



Steven Winter Associates, Inc.
Architects and Engineers

50 Washington Street
Norwalk, CT 06854
www.swinter.com

Telephone
Facsimile
E-mail:

(203) 857-0200
(203) 852-0741
swinter@swinter.com

April 16, 2009

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

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

Project Number: LGEA10



TABLE OF CONTENTS

INTRODUCTION	3
EXECUTIVE SUMMARY.....	4
1. HISTORIC ENERGY CONSUMPTION.....	7
1.1. ENERGY USAGE AND COST ANALYSIS.....	7
1.2. UTILITY RATE	10
1.3. ENERGY BENCHMARKING	10
2. FACILITY AND SYSTEMS DESCRIPTION	12
2.1. BUILDING CHARACTERISTICS	12
2.2. BUILDING OCCUPANCY PROFILES	12
2.3. BUILDING ENVELOPE	12
2.3.1. EXTERIOR WALLS	12
2.3.2. ROOF	13
2.3.3. BASE.....	13
2.3.4. WINDOWS	13
2.3.5. EXTERIOR DOORS.....	14
2.3.6. BUILDING AIR TIGHTNESS.....	14
2.4. HVAC SYSTEMS.....	14
2.4.1. HEATING	14
2.4.2. COOLING.....	14
2.4.3. VENTILATION.....	14
2.4.4. DOMESTIC HOT WATER	15
2.5. ELECTRICALS SYSTEMS	15
2.5.1. LIGHTING.....	15
2.5.3. ELEVATORS.....	16
2.5.4. OTHER ELECTRICALS SYSTEMS.....	16
3. EQUIPMENT LIST	17
4. ENERGY CONSERVATION MEASURES.....	18
5. RENEWABLE AND DISTRIBUTED ENERGY MEASURES.....	26
5.1. EXISTING SYSTEMS	26
5.2. WIND	26
5.3. SOLAR PHOTOVOLTAIC.....	26
5.4. SOLAR THERMAL COLLECTORS.....	26
5.5. COMBINED HEAT AND POWER.....	26
5.6. GEOTHERMAL.....	26
6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES	27
6.1. LOAD PROFILES	27
6.2. TARIFF ANALYSIS.....	28
6.3. ENERGY PROCUREMENT STRATEGIES.....	29
7. METHOD OF ANALYSIS.....	31
7.1. ASSUMPTIONS AND TOOLS.....	31
7.2. DISCLAIMER	31
APPENDIX A: LIGHTING SURVEY	32
APPENDIX B: THIRD PARTY SUPPLIERS (ESCOs).....	33
APPENDIX C: INCENTIVE PROGRAMS	35
APPENDIX D: CARBON FOOTPRINT ASSESSMENT.....	37

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 municipal buildings. The audit included a review of the:

- City Hall
- Senior Center Annex
- Arts Guild
- Senior 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 audit report will be submitted for each building that was assessed. This report applies only to the Senior Center Annex located at 125 West Milton Avenue, Rahway, NJ 07065

The Senior Center Annex building is a residential type building consisting of 5,538sq.ft of conditioned space. The building houses a meeting room, senior center offices, a kitchen, an activity room, and consists of two above grade floors, an attic and basement. The building is mostly used on weekdays from 9am to 4pm; sometimes it is open on Saturdays too. 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.

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 Center Annex located at 125 West Milton Avenue. The building is two stories with conditioned floor area of 5,538 square feet. The building was built in late 1800's.

Based on the inspections performed by Steven Winter Associates (SWA) staff from August 11th through August 13th, 2009, and again later in November 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 Annex building consumed 12,056 kilowatt hours (kWh) of electricity at a cost of \$2,155.50 and 3,481 therms of natural gas at a total cost of approximately \$5,096. Combined energy consumption (electricity and gas) for that period was 389 million Btu (MMBtu) at a total 12-month cost of \$7,252.

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

The Site Energy Use Intensity is 73 kBtu/ft²yr compared to the national average of Entertainment/Culture type buildings consuming 95 kBtu/ft²yr. Implementing this report's recommendations will reduce use by approximately 7.9kBtu/ft²yr, which would make the building's energy consumption much better than the national average consumption for Entertainment/Culture type buildings.

Based on the assessment of the Senior Center Annex 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 15 single pane wood framed windows with similar type vinyl double pane, thermally insulated windows
- Thermally isolated second floor used as storage

Category II Recommendations: Operations and Maintenance

- Perform regular maintenance on exterior wall assemblies
- Maintain and perform regular maintenance
- Maintain and inspect all
- 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
- Install piping insulation on all hot water pipes throughout building

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

At this time, SWA highly recommends **2** Energy Conservation Measure (ECM) for the Senior Center Annex building summarized in Table 1. The total investment cost for this ECM with incentives is **\$1,204**. SWA estimates a first year savings of **\$715** with a simple payback of **1.7 years**. SWA estimates that implementing the highly recommended ECMs will reduce the carbon footprint of the Senior Center Annex building by **3,634 lbs of CO₂**, which is equivalent to avoiding the need of 9 trees to absorb the annual CO₂ generated. SWA also recommends **1** ECM with a total first year savings of **\$4,419** that are summarized in Table 2. Because the building equipment is relatively new, SWA did not find any End of Life Cycle Energy Conservation Measures that could be applicable.

The average estimated NJ commercial utility rates for electric and gas are \$0.150/kWh and \$1.550/therm respectively. The Senior Center Annex building annual utility costs are \$347.1 higher for electric, when compared to the average estimated NJ commercial utility rates; potential savings from smart energy procurement could yield 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 \$5,000 for the installation of a 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 renewable energy measures.

The following table summarizes 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
2	install a new programmable thermostat; one in truck bays other in kitchen	similar projects	150	none at this time	150	287	0.1	152	2.9	0	274	12	3,289	0.5	2093	174	183	2,578	393
1.2	21 New CFL fixtures to be installed with incentives	RS Means, lit search	1,054	none at this time	1,054	2,366	0.5	0	1.5	18	441	5	2,008	2.4	99	20	41	3,336	3,241
TOTALS			1,204	0	1,204	2,653	0.6	152	4.4	18	715	-	5,297	1.7	-	-	-	5,914	3,634

Assumptions: Discount Rate: 3% per DOE FEMP; Energy Price Escalation Rate: 0% per DOE FEMP Guide lines

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 5 kW PV rooftop system (with \$1/W INCENTIVE and \$600/1M Wh SREC)	similar projects	37,500	5,000	32,500	5,672	5.0	0	3.5	0	4,419	25	76,941	7.4	294	12	11	25,808	7,771
TOTALS			37,500	5,000	32,500	5,672	5.0	0	3.5	0	4,419	-	76,941	7.4	-	-	-	25,808	7,771

