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*May 29, 2009*

**Local Government Energy Program  
Energy audit report**

*For*

***Borough of Waldwick  
Waldwick, NJ 07463***

***Project Number: LGEA02***



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## **INTRODUCTION**

On March 9<sup>th</sup> & 23<sup>rd</sup>, Steven Winter Associates, Inc. (SWA) performed an energy audit and assessment of the Borough of Waldwick Department of Public Works and Department of Public Safety buildings located in Waldwick, NJ. Current conditions and energy-related information was collected in order to analyze and facilitate the implementation of energy conservation measures for the building.

Energy data collected in the field was imported into the eQUEST energy conservation software to generate a baseline model of the building. SWA simulated the installation of energy improvement measures on the baseline model of the building. Energy saving calculations and projected economics are automated and served as the basis for our conclusions.

There are two separate buildings that were evaluated for this energy audit; The Department of Public Safety and Department of Public Works buildings. The DPS building was built in 2002/2003 and houses the Borough of Waldwick Police department as well as the fire department. The building consists of 9,900 square feet of conditioned space. There are approximately 24 employees and the building is operated on a 24 hour schedule, year-round.

The DPW building houses offices and garage space for the Borough of Waldwick Department of Public Works. The office space consists of 5,000 square feet and is fully conditioned. The garage portion of the building consists of 10,000 square feet of heated only space. The DPW building is operated mostly on weekdays from 7am to 3:30pm.

The present report is for the DPW building only.

The goal of this energy audit is to provide sufficient information to make decisions regarding the implementation of the most appropriate and most cost effective energy conservation measures for the building.

## EXECUTIVE SUMMARY

An energy audit was performed and two separate reports were created for the Borough of Waldwick. The first report covers the Department of Public Safety (DPS) building located at 15 E. Prospect Street, Waldwick, NJ 07463. The second report covers the Department of Public Works (DPW) building located at 19 Industrial Park, Waldwick, NJ 07463. The Department of Safety building is a one story building that houses both the Borough of Waldwick Police Headquarters and Fire Station. The Department of Public Works building houses both garage space and office space for the Borough of Waldwick Department of Public Works. Based on the field visits performed by Steven Winter Associates (SWA) staff on March 9<sup>th</sup> and March 23<sup>rd</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 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.

In the most recent year (2008), the Borough of Waldwick DPW building consumed approximately 61,564 kWh or \$10,961.12 worth of electricity and 8,215 therms or \$11,967.51 worth of natural gas. With electricity and gas combined, the building consumed 1032 MMBtus of energy that cost a total of \$22,928.63. SWA benchmarked the DPS building using the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. The Portfolio Manager is not currently capable of generating a benchmark score for the building to compare on a national average since the building is a mix of office space and DPW garage. The Portfolio Manager is capable of generating a site energy use intensity number using 2008 as a baseline year. The site energy use intensity for the DPW building is 74 kBtu/sq.ft/year. After energy efficiency improvements are made, future utility bills can be added to the Portfolio Manager and the site energy use intensity of a different time period can be compared to the year 2008 baseline to show changes in energy consumption over time.

SWA recommends a total of 5 Energy Conservation Measures (ECMs) for the DPW building. The total investment cost for these ECMs is **\$71,242**. The total investment cost for these ECMs if maximum incentives are achieved is **\$68,792** with the addition of a possible **\$40,000** loan. SWA estimates a first year savings of **\$5,770** with a simple payback of **12.3 years**.

There are various incentives that the DPW building could apply for that could also help lower the cost of installing the ECMs. SWA recommends that the DPW building applies 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. Specifically, the building could qualify for up to \$720 for replacing the central DX AC rooftop HVAC units and up to \$1,590 in prescriptive lighting measures. The DPW would also qualify for up to \$140 for installing the recommended wall-mounted occupancy sensors. The DPW building could also take advantage of incentives based on the installation of a photovoltaic (PV) system. Currently, the New Jersey Office of Clean Energy offers a Renewable Energy Incentive program that would pay \$5,000 for the installation of a 5kW PV 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. There is also a utility-sponsored loan program through PSE&G that would allow the building to pay for the installation of the PV system through a loan issued by PSE&G. This loan would cover the installation cost of the PV system and would be paid for through SRECs over a 15 year period. The total investment cost if all the incentives are paid to their maximum amount is **\$68,792** with the possibility of a \$40,000 loan for the PV system.

The following table summarizes the proposed Energy Conservation Measures (ECM) and their economical relevance.

**SCOPE OF WORK – SUMMARY TABLE**

ECM#	ECM description	Installed Cost		1st year energy savings					SPP	LoM	Lifetime	
		Estimated \$	Source	Usage	Unit	Demand	Unit	\$ Savings/year			Cost Savings	ROI
1	Re-insulate plenum	\$ 8,400	Estimated	406	therms	0.0	-	\$ 816	10.3	20	\$ 11,919	2.1%
2	Airseal doors and windows in office	\$ 3,871	Estimated	177	therms	0.0	-	\$ 357	10.9	15	\$ 4,196	0.6%
3	Replace rooftop HVAC units	\$ 8,500	RMeans	1,820	kWh	0.2	kW	\$ 316	26.9	15	\$ 3,720	-3.7%
4	Replace various lighting	\$ 10,471	RMeans	5,293	kWh	0.6	kW	\$ 921	11.4	20	\$ 13,452	1.4%
5	Install 5kW PV system	\$ 40,000	RMeans	5,250	kWh	2.0	kW	\$ 3,360	11.9	25	\$ 57,225	1.7%
<b>Total</b>	<b>Total Scope of Work</b>	<b>\$ 71,242</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2.8</b>	<b>kW</b>	<b>\$ 5,770</b>	<b>12.3</b>		<b>\$ 90,513</b>	

**Definitions:**

SPP: Simple Payback (years)

LoM: Life of Measure (years)

ROI: Return on Investment (%)

