVE PROGRAMS34
APPENDIX D: CARBON FOOTPRINT ASSESSMENT.....36

INTRODUCTION

On August 11th, 12th and 13th of 2009, Steven Winter Associates, Inc. (SWA) performed an energy audit and conditions assessment of the City of Rahway buildings. The audit included a review of the:

- City Hall
- Recreation Center
- Arts Guild
- Senior Citizens Center
- Senior Center Annex
- Main Street Fire House
- Auxiliary (Maple Avenue) Fire House
- Department of Public Works

The buildings are located in Union County, NJ. This assessment was conducted under the New Jersey Clean Energy Local Government Energy Audit Program. A separate report has been submitted for each of the buildings that were assessed. This report applies only to the Senior Citizens Center located at 1306 Esterbrook Avenue, Rahway, NJ 07065.

The Senior Center was built in 1996 and consists of 12,000 sq ft of conditioned space. The building houses offices, conference rooms, a loading bay, and a large meeting room used for public gatherings. It consists of two above grade floors and a basement. The building is utilized weekdays from 9am to 4pm with occasional Saturdays for an exercise class. .

Existing conditions and energy-related information, in addition to copies of past utility bills, were collected in order to analyze and facilitate the implementation of energy conservation measures for the building. The goal of this energy audit is to provide sufficient information to the City of Rahway to make decisions regarding the implementation of the most appropriate and most cost effective energy conservation measures for the building. SWA also completed the Carbon Footprint Assessment for the Arts Guild building which is presented in Appendix D. SWA provides a separate addendum to this report to the City of Rahway called “Guidelines for Operating Existing Buildings “according to the Leadership in Energy and Environmental Design (LEED) program instituted by USGBC.

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

EXECUTIVE SUMMARY

The document contains the energy audit report and conditions assessment report for the Senior Citizens Center (Senior Center) located at 1306 Esterbrook Ave. The building was built in 1996 and is two stories with conditioned floor area of 12,000 square feet.

Based on the inspections performed by Steven Winter Associates (SWA) staff from August 11th through August 13th, 2009, and the results of a comprehensive energy analysis, this report describes the site's current conditions and recommendations for improvements. Suggestions for measures related to energy and 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 March, 2008 to February 2009, the Senior Center building consumed 98,240 kilowatt hours (kWh) of electricity at a cost of \$17,603.98 and 8,369 therms of natural gas at a cost of \$12,878. Combined energy consumption (electricity and gas) for that period was 1,172 million Btu (MMBtu) at a total 12-month cost of approximately \$30,482.

SWA has entered energy information about the Senior Center building in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. The Portfolio Manager system does not provide an Energy Star score for Entertainment type buildings; however it provides a kBtu/ft²yr number for this building, and also compares this number with a national average number of similar buildings. SWA also completed the Carbon Footprint Assessment for the Arts Guild building which is presented in Appendix D.

The Site Energy Use Intensity is 100 kBtu/ft²yr compared to the national average of an office building consuming 95 kBtu/ft²yr. Implementing this report's recommendations will reduce use by approximately 10 kBtu/ft²yr, which when implemented would make the building energy consumption better than the national average. SWA encourages the City of Rahway to continue entering utility data in *Energy Star Portfolio Manager* in order to track weather normalized source energy use over time to review the building's performance.

Based on the assessment of the Senior Center 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

- Replace three (3) roof-top package units

Category II Recommendations: Operations and Maintenance

- Perform regular maintenance on exterior wall assemblies, caulking or re-pointing tiles in order to prevent future damage, replace missing tiles
- Maintain and perform regular maintenance on all metal roof assemblies, gutters, and downspouts
- Replace and maintain weather stripping on all exterior doors
- Air seal building
- Provide water efficient fixtures and controls
- Use Energy Star labeled appliances
- Use smart power electric strips
- Maintain and inspect all windows for deteriorating weather-stripping and replace as needed, when conditions warrant full replacement

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

At this time, SWA highly recommends **3** Energy Conservation Measures (ECMs) for the Senior Center that are summarized in Table 1. The total investment cost for these ECMs before incentives is **\$4,848**. SWA estimates a first year savings of **\$2,315** with a simple payback of **1.9 years**. SWA estimates that implementing the highly recommended ECMs will reduce the carbon footprint of the Senior Center by **17,063 lbs of CO₂**, which is equivalent to removing approximately 1 car from the road each year or avoiding the need of 42 trees to absorb the annual CO₂ generated. SWA also recommends **2** ECMs with a total first year savings of **\$8,558** that are summarized in Table 2.

The average estimated NJ commercial utility rates for electric and gas are \$0.150/kWh and \$1.550/therm respectively. The Senior Center building annual utility costs are \$2,867.98 higher for electricity when compared to the average estimated NJ commercial utility rates; potential savings from smart energy procurement could yield even better results.

There are various incentives the City of Rahway could apply for that would help lower the cost of installing the ECMs; these incentives are built in the savings shown in the tables that follow. More details can be found in Appendix C. SWA recommends that the City of Rahway apply for the NJ SmartStart program through the New Jersey Office of Clean Energy. This incentive can help provide technical assistance for the building in the implementation phase of any energy conservation project. SWA also recommends that the City of Rahway apply for the NJ Direct Install program for measures recommended in Section four by contacting the following contractor in Union County:

Tri-State Light & Energy, Inc.
Direct Install Administrator
Phone: 610-789-1900
Email: NJDirectInstall@TSLE.com

Currently, the New Jersey Office of Clean Energy offers a Renewable Energy Incentive that would pay \$7,500 for the installation of a 7.5kW photovoltaic system. There is also an incentive that issues a Solar Renewable Energy Certificate for every 1000kWh (1MWh) of electricity generated that can be sold or traded for the current market rate of electricity. Renewable energy measures require application approval and negotiations with the utility and proof of performance. There is also a utility-sponsored loan program through PSE&G that would allow the building to pay for the installation of a PV system through a loan issued by PSE&G. The City of Rahway should check with PSE&G if they offer similar rebates and help for other renewable energy measures.

The following tables summarize the proposed Energy Conservation Measures (ECMs) and their economic relevance. In order to clearly present the overall energy opportunities for the building and ease the decision and choice of which ECM to implement, SWA calculated each ECM independently and did not incorporate slight or 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 energy cost savings, \$	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, \$	CO ₂ reduced, lbs/yr
1.2	10 New CFL fixtures to be installed with incentives	RS Means, lit search	518	none at this time	518	2,575	0.5	0	0.7	23	484	5	2,203	1.1	348	70	93	4,298	3,527
1.1	15 New T5 fixtures to be installed with incentives	RS Means, lit search	3,230	240	2,990	8,120	1.7	0	2.3	63	1,516	15	17,844	2.0	528	35	50	12,105	11,124
1.3	5 New occupancy sensors to be installed with incentives	RS Means, lit search	1,100	100	1,000	1,760	0.4	0	0.5	0	315	15	3,707	3.2	271	18	30	2,136	2,411
TOTALS			4,848	340	4,508	12,454	2.6	0	3.5	86	2,315	-	23,754	1.9	-	-	-	18,539	17,063

Assumptions: Discount Rate: 3% per DOE FEMP; Energy Price Escalation Rate: 0% per DOE FEMP Guidelines
Note: A 0.0 electrical demand reduction / month indicates that it is very low / negligible

Table 2 - Recommended 5-10 Year Payback ECMs																			
ECM #	ECM description	source	est. installed cost, \$	est. incentives, \$	net est. ECM cost with incentives, \$	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, \$	total 1st yr savings, \$	life of measure, yrs	est. lifetime energy cost savings, \$	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, \$	CO ₂ reduced, lbs/yr
3	install 7.5 kW PV rooftop system (with \$1/W INCENTIVE and \$600/1MWh SREC)	similar projects	56,250	7,500	48,750	8,508	7.5	0	2.4	0	6,628	25	115,412	7.4	294	12	11	38,711	11,656
2	retro commissioning	similar projects	15,000	none at this time	15,000	2,104	0.8	418	4.1	910	1,931	12	12,247	7.8	54	5	7	4,217	2,882
TOTALS			71,250	7,500	63,750	10,612	8.3	418	6.5	910	8,558	-	127,659	7.4	-	-	-	42,929	14,539

1. HISTORIC ENERGY CONSUMPTION

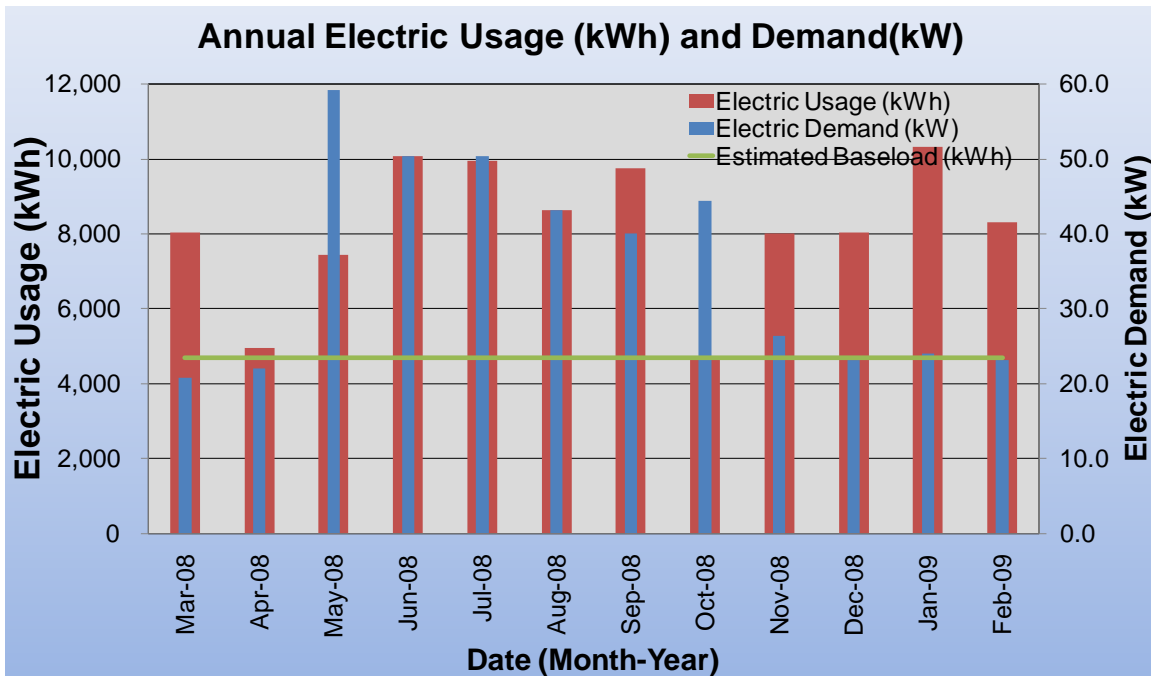
1.1. Energy usage and cost analysis

SWA analyzed utility bills from March 2008 through February 2009 that were received from the utility companies supplying the Senior Center with electricity and delivering the natural gas, and from AMG, the vendor supplying the natural gas.

