



**Steven Winter Associates, Inc.**  
Architects and Engineers

50 Washington Street  
Norwalk, CT 06854  
[www.swinter.com](http://www.swinter.com)

Telephone  
Facsimile  
E-mail:

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

*April 16, 2010*

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

***City of Rahway  
Arts Guild building  
Rahway, NJ 07065***

***Project Number: LGEA10***



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## INTRODUCTION

On August 11<sup>th</sup>, 12<sup>th</sup> and 13<sup>th</sup> 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 Arts Guild facility located at 1670 Irving Street, Rahway, NJ 07065.

The Arts Guild building was opened in 1997 after the existing old library building was retrofitted to become an art gallery and education complex which includes a 1,200 square foot gallery. Despite occupying a former two-story building with a full basement, the gallery and arts guild office do not utilize the entire facility. The main exterior surface of the building is red masonry brick. This building is home to a combination of arts gallery, office and classrooms and is open from Monday to Friday 9am to 3:30 pm. The building is also open on Saturdays for classes and art shows, as well as occasional weekday nights beyond 3:30 PM.

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 Arts Guild building located at 1670 Irving Street, Rahway, NJ 07065.

Based on the inspections performed by Steven Winter Associates (SWA) staff from August 11<sup>th</sup> through August 13<sup>th</sup>, 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 Arts Guild building consumed 12,680 kWh or \$2,780.55 worth of electricity at a rate of approximately \$0.21/kWh and 5,883 therms or \$9,096 worth of natural gas at an approximate rate of \$1.54/therm. The joint energy consumption for the building, including both electricity and natural gas, was 632 MMBtu of energy for a total cost of \$11,877.

SWA has entered energy information about the Arts Guild building in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* energy benchmarking system. SWA entered this building type as Social/Meeting to calculate the building performance benchmark. The Portfolio Manager system does not provide an Energy Star score for Social/Meeting type buildings; however it provides a kBtu/ft<sup>2</sup>yr 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 18 kBtu/ft<sup>2</sup>yr compared to the national average of Social/Meeting type buildings consuming 52 kBtu/ft<sup>2</sup>yr. Implementing this report's recommendations will reduce use by an additional 1.2 kBtu/ft<sup>2</sup>yr approximately, which when implemented would make the building energy consumption even better than it is now. 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 Arts Guild 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 hot air furnace in cellar

### **Category II Recommendations: Operations and Maintenance**

- Maintain boiler room and building piping insulation
- Maintain exterior wall brick veneer, re-pointing as necessary
- Perform thorough asphalt roof inspection, repairing and replacing missing insulation
- Perform regular maintenance of all gutters and downspouts
- Replace and maintain weather stripping on all exterior doors
- Air seal building
- Use Energy Star labeled appliances
- Use smart power electric strips

- Maintain and inspect all windows for deteriorating weather-stripping or caulking, replace windows as needed

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

At this time, SWA highly recommends **1** Energy Conservation Measure (ECM) for the Arts Guild building summarized in Table 1. The total investment cost for this ECM before incentives is **\$150**. SWA estimates a first year savings of **\$2,944** with a simple payback of **0.6 years**. SWA estimates that implementing the highly recommended ECMs will reduce the carbon footprint of the Arts Guild building by **1,856 lbs of CO<sub>2</sub>**, which is equivalent to avoiding the need of 5 trees to absorb the annual CO<sub>2</sub> generated. SWA also recommends **2** ECMs with a total first year savings of **\$5,107** 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 Arts Guild building annual utility costs are \$878.55 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](mailto: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 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 <sub>2</sub> reduced, lbs/yr
2	install 1 new programmable thermostat	similar projects	150	none at this time	150	0	0.0	159	0.5	0	245	12	2,944	0.6	1862	155	164	2,292	1,856
<b>TOTALS</b>			<b>150</b>	<b>0</b>	<b>150</b>	<b>0</b>	<b>0.0</b>	<b>159</b>	<b>0.5</b>	<b>0</b>	<b>245</b>	<b>-</b>	<b>2,944</b>	<b>0.6</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2,292</b>	<b>1,856</b>

**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 <sub>2</sub> reduced, lbs/yr
1	47 New CFL fixtures to be installed with incentives	RS Means, lit search	2,359	none at this time	2,359	1,981	0.4	0	0.2	28	462	5	2,103	5.1	-5	-1	16	2,238	2,714
3	install 5 kW PV rooftop system (with \$1/W INCENTIVE and \$600/MWh SREC)	similar projects	37,500	5,000	32,500	5,672	5.0	0	0.6	0	4,645	25	80,892	7.0	306	12	12	29,758	7,771
<b>TOTALS</b>			<b>39,859</b>	<b>5,000</b>	<b>34,859</b>	<b>7,653</b>	<b>5.4</b>	<b>0</b>	<b>0.8</b>	<b>28</b>	<b>5,107</b>	<b>-</b>	<b>82,995</b>	<b>6.8</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>31,997</b>	<b>10,485</b>

# 1. HISTORIC ENERGY CONSUMPTION

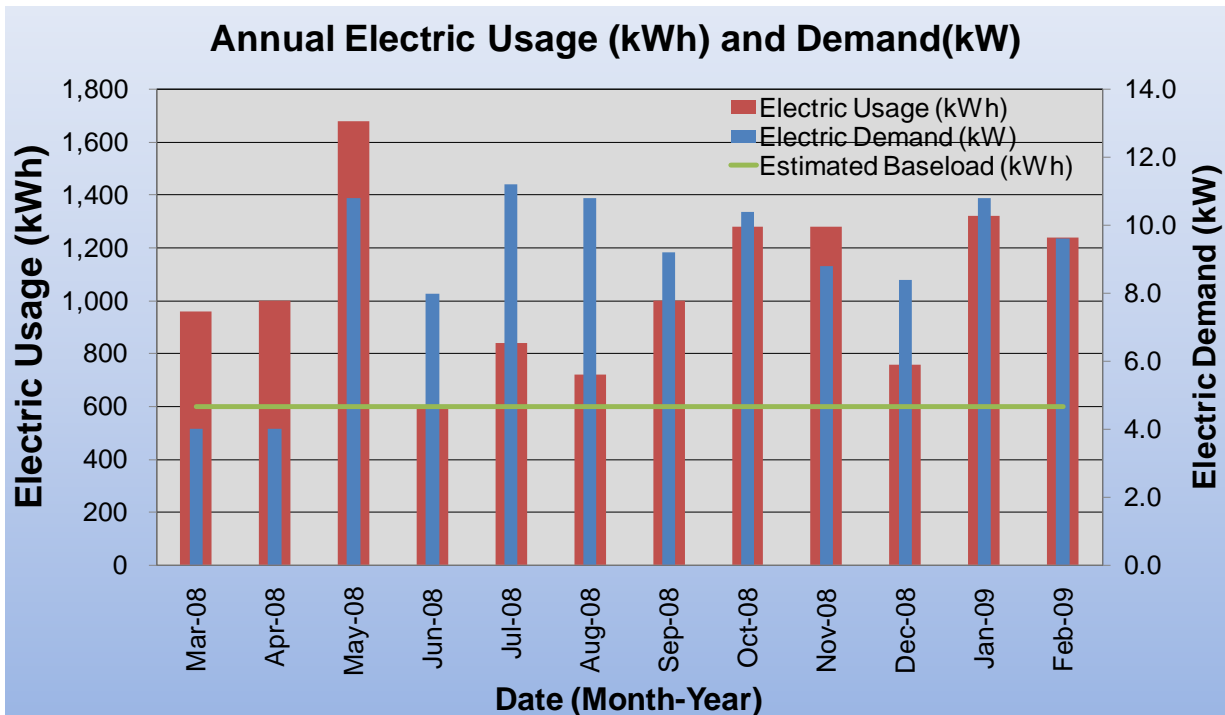
## 1.1. Energy usage and cost analysis

SWA analyzed utility bills from March 2008 through February 2009 that were received from the utility companies supplying the Arts Guild building with electric and natural gas.