1. HISTORIC ENERGY CONSUMPTION

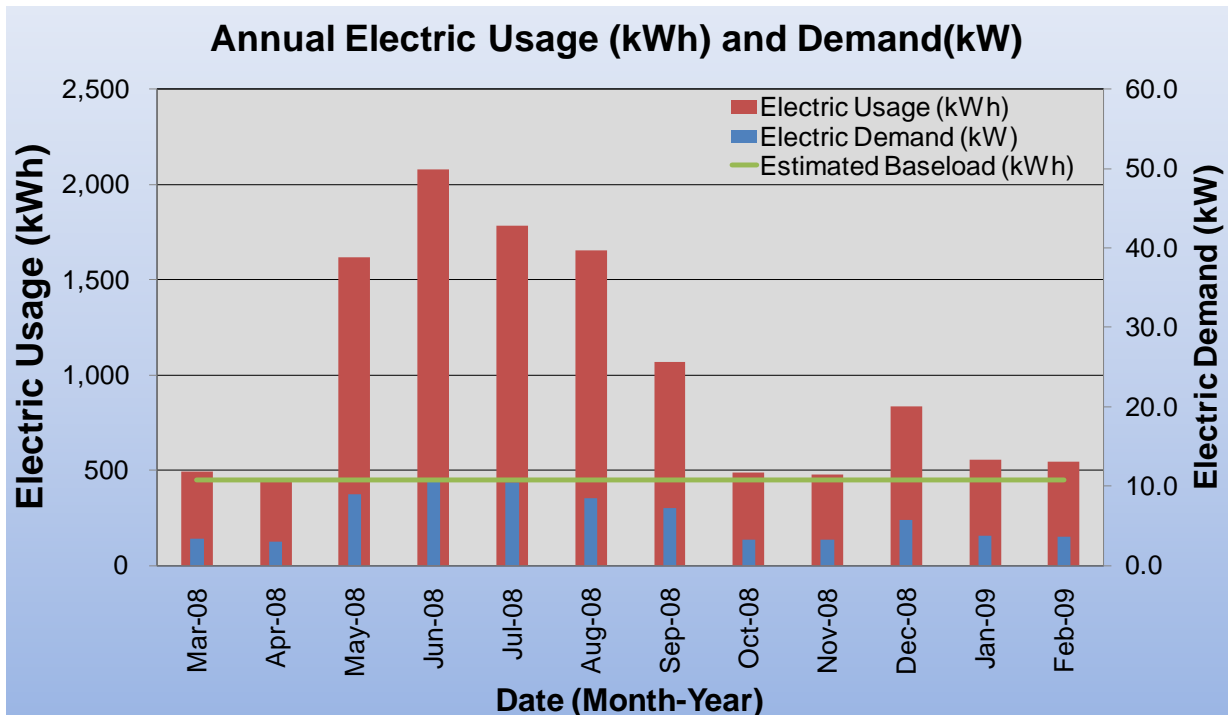
1.1. Energy usage and cost analysis

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

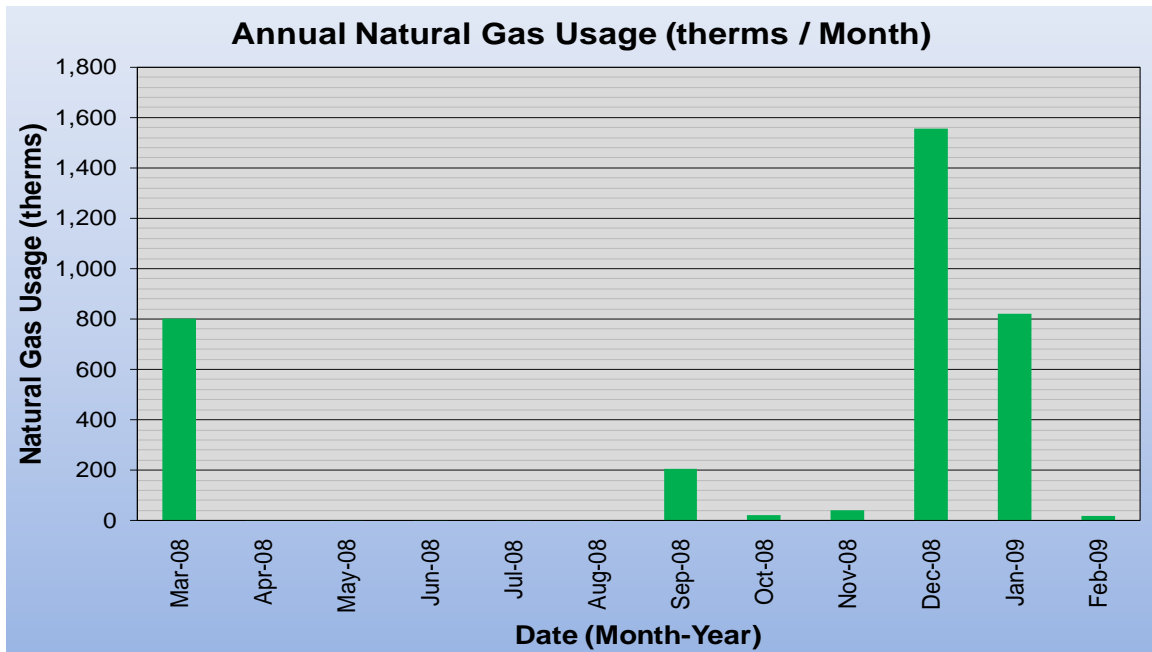
Electricity – The City of Rahway purchases electricity from PSE&G at an average rate of **\$0.179 per kWh** based on the 12 months of utility bills from March 2008 through February 2009. The Senior Center Annex used approximately **12,056 kWh or \$2,155.50 worth of electricity**. The kW demand data was estimated; it shows that demand averaged 6 kilowatts with a peak demand of 11kW.

Natural Gas – The Senior Center Annex uses natural gas purchased from AMG, a division of Pepco Energy Services Co. and purchase the transport of the gas from Elizabethtown Gas. **The average rate for natural gas was \$1.46/therm** based on the 12 months of utility bills from March 2008 through February 2009. The building used **3,481 therms or \$5,096 worth of natural gas** in a year.

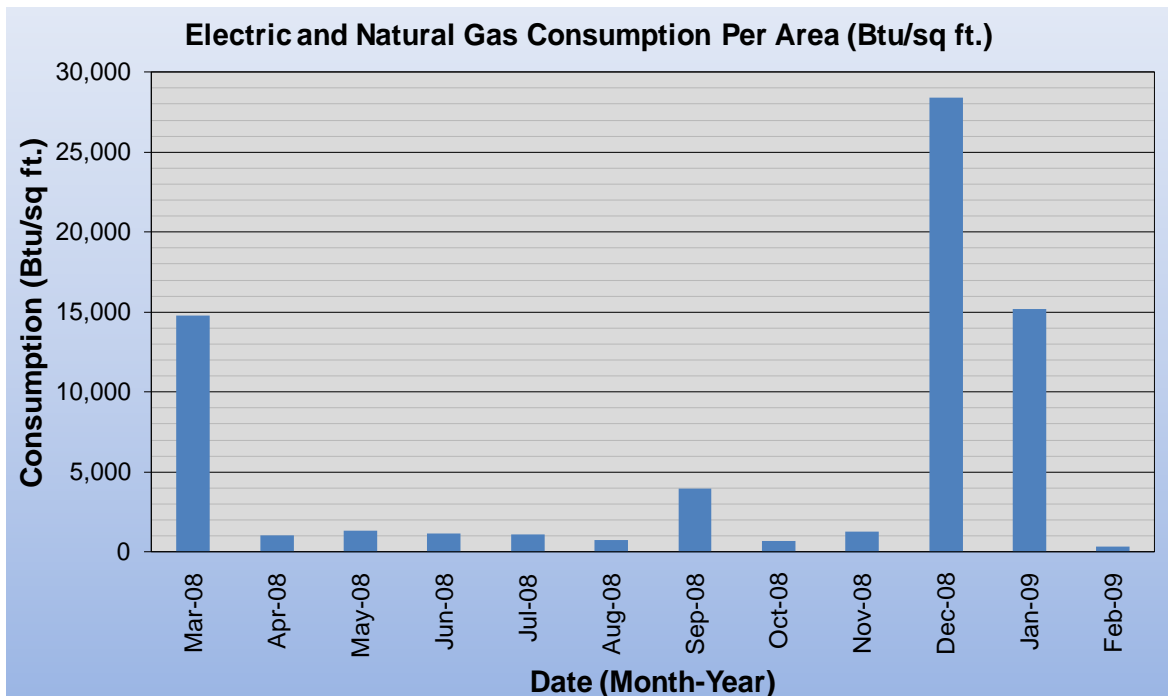
The following chart shows electricity use for the Senior Center Annex based on utility bills for the 12 month period of March 2008 to February 2009.