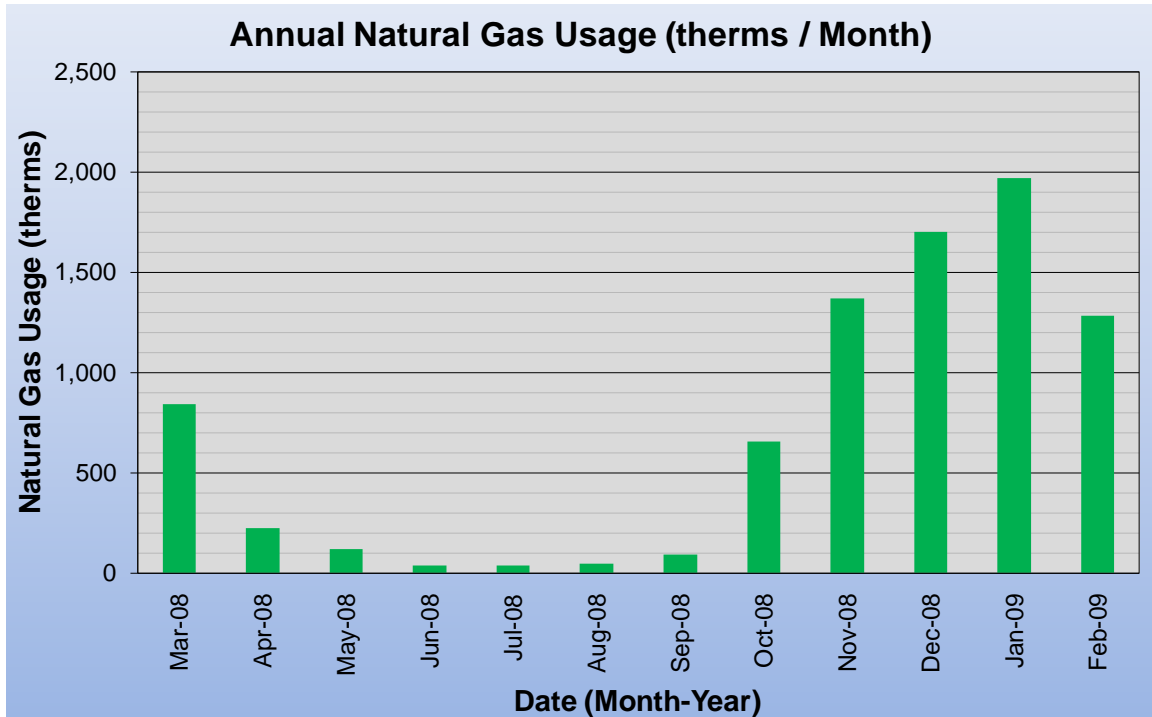
Electricity – The City of Rahway purchases electricity from PSE&G at an average rate of **\$0.179 per kWh for the Senior Center in 2008-2009**. The Senior Center used **98,240 kWh at a cost of \$17,603**. The data also reflected that demand averaged 36 kilowatts with a peak demand of 59.2.

Natural Gas – The Senior Center uses natural gas purchased from AMG, a division of Pepco Energy Services Co. and purchases the transport of the gas from Elizabethtown Gas. **The average rate for natural gas in 2008-2009 was \$1.539 per therm** based on the 12 months of utility bills from March 2008 through February 2009. The building used **8,369 therms of natural gas costing \$12,878**.

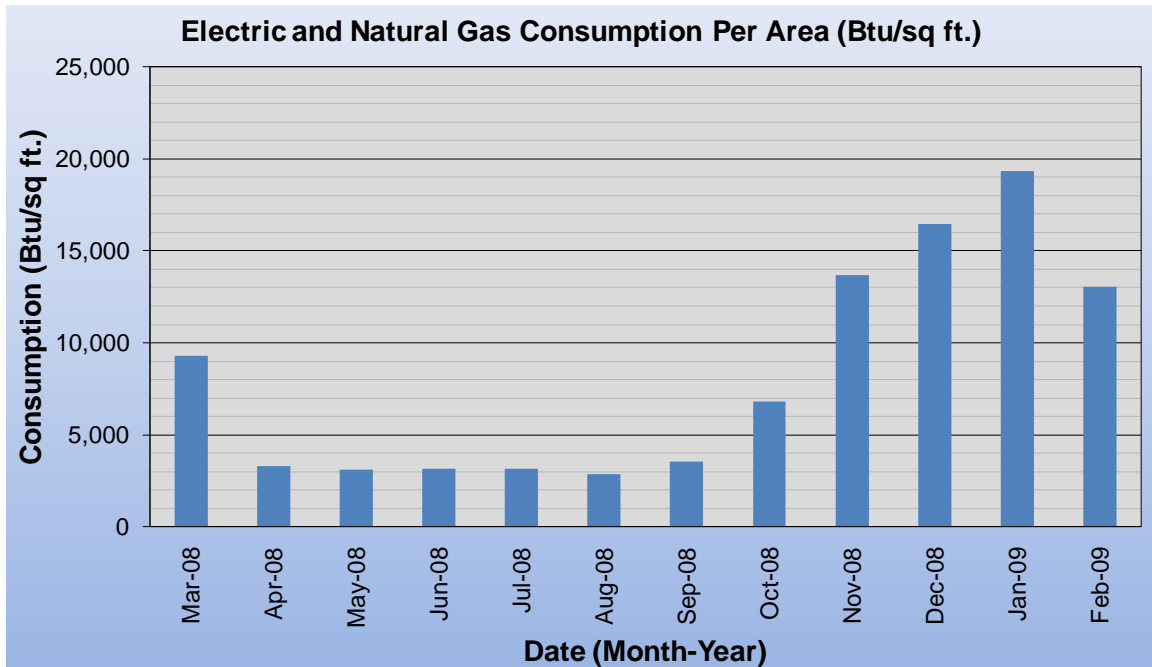
The following chart shows electricity use for the Senior Center building based on utility bills for the 12 month period of March 2008 to February 2009.



The following chart shows the natural gas usage for the Senior Center based on utility bills for the period starting March 2008 through February 2009.

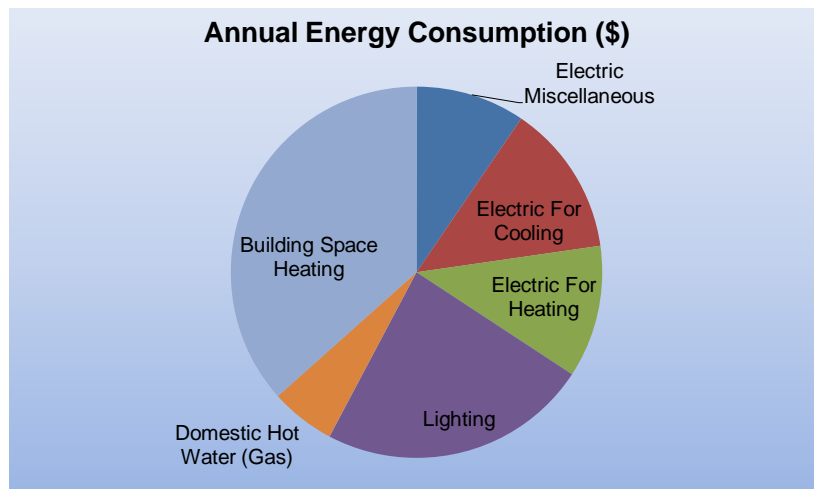
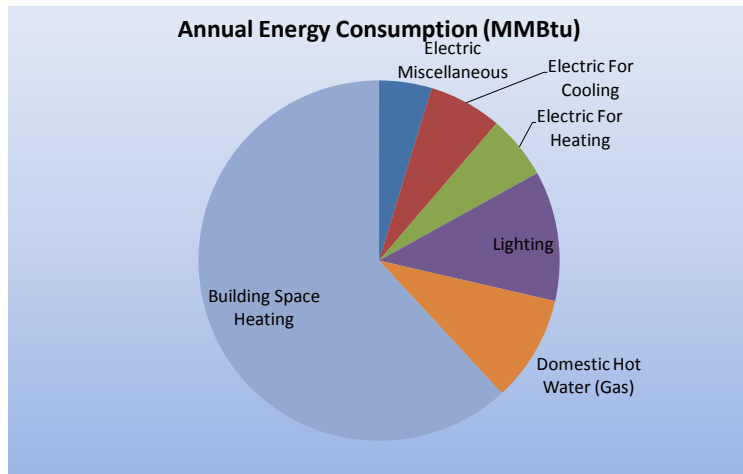


The following chart shows combined natural gas and electric consumption in Btu/sq ft for the Senior Center based on utility bills for the 12 month period of March 2008 to February 2009.



The following table and pie charts show energy use for the Senior Center based on utility bills for the 12 month period of March 2008 to February 2009. Note electrical cost at \$53/MMBtu of energy is 3.5 times as expensive to use as natural gas at \$15/MMBtu.

2008 Annual Energy Consumption / Costs					
	MMBtu	% MMBtu	\$	% \$	\$/MMBtu
Electric Miscellaneous	55	5%	\$2,900	10%	53
Electric For Cooling	77	7%	\$4,028	13%	53
Electric For Heating	67	6%	\$3,512	12%	53
Lighting	136	12%	\$7,163	24%	53
Domestic Hot Water (Gas)	112	10%	\$1,718	6%	15
Building Space Heating	725	62%	\$11,160	37%	15
Totals	1,172	100%	\$30,482	100%	26
Total Electric Usage	335	29%	\$17,604	58%	53
Total Gas Usage	837	71%	\$12,878	42%	15
Totals	1,172	100%	\$30,482	100%	26



1.2. Utility rate

The building purchases electricity from PSE&G. The Senior Center uses Account # 08 51 359 083 07 at service address 1306 Esterbrook Ave, Rahway, NJ 07065. Natural Gas service is provided by Elizabethtown Gas, account number 6299014310. The gas itself is purchased from AMG, a division of Pepco Energy Services Co. Electricity was billed at an average aggregated rate of **\$0.179/kWh** and natural gas was billed at an average aggregated rate of **\$1.539/therm**.