**Assumptions:**

Discount rate: 3.2% per DOE FEMP guidelines

Energy price escalation rate: 0% per DOE FEMP guidelines

## 1. HISTORIC ENERGY CONSUMPTION

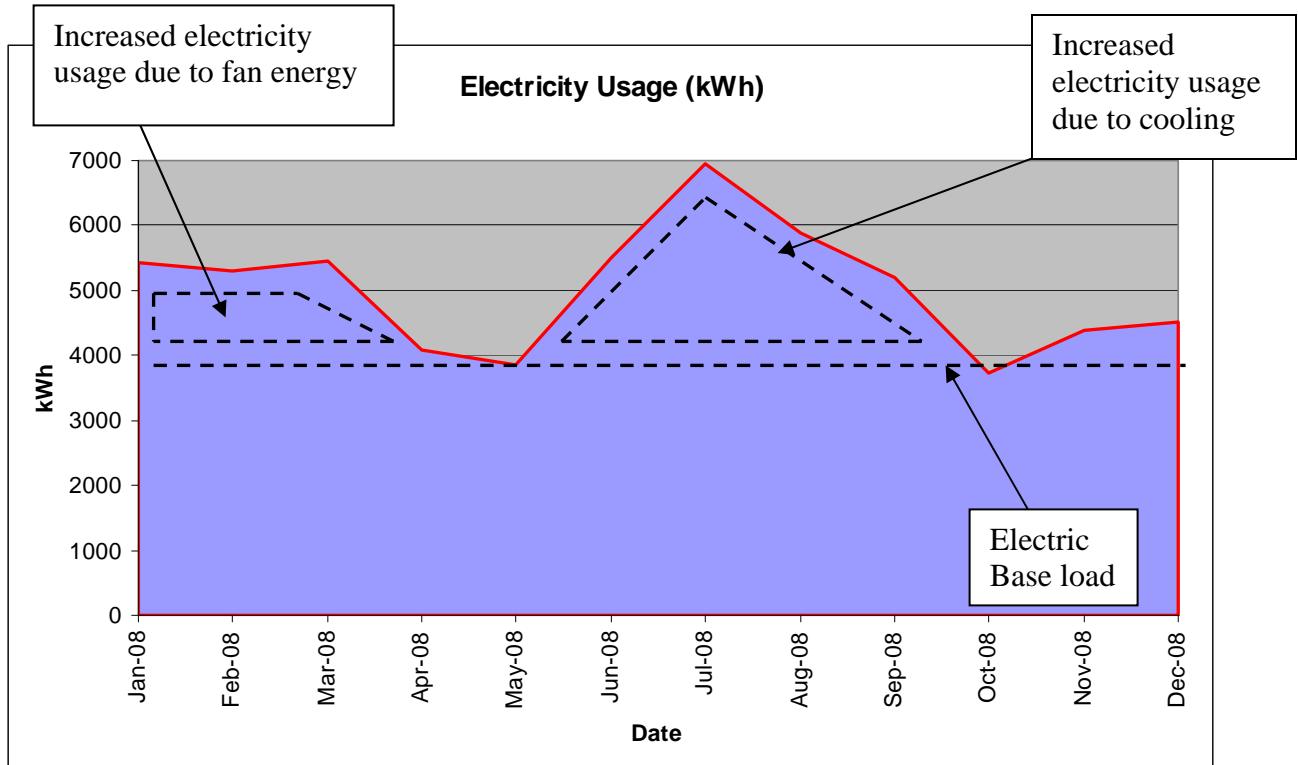
### 1.1. Energy usage and cost analysis

SWA received and analyzed utility bills from January 2007 through January 2009 that were received from the Borough of Waldwick.

Electricity - The DPW building has two electric meters for incoming electricity supply. One meter covers the entire electrical supply for the building and the other meter is dedicated to the DPW sign outside of the building. The building buys electricity from PSE&G at **an average aggregated rate of \$.178/kWh** based on 2008 electric bills. The building purchased **approximately 61,564 kWh or \$10,961.12 worth of electricity in 2008**. Based on 2008 data, the building also has **an average monthly demand of 22.8 kW and monthly peak demand of 28.0 kW**.

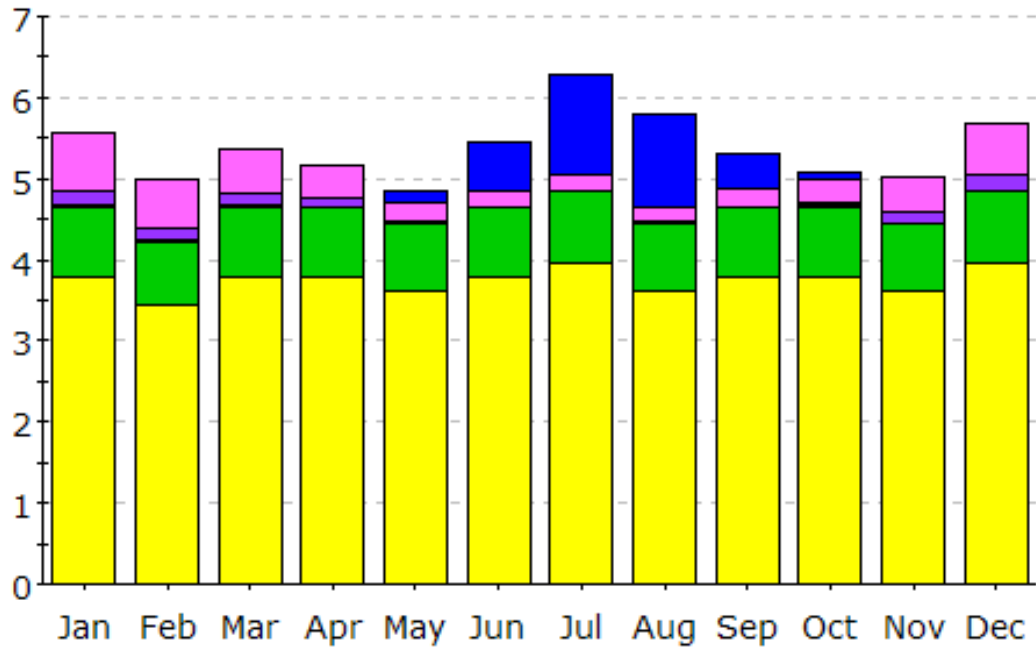
Natural Gas – The DPW building has one gas meter for incoming natural gas from PSE&G. In 2008, the **average aggregated rate for natural gas was \$1.46/therm**. The building purchased **approximately 8,215 therms or \$11,967.51 worth of natural gas in 2008**.

The following chart shows electricity usage for the DPW building based on utility bills for the year 2008.



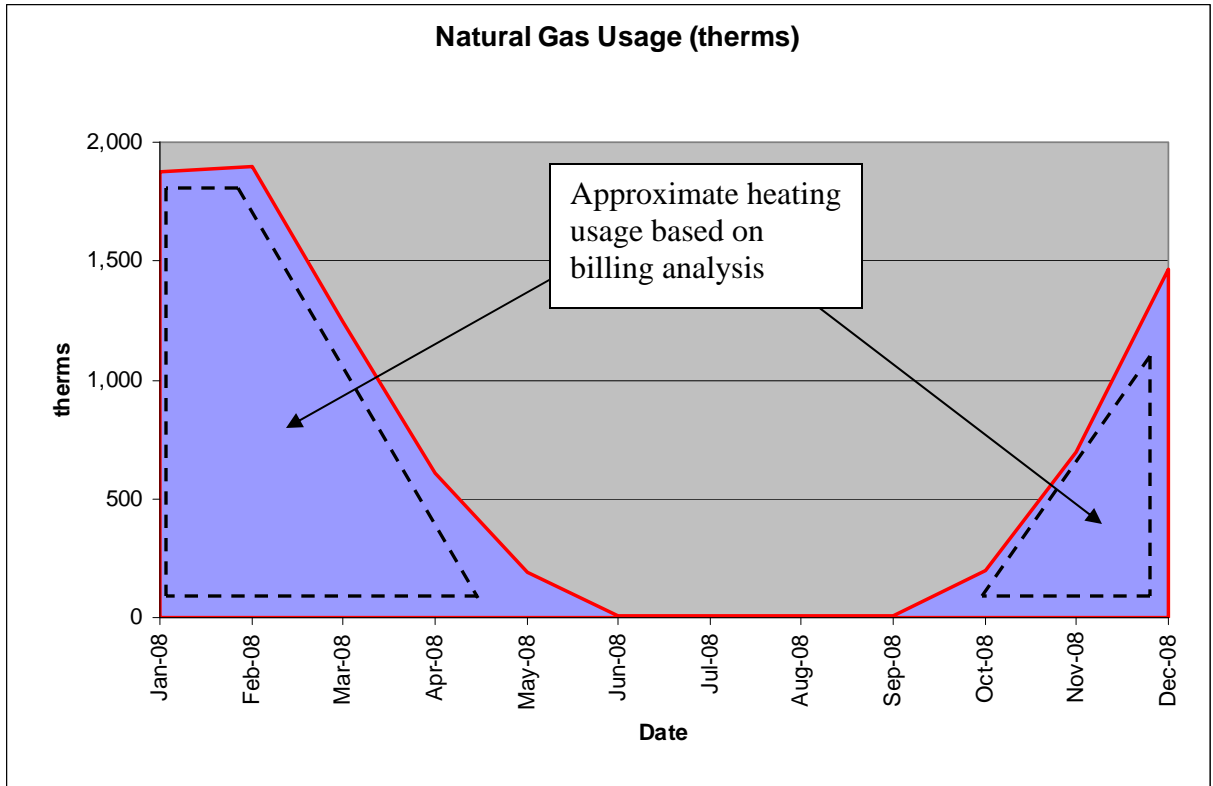
In the above chart, we can see a clear electric base load by looking at the shoulder months (May, October) when we are between seasons and using minimal heating or cooling. The electricity for the DPW peaks in the summer as expected due to cooling but also in the winter due to the use of fan energy to assist in heating the building. Below is an electricity usage chart from the DPS eQUEST model that shows the same trend but also breaks down the electricity usage by end use.