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

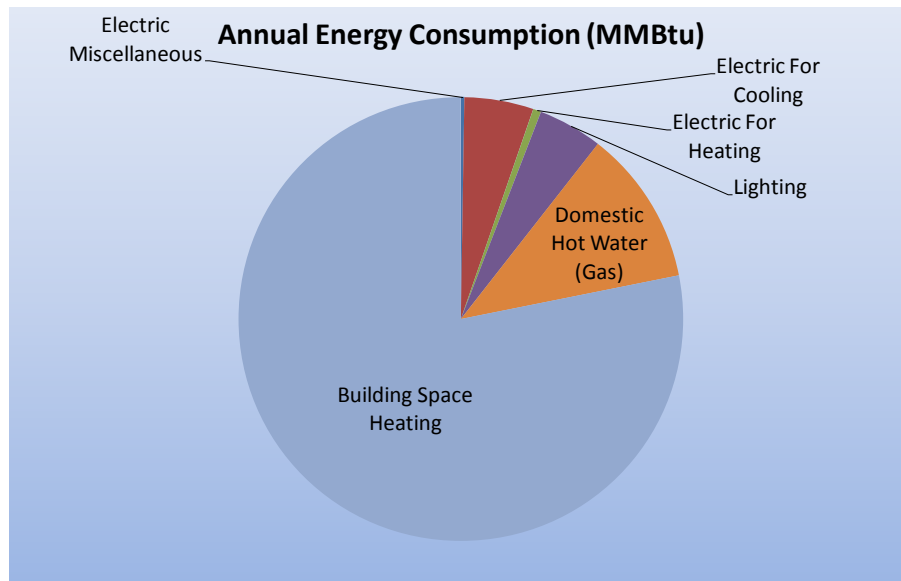


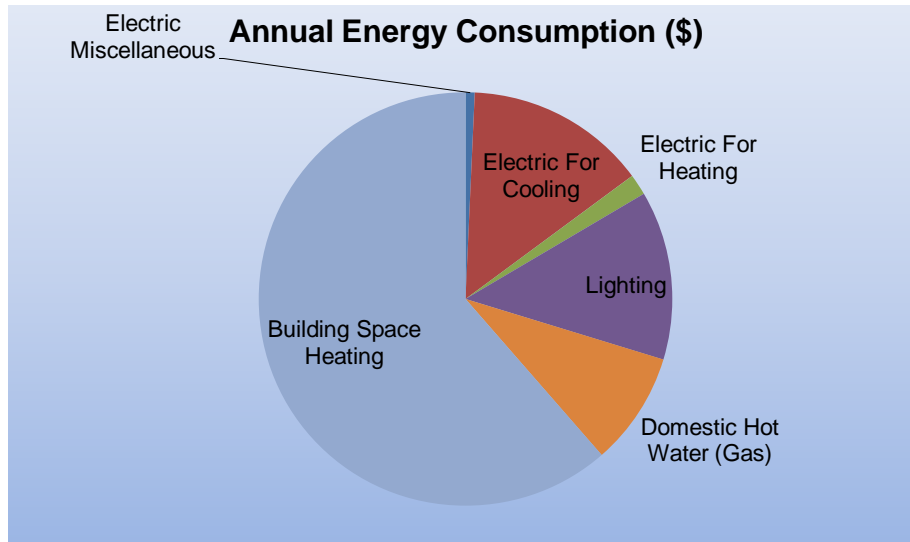
The following chart shows combined natural gas and electric consumption in Btu/sq ft for the Senior Center Annex based on utility bills for the 12 month period of March 2008 to February 2009.



The following table and pie charts show energy use for the Senior Center Annex based on utility bills for the 12 month period of March 2008 to February 2009. Note electrical cost at \$52/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	1	0%	\$52	1%	52
Electric For Cooling	20	5%	\$1,027	14%	52
Electric For Heating	2	1%	\$119	2%	52
Lighting	18	5%	\$958	13%	52
Domestic Hot Water (Gas)	44	11%	\$642	9%	15
Building Space Heating	304	78%	\$4,454	61%	15
Totals	389	100%	\$7,252	100%	19
Total Electric Usage	41	11%	\$2,156	30%	52
Total Gas Usage	348	89%	\$5,096	70%	15
Totals	389	100%	\$7,252	100%	19





1.2. Utility rate

The building purchases electricity from PSE&G. The Senior Center Annex uses Account # 08 51 367 122 87 with service address 125 West Milton Avenue, Rahway, NJ 07065. Natural Gas service is provided by Elizabethtown Gas, account number 8712206210. 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 **\$1.464/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 and it 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 73 kBtu/ft²yr compared to the national average of Entertainment/Culture type buildings consuming 95 kBtu/ft²yr. Implementing this report's recommendations will reduce use by approximately 1.5 kBtu/ft²yr, which when implemented would make the building much better than the national average of similar buildings.

SWA has created the Portfolio Manager site information for the City of Rahway. 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 Citizen Annex

Building ID: 1844651
 For 12-month Period Ending: February 28, 2009¹
 Date SEP becomes ineligible: N/A

Date SEP Generated: December 23, 2009

Facility City of Rahway - Senior Citizen Annex 125 West Milton Avenue Rahway, NJ 07065	Facility Owner N/A	Primary Contact for this Facility N/A
--	------------------------------	---

Year Built: 1890
 Gross Floor Area (ft²): 5,538

Energy Performance Rating² (1-100) N/A

Site Energy Use Summary³

Electricity - Grid Purchase(kBtu)	41,713
Natural Gas (kBtu) ⁴	365,001
Total Energy (kBtu)	406,714

Energy Intensity⁵

Site (kBtu/ft ² /yr)	73
Source (kBtu/ft ² /yr)	94

Emissions (based on site energy use)

Greenhouse Gas Emissions (MtCO ₂ e/year)	26
---	----

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	-64%
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:

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.

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.

2. FACILITY AND SYSTEMS DESCRIPTION

2.1. Building Characteristics

The Rahway Senior Center Annex was a residential building that is now used as an annex to the Senior Center for the purpose of entertainment and promoting culture. The original structure remains with no additional changes except to the HVAC equipment. The Senior Center Annex consists of 5,538 square feet of conditioned space. The building houses a meeting room, senior center offices, a kitchen and activity room and consists of two above grade floors, an attic and basement floor.

2.2. Building occupancy profiles

The building is not very often used – only 30-40 hours per week for classes, playing cards, etc. The Senior Center Annex is open to the senior residents on Monday through Friday from 9:00 AM to 4:00 PM. Typical occupancy for the Senior Center Annex staff is two persons, however, it fluctuates greatly depending on the number of seniors in attendance and the actual occupancy rarely approaches the building maximum.