1.3. Energy benchmarking

The building information and utility data were entered into the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. SWA has created a Portfolio Manager account for Rahway at the link below. SWA has shared the City of Rahway benchmarking profile that was developed for this report with the account listed below. The City can utilize the benchmarking tool to add future data and track energy performance. A summary report of the Portfolio Manager results is provided on the following page. A rating score cannot be calculated at this time as Portfolio Manager cannot create a rating score for this type of building.

The Site Energy Use Intensity is 100 kBtu/ft²yr compared to the national average of this type of building consuming 95 kBtu/ft²yr. Implementing this report's recommendations will reduce use by approximately 10 kBtu/ft²yr, which when implemented would make the building energy consumption better than the national average consumption for recreation type buildings.

SWA has created a Portfolio Manager account for the City of Rahway to access the information. This information can be accessed at: <https://www.energystar.gov/istar/pmpam/>

Username:RahwayTownship
Password: RAHWAYNJ

SWA is also sharing the Portfolio Manager information with TRC Energy Services.



STATEMENT OF ENERGY PERFORMANCE City of Rahway - Senior Center

Building ID: 1844628
For 12-month Period Ending: February 28, 2009¹
Date SEP becomes ineligible: N/A

Date SEP Generated: January 06, 2010

Facility City of Rahway - Senior Center 1306 Esterbrook Avenue Rahway, NJ 07065	Facility Owner N/A	Primary Contact for this Facility N/A
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Year Built: 1996
Gross Floor Area (ft²): 12,000

Energy Performance Rating² (1-100) N/A

Site Energy Use Summary³

Electricity - Grid Purchase (kBtu)	363,657
Natural Gas (kBtu) ⁴	830,653
Total Energy (kBtu)	1,194,310

Energy Intensity⁵

Site (kBtu/ft ² /yr)	100
Source (kBtu/ft ² /yr)	174

Emissions (based on site energy use)

Greenhouse Gas Emissions (MtCO ₂ e/year)	100
---	-----

Electric Distribution Utility

Public Service Elec & Gas Co

National Average Comparison

National Average Site EUI	95
National Average Source EUI	265
% Difference from National Average Source EUI	-34%
Building Type	Entertainment/Culture

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

Meets Industry Standards⁶ for Indoor Environmental Conditions:

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

Certifying Professional
N/A

Notes:

- 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.
- 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.
- Values represent energy consumption, annualized to a 12 month period.
- 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.
- Values represent energy intensity, annualized to a 12 month period.
- 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.

The government estimates the average time needed to fill out this form is 6 hours (includes the time for entering energy data, PE facility inspection, and notarizing the SEP) and welcomes suggestions for reducing this level of effort. Send comments (referencing OMB control number) to the Director, Collection Strategies Division, U.S., EPA (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460.

EPA Form 5900-16

2. FACILITY AND SYSTEMS DESCRIPTION

2.1. Building Characteristics

The Rahway Senior Center building was built in the 1996. The original structure remains with no additions. The Senior Center consists of 12,000 square feet of conditioned space. The building houses offices, conference rooms, a loading bay, and a large meeting room that can be used for public gatherings. It consists of two above grade floors and a basement.

2.2. Building occupancy profiles

The Senior Center is open to the public on Monday through Friday from 9:00 AM to 4:00 PM and additional hours on Saturday for various exercise classes. Typical occupancy for the Senior Center is four staff persons however the regular occupancy rarely approaches the building maximum.

2.3. Building envelope

2.3.1.Exterior Walls

The exterior wall of the senior center is uniform throughout with a tile finish and wood stud wall to the interior and 3.5” layer of foam insulation. Cosmetically, the tile is in mostly good condition however there some areas in the rear of the building with cracked tiles and poor degraded caulking. SWA recommends regular maintenance on exterior wall assemblies in order to prevent damage from water penetrating walls, absorbed by insulation.



Example of damaged tile in the rear of the building

Exterior wall insulation levels could not be visually verified. IR (Infrared) images were not taken in the field due to the warm weather and rain at the time of the inspection.

2.3.2.Roof

There are three roofing systems, a hip standing seam metal roof, pitched standing seam metal roof and a pitched and ridged composite synthetic roof. Both standing seam metal roofs are composed of a metal roof deck above a 1/2” treated plywood layer, 2”x6” wooden roof framing, R-19 layer of foam insulation and vapor barrier. The composite roof consists of the synthetic

roof layer above a treated plywood layer, 2"x6" wooden roof framing, R-19 layer of foam insulation and vapor barrier.

2.3.3.Base

The building's base is 6" concrete slab-below-grade. There were no reported problems with water penetration or moisture. 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

There are two typical window types, the first are the single pane aluminum framed operable double-hung units and the fixed vinyl, double glazed units by the loading dock. The double hung windows are in fair condition; however the fixed vinyl units are in good. There is also a pair of sidelight single pane windows alongside the glass door to the main entrance. The expense of installing new windows would not be cost-effective, especially considering the limited occupancy of the building.

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

2.3.5.Exterior doors

There are two types of exterior doors at this location, aluminum framed single pane glass doors and aluminum framed fiberglass doors. The glass doors weather-stripping is in good condition and seals tightly however, the fiberglass door has a large air gap due to a combination of damage to the frame and no weather-stripping.



Air gap at fiberglass door

SWA recommends maintaining weather-stripping around all of the doors of the building in order to prevent conditioned air from leaking outside of the building. Weather-stripping should be checked at least once a year and replaced as soon as signs of deterioration start to show.

If not properly maintained, exterior doors and overhead doors can become major sources of heat loss and infiltration. As a best practice, SWA recommends checking the weather-stripping

of each door on a regular basis and replacing any broken seals immediately. This will help optimize comfort and energy performance. When it becomes necessary to replace any or all of the overhead garage doors, insulated doors with good weather-stripping should be strongly considered. This will provide increased comfort, as well as energy savings during the heating season.

2.3.6. Building air tightness

In addition to the above mentioned recommendations SWA suggests air sealing, caulking and/or insulating around all plumbing, electrical, HVAC and structural envelope penetrations. This should include bottom and top plates, recessed light fixtures, electrical boxes, chimney walls and window, or sleeve air conditioner units. The air tightness of buildings helps to maximize other implemented energy measures and investments and minimizes long term maintenance and repair cost.

2.4. HVAC systems

2.4.1. Heating

The Senior Center has a direct fired gas furnace installed in the cellar for heating the basement and back room. Additionally, there are 3 DX direct gas fired rooftop package units (RTU) for heating various spaces in the winter season. The heating capacity is adequate and the annual therms consumption of the building seems normal based on its use.

The rooftop units are 13 years old and still have about 13% of life remaining. SWA recommends retro-commissioning for achieving optimal performance. Also, SWA recommends replacing these units in the near future as part of capital improvements. The energy savings alone do not justify the replacement; however, the units are nearing their end.

2.4.2. Cooling

Cooling is provided in the Senior Center by 3 rooftop DX package units that are also used for heating. There is approximately 37.5 tons of cooling which is considered adequate. The rooftop units are 13 years old and still have about 13% of life remaining. See 2.4.1., "Heating" section for recommendations on the rooftop system.

2.4.3. Ventilation

Ventilation is provided by fresh air drawn through the RTU used for heating and cooling, as mentioned above.

2.4.4. Domestic Hot Water

The domestic hot water is supplied by a Rheem combination water heater / storage system with a water heating capacity of about 38,000 Btu per hour (Btuh) and a 40 gallon storage tank, installed in 2009. The system burns natural gas and has a rated Energy Factor (EF) of 0.58. There is no recommendation for replacing or upgrading this new unit.

2.5. Electrical systems

2.5.1. Lighting

In accordance with requirements of the Local Government Energy Audit program, SWA, Inc. performed an investment grade lighting audit, which provides a comprehensive survey of existing lighting, and an extensive technical and financial analysis.

The existing lighting consists of mostly T8 fluorescent fixtures with electronic ballasts. SWA recommends the replacement of the high pressure sodium lamps in the Meeting room on the 1st Floor with more efficient T5 lamps. SWA recommends the replacement of all halogen and incandescent bulbs with energy efficient Compact Fluorescents. Compact Fluorescents (CFLs) utilize a fraction of the wattage of halogens or incandescent to produce the equivalent lumens. The bulbs also have a lifetime of approximately 8-10,000 hours, reducing labor costs replacing bulbs.

SWA also recommends installing occupancy sensors in bathrooms, closets, offices and areas that are occupied only part of the day. Typically, occupancy sensors have an adjustable time delay that turns off the lights automatically if no motion or sound is detected within a set time period. See attached lighting schedule in Appendix A for a complete inventory of lighting throughout the building and estimated power consumption.

2.5.2. Appliances and process

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

Computers left on in the building consume a lot of energy. A typical desk top computer uses 65 to 250 watts and uses the same amount of energy when the screen saver is left on. Televisions in meeting areas use approximately 3-5 watts of electricity when turned off. SWA recommends all computers and all appliances (i.e. fridges, coffee makers, televisions, etc) be plugged in to power strips and turned off each evening just as the lights are turned off.

2.5.3. Elevators

The Senior Center does not have any elevators.

2.5.4. Other electrical systems

Not Applicable.