(x000) **Electric Consumption (kWh)**

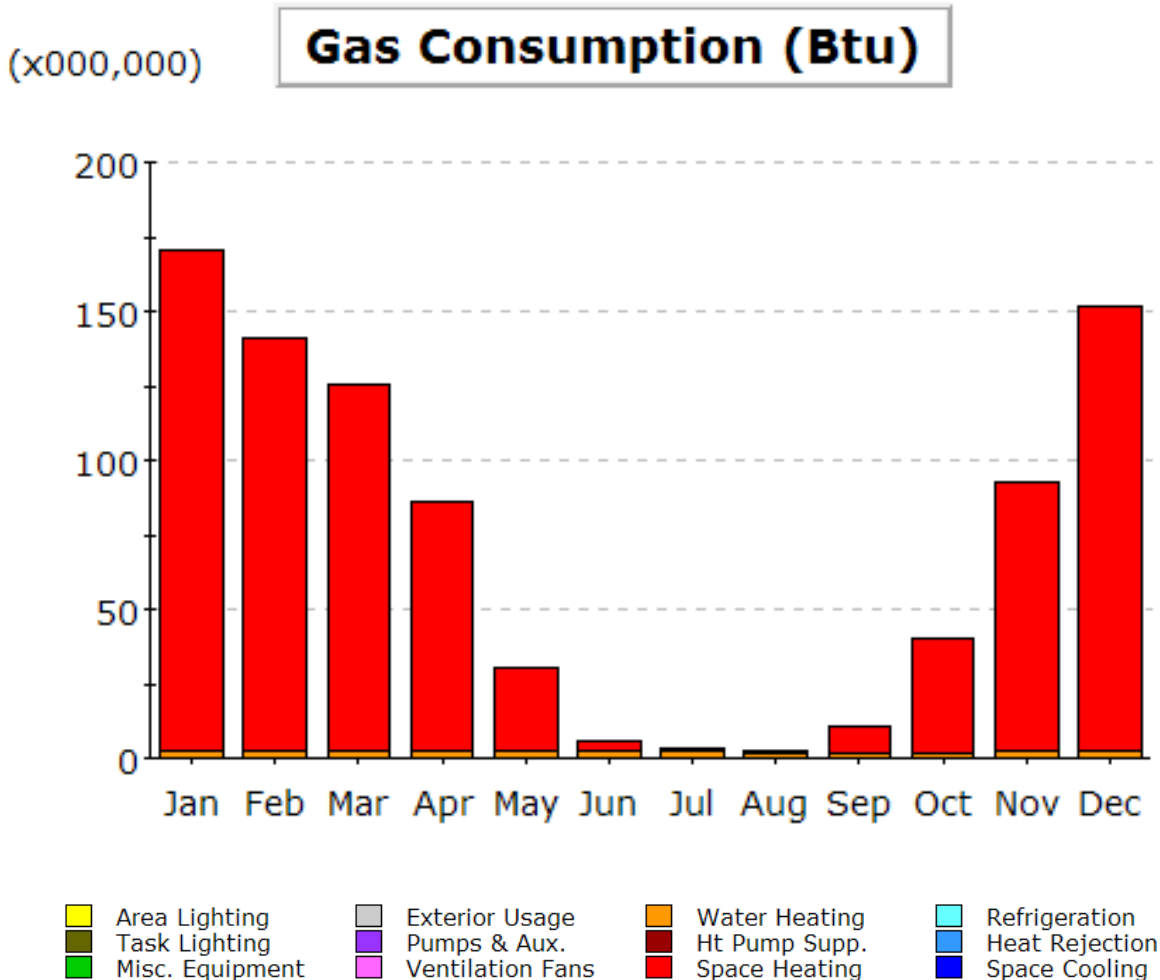


- Area Lighting
- Misc. Equipment
- Pumps & Aux.
- Ventilation Fans
- Exterior Usage
- Space Heating
- Water Heating
- Ht Pump Supp.
- Refrigeration
- Heat Rejection
- Space Cooling

The following chart shows the natural gas usage for the DPW building base on utility bills for the year 2008.



In the above chart, the natural gas usage follows a heating trend as expected. During the summer it is clear that the natural gas usage is very minimal which reflects that heat is not being used and the DHW load is minimal. This usage is similarly reflected in the chart below, taken from the eQUEST model. This chart also shows an estimated breakdown of natural gas by end use.



### 1.2. Utility rate

The DPW building currently buys electricity and gas from PSE&G at the BGS general service rate. The BGS general service is a typical rate where customers pay for natural gas based on usage and electricity based on usage with the addition of an electrical charge demand. The DPW building uses account #31 970 924 57, which is an electric only account that monitors the exterior sign at the service address of 19 Industrial Park, Waldwick, NJ 07463. The DPW building uses account #31 780 027 58 at the service address of 19 Industrial Park, Waldwick, NJ 07463 for the building electric and gas. Electricity for the exterior sign was billed at an average rate of **\$0.252/kWh**. Electricity for the building was billed at an average rate of **\$0.174/kWh** and gas was billed at an average aggregated rate of **\$2.01/therm**.

### 1.3. Energy benchmarking

The DPW building information and utility data were entered into the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* energy benchmarking system. The building data could be documented; however, a performance score could not be generated since the building is mixed use of office space and DPW garage. The Energy Star Portfolio Manager

currently is not capable of generating a benchmark score for certain building types such as DPW garages. SWA recommends that the Borough of Waldwick create a Portfolio Manager account at the link below. When an account is created, SWA can share the Borough of Waldwick facilities and allow future data to be added and tracked using the benchmarking tool.

[http://www.energystar.gov/index.cfm?c=evaluate\\_performance.bus\\_portfoliomanager](http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager)

OMB No. 2060-0347



**STATEMENT OF ENERGY PERFORMANCE**  
**Borough of Waldwick - DPW Building**

Building ID: 1693774  
 For 12-month Period Ending: November 30, 2008<sup>1</sup>  
 Date SEP becomes ineligible: N/A

Date SEP Generated: May 26, 2009

<b>Facility</b> Borough of Waldwick - DPW Building 19 Industrial Park Waldwick, NJ 07463	<b>Facility Owner</b> N/A	<b>Primary Contact for this Facility</b> N/A
---------------------------------------------------------------------------------------------------	------------------------------	-------------------------------------------------

Year Built: 1987  
 Gross Floor Area (ft<sup>2</sup>): 15,000

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

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

Natural Gas (kBtu) <sup>4</sup>	888,526
Electricity (kBtu)	216,244
Total Energy (kBtu)	1,104,770

**Energy Intensity<sup>5</sup>**

Site (kBtu/ft <sup>2</sup> /yr)	74
Source (kBtu/ft <sup>2</sup> /yr)	110

**Emissions (based on site energy use)**

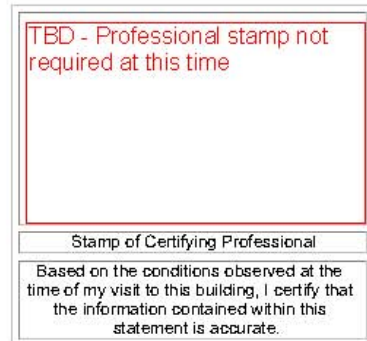
Greenhouse Gas Emissions (MtCO <sub>2</sub> e/year)	80
-----------------------------------------------------	----

**Electric Distribution Utility**

PSE&G - Public Service Elec & Gas Co

**National Average Comparison**

National Average Site EUI	104
National Average Source EUI	213
% Difference from National Average Source EUI	-48%
Building Type	Other



**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:**

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 (20221), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460.