2.3. Building envelope

2.3.1. Exterior Walls

There are two typical exterior envelope styles. The first consists of a red masonry brick wall for the portion of the basement that is above grade. The remainder of the building consists of the same wall; however, it has an additional layer of aluminum siding at the exterior. There is some water damage by the transition between the sloped roof and flat vertical sections of exterior wall.



Typical exterior wall surfaces

The energy codes or lack thereof at the time of the garages construction would have required a minimum level of insulation in the exterior walls. Exterior wall insulation levels could not be visually verified and 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

The existing roof consists of various A-Frame sections of pitched roofs with dark brown asphalt shingles. Underneath the roof shingles are layers of treated plywood, fiberglass board insulation, the existing roof framing and a vapor barrier.

2.3.3. Base

The building's base is 4" 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 at this time as it would not be cost effective.

2.3.4. Windows

Most of the original windows at the building have been replaced. However, a few of the original wood frame, single pane windows are still installed. They are in poor condition, as they do not close tightly, and have damage to their frames.



Typical original windows

The newer vinyl double glazed windows have thermal bridging and insulated spacers. Most of the vinyl windows are operable double-hung units; however, there are a few operable sliding units.



Vinyl Slider Windows

There is also a pair of sidelite windows and a single transom, single glazed windows alongside the glass main entrance door. 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 three exterior doors installed at the Senior Center Annex. An aluminum frame single pane glass door, solid metal cellar access door and wood panel door with glass window. All of the doors were observed to be in good age appropriate condition with tight seals and weather-stripping in good condition. SWA recommends that the exterior doors of the building be weather-stripped in order to decrease the amount of conditioned air that is lost around each door. SWA also recommends checking the weather-stripping of each door on a regular basis and replacing any broken seals. Tight seals around doors will help ensure the building to be kept continuously insulated.

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 Annex is heated by a new 2005 Utica Steam boiler with an estimated efficiency of 80%. It has 80% of life remaining and is in good condition. The boiler produces low pressure steam for building heating through baseboards, and radiators. The building first floor has a heating thermostat which is manually regulated. SWA proposes to install programmable thermostats with night setback capabilities for energy savings. The building is heated for 24 hours a day throughout the heating season and maintained at 72-74 deg F.

2.4.2.Cooling

The building is cooled by a Direct Expansion type split AC of 5 ton capacity installed in 2005. The indoor unit is located high up in the attic with ducts coming down to first floor; outdoor unit is near the back entrance of the building. AC is turned on or off from a manual thermostat by the building operators when the first open the building to let people in. SWA proposes to install programmable thermostats with night setback capabilities for energy savings.

2.4.3.Ventilation

The building is mostly naturally ventilated. The fan coil unit in the attic does draw some fresh air for circulation.

2.4.4. Domestic Hot Water

The domestic hot water is supplied by a 2005 installed GE combination water heater / storage system with a water heating capacity of about 40,000 Btu per hour (Btuh) and a 40 gallon storage tank. The system burns natural gas and has an estimated efficiency of 82%. It has 60% life remaining. The building is not very often used and the need for hot water is intermittent, at best, if any.

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.

Most of the lighting is comprised of older T12 lamps with magnetic ballasts. SWA recommends replacing these fixtures with T8 lamps with fixtures with electronic ballasts, which are far more efficient. 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 considered installing occupancy sensors in bathrooms, closets, offices and areas that are occupied only part of the day and investment is justified. 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, since internal clocks still use minimal power. 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 Annex does not have any elevators.

2.5.4. Other electrical systems

There are not currently any other significant energy impacting electrical systems installed at the Senior Center Annex building.

3. EQUIPMENT LIST

Building System	Description	Location	Model#	Fuel	Space served	Year Equip Installed	Remaining useful life %
Heating	Steam boiler, 159MBH output, 262.5MBH input, 15 psi, DOE heating capacity rated 212MBH (@80% efficiency)	Basement	Utica Boilers, Model PEG262CIDE, S/N UAC10604	Gas	Whole building	2005	80%
Cooling	Fan coil unit, with DX cooling coil, 5 ton capacity, 3/4hp blower motor	Attic	Intl. Comfort Air Products, Model NFCX6000c2, S/N L0108-78718	Elec.	Whole building	2005	73%
Cooling	Condensing unit, 5 ton capacity to match the indoor unit above; R-22	Outside	HEIL, model AG060GA1, S/N L995280771	Elec.	Whole building	2005	73%
DHW	40 gallons storage, gas fired, 40,000 Btu; est. 82% efficiency	Basement	GE, Model PG40T9A, S/N GENG 0302 H04988	Gas	Whole building	2005	60%

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 existing single pane windows with new vinyl or aluminum framed windows (with thermal break), double pane, argon filled, with low emissivity coating. This measure would not only make the building more comfortable year round but will also save significant amount of energy.
- Thermally isolate the second floor: This is an old residential building which is being used as an annex to the Senior Center. Only first floor is used for public activities; second floor and basement are only used as stores, they are however heated throughout the winter season. SWA recommends to thermally seal off the unused building portions, and designate this a secondary heating zone. This zone can then be maintained at a lower temperature, say 55 deg F. Substantial interior work may be required to create the thermal isolation.

Category II Recommendations: Operations and Maintenance

- Maintain exterior wall tile – All exterior wall surfaces should be maintained on a regular basis, re-pointing or caulking as necessary, to prevent water infiltrating wall assemblies. There are damaged tile areas that need to be replaced and sealed.
- Maintain asphalt roofs - SWA recommends regular maintenance on all roof surfaces, checking for clogged downspouts, and cleaning gutters. Any damage to the roof surface should be repaired immediately to prevent additional interior damage.
- Window maintenance - 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.
- 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.
- 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.
- 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
- Pipe Insulation – All hot water, steam and DHW pipes should be inspected and any missing or deteriorated insulation should be replaced with new.

Category III Recommendations: Energy Conservation Measures

Please see the following page for recommendations:

<i>ECM#</i>	<i>Description</i>
1	Building Lighting Upgrades
2	Install Programmable Thermostats
3	Install 5 Kilowatt Solar Photovoltaic System

ECM#	Table 1 - Highly Recommended 0-5 Year Payback ECMs
2	install a new programmable thermostat; one in truck bays other in kitchen
1.2	21 New CFL fixtures 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)

ECM #1: Building Lighting Upgrades

Description:

On the days of the conditions assessment inspections, SWA completed a lighting inventory of the Senior Center (see Appendix A). The existing lighting consists of mostly older technology T12 fluorescent fixtures with magnetic ballasts. These could be replaced with fixtures equipped with electronic ballasts and T8 (one inch diameter) lamps SWA also performed an evaluation of installing occupancy sensors in offices and bathrooms that may be left unoccupied a considerable amount of time throughout the day. The labor for the lighting improvement measures was estimated using local prevailing electrical contractor wages.

SWA recommends ECM 1.2 below because its payback is only 2.4 years. SWA considered other measures but the payback is very high because the building is not very heavily used. The combined payback on lighting works out to 6.8 years, though.