3. EQUIPMENT LIST

Building System	Description	Location	Model#	Fuel	Space served	Year Equip Installed	Remaining useful life %
Heating	Heating furnace, 150MBH input; 115V, 1 Ph, 60Hz; Temp rise 45-75 deg F; est. 80% AFUE	Basement	International Comfort Products, Comfortmaker, model GNE150J20A1, S/N L9751 42955	Gas	Back rooms, basement	1998	45%
HVAC	Roof top DX package unit, 10 ton cooling, 11.5EER, R22, gas heating, 250MBH input, 230MBH output; 208V/60Hz/3Ph	Roof	Trane, model YCD121C3HOA A, S/N L51103311D	Elec./Gas	Main Area, Lobby, etc.	1996	13%
HVAC	Roof top DX package unit, 7.5 ton cooling, 9.8EER, R22, gas heating, 205MBH input, 166MBH output; 208V/60Hz/3Ph	Roof	Trane, model YCD091D3HOB E, S/N L51103190D	Elec./Gas	Card Room	1996	13%
HVAC	Roof top DX package unit, 20 ton cooling, 10.6EER, R22, gas heating, 300MBH input, 243MBH output; 208V/60Hz/3Ph	Roof	Trane, model YCD241C3HOA A, S/N L9952 60771	Elec./Gas	Main Area	1996	13%
Heating	40 Gallon domestic hot water heater; I/P 38,000 Btu/hr, 258 therms	Mechanical Room	Rheem, Gaurdian, model 22V40, S/N RHLN0809A095 64	Gas	Whole building	2009	95%

Note:

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

4. ENERGY CONSERVATION MEASURES

Based on the assessment of this building, SWA has separated the investment opportunities into three categories of recommendations:

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

- Replace three (3) rooftop package units: These units were installed in 1996 and have only about 13% of remaining service life. SWA recommends that these units be replaced in the near future. The estimated cost of replacement is approximately \$80,000

Category II Recommendations: Operations and Maintenance

- Repair and maintain exterior wall assemblies – SWA recommends replacing missing exterior wall tiles, caulking, and / or re-pointing tiles. Maintaining exterior wall assemblies will prevent future damage due to water infiltration.
- Repair and maintain roof - SWA recommends scheduling regular roof maintenance to inspect for any roof damage, to verify seams are sealed, and to verify all roof sections are draining properly. All downspouts should be checked for clogs.
- Weather Stripping – As a best practice, exterior/overhead doors and vestibule doors should be observed annually for deficient weather-stripping and replaced as needed.
- Air Sealing - SWA suggests air sealing, caulking and/ or insulating around all plumbing, electrical, HVAC and structural envelope penetrations. This should include bottom and top plates, recessed light fixtures, electrical boxes, chimney walls and window, or sleeve air conditioner units. The air tightness of buildings helps to maximize other implemented energy measures and investments and minimizes long term maintenance and repair cost. Any other accessible gaps or penetrations in the thermal envelope should also be sealed with caulk or spray foam.
- Water Efficient Fixtures & 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-consuming fixtures and appliances will save both energy and money through reduced energy consumption for water heating, while also decreasing water and sewer bills.
- Energy Star Appliances - If personal refrigerators are utilized by staff, consider installing a centrally located and shared Energy Star labeled refrigerator in order to minimize operating costs of multiple refrigerators. Consider all Energy Star labeled equipment and appliances, including: refrigerators, printers, computers, copy machines, etc.

- Use smart power electric strips - in conjunction with occupancy sensors to power down computer equipment when left unattended for extended periods of time.
- Lighting Controls - Occupancy sensors and/or photocells, should also be considered. In applications where occupants tend to leave the lights running inadvertently, such as during fire response or other extended periods of absence, the occupancy sensors automatically shut-off the lights. Since operating hours vary, a survey of the building occupants can provide the most accurate feedback on lighting usage patterns within the facility to help determine the appropriateness of lighting controls.
- Maintain and inspect all windows for deteriorating weather-stripping and replace as needed, when conditions warrant full replacement. 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 frame. Building staff should also verify that windows open and close properly and repair, as needed.

Category III Recommendations: Energy Conservation Measures

Summary Table

<i>ECM#</i>	<i>Description</i>
1	Building Lighting Upgrades
2	Retro-Commissioning
3	Install 5 Kilowatt Solar Photovoltaic System

ECM#	Table 1 - Highly Recommended 0-5 Year Payback ECMs
1.2	10 New CFL fixtures to be installed with incentives
1.1	15 New T5 fixtures to be installed with incentives
1.3	5 New occupancy sensors to be installed with incentives
Table 2 - Recommended 5-10 Year Payback ECMs	
3	install 5 kW PV rooftop system (with \$1/W INCENTIVE and \$600/1MWh SREC)
2	retro commission- ing

ECM #1: Building Lighting Upgrades

Description:

On the days of the site visits, SWA completed a lighting inventory of the Senior Center building (see Appendix A). The existing lighting consists of mostly T8 fluorescent fixtures with electronic ballasts. SWA recommends the replacement of the high pressure sodium lamps in the Meeting room on the 1st Floor with more efficient T5 lamps. The total savings for the first year replacement is approximately \$1,516 with the T5 lamp installation. All incandescent bulbs should be replaced with compact fluorescent bulbs, which use a fraction of the electricity and produce less heat than the incandescent bulbs. SWA has performed an evaluation of installing occupancy sensors in large spaces, offices and bathrooms that may be left unoccupied a considerable amount of time throughout the day. The labor in all these installations was evaluated using prevailing electrical contractor wages. The City of Rahway may decide to perform this work with in-house resources from its Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor, to obtain savings.

Installation cost:

Estimated installed cost: \$4,848 (estimated labor cost of \$3,151)

Source of cost estimate: RS Means; Vendors

Economics:

ECM #	ECM description	source	est. installed cost, \$	est. incentives, \$	net est. ECM cost with incentives, \$	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, \$	total 1st yr savings, \$	life of measure, yrs	est. lifetime energy cost savings, \$	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, \$	CO2 reduced, lbs/yr
1.1	15 New T5 fixtures to be installed with incentives	RS Means, lit search	3,230	240	2,990	8,120	1.7	0	2.3	63	1,516	15	17,844	2.0	528	35	50	12,105	11,124
1.2	10 New CFL fixtures to be installed with incentives	RS Means, lit search	518	none at this time	518	2,575	0.5	0	0.7	23	484	5	2,203	1.1	348	70	93	4,298	3,527
1.3	5 New occupancy sensors to be installed with incentives	RS Means, lit search	1,100	100	1,000	1,760	0.4	0	0.5	0	315	15	3,707	3.2	271	18	30	2,136	2,411
TOTALS			4,848	340	4,508	12,454	2.6	0	3.5	97	2,326	6	23,884	1.9	442	80	NA	18,648	17,063

Assumptions: Calculated the savings for this measure using best estimates and staff interviews regarding the time of lights actually on.

Rebates/financial incentives:

*NJ Clean Energy - T5 lamps with electronic ballast in existing facilities (\$10-30 per fixture, depending on quantity and lamps)
Maximum incentive amount is \$240.*

*NJ Clean Energy - Wall Mounted occupancy sensors (\$20 per control)
Maximum incentive amount is \$100.*

Options for funding the Lighting ECM (Please see Appendix C also):

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

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

This project may benefit from enrolling in the NJ Direct Install program by contacting the following contractor in Union County:

Tri-State Light & Energy, Inc.
Direct Install Administrator
Phone: 610-789-1900
Email: NJDirectInstall@TSLE.com

<http://www.njcleanenergy.com/commercial-industrial/programs/direct-install>

ECM#2: Retro-Commissioning

Description:

Retro-commissioning is a process that seeks to improve how building equipment and systems function together. Depending on the age of the building, retro-commissioning can often resolve problems that occurred during design or construction and / or address problems that have developed throughout the building's life. Owners often undertake retro-commissioning to optimize building systems, reduce operating costs, and address comfort complaints from building occupants.

SWA recommends retro-commissioning to optimize system operation for the Senior Center building. Most systems have been operating for more than 10 years. The retro-commissioning process should include a review of existing operational parameters for all installed equipment. During retro-commissioning, the individual temperatures should be reviewed to identify opportunities for optimizing system performance.

Installation cost:

Estimated installed cost: \$15,000 (estimated labor cost of \$13,261)

Source of cost estimate: Similar projects

Economics (without incentives):

ECM #	ECM description	source	est. installed cost, \$	est. incentives, \$	net est. ECM cost with incentives, \$	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, \$	total 1st yr savings, \$	life of measure, yrs	est. lifetime energy cost savings, \$	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, \$	CO ₂ reduced, lbs/yr
2	retro commissioning	similar projects	15,000	none at this time	15,000	2,104	0.8	418	4.1	910	1,931	12	12,247	7.8	54	5	7	4,217	2,882

Assumptions: Typical savings for retro-commissioning range from 5-20%, as a percentage of the total space conditioning consumption. SWA assumed 5% savings. Estimated costs for retro-commissioning range from \$0.50-\$2.00 per square foot. SWA assumed \$1.25 per square foot of a total square footage of 12,000. SWA also assumed 0.5 hr/wk on the average operational savings when systems are operating per design vs. the need to make more frequent adjustments.

Rebates / financial incentives: *There are no direct incentives for this measure.*

Options for funding ECM (Please see Appendix C also):

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

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

This project may benefit from enrolling in NJ Direct Install program by contacting the following contractor in Union County:

Tri-State Light & Energy, Inc.

Direct Install Administrator

Phone: 610-789-1900

Email: NJDirectInstall@TSLE.com

<http://www.njcleanenergy.com/commercial-industrial/programs/direct-install>

ECM#3: Install 7.5kW PV system

Description:

Currently, the Senior Center building does not use any renewable energy systems. Renewable energy systems such as photovoltaic panels, can be mounted on the building roofs, and can offset a portion of the purchased electricity for the building. Power stations generally have two separate electrical charges: usage and demand. Usage is the amount of electricity in kilowatt-hours that a building uses from month to month. Demand is the amount of electrical power that a building uses at any given instance in a month period. During the summer periods, when electric demand at a power station is high due to the amount of air conditioners, lights, equipment, etc., being used within the region, demand charges go up to offset the utility’s cost to provide enough electricity at that given time. Photovoltaic systems not only offset the amount of electricity use by a building, but also reduce the building’s electrical demand, resulting in a higher cost savings as well. SWA presents below the economics, and recommends at this time that City of Rahway further review installing a 7.5kW PV system to offset electric demand and reduce the annual net electric consumption for the building, and review guaranteed incentives from NJ rebates to justify the investment. Utilities provide the ability to buy SRECs at \$600 / MWh or best market offer.

There are many possible locations for a 7.5kW PV installation on the building roof. A commercial multi-crystalline 123 watt panel (17.2 volts, 7.16 amps) has 10.7 square feet of surface area (11.51 watts per square foot). A 7.5kW system needs approximately 33 panels which would take up 600 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: \$56,250 (estimated labor costs, \$18,000)

Source of cost estimate: Similar projects

Economics (with incentives):

ECM #	ECM description	source	est. installed cost, \$	est. incentives, \$	net est. ECM cost with incentives, \$	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, \$	total 1st yr savings, \$	life of measure, yrs	est. lifetime energy cost savings, \$	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, \$	CO ₂ reduced, lbs/yr
3	install 7.5 kW PV rooftop system (with \$1/W INCENTIVE and \$600/MWh SREC)	similar projects	56,250	7,500	48,750	8,508	7.5	0	2.4	0	6,628	25	115,412	7.4	294	12	11	38,711	11,656

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

Rebates/financial incentives (Please see Appendix C also):

NJ Clean Energy - Renewable Energy Incentive Program, Incentive based on \$1.00 / watt Solar PV application. Incentive amount for this application is \$7,500.