EPA Form 5800-16

## **2. FACILITY AND SYSTEMS DESCRIPTION**

### **2.1. Building Characteristics**

The DPW building was built approximately 22 years ago and currently houses both office space and the DPW garage. The building has a total floor area of 15,000 square feet; 10,000 square feet of DPW garage and 5,000 square feet of office space. The office section is typical one-story office space while the garage is a high bay garage with storage for DPW equipment.

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

During the site visit, there were approximately 5 employees observed in the building at once. The building is operated from 7:30am until 3pm, Monday through Friday, unless conditions such as winter weather required workers to access DPW equipment during off hours.

### **2.3. Building envelope**

#### **2.3.1. Exterior walls**

The exterior walls consist of 8” CMU blocks with no insulation. While insulation could be added to the exterior walls of the building, SWA has determined that it is not cost effective to do so at this time. SWA recommends that if any portion of the building is rehabbed or improved as part of a capital improvement plan, to add extra insulation to keep the building thermally protected whenever possible.

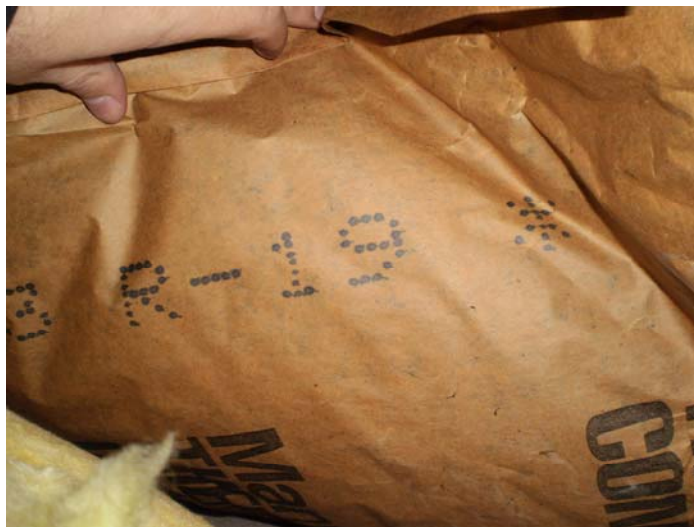
#### **2.3.2. Roof**

The roof of the building is flat and was recently replaced with a silicone membrane on a metal deck. The roof surface appeared to be in good condition and would not be cost effective to upgrade at this point in time.

The plenum above the office area between the ceiling and roof was observed and showed some deficiencies in insulation. Below is a photograph of the insulation located on the ceiling, located within the plenum above the office area.



Plenum above office – batt insulation is compressed and out of place



R-19 batt insulation observed in the plenum

SWA observed that the R-19 batt insulation located in this plenum was compressed and moved around over time as the roof was accessed for different reasons. SWA recommends air-sealing and replacing deficient R-19 batts with insulation of a higher R-value. SWA recommends caulking the ceiling tiles in-place to form a tighter airseal, re-using batts that are in good shape and substituting new batts for deficient ones and also adding approximately R-11 worth of blown insulation on top of the batt insulation. Since there is equipment located in this plenum that will occasionally have to be accessed, SWA recommends creating designated areas for plenum access so that blown insulation will not fall down every time the plenum is accessed.

On the day of the energy audit, the outside temperature was approximately 41°F outside and 70°F inside. When the plenum above the office was accessed, the temperature inside of the plenum was measured to be around 72°F. The higher temperature in the plenum is proof that hot air is leaking through the insulation on the ceiling and being trapped in the plenum. Allowing heat to transfer into the plenum is essentially enlarging the volume of conditioned space for the building. By completely air-sealing and re-insulating the attic, SWA believes a

significant savings will be achieved by trapping more conditioned air inside of the office space and not allowing heat transfer between the ceiling and plenum.

### **2.3.3. Base**

The building's base is 8" concrete slab-on-grade. There were no reported problems with water penetration or moisture.

### **2.3.4. Windows**

All of the windows in the building are single-pane, metal framed windows. These windows have a poor insulating quality and allow heat to transfer out of the building during the heating season and allow heat to transfer in during the cooling season. In addition to the windows being poorly insulated, many of the windows were noticed to be poorly sealed to the envelope of the building and daylight could be seen around the frame of the window. Below is a picture showing a typical window for the DPW building, with an approximate 1/4" gap around the frame of the window.



Poorly sealed window located in sign shop

### **2.3.5. Exterior doors**

The entranceways for the DPW building consist of a mix of insulated and un-insulated metal doors. A majority of these doors are poor insulators and allow expensive, conditioned air to leak out of the building. These doors consisted of metal frames as well as metal doors. The doors were observed to be missing weather-stripping so that they did not seal well to the frames. In many cases, the frame assembly was not sealed well to the building and gaps were left between the masonry and the door frame. Areas where there were large gaps between the masonry and door frame were absorbed to be stuffed with compressed insulation that has a compromised insulation value. SWA recommends air sealing around all of the doors and windows in the office portion of the building in order to prevent conditioned air from leaking outside of the building. Below is a picture of a door located in the DPW garage that was not sealed well to the frame and also lacked weather-stripping. The DPW portion of the building also could benefit from air sealing but due to the nature of the garage and how often the overhead doors open and shut, SWA deems it not cost-effective to airseal these doors at this time; however, insulated panels should be installed as these doors are replaced and a tight air seal around the doors should be kept consistent.

Unsealed door frame  
with compressed  
insulation



Since the DPW building also houses a large garage area, there are several large garage doors. These garage doors consist of minimally insulated panels and are also not sealed well to the frame of the building. SWA does not deem it cost-effective to replace these doors at this time but when these garage panel doors are replaced, they should be replaced with well-insulated panels and weather-stripping the doors well enough to make a seal when the door is closed. During winter months especially, the leakage through and around these doors allow conditioned air to flow outside wasting energy. Below is a picture of one of these doors.



Daylight seen  
around doors

### 2.3.6. Building air tightness

The DPW garage and offices both have unique air tightness. The DPW garage has an extremely leaky shell with poor air sealing to separate conditioned air from outside air. Due to the nature of the garage, overhead doors are constantly opening and closing which lessen the effects of air sealing in the building envelope itself. The DPW offices are relatively air tight with the exception of the plenum above the drop ceiling. The drop ceiling provides a poor air and thermal seal from the plenum above and therefore, the volume of the building that requires heat is expanded. Conditioned air is allowed to leak into the plenum, which is approximately 8' by 5,000 square feet (40,000 cubic feet), and therefore increases the heating demand on the boiler. The plenum essentially creates a large and unnecessary heating load on the heating system.

## **2.4. HVAC systems**

### **2.4.1. Heating**

The DPW building has three distinct areas; each with their own mechanical system. The building is broken up into an office area, a smaller garage and a larger garage. The office area heating system that consists of rooftop units is ducted through the plenum to the different office areas. The garage areas consist of ceiling-mounted units that blow heated air directly into the space without ducting.

#### **DPW Office**

The DPW office area contains two 5 ton roof top Carrier units for electric DX cooling and gas heating. These units are ducted via a plenum to the office areas below the roof/ceiling. These units are approximately 22 years old and likely use R11 as a refrigerant.