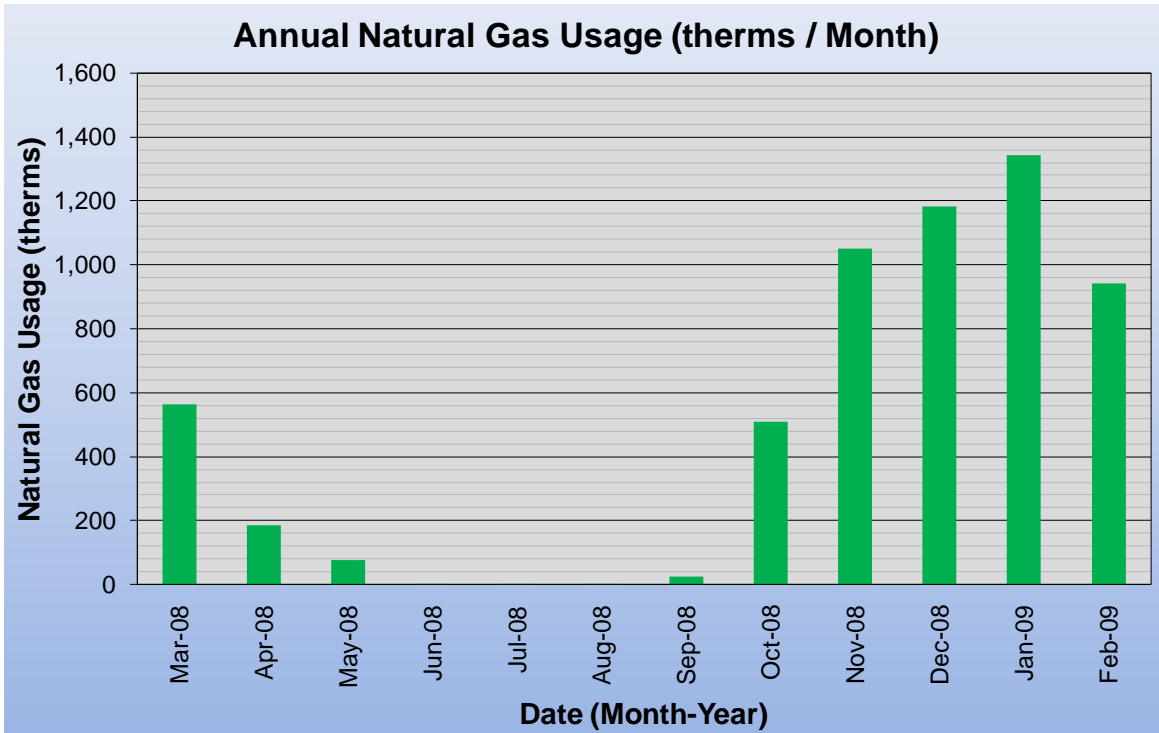
**Electricity** – The City of Rahway purchases electricity from PSE&G at an average rate of \$0.21 per kWh for the Arts Guild in 2008-2009. The Arts Guild used 12,680 kWh at a cost of \$2,780. The data also reflected that demand averaged 9 kilowatts with a peak demand of 11.2.

**Natural Gas** – The Arts Guild 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 \$1.54 per therm based on the 12 months of utility bills from March 2008 through February 2009. The building used 5,883 therms of natural gas costing \$9,096.

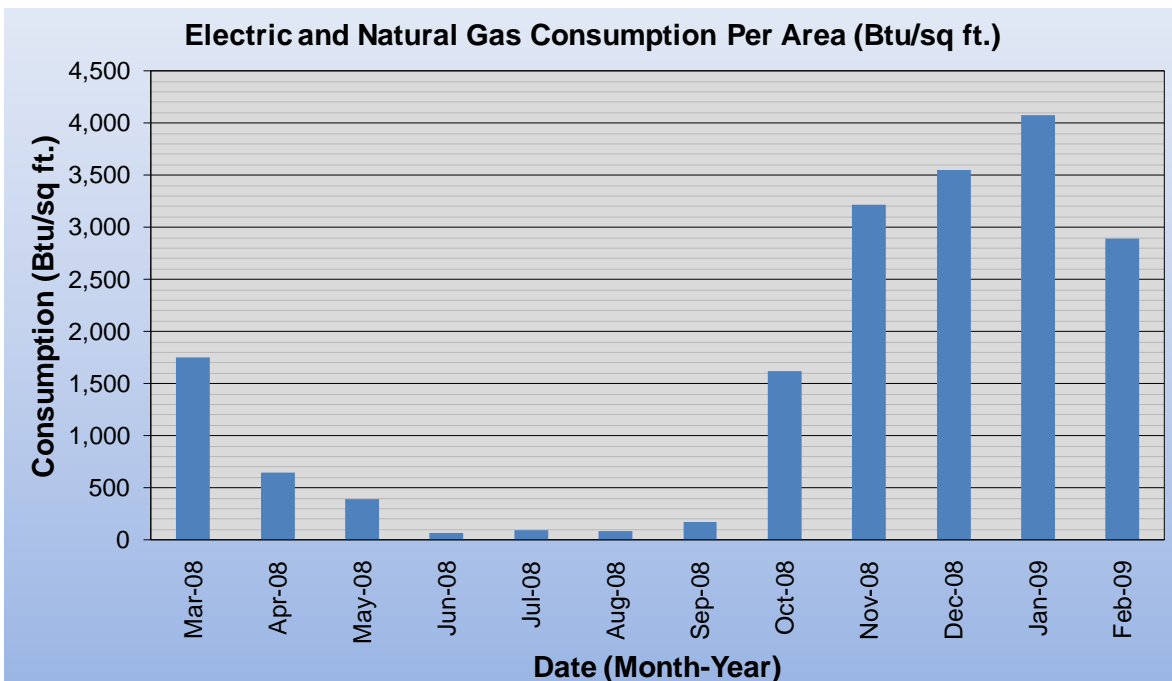
The following chart shows electricity use for the Arts Guild building based on utility bills for the 12 month period of March 2008 to February 2009.