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

NJ Clean Energy - Solar Renewable Energy Certificate Program. Each time a solar electric system generates 1000kWh (1MWh) of electricity, a SREC is issued which can then be sold or traded separately from the power. The buildings must also become net-metered in order to earn SRECs as well as sell power back to the electric grid. \$4,800 has been incorporated in the above costs, however it requires proof of performance, application approval and negotiations with the utility.

Options for funding ECM:

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

5. RENEWABLE AND DISTRIBUTED ENERGY MEASURES

5.1. Existing systems

There are currently no existing renewable energy systems.

5.2. Wind

Description:

Wind power production is not appropriate for this location, because required land is not available for the wind turbine. Also available wind energy resource is very low.

5.3. Solar Photovoltaic

Please see the above recommended ECM#3.

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 inconsistent use of domestic hot water throughout the building to justify the expenditure.

5.5. Combined Heat and Power

Description:

SWA considered the installation of a combined heat and power system for the Senior Center but does not recommend its installation because of the HVAC equipment type and insufficient year-round thermal loads.

5.6. Geothermal

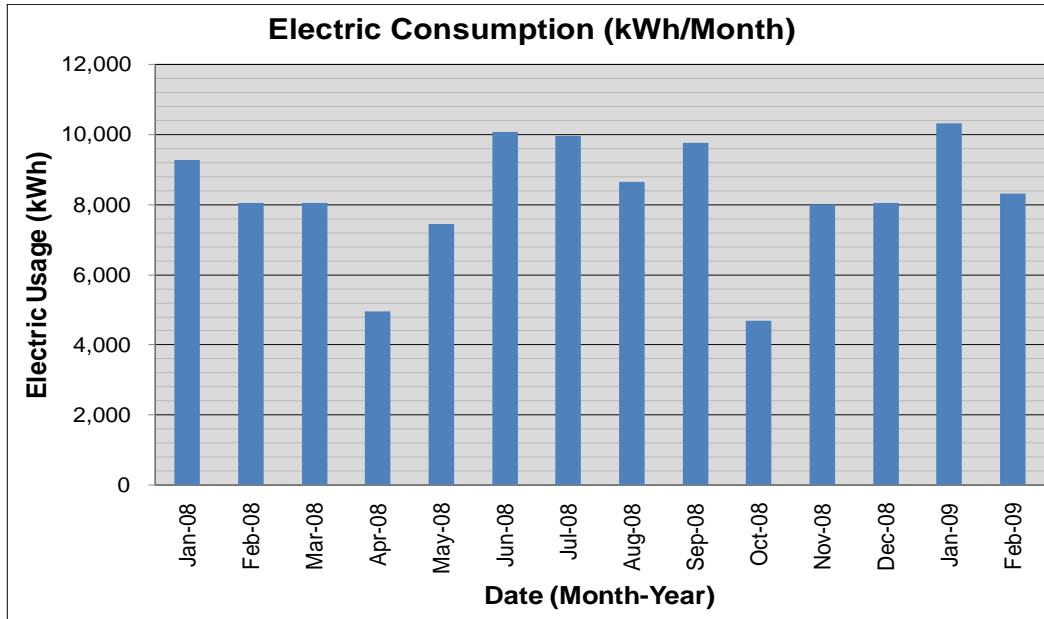
Description:

Geothermal will not be cost effective because the building has small cooling usage..

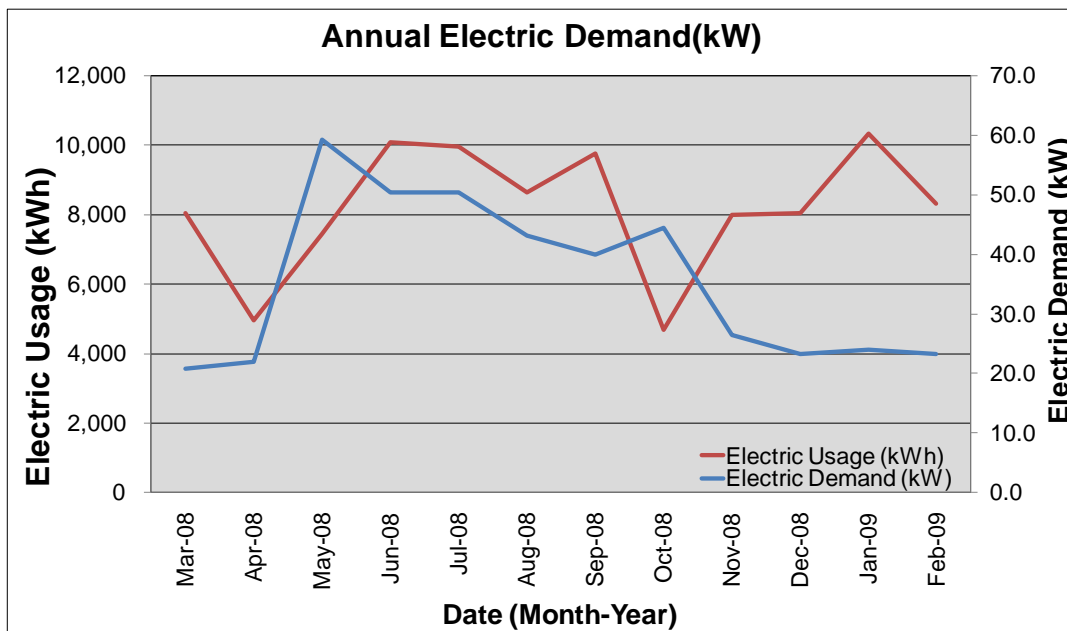
6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

6.1. Load profiles

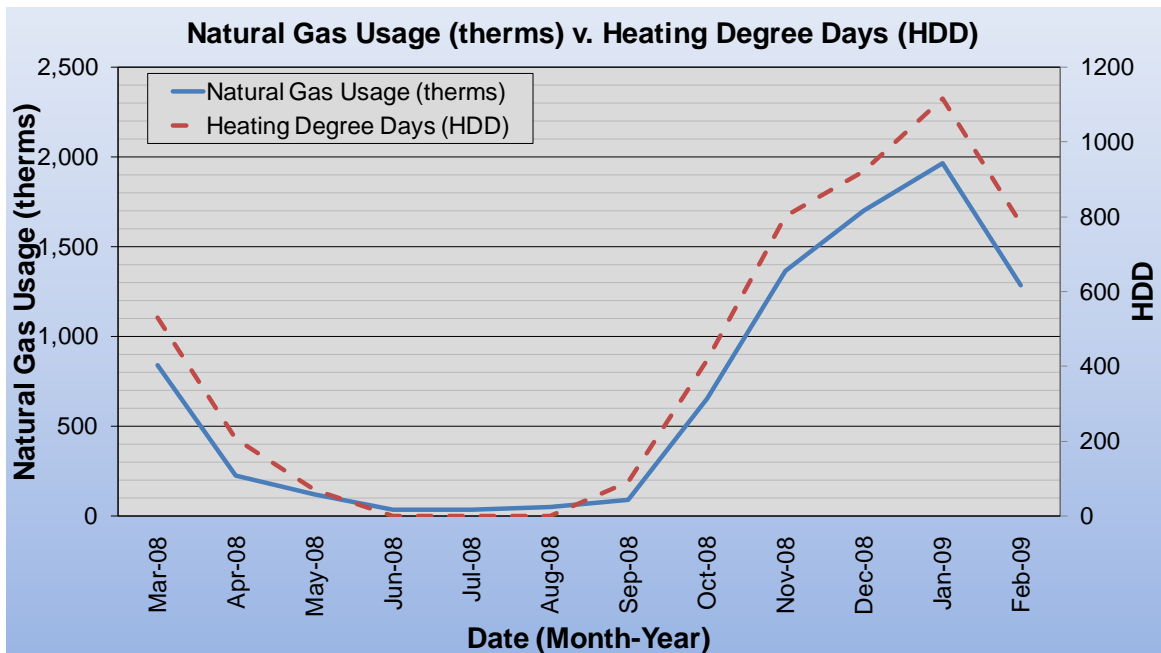
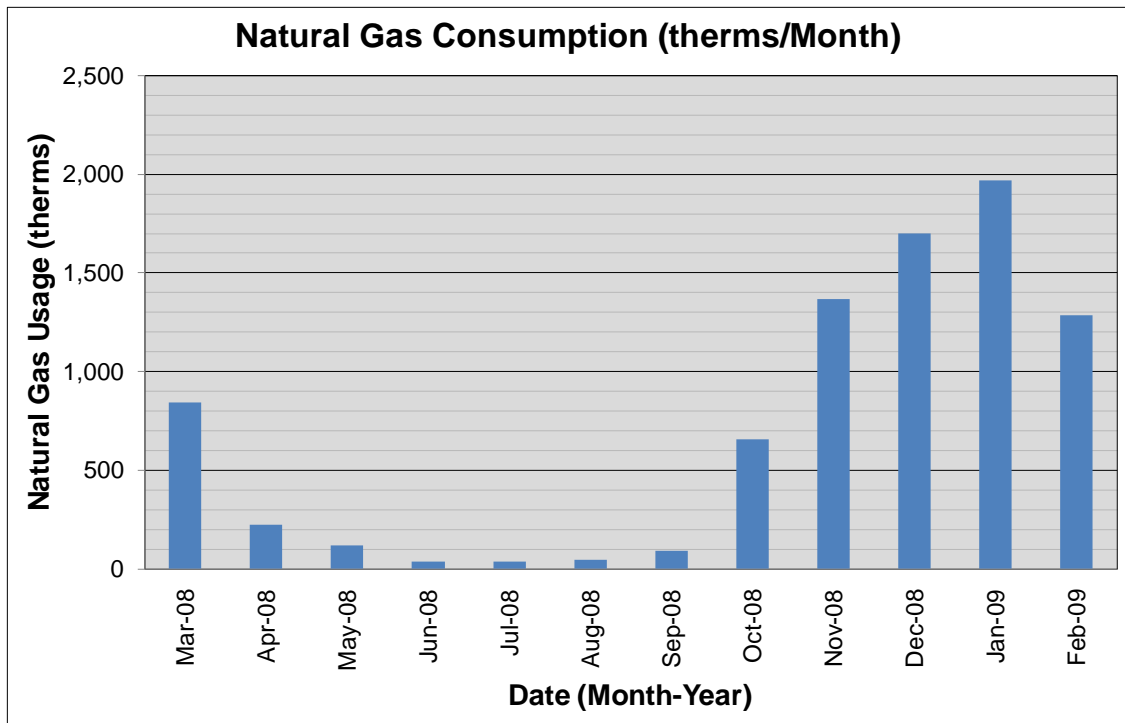
The following are charts that show the annual electric and natural gas load profiles for the Senior Center.