Installation cost:

Estimated installed cost: \$4,693

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	11 New T8 fixtures to be installed with incentives	RS Means, lit search	2,369	330	2,039	540	0.1	0	0.3	11	108	15	1,266	18.9	-30	-2	-6	-968	739
1.2	21 New CFL fixtures to be installed with incentives	RS Means, lit search	1,054	none at this time	1,054	2,366	0.5	0	1.5	18	441	5	2,008	2.4	99	20	41	3,336	3,241
1.3	8 New occupancy sensors to be installed with incentives	RS Means, lit search	1,760	160	1,600	396	0.1	0	0.2	10	81	15	948	19.9	-32	-2	-7	-798	542
TOTALS			5,183	490	4,693	3,301	0.7	0	2.0	101	692	13	4,964	6.8	34	3	NA	2,197	4,522

Assumptions: SWA calculated the savings for this measure estimating run time for the circulators and estimating the efficiency of the existing motors based on industry standards.

Rebates/financial incentives:

*NJ Clean Energy – T8 lamps with electronic ballast in existing facilities (\$10-30 per fixture, depending on quantity and lamps)
Maximum incentive amount is \$ 330.*

*NJ Clean Energy - Wall Mounted occupancy sensors (\$20 per control)
Maximum incentive amount is \$160.*

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: *Install Programmable Thermostats*

Description:

The Senior Center Annex building has only one heating zone in the whole building. Temperature controls are manual, without setback and have poor accuracy. Temperatures may not setback at night or after-hours if not manually set. Additional energy is used to keep the spaces warm, which would not be expended if controls could be properly operated.

SWA proposes to replace existing thermostats with one heat-cool strategically placed, Energy Star, programmable- wall mounted and tamper secure thermostats that will greatly improve the control, heat and cool energy expended in the spaces mentioned above.

Installation cost:

Estimated installed cost: \$150 (estimated labor cost, \$75)

Source of cost estimate: *RS Means; Published and established costs and 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	install a new programmable thermostat; one in truck bays other in kitchen	similar projects	150	none at this time	150	287	0.1	152	2.9	0	274	12	3,289	0.5	2093	174	183	2,578	393

Assumptions: Since the utility bills have accounting fluctuations, it is difficult to determine the energy used for heating the building. SWA estimated the heating energy usage from the electric and fuel oil bills, assuming overall typical savings of 5% for scheduled setbacks and controls. Estimated programmable thermostat cost / installation are based on similar projects.

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 5kW PV system

Description:

Currently, the Senior Center Annex 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 5kW PV system to offset electrical demand and reduce the annual net electric consumption for the building, and review guaranteed incentives from NJ rebates to justify the investment. Utilities provide the ability to buy SRECs at \$600 / MWh or best market offer.

There are many possible locations for a 5kW PV installation on the building roof, which is part of an old structure. Hence, a detailed structural analysis must be conducted before this measure could be implemented. A commercial multi-crystalline 123 watt panel (17.2 volts, 7.16 amps) has 10.7 square feet of surface area (11.51 watts per square foot). A 5kW system needs approximately 41 panels which would take up 435 square feet. The installation of a renewable Solar Photovoltaic power generating system could serve as a good educational tool and exhibit for the community.

Installation cost:

Estimated installed cost: \$37,500 (estimated labor costs, \$15,000)

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 5 kW PV rooftop system (with \$1/W INCENTIVE and \$600/1MWh SREC)	similar projects	37,500	5,000	32,500	5,672	5.0	0	3.5	0	4,419	25	76,941	7.4	294	12	11	25,808	7,771

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 \$5,000.

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

NJ Clean Energy - Solar Renewable Energy Certificate Program. Each time a solar electric system generates 1000kWh (1MWh) of electricity, a SREC is issued which can then be sold or traded separately from the power. The buildings must also become net-metered in order to earn SRECs as well as sell power back to the electric grid. \$3,000 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 ECM#3 above.

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:

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

5.6. Geothermal

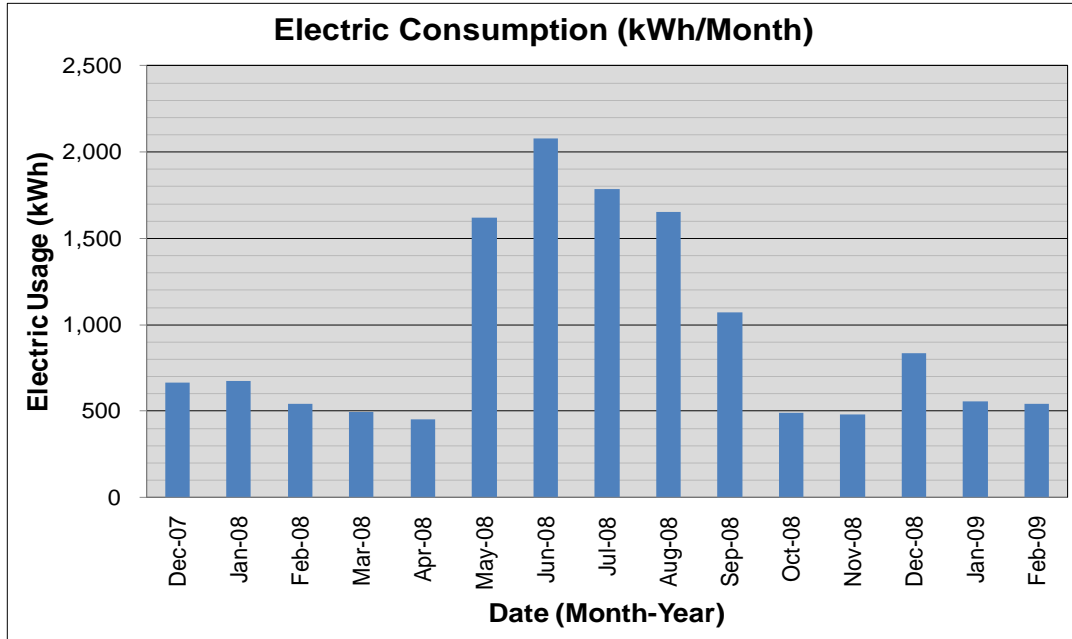
Description:

Geothermal is not applicable for this Firehouse because small energy needs for the building do not justify a huge investment.

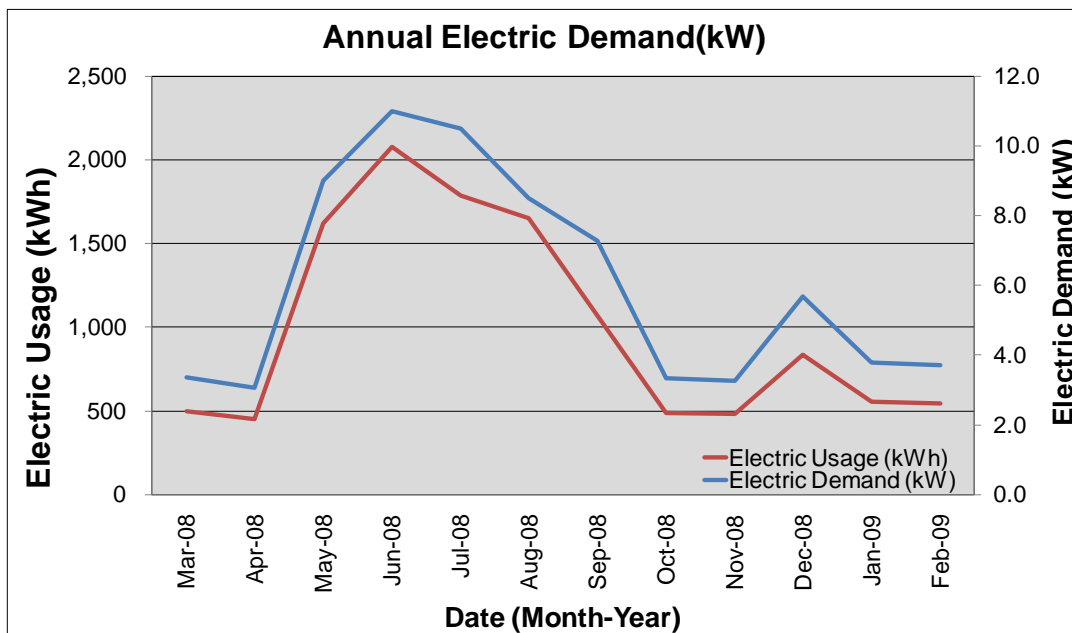
6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