#### **Smaller Garage**

The smaller garage houses three Reznor gas-fired linear radiant heaters in the ceiling. These units are from 1988 and each has an output of 71.4 MBtuh. This area does not have cooling. A single 3-phase, wall-mounted fan exhausts this area. SWA recommends replacing all three Reznor gas heaters with updated models that are at least 16% more efficient.

#### **Larger Garage**

The larger garage houses nine Reznor gas-fired radiant heaters in the ceiling. These units are also from 1988 and have an output of 71.5 MBtuh. There are also three Reznor gas-fired radiant heaters in the ceiling that were installed in 2008. These units are smaller with an output of 60 MBtuh. Two wall thermostats control all twelve of the radiant heaters. There are two 3-phase, ceiling-mounted fans that exhaust this area. SWA recommends replacing the nine Reznor gas heaters with updated models that are at least 16% more efficient.

All of the HVAC systems for the entire building have been in service for more than 20 years, except for the three newer Reznor heaters in the larger garage, and are now outliving their expected lifespan. Better energy performance should be expected when older radiant units are replaced with newer energy efficient units. As per manufacturer stipulations, their efficiency goes down below 50% or less of their original value. These units are obviously consuming much more energy and incurring more utility expenses and also emitting much more Green House Gases (GHG) than necessary.

### **2.4.2. Cooling**

The cooling system serves only the office portion of the building. The two rooftop Carrier units for the office area provide both electric DX cooling as well as gas heating. These units were installed in 1988 and likely have an EER of less than 6.5. These units are highly inefficient and also likely contain R22 refrigerant. R22 CFC refrigerant has been totally discontinued since 2000. SWA recommends replacing these units with new, higher efficient units with an EER of 12. SWA also recommends specifying R410A refrigerant since R22 CFC refrigerant has been totally discontinued since 2000.

### 2.4.3. Ventilation

Air-handling units are used for the office and bring in outside air and condition it before it enters the building. The smaller garage contains one 3 phase wall-mounted exhaust fan. The larger garage contains two 3 phase ceiling mounted exhaust fans.

### 2.4.4. Domestic Hot Water

Domestic Hot Water is provided to the office area only by a natural gas direct-fired hot water storage tank. The storage tank has a capacity of 50 gallons of storage and an output of 40 MBtuh.

More efficient hot water appliances will save energy through reduced energy consumption for water heating and money; through reducing water and sewer bills. Energy savings appliances bearing the ENERGY STAR label should be selected to ensure efficiency performance. No appliances were accessed during this audit.

## 2.5. Electrical systems

### 2.5.1. Lighting

*Interior Lighting* – The DPW building showed a great need for updated lighting throughout the office and garage areas. All of the fixtures appeared to be original to the building and contained inefficient ballasts as well as inefficient fluorescent bulbs. SWA recommends replacing all magnetic ballasts with electronic ballasts and all T12 fluorescent bulbs with T8 fluorescent bulbs. Replacing the magnetic ballasts alone will result in a 15-20% savings per light fixture and replacing T12 bulbs with T8 bulbs will result in an additional 10-15% savings per light fixture. SWA does not recommend replacing the bulbs only since the savings will only be fractional. T8 bulbs were not meant to be installed in T12 magnetic ballasts and could severely reduce the lifetime of each bulb. There are currently no occupancy sensors installed within the DPW building. SWA recommends installing wall-mounted occupancy sensors in the office areas of the building in order to limit the amount of time that lights are left on unnecessarily. See the lighting schedule attached in the Appendix A for complete lighting retrofit details.

*Exit Lights* – The building has 11 exit signs installed, 6 of which are older fluorescent type fixtures. Fluorescent exit signs waste an unnecessary amount of energy since they run 24 hours per day and should be upgraded to newer LED exit signs. SWA recommends replacing all fluorescent exit signs with newer 5W LED models. **Replacing the 6 fluorescent exit signs results in an approximate savings of 788 kWh per year or \$157.68 per year.**

*Exterior Lighting* – The exterior lighting was surveyed during the building audit. SWA has deemed it not cost effective to replace exterior lighting at this time. All exterior lighting is controlled by a timer. There is no need for any immediate upgrade of lighting or timer however, SWA recommends adjusting the timer to limit the amount of time the exterior lights are on to only when necessary. It is important for the building maintenance staff to stay aware of Daylight Savings Time and adjust the timer accordingly.

### **2.5.2. Appliances and process**

SWA has surveyed all appliances installed at the DPW building and have deemed that it would not be cost effective to replace any appliances at this time. SWA recommends that whenever any appliances including hand dryers, computers, refrigerators, etc. are purchased that the most energy efficient options are always chosen, including Energy Star labeled equipment.

### **2.5.3. Elevators**

The DPW building is a one-story building and therefore has no elevator installed.

### **2.5.4. Other electrical systems**

There are currently no other electrical systems in the building.

### 3. EQUIPMENT LIST

#### INVENTORY

Building System	Description	Model#	Fuel	Space served	Estimated Remaining useful life %
Heating/Cooling	Two 5 ton rooftop Carrier units – electric DX cooling and gas heating ducted to office areas below the roof/ceiling; likely uses R11 refrigerant	48 HDT 006570	Natural Gas/Electric	Office Area	0% (unit no longer performs efficiently)
Heating	Three Reznor gas-fired, linear radiant heaters mounted in ceiling of smaller garage, 71.5 MBtuh, installed in 1988	R1RH75-1-A	Natural Gas	Smaller Garage	30%
Heating	Nine Reznor gas-fired, radiant heaters mounted in ceiling of larger garage, 71.5MBtuh, installed in 1988	R1RH75-1-A	Natural Gas	Larger Garage	30%
Heating	Three Reznor gas-fired radiant heaters mounted in ceiling of larger garage, 60MBtuh, installed in 2008	R1HN60	Natural Gas	Larger Garage	95%
Domestic Hot Water	One Rudd gas-fired hot water storage tank, 40MBtuh, 50 gallons	PVP 50E-1A	Natural Gas	Office Area	30%
Lighting	See details appendix A	-	-	-	-

**Note:**

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

#### 4. ENERGY CONSERVATION MEASURES

##### Summary table

<b>ECM#</b>	<b>Description</b>
<b>1</b>	<b>Re-insulate plenum; The plenum above the office ceiling allows excess conditioned air to escape and wastes a significant amount of heating energy. The existing insulation should be removed and replaced with more insulation</b>
<b>2</b>	<b>Airseal doors and windows in office; The existing windows and doors in the office are original to the building and provide a thermal bridge between the office areas and the outside allowing heat to escape during the winter and enter during the summer. These doors and windows should be air sealed in order to limit the amount of heat/air transfer between the offices and outside</b>
<b>3</b>	<b>Replace rooftop HVAC units; The rooftop HVAC units have outlasted their existing service lives. These units are very inefficient and no longer perform as designed.</b>
<b>4</b>	<b>Lighting Upgrade; See appendix A for entire lighting retrofit schedule</b>
<b>5</b>	<b>Install 5kW PV system; Install a 5kW PV system requiring 1,500 square feet of south/west exposed roof surface in order to offset partial electric use and demand within building</b>

## ECM#1: Re-insulate plenum

### Description:

SWA observed deficient R-19 batt insulation located in the plenum above the drop-ceiling tiles of the office area. The insulation was observed to be compressed and also moved around, reducing the effective R-value of the insulation. On the day of the site visit, the outside temperature was approximately 41°F and the indoor temperature of the office space was 70°F. When the plenum was accessed, the temperature above the ceiling measured 71°F. Since hot air rises, it is evident that the heating from the building is allowed to freely trespass into the plenum. The plenum is 8 feet high by 5,000 square feet which provides a volume of 40,000 square feet that is not thermally separated from the rest of the building. Since the plenum is not properly thermally separated from the office building, heat travels right through the ceiling tiles into the plenum which greatly increases the heating load of the building. SWA recommends replacing the existing R-19 batts of insulation with new, decompressed batts of R-19 insulation with an additional six inches of blown insulation over the batts. The blown insulation will have an R-value of 11, raising the new total value of insulation to R-30. Ideally, the ceiling should also be air sealed between the insulation and drop ceiling, however this is difficult to do with a drop ceiling. SWA also recommends creating scuttle holes that allow access to key areas of the plenum in order to allow servicing of existing ducts and electrical conduits without disturbing the insulation value of the ceiling.