Some minor unusual electric fluctuations shown may be due to adjustments between estimated and actual meter readings. Also, note on the following chart how the electrical Demand peaks follow the electrical consumption peaks.



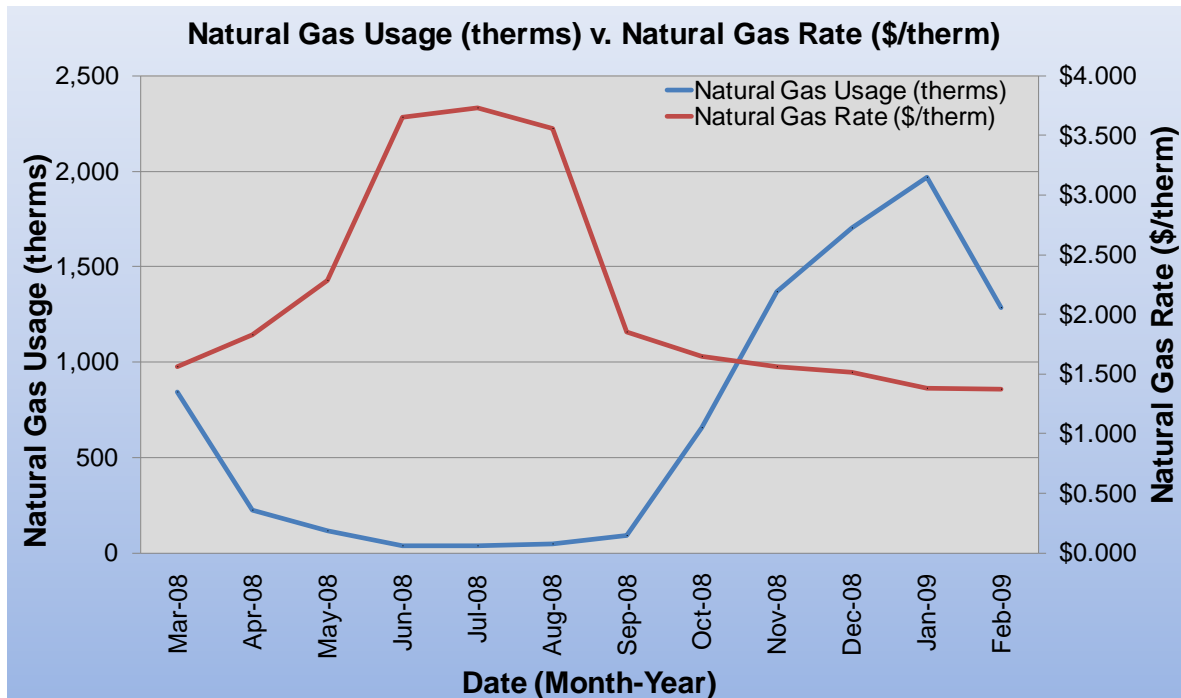
The following is a chart of the natural gas annual load profile for the building, peaking in the coldest months of the year and a chart showing natural gas consumption following the “heating degree days” curve. Some utility bills have more than one month estimated and combined.



6.2. Tariff analysis

The City of Rahway currently buys electricity and gas from Public Service Gas and Electric and Elizabethtown Gas respectively, on general service rates. The general service is a typical rate

where customers pay for natural gas based on usage and for electricity based on consumption as well as peak electrical demand. The general service rate is the best option at this time.



The Senior Center is direct-metered (via one main meter) and currently purchases electricity from PSE&G at a general service rate. The general service rate for electric charges is market-rate driven and based on consumption (in kilowatt hours) and a separate charge based on demand (in kilowatts). 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 Senior Center building receives natural gas via one incoming meter. Pepco supplies the gas and Elizabeth Town transports it.

SWA analyzed the utility rate for natural gas and electricity supply over an extended period. Electric bill analysis shows fluctuations up to 45% over the most recent 12 month period. Natural gas bill analysis shows fluctuations up to 63% over the most recent 12 month period. Some of these fluctuations may have been caused by adjustments between estimated and actual meter readings, others may be due to unusual high and escalating energy costs in 2008. The average estimated NJ commercial utility rates for electric and gas are \$0.150/kWh and \$1.550/therm respectively. The Senior Center building annual utility costs are \$2,867.98 higher for electricity, when compared to the average estimated NJ commercial utility rates; potential savings from smart energy procurement could yield even better results.

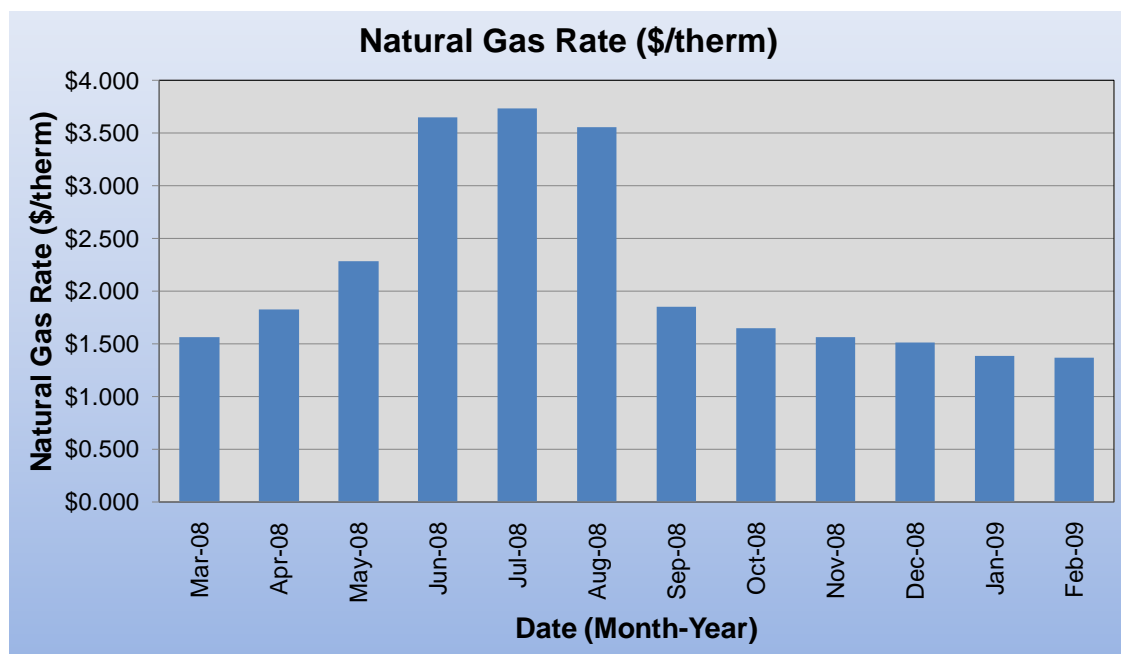
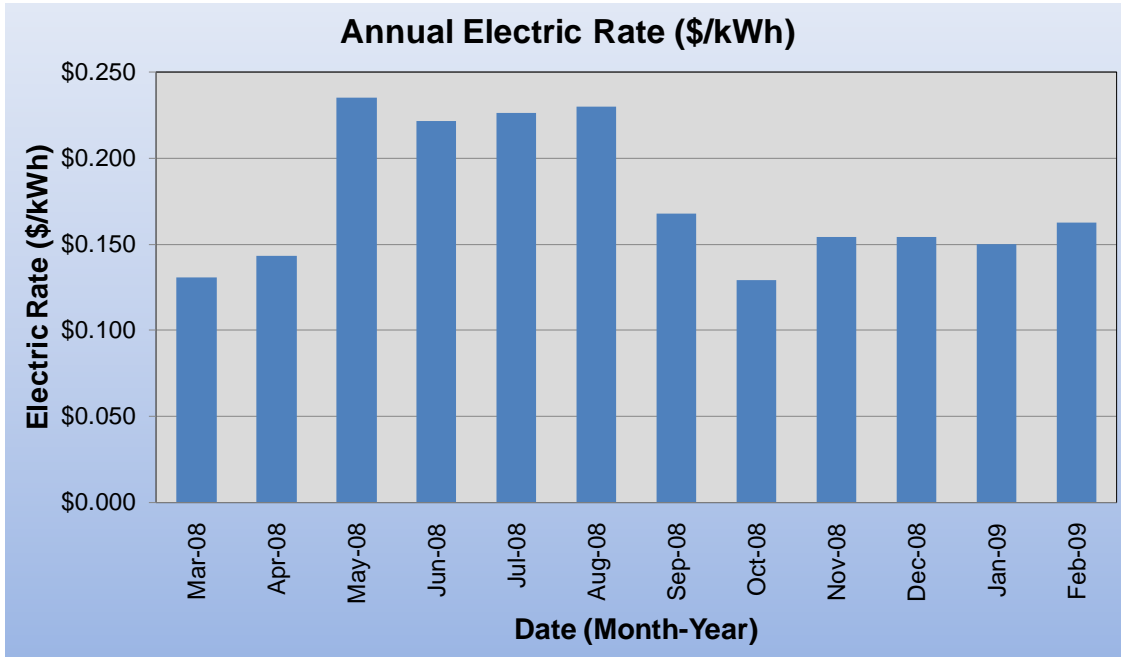
SWA recommends that the City of Rahway further explore opportunities of purchasing both natural gas and electricity from ESCOs in order to reduce rate fluctuation and the annual cost of energy for the Senior Center building. An Energy Services Company (ESCO) is a consultancy group that engages in a performance-based contract with a client firm to implement measures which reduce energy consumption and costs in a technically and financially viable manner. Appendix B contains

a complete list of third party energy suppliers for the Rahway service area.

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

The Senior Center 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, which is the typical threshold for considering this option.

The following charts show the building monthly spending per unit of energy in 2008.