6.1. Load profiles

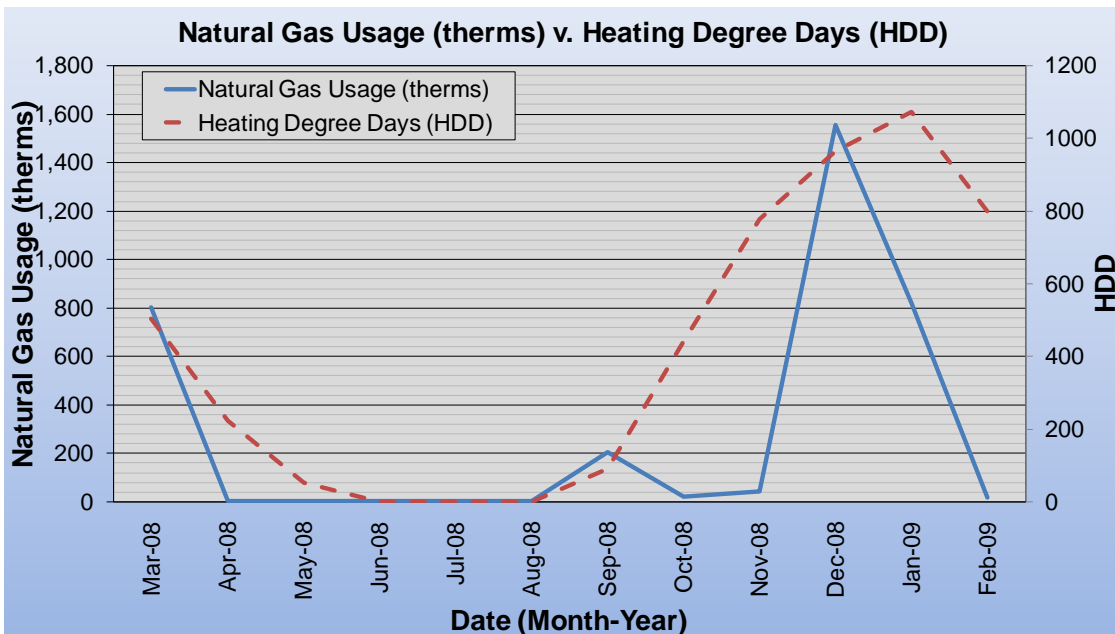
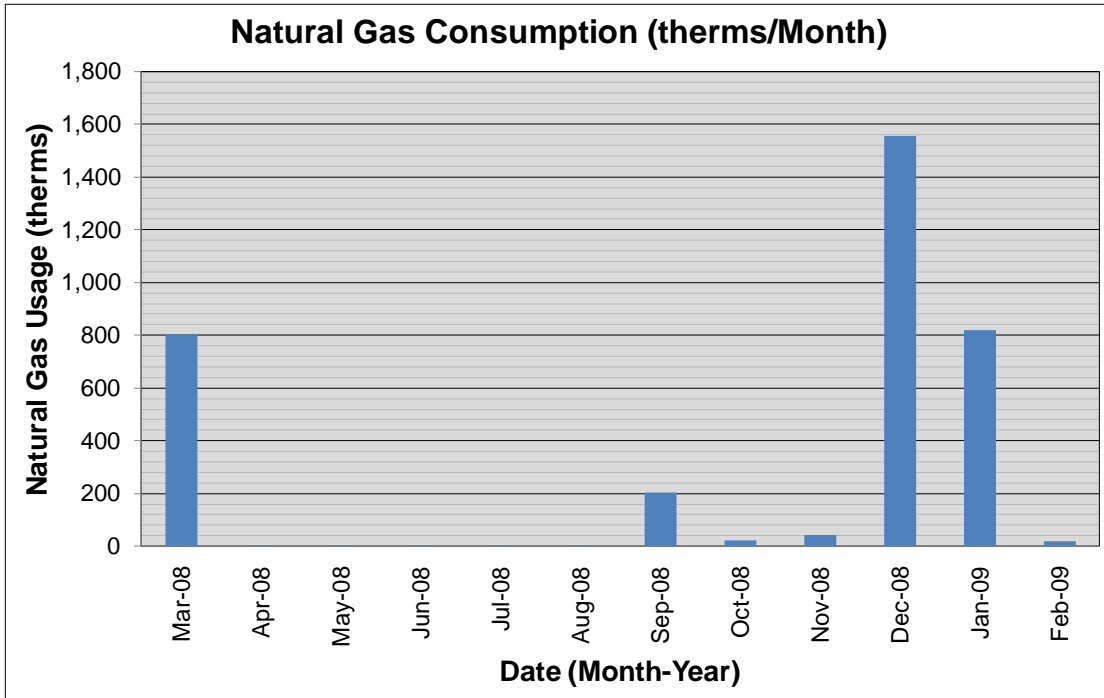
The following are charts that show the annual electric and natural gas load profiles for the Senior Center.



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

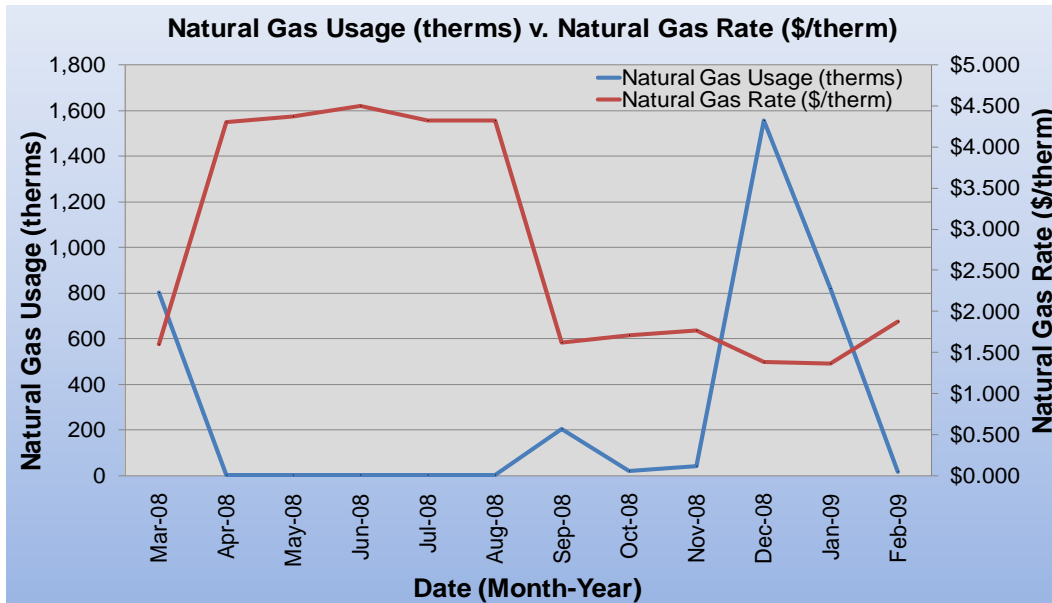


The following is a chart of the natural gas annual load profile for the building, peaking in the coldest months of the year and a chart showing natural gas consumption following the “heating degree days” curve. Some utility bills have more than one month estimated and combined.