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

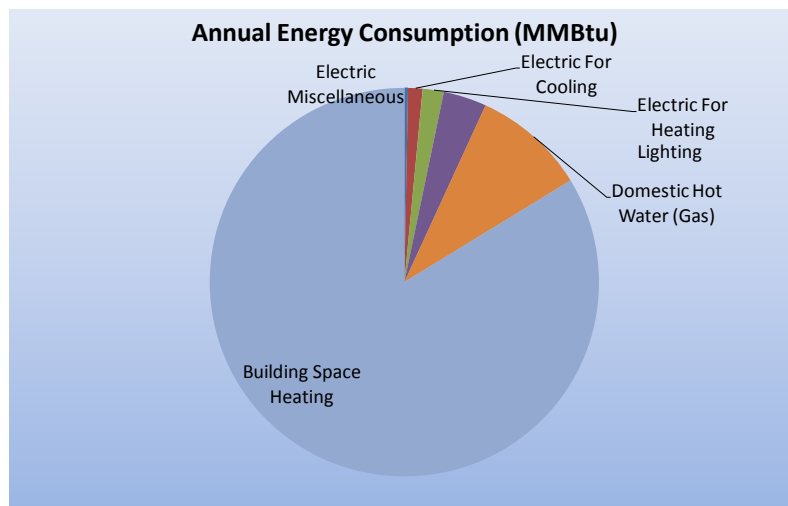
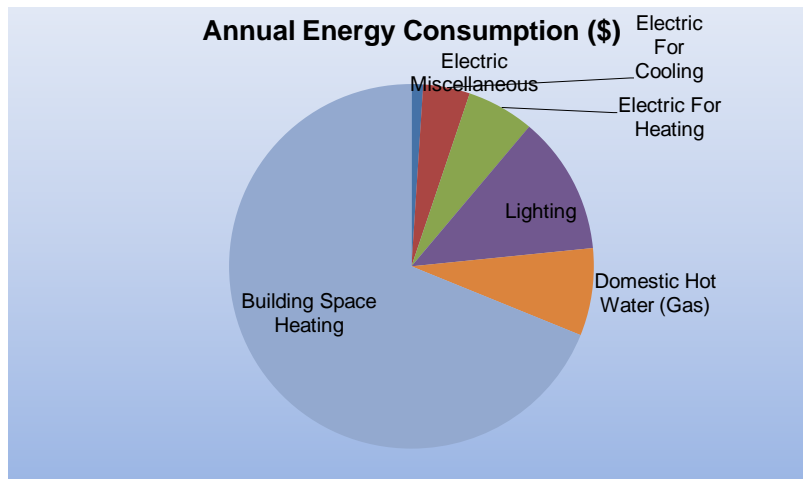


The following chart shows combined natural gas and electric consumption in Btu/sq ft for the Arts Guild building based on utility bills for the 12 month period of March 2008 to February 2009.



The following table and pie charts show energy use for the Arts Guild building based on utility bills for the 12 month period of March 2008 to February 2009. Note electrical cost at \$64/MMBtu of energy is 4 times as expensive to use as natural gas at \$15/MMBtu.

2008 Annual Energy Consumption / Costs					
	MMBtu	% MMBtu	\$	% \$	\$/MMBtu
Electric Miscellaneous	2	0%	\$122	1%	64
Electric For Cooling	8	1%	\$491	4%	64
Electric For Heating	11	2%	\$710	6%	64
Lighting	23	4%	\$1,456	12%	64
Domestic Hot Water (Gas)	59	9%	\$918	8%	15
Building Space Heating	529	84%	\$8,178	69%	15
<b>Totals</b>	<b>632</b>	<b>100%</b>	<b>\$11,877</b>	<b>100%</b>	<b>19</b>
<b>Total Electric Usage</b>	<b>43</b>	<b>7%</b>	<b>\$2,781</b>	<b>23%</b>	<b>64</b>
<b>Total Gas Usage</b>	<b>588</b>	<b>93%</b>	<b>\$9,096</b>	<b>77%</b>	<b>15</b>
<b>Totals</b>	<b>632</b>	<b>100%</b>	<b>\$11,877</b>	<b>100%</b>	<b>19</b>



## 1.2. Utility rate

The building purchases electricity from PSE&G. The Arts Guild uses Account # 09 51 421 388 05 at service address 1670 Irving Street, Rahway, NJ 07065. Natural Gas service is provided by third party provided by Elizabethtown Gas, account number 8492382320. The gas itself is purchased from AMG, a division of Pepco Energy Services Co. Electricity was billed at an average aggregated rate of **\$0.219/kWh** and natural gas was billed at an average aggregated rate of **\$1.54/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 18 kBtu/ft<sup>2</sup>yr compared to the national average of a Social/Meeting type building consuming 52kBtu/ft<sup>2</sup>yr. Implementing recommendations in this report will reduce use by 1.2 kBtu/ft<sup>2</sup>yr approximately, and make the building performance better than the national average of similar buildings. At the outset, the building may seem very energy efficient, but there is a caveat. As stated in the Introduction section, only part of the building area is used for activities, which is about 2400 sqft. The total building area is 34,157 sqft., whole of which is heated; there is no cooling. SWA used the total building area for calculating the benchmark. Because only a small part of the building is actually used, the energy performance of the building is overstated.

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 - Arts Guild

Building ID: 1844732  
For 12-month Period Ending: February 28, 2009<sup>1</sup>  
Date SEP becomes ineligible: N/A

Date SEP Generated: January 06, 2010

<b>Facility</b> City of Rahway - Arts Guild 1670 Irving Street Rahway, NJ 07065	<b>Facility Owner</b> N/A	<b>Primary Contact for this Facility</b> N/A
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Year Built: 1900  
Gross Floor Area (ft<sup>2</sup>): 34,157

Energy Performance Rating<sup>2</sup> (1-100) N/A

### Site Energy Use Summary<sup>3</sup>

Electricity - Grid Purchase(kBtu)	44,875
Natural Gas (kBtu) <sup>4</sup>	557,816
Total Energy (kBtu)	602,691

### Energy Intensity<sup>5</sup>

Site (kBtu/ft <sup>2</sup> /yr)	18
Source (kBtu/ft <sup>2</sup> /yr)	21

### Emissions (based on site energy use)

Greenhouse Gas Emissions (MtCO <sub>2</sub> e/year)	37
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### Electric Distribution Utility

Public Service Elec & Gas Co

### National Average Comparison

National Average Site EUI	52
National Average Source EUI	102
% Difference from National Average Source EUI	-79%
Building Type	Social/Meeting

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 Standards<sup>6</sup> 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 Arts Guild was opened in 1997 after the existing library building was retrofitted to an art gallery and education complex. It features a 1,200 square foot gallery. Despite occupying a larger former two-story building with a full basement, the gallery and arts guild office do not utilize the entire facility. Only 2400 sqft. of the total area, 34,157 sqft. is actually used for activities; remaining area is mostly used as storage. The main exterior surface of the building is red masonry brick. This building is home to a combination of arts gallery, office and classrooms. The office is open from Monday to Friday 9:00 AM to 3:30 PM. The building is also open on Saturdays for classes and art shows, as well as occasional weekday nights beyond 3:30 PM.

### **2.2. Building occupancy profiles**

There is one full time municipal employee. Due to the nature of the building's use and occupancy, the amount of people using the building at any given time is subject to severe fluctuations however, it will rarely reach maximum occupancy limits.

The office is open from Monday to Friday 9:00 AM to 3:30 PM. The building is also open on Saturdays for classes and art shows, as well as occasional weekday nights beyond 3:30 PM.

### **2.3. Building envelope**

#### **2.3.1.Exterior Walls**

The exterior walls of the building finishes are red masonry bricks. The exterior wall is composed of a 4" layer of red masonry bricks with a 4" continuous concrete masonry wall to its interior and a 1" layer of rigid board insulation and a 1/2" gypsum board layer at the interior.

Exterior wall insulation levels could not be visually verified for the exterior wall as there was no existing access to the insulation layer 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 roof of the Arts Guild is a combination of sloped A-Frame and Hip gray asphalt shingle roofs. The roof lies on top of a layer of pretreated plywood, 1.5" layer of rigid board insulation, wooden roof structure and vapor barrier.