7. METHOD OF ANALYSIS

7.1. Assumptions and tools

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

7.2. Disclaimer

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

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

Appendix A: Lighting Survey

Location			Existing Fixture Information											Retrofit Information											Annual Savings					
Marker	Floor	Room Identifier	Fixture Type	Ballast	Lamp Type	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Controls	Operational Hours per Day	Operational Days per Year	Ballast Wattage	Total Watts	Energy Use kWh/year	Category	Fixture Type	Lamp Type	Ballast	Controls	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Operational Hours per Day	Operational Days per Year	Ballast Watts	Total Watts	Energy Use kWh/year	Fixture Savings (kWh)	Controls Savings (kWh)	Total Savings (kWh)
1	1	Meeting Room	Recessed	N	HPS	15	1	250	S	8	347	63	3,813	13,033	T5	Recessed	4T5	E	S	15	4	28	8	347	6	1686	4914	8120	0	8120
2	1	Meeting Room	Exit Sign	N	LED	1	1	5	N	24	365	1	6	53	NA	Exit Sign	LED	N	N	1	1	5	24	365	1	6	53	0	0	0
3	1	Kitchen	Recessed	E	4T8	2	2	32	S	4	347	6	134	194	NA	Recessed	4T8	E	S	2	2	32	4	347	6	134	194	0	0	0
4	1	Corridor	Recessed	E	4T8	1	2	32	S	16	347	6	70	389	NA	Recessed	4T8	E	S	1	2	32	16	347	6	70	389	0	0	0
5	1	Corridor	Exit Sign	E	LED	1	1	5	N	24	365	1	6	53	NA	Exit Sign	LED	E	N	1	1	5	24	365	1	6	53	0	0	0
6	1	Loading	Recessed	E	4T8	2	3	32	S	4	347	10	202	294	NA	Recessed	4T8	E	S	2	3	32	4	347	10	202	294	0	0	0
7	1	Bathroom Men	Recessed	E	4T8	2	4	32	S	2	347	13	269	196	NA	Recessed	4T8	E	S	2	4	32	2	347	13	269	196	0	0	0
8	1	Bathroom Women	Recessed	E	4T8	3	4	32	S	2	347	13	397	294	NA	Recessed	4T8	E	S	3	4	32	2	347	13	397	294	0	0	0
9	1	Office	Recessed	E	4T8	4	4	32	S	8	347	13	525	1,566	C	Recessed	4T8	E	OS	4	4	32	6	347	13	525	1174	0	391	391
10	1	Storage	Recessed	E	4T8	3	4	32	S	2	347	13	397	294	NA	Recessed	4T8	E	S	3	4	32	2	347	13	397	294	0	0	0
11	1	Lobby	Recessed	E	4T8	14	4	32	S	16	347	13	1,805	10,960	NA	Recessed	4T8	E	S	14	4	32	16	347	13	1,805	10,960	0	0	0
12	1	Janitor's Closet	Screw-in	E	Inc	1	1	75	S	2	347	0	75	52	CFL	Screw-in	CFL	E	S	1	1	25	2	347	0	25	17	35	0	35
13	1	Lobby	Exit Sign	E	LED	1	1	5	N	24	365	1	6	53	NA	Exit Sign	LED	E	N	1	1	5	24	365	1	6	53	0	0	0
14	1	Lobby	Screw-in	E	Inc	4	1	100	S	16	347	0	400	2,221	CFL	Screw-in	CFL	E	S	4	1	35	16	347	0	140	777	1,444	0	1,444
15	1	Corridor	Recessed	E	4T8	2	2	32	S	16	347	6	134	777	NA	Recessed	4T8	E	S	2	2	32	16	347	6	134	777	0	0	0
16	1	Corridor	Exit Sign	E	LED	1	1	5	N	24	365	1	6	53	NA	Exit Sign	LED	E	N	1	1	5	24	365	1	6	53	0	0	0
17	1	Meeting Room	Recessed	E	4T8	4	4	32	S	8	347	13	525	1,566	C	Recessed	4T8	E	OS	4	4	32	6	347	13	525	1174	0	391	391
18	1	Meeting Room2	Recessed	E	4T8	4	4	32	S	8	347	13	525	1,566	C	Recessed	4T8	E	OS	4	4	32	6	347	13	525	1174	0	391	391
19	1	Bathroom	4U-Shape	E	4T8	2	2	32	S	2	347	6	134	97	NA	4U-Shape	4T8	E	S	2	2	32	2	347	6	134	97	0	0	0
20	1	Bathroom Corridor	Recessed	E	4T8	1	2	32	S	16	347	6	70	389	NA	Recessed	4T8	E	S	1	2	32	16	347	6	70	389	0	0	0
21	1	Meeting Room	Recessed	E	4T8	4	4	32	S	8	347	13	525	1,566	C	Recessed	4T8	E	OS	4	4	32	6	347	13	525	1174	0	391	391
22	1	Meeting Room	Recessed	E	4T8	4	2	32	S	8	347	6	262	777	C	Recessed	4T8	E	OS	4	2	32	6	347	6	262	583	0	194	194
23	1	Stairwell	Recessed	E	4T8	3	1	32	S	16	347	3	99	583	NA	Recessed	4T8	E	S	3	1	32	16	347	3	99	583	0	0	0
24	B	Boiler Room	Recessed	E	4T8	2	2	32	S	2	347	6	134	97	NA	Recessed	4T8	E	S	2	2	32	2	347	6	134	97	0	0	0
25	B	Boiler Room	Recessed	M	8T12	2	2	80	S	2	347	35	355	271	T12	Recessed	8T12	M	S	2	2	80	2	347	35	355	271	0	0	0
26	B	Boiler Room	Recessed	E	4T8	11	2	32	S	2	347	6	710	534	NA	Recessed	4T8	E	S	11	2	32	2	347	6	710	534	0	0	0
27	2	Storage Room	Recessed	E	4T8	7	2	32	S	2	347	6	454	340	NA	Recessed	4T8	E	S	7	2	32	2	347	6	454	340	0	0	0
28	2	Storage Room	Screw-in	N	Inc	1	1	60	S	2	347	0	60	42	CFL	Screw-in	CFL	N	S	1	1	20	2	347	0	20	14	28	0	28
29	2	Storage Room	Recessed	E	4T8	1	2	32	S	2	347	6	70	49	NA	Recessed	4T8	E	S	1	2	32	2	347	6	70	49	0	0	0
30	Ext	Exterior	Exterior	N	CFL	2	1	23	T	12	365	0	46	201	NA	Exterior	CFL	N	T	2	1	23	12	365	0	46	201	0	0	0
31	Ext	Exterior	Exterior	N	Hal	4	1	65	T	12	365	16	276	1,419	CFL	Exterior	CFL	N	T	4	1	20	12	365	0	80	350	1,069	0	1,069
Totals:						109	68					295	12,490	39,975						109	71	891				9,817	27,521	10695	1760	12454

Rows Highlighted Yellow Indicate an Energy Conservation Measure is recommended for that space

Proposed Lighting Summary Table				Legend				
Total Surface Area (SF)		12,000		Fixture Type	Lamp Type	Control Type	Ballast Type	Retrofit Category
Average Power Cost (\$/kWh)		0.1790		Exit Sign	LED	N (None)	N/A (None)	N/A (None)
Exterior Lighting		Existing	Proposed	Screw-in	Inc (Incandescent)	S (Switch)	E (Electronic)	TB (Install new TB)
Exterior Annual Consumption (kWh)	1,621	552	1,069	Pin	1T5	OS (Occupancy Sensor)	M (Magnetic)	T5 (Install new T5)
Exterior Power (watts)	322	126	196	Parabolic	2T5	T (Timer)		CFL (Install new CFL)
Total Interior Lighting		Existing	Proposed	Recessed	3T5	PC (Photocell)		LEDex (Install new LED Exit)
Annual Consumption (kWh)	38,355	26,969	11,386	2U-shape	4T5	D (Dimming)		LED (Install new LED)
Lighting Power (watts)	12,168	9,691	2,477	Circuline	2T8	DL (Daylight Sensor)		D (Delamping)
Lighting Power Density (watts/SF)	1.01	0.81	0	Exterior	3T8	M (Microphonic Sensor)		C (Controls Only)
Estimated Cost of Fixture Replacement (\$)	3,748				4T8			PSMH (Install new Pulse-Start Metal Halide)
Estimated Cost of Controls Improvements (\$)	1,100				6T8			
Total Consumption Cost Savings (\$)	2,326				8T8			
					2T12			
					3T12			
					4T12			
					6T12			
					8T12			
					CFL (Compact Fluorescent Lightbulb)			
					MR16			
					MV (Mercury Vapor)			
					MH (Metal Halide)			
					HPS (High Pressure Sodium)			
					LPS (Low Pressure Sodium)			

DISCLAIMER: LIGHTING COUNTS IN THE SPREADSHEET ABOVE ARE GOOD ONLY FOR AREAS ACCESSIBLE TO SWA AUDITORS. SWA DOES NOT ACCEPT RESPONSIBILITY FOR MISSING LIGHTS, AS SOME SPACES WERE NOT ACCESSIBLE ON THE DAYS OF FIELD VISIT. THEREFORE, THE LIGHTING COUNTS MAY NOT BE ACCURATE.