6.2. Tariff analysis

The City of Rahway currently buys electricity and gas from PSE&G, Pepco, 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 Annex building is direct-metered (via one main meter). The general service rate for electric charges is market-rate based on use. Senior Center Annex building billing does not show a breakdown of demand costs. Demand prices are not reflected in the utility bills and cannot 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 Senior Center Annex building receives natural gas via one incoming meter. Pepco supplies the gas and Elizabeth Town transports it. An Energy Services Company (ESCO) is a consultancy group that engages in a performance-based contract with a client firm to implement measures which reduce energy consumption and costs in a technically and financially viable manner.

SWA analyzed the utility rate for natural gas and electricity supply over an extended period. Electric bill analysis shows fluctuations up to 20% over the most recent 12 month period. Natural gas bill analysis shows fluctuations up to 93% 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 Annex building annual utility costs are \$347.1 higher for electric when compared to the average estimated NJ commercial utility rates; potential savings from smart energy procurement could yield better results.

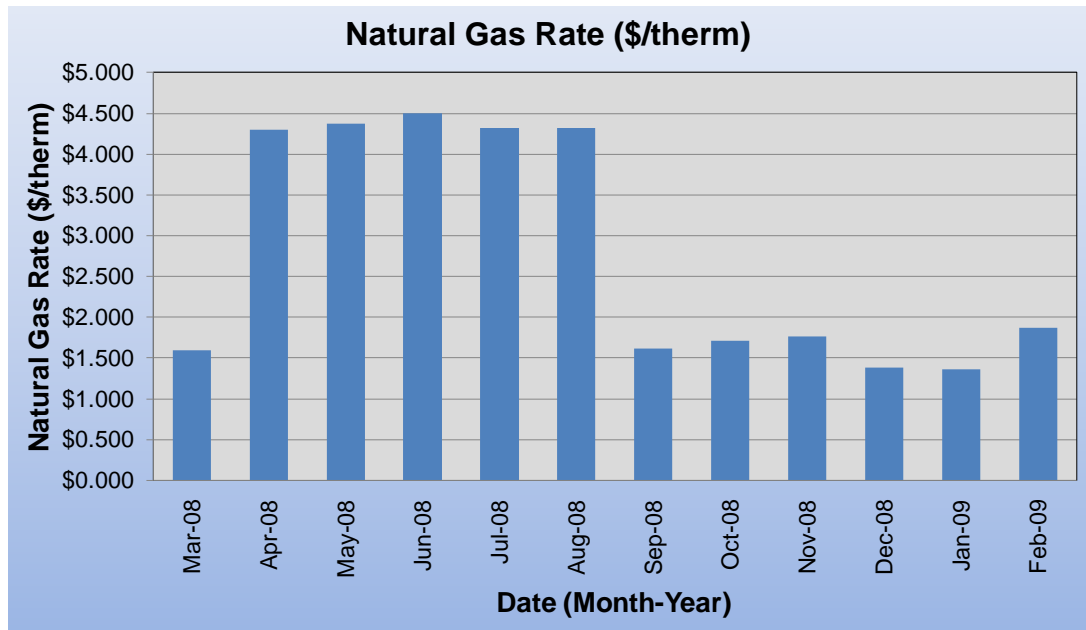
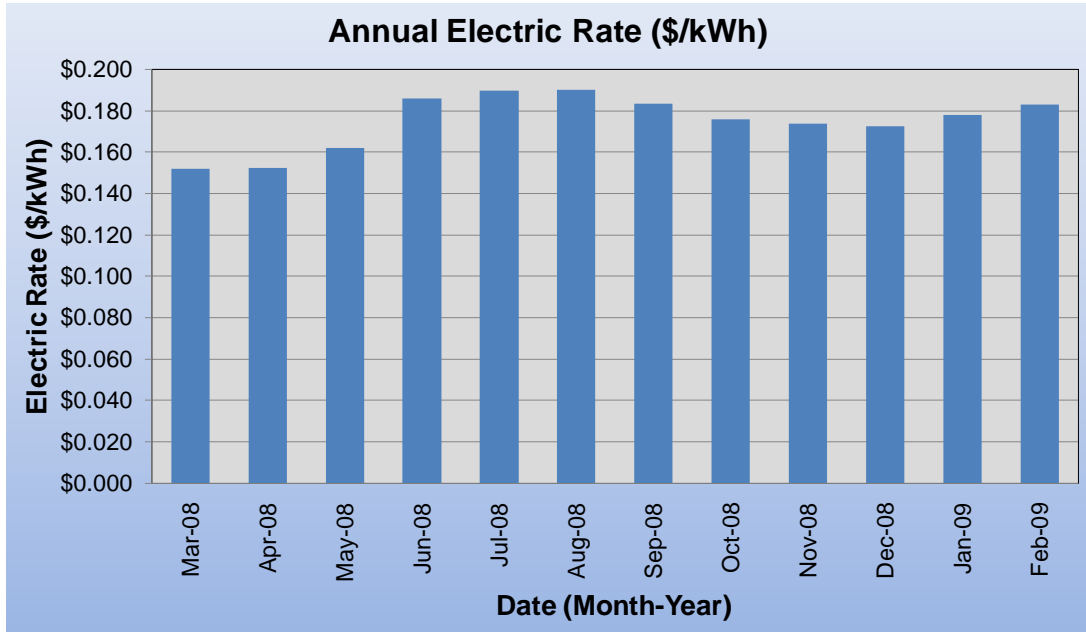
SWA recommends that the City of Rahway further explore opportunities of purchasing both natural gas and electricity from ESCOs in order to reduce rate fluctuation and ultimately reduce the annual cost of energy for the Senior Center Annex building. Appendix B contains a complete list of third

party energy suppliers for the Rahway service area.