### Installation cost:

Estimated installed cost: \$8,400

Source of cost estimate: RS Means

### Economics:

1st year energy savings					SPP	LoM	lifetime	ROI
usage	unit	demand	unit	\$ savings			cost savings	
406	therm	0.0	-	\$ 816	10.3	20	\$ 11,919	2.1%

**Assumptions:** SWA calculated the savings for this measure using measurements taken the day of the field visit, billing analysis as well as an eQUEST model. SWA extracted natural gas usage for heating only and assumed that this measure will save 5% of the heating usage.

### Rebates/financial incentives:

*This measure does not qualify for a rebate or other financial incentive at this time.*

### Options for funding ECM:

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

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

## ECM#2: Airseal doors and windows in office

### Description:

On the day of the site visit, SWA observed that the windows and exterior doors of the office building were leaky and provided a minimal thermal barrier to the outside. The windows were metal-framed with single pane glasses and are not deemed cost-effective to replace at this time. The frames of both the windows and doors were not sealed well to the masonry of the building and allowed a significant amount of leakage around them. SWA recommends that air leakage is minimized by air sealing around all of the windows and doors of the office portion of the building. Air sealing would not be cost effective at this time in the garage areas due to nature of the building and leakage from areas besides windows and doors.

### Installation cost:

Estimated installed cost: \$3,871

Source of cost estimate: RS Means, estimate is based on rate of caulking. SWA recommends receiving an estimate from a well known air sealing company such as ZERODRAFT for a more accurate price estimate.

### Economics:

1st year energy savings					SPP	LoM	lifetime	ROI
usage	unit	demand	unit	\$ savings			cost savings	
177	therm	0.0	-	\$ 357	10.9	15	\$ 4,196	0.6%

**Assumptions:** SWA calculated the savings for this measure using measurements taken the day of the field visit, billing analysis as well as an eQUEST model. SWA assumes that the total infiltration rate for the office exterior walls only will be reduced from 0.9ACH to 0.7ACH.

### Rebates/financial incentives:

*This measure does not qualify for a rebate or other financial incentive at this time.*

### Options for funding ECM:

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

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

### ECM#3: Replace rooftop HVAC units

#### Description:

SWA observed that the two 5 ton rooftop Carrier units located on top of the office area have outlived their useful life. These units provide electric DX cooling and gas heating to the office area via ducts located in the plenum. The efficiency of these units is estimated to have an EER value of <6.5 compared to newer units with an EER value of >12. These units most likely use R11 refrigerant that was totally discontinued in 2000. SWA recommends replacing these units with newer units that have an EER value of greater than 12 and specifying that an R410A refrigerant is used.

#### Installation cost:

Estimated installed cost: \$8,500  
Source of cost estimate: RS Means

#### Economics:

1st year energy savings					SPP	LoM	lifetime	ROI
usage	unit	demand	unit	\$ savings/yr			cost savings	
1,820	kWh	0.2	kW	\$ 316	26.9	15	\$ 3,720	-3.7%

**Assumptions:** SWA calculated the savings for this measure using measurements taken the day of the field visit, billing analysis as well as an eQUEST model.

#### Rebates/financial incentives:

*NJ Clean Energy – NJ SmartStart Building Equipment Incentive, Incentive is for Central DX AC systems (\$40-\$72 per ton). Maximum incentive amount is \$720 for replacement of rooftop units.*

#### Options for funding ECM:

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

## ECM#4: Lighting Upgrade

**Description:**

The DPW building uses mostly lighting that is 22 years old and original to the building. This lighting is inefficient and can greatly be reduced by replacing each inefficient fixture. There are approximately 81 lighting fixtures throughout the building, 50 of which should be replaced. The light fixtures vary throughout the building but are mostly T12 linear fluorescent tubes in fixtures containing magnetic ballasts. Magnetic ballasts consume an excess amount of power compared to newer electronic ballast. In addition to inefficient ballasts, T12 fluorescent tubes consume more power than T8 fluorescent tubes with comparable light output. The DPW building also contains many fluorescent exit signs that consume 20W of power compared to newer LED models that consume only 5W of power. Switching from fluorescent exit signs to LED exit signs is always cost-effective since they are left on 24/7. SWA recommends replacing all fixtures containing magnetic ballasts and T12 fluorescent tubes with fixtures containing electronic ballast and T8 fluorescent tubes with similar light output. SWA also recommends that all fluorescent exit signs should also be replaced with LED models. The costs for retrofitting the lighting only, and not the occupancy sensors, have a 10% discount factored in for retrofitting all of the lighting at one time. For a complete existing and retrofit lighting schedule, please see Appendix A.

SWA also recommends installing occupancy sensors in the offices of the DPW building in order to reduce the amount of time that lights are left on. Passive infrared occupancy sensors would be the most cost-effective option to install for these offices. The occupancy sensors should be set up in a manual on – automatic off configuration. In this configuration, the lights would have to be turned on when entering the offices via a button located on the occupancy sensor. When no motion is detected within range of the occupancy sensor for a set period of time, the lights in the offices will be automatically shut off by the sensor.

**Installation cost:**

Estimated installed cost: \$10,471  
 Source of cost estimate: *RS Means*

**Economics:**

1st year energy savings					SPP	LoM	lifetime	ROI
usage	unit	demand	unit	\$ savings/yr			cost savings	
5,293	kWh	0.6	kW	\$ 921	11.4	20	\$ 13,452	1.4%

**Assumptions:** SWA calculated the savings for this measure using measurements taken the day of the field visit, and billing analysis. Costs for the lighting retrofit are taken from *RS Means* and have a 10% discount factored in to represent a cost savings associated with reduced labor for retrofitting the entire building at once. Occupancy sensors are priced as is.

**Rebates/financial incentives:**

*NJ Clean Energy – Prescriptive Lighting Incentive, Incentive based on installing T5 or T8 lamps with electronic ballasts in existing facilities (\$10-\$30 per fixture, depending on quantity of lamps). Maximum incentive amount \$1,470*

*NJ Clean Energy – Prescriptive Lighting Incentive, Incentive based on installing LED Exit signs (\$10/\$20 per fixture). Maximum incentive amount \$120*

*NJ Clean Energy – NJ SmartStart Lighting Controls Incentive, Incentive based on installing wall-mounted occupancy sensors (\$20 per fixture). Maximum incentive amount is \$140.*

**Options for funding ECM:**

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

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

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

*Please see section 5: RENEWABLE AND DISTRIBUTED ENERGY MEASURES*

## 5. RENEWABLE AND DISTRIBUTED ENERGY MEASURES

### 5.1. Existing systems

There are currently no existing renewable energy systems.

### 5.2. Solar Photovoltaic

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

##### **Description:**

Currently, the DPW building does not use any renewable energy systems. Renewable energy systems such as photovoltaic panels can be mounted on the roof and 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 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 utilities cost of providing enough electricity at that given time. Photovoltaic systems not only offset the amount of electricity usage by a building but also reduce the buildings electric demand, resulting in a higher cost savings as well. SWA recommends installing a 5kW PV system that will offset the highest annual demand for the building and allow the DPS building to actually sell electrical power back to the utility company.