Appendix B: Third Party Suppliers (ESCOs)

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

PSE&G ELECTRICAL SERVICE TERRITORY		
Last Updated: 06/15/09		
<p>Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095 (800) 437-7872 www.hess.com</p>	<p>BOC Energy Services, Inc. 1135 Mountain Avenue Murray Hill, NJ 011374 (800) 247-2644 www.boc.com</p>	<p>Commerce Energy, Inc. 4400 Route 9 South, Suite 100 Freehold, NJ 07728 (800) 556-84113 www.commerceenergy.com</p>
<p>Constellation NewEnergy, Inc. 900A Lake Street, Suite 2 Ramsey, NJ 07446 (888) 635-0827 www.newenergy.com</p>	<p>Direct Energy Services, LLC 120 Wood Avenue Suite 611 Iselin, NJ 08830 (866) 547-2722 www.directenergy.com</p>	<p>FirstEnergy Solutions Corp. 300 Madison Avenue Morristown, NJ 0113113 (800) 977-0500 www.fes.com</p>
<p>Glacial Energy of New Jersey, Inc. 207 LaRoche Avenue Harrington Park, NJ 07640 (877) 569-2841 www.glacialenergy.com</p>	<p>Integrus Energy Services, Inc. 99 Wood Ave, South, Suite 802 Iselin, NJ 08830 (877) 763-9977 www.integrusenergy.com</p>	<p>Strategic Energy, LLC 55 Madison Avenue, Suite 400 Morristown, NJ 011360 (888) 925-9115, www.sel.com</p>
<p>Liberty Power Holdings, LLC Park 80 West, Plaza II, Suite 200 Saddle Brook, NJ 07663 (866) 769-31139 www.libertypowercorp.com</p>	<p>Pepco Energy Services, Inc. 112 Main St. Lebanon, NJ 08833 (800) ENERGY-9 (363-7499) www.pepco-services.com</p>	<p>PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002 (800) 281-2000 www.pplenergyplus.com</p>
<p>Sempra Energy Solutions The Mac-Cali Building 581 Main Street, 8th Floor Woodbridge, NJ 07095 (877) 273-6772 www.semprasolutions.com</p>	<p>South Jersey Energy Company One South Jersey Plaza Route 54 Folsom, NJ 08037 (800) 800-756-3749 www.southjerseyenergy.com</p>	<p>Suez Energy Resources NA, Inc. 333 Thornall Street 6th Floor Edison, NJ 08837 (888) 644-1014 www.suezenergyresources.com</p>
<p>UGI Energy Services, Inc. 704 East Main Street, Suite 1 Moorestown, NJ 080113 (856) 273-9995 www.ugienergyservices.com</p>	<p>American Powernet Management, LP 437 North Grove St. Berlin, NJ 08009 (800) 437-7872 www.hess.com</p>	<p>ConEdison Solutions Cherry Tree, Corporate Center 1135 State Highway 38 Cherry Hill, NJ 08002 (888) 665-0955 www.conedsolutions.com</p>
<p>Credit Suisse, (USA) Inc. 700 College Road East Princeton, NJ 08450 212-1138-3124 www.creditsuisse.com</p>	<p>Sprague Energy Corp. 12 Ridge Road Chatham Township NJ 011328 (800) 225-1560 www.spragueenergy.com</p>	

ELIZABETHTOWN GAS COMPANY NATURAL GAS SERVICE TERRITORY

Last Updated: 06/15/09

<p>Cooperative Industries 412-420 Washington Avenue Belleville, NJ 07109 800-6BUYGAS (6-289427) www.cooperativenet.com</p>	<p>Direct Energy Services, LLP 120 Wood Avenue, Suite 611 Iselin, NJ 08830 866-547-2722 www.directenergy.com</p>	<p>Glacial Energy of New Jersey, Inc. 207 LaRoche Avenue Harrington Park, NJ 07640 1-877-569-2841 www.glacialenergy.com</p>
<p>Gate way Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701 800-805-8586 www.gesc.com</p>	<p>UGI Energy Services, Inc. d/b/a GASMARk 704 East Main Street, Suite 1 Moorestown, NJ 08057 856-273-9995 www.ugienergyservices.com</p>	<p>Great Eastern Energy 116 Village Riva, Suite 200 Princeton, NJ 08540 888-651-4121 www.greataeastern.com</p>
<p>Hess Energy, Inc. One Hess Plaza Woodbridge, NJ 07095 800-437-7872 www.hess.com</p>	<p>Metromedia Energy, Inc. 6 Industrial Way Eatontown, NJ 07724 877-750-7046 www.metromediaenergy.com</p>	<p>Intelligent Energy 2050 Center Avenue, Suite 500 Fort Lee, NJ 07024 800-724-1880 www.intelligentenergy.org</p>
<p>MxEnergy, Inc. 510 Thornall Street, Suite 270 Edison, NJ 088327 800-375-1277 www.mxenergy.com</p>	<p>NATGASCO (Mitchell Supreme) 532 Freeman Street Orange, NJ 07050 800-840-4GAS www.natgasco.com</p>	<p>Metro Energy Group, LLC 14 Washington Place Hackensack, NJ 07601 888-53-Metro www.metroenergy.com</p>
<p>PPL EnergyPlus, LLC 811 Church Road - Office 105 Cherry Hill, NJ 08002 800-281-2000 www.pplenergyplus.com</p>	<p>Stuyvesant Energy LLC 10 West Ivy Lane, Suite 4 Englewood, NJ 07631 800-646-6457 www.stuyfuel.com</p>	<p>Pepco Energy Services, Inc. 112 Main Street Lebanon, NJ 08833 800-363-7499 www.pepco-services.com</p>
<p>Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 07928 800-225-1560 www.spragueenergy.com</p>	<p>South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037 800-756-3749 www.sjindustries.com/sje.htm</p>	<p>Woodruff Energy 73 Water Street Bridgeton, NJ 08302 800-557-1121 www.woodruffenergy.com</p>

Appendix C: Incentive Programs

New Jersey Clean Energy Pay for Performance

The NJ Clean Energy Pay for Performance (P4P) Program relies on a network of Partners who provide technical services to clients. LGEA participating clients who are not receiving Direct Energy Efficiency and Conservation Block Grants are eligible for P4P. SWA is an eligible Partner and can develop an Energy Reduction Plan for each project with a whole-building traditional energy audit, a financial plan for funding the energy measures and an installation construction schedule.

The Energy Reduction Plan must define a comprehensive package of measures capable of reducing a building's energy consumption by 15+%. P4P incentives are awarded upon the satisfactory completion of three program milestones: submittal of an Energy Reduction Plan prepared by an approved Program Partner, installation of the recommended measures and completion of a Post-Construction Benchmarking Report. The incentives for electricity and natural gas savings will be paid based on actual savings, provided that the minimum 15% performance threshold savings has been achieved.

For further information, please see:

<http://www.njcleanenergy.com/commercial-industrial/programs/pay-performance/existing-buildings> .

Direct Install 2010 Program

Direct Install is a division of the New Jersey Clean Energy Programs's Smart Start Buildings. It is a turn-key program for small to mid-sized facilities to aid in upgrading equipment to more efficient types. It is designed to cut overall energy costs by upgrading lighting, HVAC and other equipment with energy efficient alternatives. The program pays **up to 80%** of the retrofit costs, including equipment cost and installation costs.

Eligibility:

- Existing small and mid-sized commercial and industrial facilities with peak electrical demand **below 200 kW** within 12 months of applying
- Must be located in New Jersey
- Must be served by one of the state's public, regulated or natural gas companies
- Electric: Atlantic City Electric, Jersey Central Power & Light, Orange Rockland Electric, PSE&G
- Natural Gas: Elizabethtown Gas, New Jersey Natural Gas, PSE&G, South Jersey Gas

For the most up to date information on contractors in New Jersey who participate in this program, go to: <http://www.njcleanenergy.com/commercial-industrial/programs/direct-install>

Smart Start

New Jersey's SmartStart Building Program is administered by New Jersey's Office of Clean Energy. The program also offers design support for larger projects and technical assistance for smaller projects. If your project specifications do not fit into anything defined by the program, there are even incentives available for custom projects.

There are a number of improvement options for commercial, industrial, institutional, government, and agricultural projects throughout New Jersey. Alternatives are designed to enhance quality while building in energy efficiency to save money. Project categories included in this program are New Construction and Additions, Renovations, Remodeling and Equipment Replacement.

For the most up to date information on how to participate in this program, go to:

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

Renewable Energy Incentive Program

The *Renewable Energy Incentive Program (REIP)* provides incentives that reduce the upfront cost of installing renewable energy systems, including solar, wind, and sustainable biomass. Incentives vary depending upon technology, system size, and building type. Current [incentive levels](#), [participation information](#), and [application forms](#) can be found here.

Solar Renewable Energy Credits (SRECs) represent all the clean energy benefits of electricity generated from a solar energy system. SRECs can be sold or traded separately from the power, providing owners a source of revenue to help offset the cost of installation. All solar project owners in New Jersey with electric distribution grid-connected systems are eligible to generate SRECs. Each time a system generates 1,000 kWh of electricity an SREC is earned and placed in the customer's account on the web-based SREC tracking system.

For the most up to date information on how to participate in this program, go to: <http://www.njcleanenergy.com/renewable-energy/home/home>.

Appendix D: Carbon Footprint Assessment

At the Kyoto summit of 1997, and more recently at the 2009 Copenhagen climate conference, world leaders have officially endorsed the theory that carbon dioxide (CO₂) and other greenhouse gases have an impact on global climate change. The total set of greenhouse gas (GHG) emissions caused by an organization is known as that organization's "carbon footprint." Calculating the carbon footprint has become an integral part of any environmental performance assessment.

Increasingly, local and federal authorities are moving toward more stringent rules aimed at curbing carbon emissions from a number of institutions. Carbon dioxide (CO₂) emissions result from activities such as heating, electricity generation, transport and wastes disposals. By reducing its carbon footprint, an organization is better able to manage resources and output, reduce energy costs, and mitigate its environmental impact.

Steven Winter Associates has conducted a carbon footprint evaluation for the city of Rahway using guidance provided by the Greenhouse Gas Protocol Initiative (GGPI). GGPI is an international accounting tool that is widely used by government and business leaders to understand quantify and manage greenhouse gas emissions. The GHG protocol initiative methodology divides emissions into three scopes depending on the source of the emissions.

Because the data collected by SWA in the Rahway energy audit were limited to energy consumption, this report focuses only on building-related emissions included in scopes 1 and 2. Excluding Scope 3 emissions, the total emission for the Senior Center building was 92.53 metric tons, or 204,029 lbs of CO₂, between March 2008 to February 2009.

Scope 1 emissions constitute direct emissions resulting from the combustion of natural gas to heat the building and provide hot water. They account for 45.19% of the building's emissions, or 41.84 metric tons.

Scope 2 emissions constitute indirect emissions from the generation and transport of purchased electricity used to power appliances, such as lighting, electronics and HVAC systems. In this case, they account for 54.81% of the building's emissions, or 50.75 metric tons.

The Senior Center building generates 8% of the total emissions for the eight audited buildings included in SWA's scope of work (1,182 metric tons). Among the eight buildings, the Senior Center has the highest position regarding contribution of greenhouse gases relative to its square footage (36.87 lbs of CO₂ per Sqft). The table below shows how the Energy Conservation Measures proposed by Steven Winter Associates can reduce the Senior Center greenhouse gas emissions:

Energy Conservation Measures Proposed by SWA					
ECM	Cost	Savings kWh/y	Saving Therms/y	CO ₂ Savings in metric tons	Total Emissions after ECM
Building Lighting Upgrades	\$4,848	12454	0	10.11	82.48
Retro-Commissioning	\$15,000	2104	418	3.80	88.79
Install 7.5kW PV system	\$56,250	8508	0	6.91	85.68
Total	\$76,098	23066	418	20.82	71.77