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

The Senior Center Annex 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 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	B	Boiler Room	Screw-in	N	Inc	6	1	60	S	4	240	0	360	346	CFL	Screw-in	CFL	N	OS	6	1	20	3	240	0	120	86	230	29	259
2	1	Elevator Lobby	Recessed	M	4T12	1	2	40	S	8	240	15	95	182	T8	Recessed	4T8	E	OS	1	2	32	6	240	6	70	101	48	34	82
3	1	Kitchen	Recessed	M	4T12	1	2	40	S	8	240	15	95	182	T8	Recessed	4T8	E	OS	1	2	32	6	240	6	70	101	48	34	82
4	1	Dining Room Porch	Recessed	N	Inc	1	1	60	S	8	240	0	60	115	CFL	Recessed	CFL	N	S	1	1	20	8	240	0	20	38	77	0	77
5	1	Dining Room TV	Recessed	M	4T12	2	2	40	S	8	240	15	175	365	T8	Recessed	4T8	E	OS	2	2	32	6	240	6	134	202	96	67	163
6	1	Dining Room Piano	Recessed	M	4T12	3	2	40	S	8	240	15	255	547	T8	Recessed	4T8	E	OS	3	2	32	6	240	6	198	302	144	101	245
7	1	Main Entry	Recessed	N	Inc	1	1	60	S	8	240	0	60	115	CFL	Recessed	CFL	N	S	1	1	20	8	240	0	20	38	77	0	77
8	1	Foyer	Recessed	N	Inc	1	1	60	S	8	240	0	60	115	CFL	Recessed	CFL	N	S	1	1	20	8	240	0	20	38	77	0	77
9	1	Office	Recessed	M	4T12	1	2	40	S	8	240	15	95	182	T8	Recessed	4T8	E	OS	1	2	32	6	240	6	70	101	48	34	82
10	1	Bathroom	Recessed	N	Inc	3	1	25	S	8	240	0	75	144	CFL	Recessed	CFL	N	S	3	1	10	8	240	0	30	58	86	0	86
11	1	Hallway	Recessed	N	Inc	2	1	60	S	8	240	0	120	230	CFL	Recessed	CFL	N	S	2	1	20	8	240	0	40	77	154	0	154
12	1	Meeting Room	Recessed	M	4T12	1	2	40	S	8	240	15	95	182	T8	Recessed	4T8	E	OS	1	2	32	6	240	0	64	92	60	31	90
13	1	Bathroom	Recessed	N	Inc	1	1	60	S	8	240	0	60	115	CFL	Recessed	CFL	N	S	1	1	20	8	240	0	20	38	77	0	77
14	2	Bathroom	Recessed	N	Inc	1	1	60	S	8	240	0	60	115	CFL	Recessed	CFL	N	S	1	1	20	8	240	0	20	38	77	0	77
15	2	Office	Recessed	M	4T12	2	2	40	S	8	240	15	175	365	T8	Recessed	4T8	E	OS	2	2	32	6	240	6	134	202	96	67	163
16	Ext	Exterior	Exterior	N	Hal	5	1	75	T	12	365	19	394	2,059	CFL	Exterior	CFL	N	T	5	1	25	12	365	0	125	548	1511	0	1511
Totals:						32	23					105	2,234	5,361						32	23	399				1,155	2,060	2905	396	3301

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

Proposed Lighting Summary Table				Legend					
		Existing	Proposed	Savings	Fixture Type	Lamp Type	Control Type	Ballast Type	Retrofit Category
Total Surface Area (SF)		5,538			Exit Sign	LED	N (None)	N/A (None)	N/A (None)
Average Power Cost (\$/kWh)		0.1790			Screw-in	Inc (Incandescent)	S (Switch)	E (Electronic)	T8 (Install new T8)
Exterior Lighting					Pin		OS (Occupancy Sensor)	M (Magnetic)	T5 (Install new T5)
Exterior Annual Consumption (kWh)	2,059	548	1,511		Parabolic	2T5	T (Timer)		CFL (Install new CFL)
Exterior Power (watts)	394	125	269		Recessed	3T5	PC (Photocell)		LEDex (Install new LED Exit)
Total Interior Lighting					2U-shape	4T5	D (Dimming)		LED (Install new LED)
Annual Consumption (kWh)	3,302	1,513	1,789		Circuline	2T8	DL (Daylight Sensor)		D (Delamping)
Lighting Power (watts)	1,840	1,030	810		Exterior	3T8	M (Microphonic Sensor)		C (Controls Only)
Lighting Power Density (watts/SF)	0.33	0.19	0			4T8			PSMH (Install new Pulse-Start Metal Halide)
						6T8			
						8T8			
						2T12			
						3T12			
						4T12			
						6T12			
						8T12			
						CFL (Compact Fluorescent Lightbulb)			
Estimated Cost of Fixture Replacement (\$)	3,423					MR16			
Estimated Cost of Controls Improvements (\$)	1,760					MV (Mercury Vapor)			
Total Consumption Cost Savings (\$)	692					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/s hopping.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>	

PSE&G 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>Dominion Retail, Inc. 395 Highway 170 - Suite 125 Lakewood, NJ 08701 866-275-4240 http://retail.dom.com</p>
<p>Gateway 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 GASMAR 704 East Main Street, Suite 1 Moorestown, NJ 080113 856-273-9995 www.ugienergyservices.com</p>	<p>Great Eastern Energy 116 Village Riva, Suite 200 Princeton, NJ 08540 888-651-4121 www.greastern.com</p>
<p>Hess Energy, Inc. One Hess Plaza Woodbridge, NJ 07095 800-437-7872 www.hess.com</p>	<p>Hudson Energy Services, LLC 871 Route 17 South Ridgewood, NJ 07450 877- Hudson 9 www.hudsonenergyservices.com</p>	<p>Intelligent Energy 2050 Center Avenue, Suite 500 Fort Lee, NJ 07024 800-724-1880 www.intelligentenergy.org</p>
<p>Keil & Sons 1 Bergen Blvd. Fairview, NJ 07002 1-877-Systrum www.systrumenergy@aol.com</p>	<p>Metromedia Energy, Inc. 6 Industrial Way Eatontown, NJ 07724 877-750-7046 www.metromediaenergy.com</p>	<p>Metro Energy Group, LLC 14 Washington Place Hackensack, NJ 07601 888-113-Metro www.metroenergy.com</p>
<p>MxEnergy, Inc. 510 Thornall Street, Suite 270 Edison, NJ 088327 800-375-1277 www.mxenergy.com</p>	<p>NATGASCO (Mitchell Supreme) 1132 Freeman Street Orange, NJ 07050 800-840-4GAS www.natgasco.com</p>	<p>Pepco Energy Services, Inc. 112 Main Street Lebanon, NJ 08833 800-363-7499 www.pepco-services.com</p>
<p>PPL EnergyPlus, LLC 811 Church Road - Office 105 Cherry Hill, NJ 08002 800-281-2000 www.pplenergyplus.com</p>	<p>Sempra Energy Solutions The Mac-Cali Building 581 Main Street, 8th fl. Woodbridge, NJ 07095 877-273-6772 800-2 SEMPRA www.semprasolutions.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>Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 011328 800-225-1560 www.spragueenergy.com</p>	<p>Stuyvesant Energy LLC 10 West Ivy Lane, Suite 4 Englewood, NJ 07631 800-646-64113 www.stuyfuel.com</p>	<p>Woodruff Energy 73 Water Street Bridgeton, NJ 08302 800-5113-1121 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 Citizen Annex building was 26.63 metric tons, or 58,719 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 73.64% of the building's emissions, or 17.40 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 6.23% of the building's emissions, or 6.23 metric tons.

The Senior Citizen Annex building generates 2 % 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 Citizen Annex has the third lowest position regarding contribution of greenhouse gases relative to its square footage (9.41 lbs of CO₂ per Sqft). The table below shows how the Energy Conservation Measures proposed by Steven Winter Associates can reduce the Senior Citizen Annex 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	\$4,083	3301	0	2.680471882	20.95
<i>Install Programmable Thermostats</i>	\$150	287	152	0.992911338	22.64
<i>Install 5kW PV system</i>	\$37,500	5672	0	4.605766893	19.02
Total	\$41,733	9260	152	8.279150113	15.35