SWA is recommending that the roof be carefully inspected and all broken or missing sections of insulation be replaced properly and the ballast placed on top so that it serves its purpose of holding the insulation in place. There is no other effective way to hold the insulation as either mechanically fastening the insulation to the roof membrane or using adhesives to fasten the insulation, would damage the roof membrane.

### **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 as it would not be cost effective.

### **2.3.4.Windows**

The existing windows are wooden frame single pane operable double hung units. They are older windows with some failing hardware and frames with physical and water damage. There are typical fixed clerestory units located above each double hung unit.



*Typical window including casement and awning style*

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**

Both the entry and exit doors are wood frame wooden paneled doors. There is also a wooden horizontal basement access door. Some of the exterior doors are in satisfactory condition with much of the weather-stripping still intact. But some of the weather-stripping on exterior doors is missing or failing and needs to be replaced. If not properly maintained, exterior doors can become major sources of heat loss and infiltration. As a best practice, SWA recommends checking the weather-stripping of each door on a regular basis and replacing any broken seals immediately. This will help optimize comfort and energy performance.

### **2.3.6.Building air tightness**

Based on a visual inspection, the building was observed to be relatively well-sealed considering the age and intended use of the building, with the exception weather-stripping of exterior doors and hardware problems with the windows. 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 Arts Guild building is heated by a natural gas furnace installed in the cellar. The furnace was converted to natural gas fuel in 1996; the original age of the furnace could not be determined. It appears though that it is more than 20 years old. SWA recommends replacing the furnace with a new one as part of capital improvement.

### **2.4.2. Cooling**

Cooling for the Arts Guild is provided by 3 window air conditioners; most of the building is not cooled.

### **2.4.3. Ventilation**

There is only natural ventilation in the building, no forced ventilation.

### **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 30,000 Btu per hour (Btuh) and a 30 gallon storage tank. The system burns natural gas. The DHW is relatively new, installed in 2002, and in good condition.

## **2.5. Electrical systems**

### **2.5.1. Lighting**

*Interior Lighting* – The Arts Guild building lighting consists of many T8 and T5 lamps with electronic ballasts. SWA recorded many incandescent bulbs found throughout the building and recommends replacement with efficient compact fluorescent bulbs. 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 an inventory of lighting throughout the building section most utilized (approximately 2400 sqft.) and estimated power consumption.

*Exit Lights* - Exit signs were found to be LED, which is of efficient type.

*Exterior Lighting* - The exterior lighting surveyed during the building audit were found to be Metal Halide fixtures. SWA recommends upgrading any manual switches for exterior lamps to astronomical timers or photocells.

### **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. The Livingston Board of Education Offices building computers are generally programmed for the power save mode, to shut down after a period of time that they have not been used.

### **2.5.3. Elevators**

The Arts Guild building 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	Hot air furnace, converted to nat.gas in 1996, Economite burner, 400MBH input, model DS45B; blower motor 3/4 hp	Cellar	Jackson Church, Model GA350-HB28, S/N 755-4797	Gas	Whole building	N/A	0%
Cooling	Window AC unit, approx 10,000Btu, Energy Star labelled, Qty. 2 nos.	Offices	Maytag	Elec.	Offices	N/A	20% est.
Cooling	Window AC unit, approx 6,000Btu, Qty. 1 nos.	Offices	Fedders Lloyd	Elec.	Offices	N/A	20% est.
Heating	30 Gallon domestic hot water heater; I/P 30,000 Btu/hr; est efficiency 82%	Cellar	Rheem, Gaurdian, model 21V30S, S/N RHNG0302A16406	Gas	Whole building	2002	50%

**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 hot air furnace in cellar – The furnace is quite old and past its service life. SWA recommends replacing the furnace as a capital improvement because energy savings that would be achieved alone do not justify the needed investment of approximately \$25,000.

##### **Category II Recommendations: Operations and Maintenance**

- Pipe Insulation – All hot water, steam and DHW pipes should be inspected and any missing or deteriorated insulation should be replaced with new.
- Repair and maintain exterior wall veneer – SWA recommends repairing, caulking, or re-pointing brick veneer. Regular maintenance of the brick veneer will prevent future damage associated with water infiltration or other wall damage.
- 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.
- Maintain gutters and downspouts – Provide regular maintenance on all gutters and downspouts as needed to prevent water / moisture infiltration and insulation damage.
- Weather Stripping – As a best practice, exterior/overhead doors and vestibule doors should be observed annually for deficient weather-stripping and replaced as needed. The perimeter of all window frames should also be regularly inspected and any missing or deteriorated caulking should be re-caulked to provide an unbroken seal around the window frame. Building staff should also verify that windows open and close properly and repair, 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.
- 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.
- 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.
- 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	<b>Building Lighting Upgrades</b>
2	<b>install 1 new programmable thermostat</b>
3	<b>Install 5 Kilowatt Solar Photovoltaic System</b>

<b>ECM#</b>	<b>Table 1 - Highly Recommended 0-5 Year Payback ECMs</b>
2	install 1 new programmable thermostat
	<b>Table 2 - Recommended 5-10 Year Payback ECMs</b>
1	47 New CFL fixtures to be installed with incentives
3	install 5 kW PV rooftop system (with \$1/W INCENTIVE and \$600/MWh SREC)

## ECM #1: Building Lighting Upgrades

### Description:

On the days of the conditions assessment inspections, SWA completed a lighting inventory of the Arts Guild building area that is most utilized (see Appendix A). Approximately 2400 sq ft of the building is open to the public and used for public events. The existing lighting consists of efficient electronic T8 or T5 lamps. Incandescent bulbs were found in the bathrooms, closet, and cellar which should be replaced with more efficient compact fluorescents bulbs. The labor for the lighting improvement measures was estimated using local prevailing electrical contractor wages. The City of Rahway may decide to utilize maintenance personnel to install new bulbs or lamps, thereby reducing the estimated installed costs.

### Installation cost:

Estimated installed cost: \$2,359 (estimated labor costs, \$1,530)

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	47 New CFL fixtures to be installed with incentives	RS Means, lit search	2,359	none at this time	2,359	1,981	0.4	0	0.2	28	462	5	2,103	5.1	-5	-1	16	2,238	2,714

**Assumptions:** SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA also assumed an aggregated 2 hrs/yr to replace aging burnt out lamps vs. newly installed.

### Rebates/financial incentives:

*There are direct incentives for this measure.*

**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](mailto:NJDirectInstall@TSLE.com)

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

**ECM#2: Install a Programmable Thermostat**

**Description:**

The Arts Guild building has 1 heating zone in the whole building served by a furnace. SWA proposes to replace the existing thermostat with one strategically placed, Energy Star, programmable- wall mounted and tamper secure thermostat that will greatly improve the control of heat energy expended.

**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 <sub>2</sub> reduced, lbs/yr
2	install 1 new programmable thermostat	similar projects	150	none at this time	150	0	0.0	159	0.5	0	245	12	2,944	0.6	1862	155	164	2,292	1,856

**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 3% for scheduled setbacks and controls. Estimated programmable thermostat cost / installation are based on similar projects.

**Rebates / financial incentives:** *There are 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](mailto:NJDirectInstall@TSLE.com)

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

### ECM#3: Install 5kW PV system

**Description:**

Currently, the Arts Guild 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 22 panels which would take up 380 square feet. The installation of a renewable Solar Photovoltaic power generating system could serve as a good educational tool and exhibit for the community.