##### **Installation cost:**

Estimated material cost:	\$35,000
Estimated labor cost:	\$10,000
Rebate@\$1 per watt	(\$5,000)
<b>Total installed cost:</b>	<b>\$40,000</b>

Source of cost estimate: Estimated based on similar projects

##### **Economics:**

1st year energy savings					SPP	LoM	lifetime	ROI
usage	unit	demand	unit	\$ savings/yr			cost savings	
5,250	kWh	2.0	kW	\$ 3,360	11.9	25	\$ 57,225	1.7%

**Assumptions:** SWA estimated the cost and savings of the system based on past PV projects.

##### **Rebates/financial incentives:**

*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.*

*PSE&G Solar Loan Program, 15 year payback, paid with SRECs (Solar Renewable Energy Certificates) with a floor value of >\$475, Incentive for should cover all \$40,000 of project. Entry into the program is based on available capacity.*

**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>*

### 5.3. Combined Heat and Power

#### Description:

CHP is not applicable to the DPW building because of HVAC system and limited DHW usage

### 5.4. Geothermal

#### Description:

Geothermal is not applicable for the DPW building because it would not be cost effective to change to a geothermal system

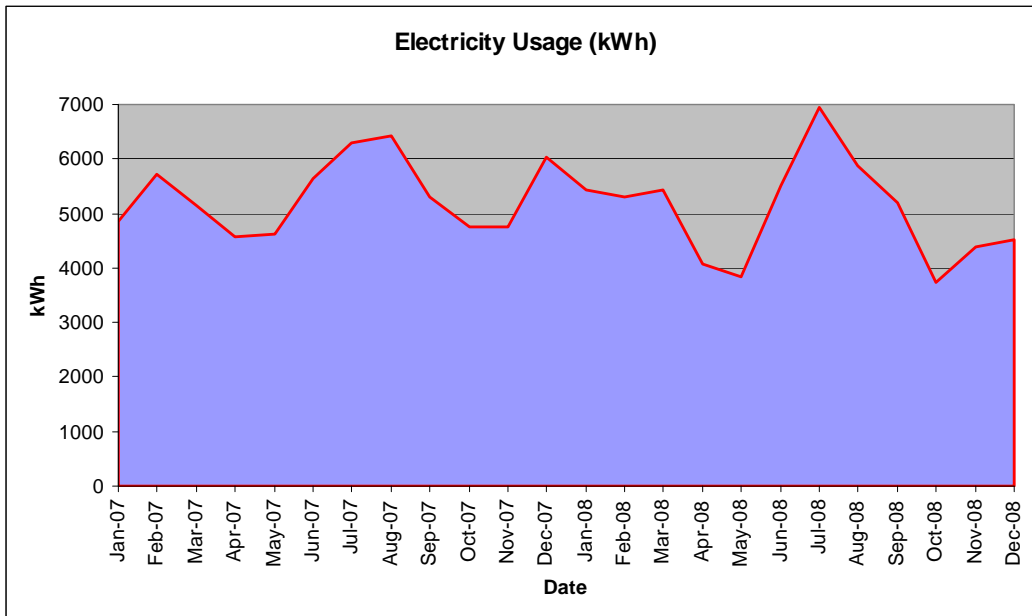
### 5.5. Wind

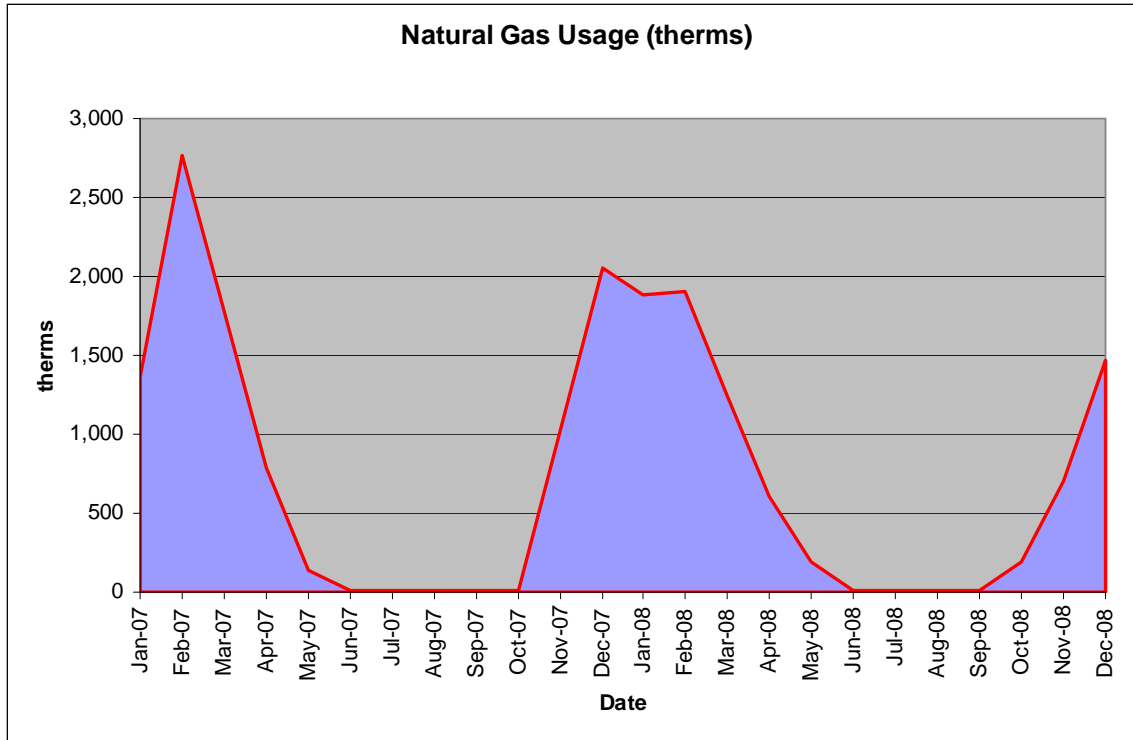
#### Description:

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.