**Installation cost:**

Estimated installed cost: \$37,500 (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 <sub>2</sub> 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 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 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 Arts Guild but does not recommend its installation because of the HVAC equipment type and insufficient year-round thermal loads.*

### **5.6. Geothermal**

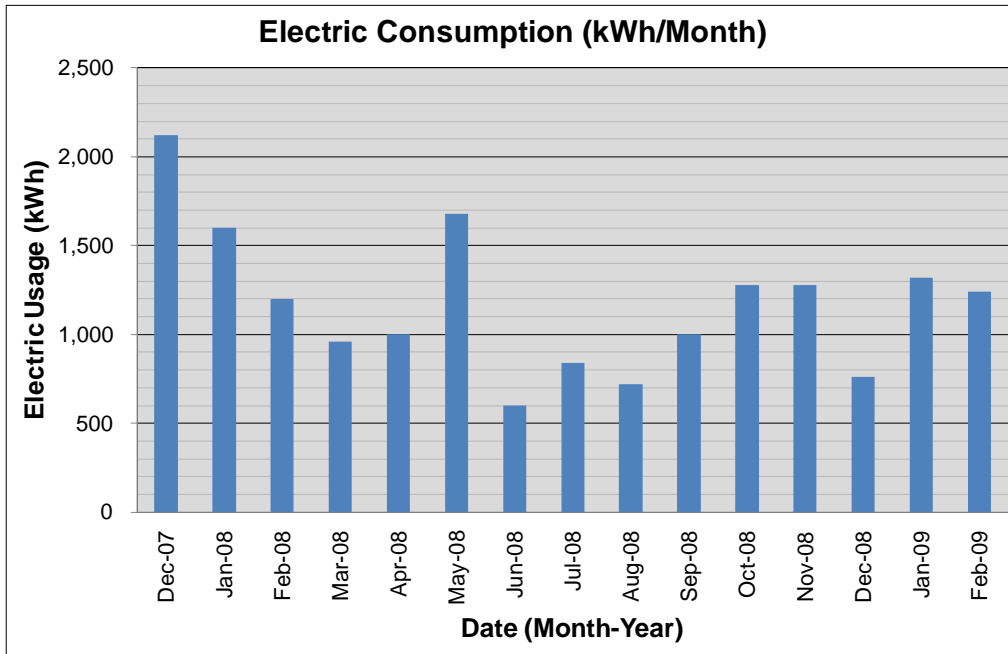
#### **Description:**

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

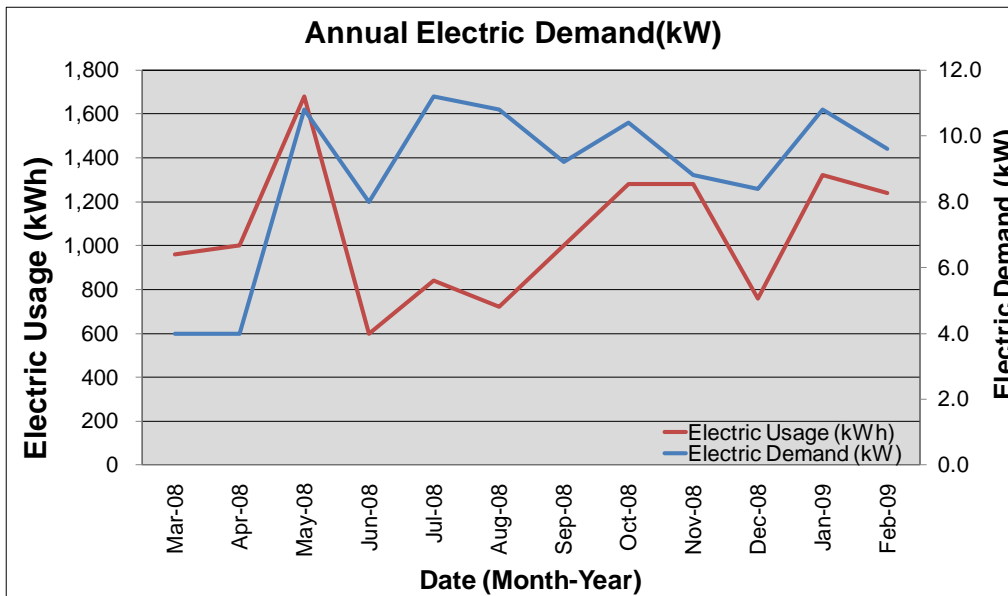
## 6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

### 6.1. Load profiles

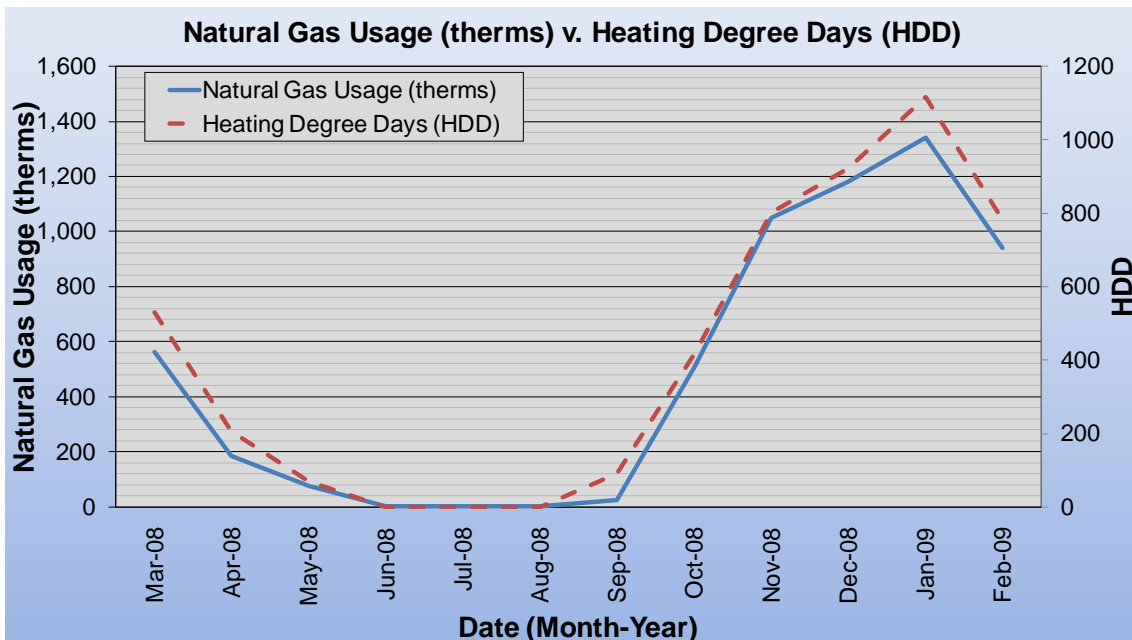
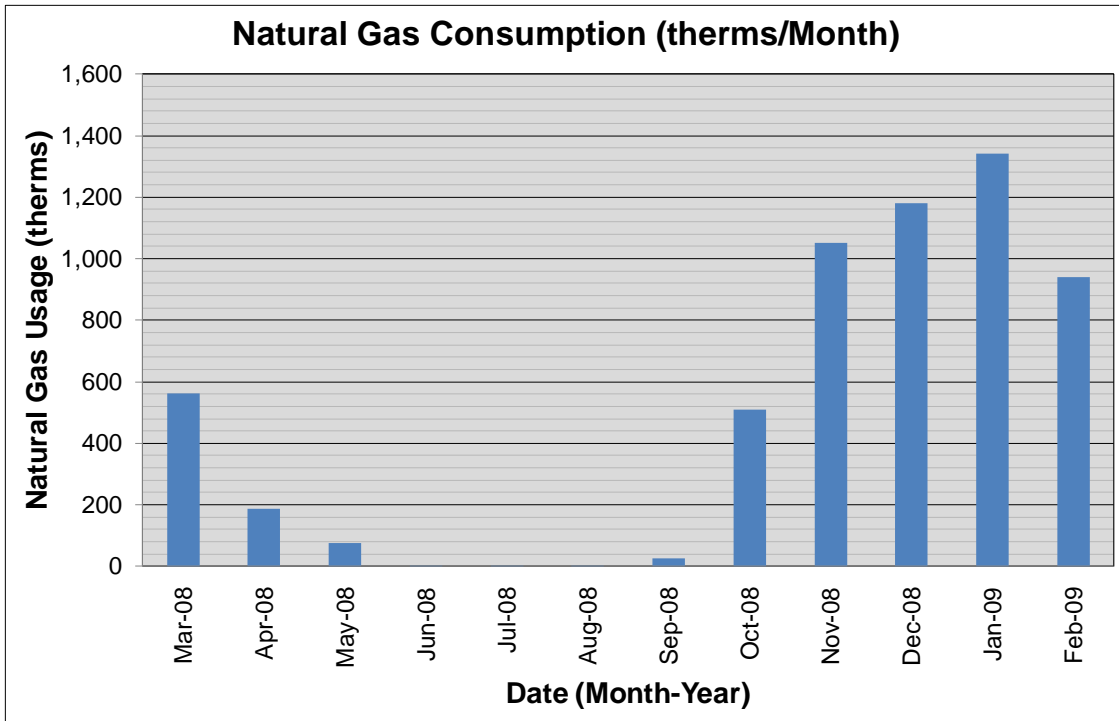
The following are charts that show the annual electric and natural gas load profiles for the Arts Guild building.



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.



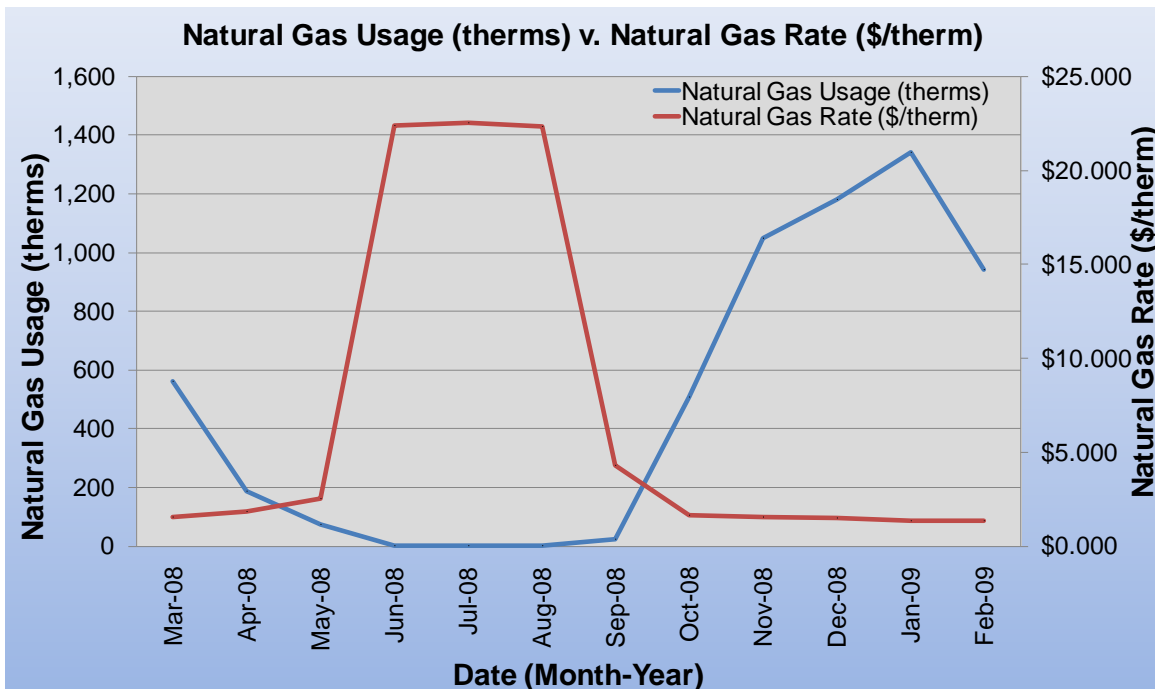
The following is a chart of the natural gas annual load profile for the building, peaking in the coldest months of the year and a chart showing natural gas consumption following the “heating degree days” curve. Some utility bills have more than one month estimated and combined.



## 6.2. Tariff analysis

The City of Rahway currently buys electricity and gas from 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 tariff option at this time; however, we suggest re-negotiating electric prices with third party suppliers (see section 6.3).



The Arts Guild building 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 Arts Guild building receives natural gas via one incoming meter. Pepco supplies the gas and Elizabethtown transports it. .

SWA analyzed the utility rate for natural gas and electricity supply over an extended period. Electric bill analysis shows fluctuations up to 54% over the most recent 12 month period. Natural gas bill analysis shows fluctuations up to 94% 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 Arts Guild building annual utility costs are \$878.55 higher for electricity, when compared to the average estimated NJ commercial utility rates; potential savings from smart energy procurement could yield even better results.

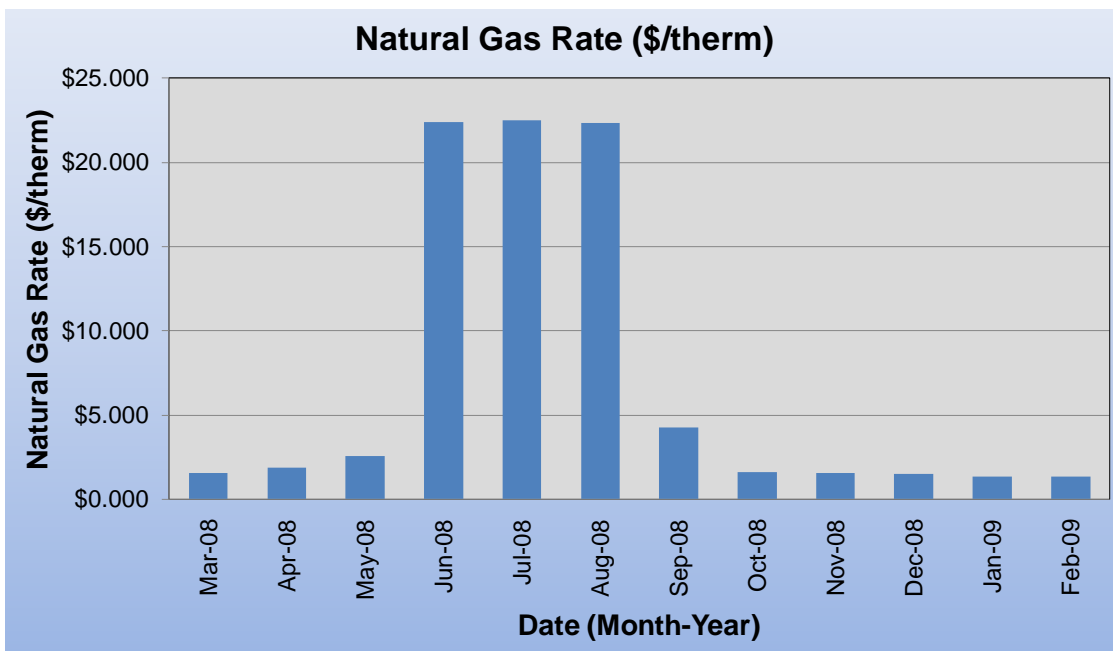
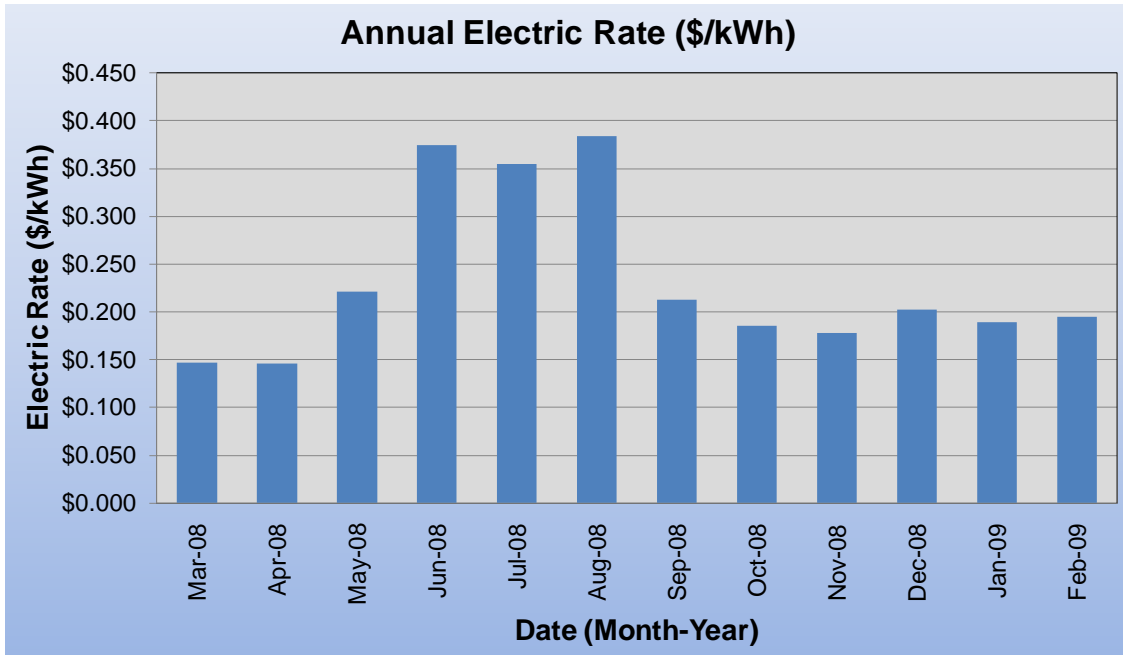
SWA recommends that the City of Rahway further explore opportunities of purchasing both natural gas and electricity from different suppliers in order to reduce rate fluctuation and the annual cost of energy for the Arts Guild building. An Energy Services Company (ESCO) is a consultancy group that engages 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 Arts Guild 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**  
 (Survey includes 2400 sqft of utilized space in the building)

Location			Existing Fixture Information										Retrofit Information										Annual Savings							
Marker	Floor	Room Identification	Fixture Type	Ballast	Lamp Type	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Controls	Operational Hours per Day	Operational Days per Year	Ballast Wattage	Total Watts	Energy Use kWh/year	Category	Fixture Type	Lamp Type	Ballast	Controls	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Operational Hours per Day	Operational Days per Year	Ballast Watts	Total Watts	Energy Use kWh/year	Fixture Savings (kWh)	Controls Savings (kWh)	Total Savings (kWh)
1	1	Gallery	Screw-in	N	Inc	7	1	75	S	3	261	0	525	411	CFL	Screw-in	CFL	N	S	7	1	25	3	261	0	175	137	274	0	274
2	1	Gallery	Screw-in	E	Inc	5	1	60	S	3	261	0	300	235	CFL	Screw-in	CFL	E	S	5	1	20	3	261	0	100	78	157	0	157
3	1	Bathroom Men	Screw-in	N	Inc	2	1	60	S	3	261	0	120	94	CFL	Screw-in	CFL	N	S	2	1	20	3	261	0	40	31	63	0	63
4	1	Bathroom Women	Screw-in	N	Inc	2	1	60	S	3	261	0	120	94	CFL	Screw-in	CFL	N	S	2	1	20	3	261	0	40	31	63	0	63
5	1	Foyer	Screw-in	N	Inc	6	1	60	S	3	261	0	360	282	CFL	Screw-in	CFL	N	S	6	1	20	3	261	0	120	94	188	0	188
6	1	Foyer	Exit Sign	N	LED	1	1	5	N	24	365	1	6	53	N/A	Exit Sign	LED	N	N	1	1	5	24	365	1	6	53	0	0	0
7	1	Rear Gallery	Parabolic	E	4T8	6	3	32	S	3	261	10	586	498	N/A	Parabolic	4T8	E	S	6	3	32	3	261	10	586	498	0	0	0
8	1	Rear Gallery	Screw-in	N	Inc	14	2	75	S	3	261	0	2,100	1,644	CFL	Screw-in	Inc	N	S	14	2	25	3	261	0	700	548	1096	0	1096
9	1	Closet	Screw-in	N	Inc	1	1	60	S	1	261	0	60	16	CFL	Screw-in	CFL	N	S	1	1	20	1	261	0	20	5	10	0	10
10	1	Bathroom	Screw-in	N	Inc	1	1	60	S	3	261	0	60	47	CFL	Screw-in	CFL	N	S	1	1	20	3	261	0	20	16	31	0	31
11	1	Closet	Parabolic	E	4T8	1	2	32	S	1	261	6	70	18	N/A	Parabolic	4T8	E	S	1	2	32	1	261	6	70	18	0	0	0
12	1	Office	Parabolic	E	4T8	3	3	32	S	3	261	10	298	249	N/A	Parabolic	4T8	E	S	3	3	32	3	261	10	298	249	0	0	0
13	1	Office	Parabolic	E	4T8	22	2	32	OS	3	261	6	1,414	1,206	N/A	Parabolic	4T8	E	OS	22	2	32	3	261	6	1,414	1,206	0	0	0
14	1	Office	Screw-in	E	CFL	12	1	39	S	3	261	8	476	442	N/A	Parabolic	8T5	E	S	12	1	39	3	261	8	476	442	0	0	0
15	B	Cellar	Screw-in	N	Inc	2	1	75	S	1	261	0	150	39	CFL	Screw-in	CFL	N	S	2	1	25	1	261	0	50	13	26	0	26
16	B	Cellar	Screw-in	N	Inc	7	1	60	S	1	261	0	420	110	CFL	Screw-in	CFL	N	S	7	1	20	1	261	0	140	37	73	0	73
17	1	Gallery	Parabolic	E	4T5	12	1	28	S	3	261	3	339	291	N/A	Parabolic	4T5	E	S	12	1	28	3	261	3	339	291	0	0	0
18	Ext	Exterior	Exterior	E	MH	2	1	250	S	4	365	63	563	914	MH	Exterior	MH	E	S	2	1	1	4	365	63	563	914	727	0	0
<b>Totals:</b>						<b>106</b>	<b>25</b>	<b>1,095</b>				<b>107</b>	<b>7,967</b>	<b>6,642</b>						<b>106</b>	<b>25</b>	<b>416</b>			<b>5,157</b>	<b>4,661</b>	<b>2,708</b>	<b>0</b>	<b>1,981</b>	

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

Proposed Lighting Summary Table				
Total Surface Area (SF)	34,157			
Average Power Cost (\$/kWh)	0.2190			
Exterior Lighting		Existing	Proposed	Savings
Exterior Annual Consumption (kWh)	914	914	0	0
Exterior Power (watts)	563	563	0	0
Total Interior Lighting		Existing	Proposed	Savings
Annual Consumption (kWh)	5,728	3,747	1,981	
Lighting Power (watts)	7,404	4,594	2,810	
Lighting Power Density (watts/SF)	0.22	0.13	0.08	
Estimated Cost of Fixture Replacement (\$)	2,359			
Estimated Cost of Controls Improvements (\$)	0			
<b>Total Consumption Cost Savings (\$)</b>	<b>462</b>			

Legend				
Fixture Type	Lamp Type	Control Type	Ballast Type	Retrofit Category
Exit Sign	LED	N (None)	N/A (None)	N/A (None)
Screw-in	Inc (Incandescent)	S (Switch)	E (Electronic)	T8 (Install new T8)
Pin	1T5	OS (Occupancy Sensor)	M (Magnetic)	T5 (Install new T5)
Parabolic	2T5	T (Timer)		CFL (Install new CFL)
Recessed	3T5	PC (Photocell)		LED (Install new LED Exit)
2U-shape	4T5	D (Dimming)		LED (Install new LED)
Circiline	2T8	DL (Daylight Sensor)		D (Delamping)
Exterior	3T8	M (Microphonic Sensor)		C (Controls Only)
	4T8			PSMH (Install new Pulse-Start Metal Halide)
	6T8			
	8T8			
	2T12			
	3T12			
	4T12			
	6T12			
	8T12			
	CFL (Compact Fluorescent Lightbulb)			
	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>

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

**ELIZABETHTOWN GAS COMPANY NATURAL GAS SERVICE TERRITORY**

**Last Updated: 06/15/09**

<p><b>Cooperative Industries</b> 412-420 Washington Avenue Belleville, NJ 07109 800-6BUYGAS (6-289427) <a href="http://www.cooperativenet.com">www.cooperativenet.com</a></p>	<p><b>Direct Energy Services, LLP</b> 120 Wood Avenue, Suite 611 Iselin, NJ 08830 866-547-2722 <a href="http://www.directenergy.com">www.directenergy.com</a></p>	<p><b>Glacial Energy of New Jersey, Inc.</b> 207 LaRoche Avenue Harrington Park, NJ 07640 1-877-569-2841 <a href="http://www.glacialenergy.com">www.glacialenergy.com</a></p>
<p><b>Gate way Energy Services Corp.</b> 44 Whispering Pines Lane Lakewood, NJ 08701 800-805-8586 <a href="http://www.gesc.com">www.gesc.com</a></p>	<p><b>UGI Energy Services, Inc. d/b/a GASMARK</b> 704 East Main Street, Suite 1 Moorestown, NJ 08057 856-273-9995 <a href="http://www.ugienergyservices.com">www.ugienergyservices.com</a></p>	<p><b>Great Eastern Energy</b> 116 Village Riva, Suite 200 Princeton, NJ 08540 888-651-4121 <a href="http://www.greateastern.com">www.greateastern.com</a></p>
<p><b>Hess Energy, Inc.</b> One Hess Plaza Woodbridge, NJ 07095 800-437-7872 <a href="http://www.hess.com">www.hess.com</a></p>	<p><b>Metromedia Energy, Inc.</b> 6 Industrial Way Eatontown, NJ 07724 877-750-7046 <a href="http://www.metromediaenergy.com">www.metromediaenergy.com</a></p>	<p><b>Intelligent Energy</b> 2050 Center Avenue, Suite 500 Fort Lee, NJ 07024 800-724-1880 <a href="http://www.intelligentenergy.org">www.intelligentenergy.org</a></p>
<p><b>MxEnergy, Inc.</b> 510 Thornall Street, Suite 270 Edison, NJ 088327 800-375-1277 <a href="http://www.mxenergy.com">www.mxenergy.com</a></p>	<p><b>NATGASCO (Mitchell Supreme)</b> 532 Freeman Street Orange, NJ 07050 800-840-4GAS <a href="http://www.natgasco.com">www.natgasco.com</a></p>	<p><b>Metro Energy Group, LLC</b> 14 Washington Place Hackensack, NJ 07601 888-53-Metro <a href="http://www.metroenergy.com">www.metroenergy.com</a></p>
<p><b>PPL EnergyPlus, LLC</b> 811 Church Road - Office 105 Cherry Hill, NJ 08002 800-281-2000 <a href="http://www.pplenergyplus.com">www.pplenergyplus.com</a></p>	<p><b>Stuyvesant Energy LLC</b> 10 West Ivy Lane, Suite 4 Englewood, NJ 07631 800-646-6457 <a href="http://www.stuyfuel.com">www.stuyfuel.com</a></p>	<p><b>Pepco Energy Services, Inc.</b> 112 Main Street Lebanon, NJ 08833 800-363-7499 <a href="http://www.pepco-services.com">www.pepco-services.com</a></p>
<p><b>Sprague Energy Corp.</b> 12 Ridge Road Chatham Township, NJ 07928 800-225-1560 <a href="http://www.spragueenergy.com">www.spragueenergy.com</a></p>	<p><b>South Jersey Energy Company</b> One South Jersey Plaza, Route 54 Folsom, NJ 08037 800-756-3749 <a href="http://www.sjindustries.com/sje.htm">www.sjindustries.com/sje.htm</a></p>	<p><b>Woodruff Energy</b> 73 Water Street Bridgeton, NJ 08302 800-557-1121 <a href="http://www.woodruffenergy.com">www.woodruffenergy.com</a></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. LG&EA 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 (CO<sub>2</sub>) 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 (CO<sub>2</sub>) 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 was 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 Arts Guild building was 35.97 metric tons, or 79,317 lbs of CO<sub>2</sub>, between March 2008 and 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 82% of the building's emissions, or 30 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 18% of the building's emissions, or 6 metric tons.

The Rahway Arts Guild building generates 4.17 % 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 Arts Guild has the lowest position regarding contribution of greenhouse gases relative to its square footage (2.3 lbs of CO<sub>2</sub> per Sqft). The table below shows how the Energy Conservation Measures proposed by Steven Winter Associates can reduce the Arts Guild greenhouse gas emissions:

Energy Conservation Measures Proposed by SWA					
ECM	Cost	Savings kWh/yr	Savings Therms/yr	CO2 Savings in metric tons	Total Emissions after ECM
Building Lighting Upgrades	\$2,359	1981	0	1.608607937	34.36
Install Programmable Thermostats	\$150	0	159	0.794855782	35.17
Install 5kW PV system	\$37,500	5672	0	4.605766893	31.36
<b>Total</b>	<b>\$40,009</b>	<b>7653</b>	<b>159</b>	<b>7.009230612</b>	<b>28.96</b>