## 6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

### 6.1. Load profiles



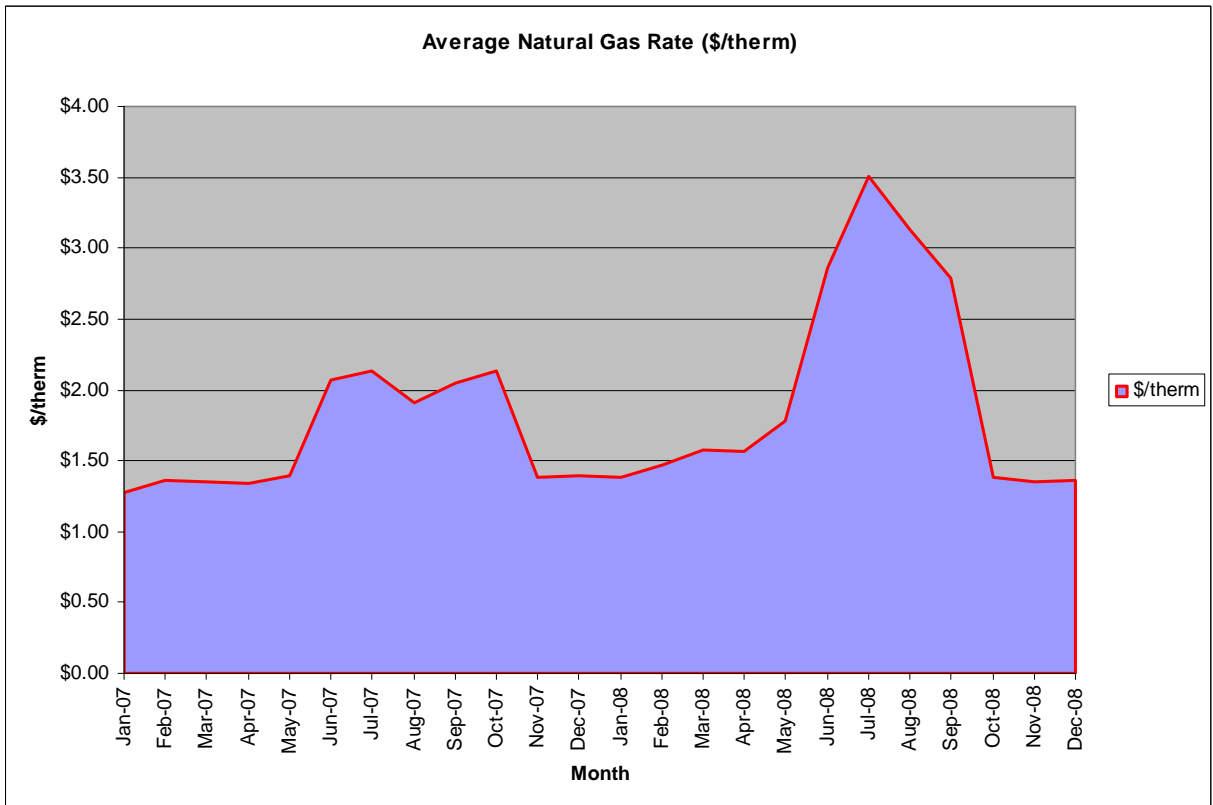
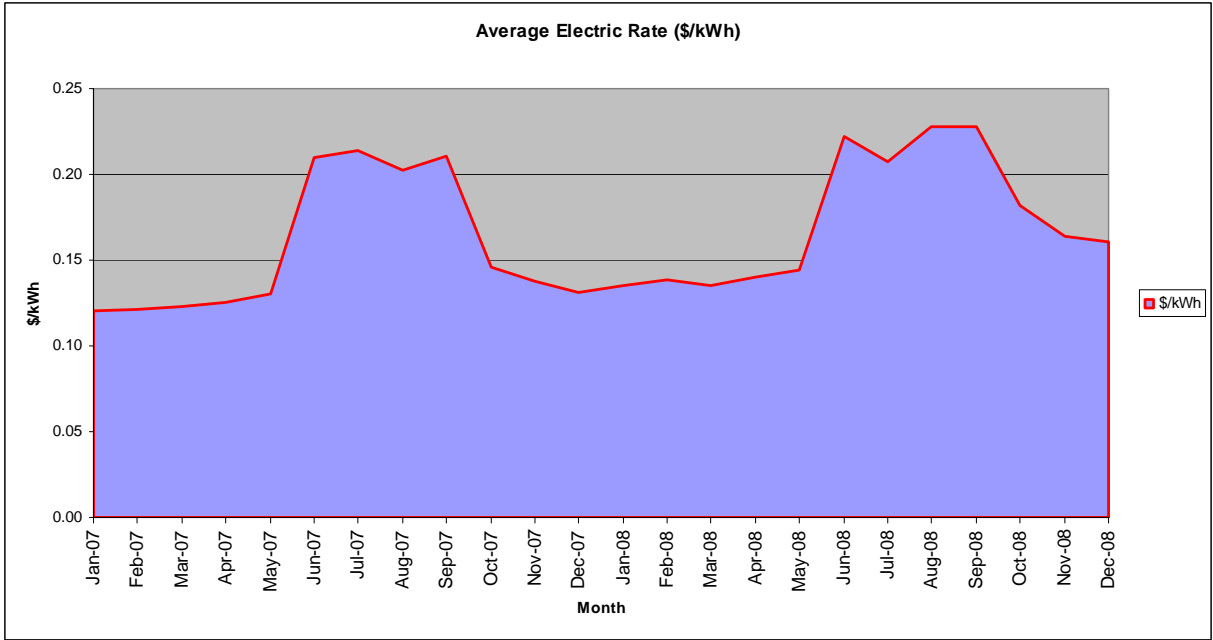


## 6.2. Tariff analysis

The DPW building currently buys electricity and gas from PSE&G at the BGS general service rate. The BGS general service is a typical rate where customers pay for natural gas based on usage and electricity based on usage with the addition of an electrical charge demand. The BGS general service rate is the best rate for the DPW building to use.

## 6.3. Energy Procurement strategies

Billing analysis shows price fluctuations of over 20% over the course of the year for the building electric account and for the natural gas account.



We recommend contacting the NJ Energy Choice program and selecting a third party energy supplier.

The building would not be eligible for enrolling in a Demand Response Program because electric demand does not exceed 50kW, which is a typical threshold for considering this option.

## 7. METHOD OF ANALYSIS

### 7.1. Assumptions and tools

Energy modeling tool: eQUEST V3.6

Cost estimates: RS Means 2009 (Facilities Maintenance & Repair Cost Data)

RS Means 2009 (Building Construction Cost Data)

RS Means 2009 (Mechanical Cost Data)

Cost estimates also based on utility bill analysis and prior experience with similar projects

### 7.2. Disclaimer

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

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

## Appendix A: Lighting study

Existing Lighting Conditions															
#	Building	Level/Floor	Location in Building	Measured Lighting Level in Footcandles	Fixture Type	Ballast Type	No. of Fixtures	No. of Lamps	Type of Lamp	Watts/Lamp	Hrs/Day	Energy Use (Watt hours/day)	Controls	Daylighting possible?	Total Power (Watts)
1	DPW	DPW Building	Garage	-	Fluorescent Exit Sign	-	2	1	Fluorescent	20	24	960	No	No	40
2	DPW	DPW Building	Carpenter's Room	46	4' Linear T8	Magnetic	1	4	Fluorescent	32	8.5	1088	No	No	128
3	DPW	DPW Building	Sign Shop	60	4' Linear T12	Magnetic	1	4	Fluorescent	40	8.5	1360	No	Yes	160
4	DPW	DPW Building	Smaller Garage	-	Fluorescent Exit Sign	-	2	1	Fluorescent	20	24	960	No	No	40
5	DPW	DPW Building	Smaller Garage	-	LED Exit Sign	-	1	1	Fluorescent	5	24	120	No	No	5
6	DPW	DPW Building	Smaller Garage workshop area	43	8' Linear T12	Magnetic	4	2	Fluorescent	95	8.5	6460	No	No	760
7	DPW	DPW Building	Smaller Garage	52	8' Linear T12	Magnetic	2	2	Fluorescent	95	8.5	3230	No	No	380
8	DPW	DPW Building	Smaller Garage	52	4' Linear T12	Magnetic	1	4	Fluorescent	40	8.5	1360	No	No	160
9	DPW	DPW Building	Smaller Garage	52	Metal Halide - 400W - MH400/U	-	6	1	Metal Halide	400	8.5	20400	No	No	2400
10	DPW	DPW Building	Larger Garage	38	8' Linear T12	Magnetic	5	2	Fluorescent	95	8.5	8075	No	No	950
11	DPW	DPW Building	Larger Garage	38	Metal Halide - 400W - MH400/U	-	20	1	Metal Halide	400	8.5	68000	No	No	8000
12	DPW	DPW Building	Larger Garage	-	LED Exit Sign	-	2	1	LED	5	24	240	No	No	10
13	DPW	DPW Building	Large Garage - Storage shed	58	8' Linear T12	Magnetic	2	2	Fluorescent	95	8.5	3230	No	No	380
14	DPW	DPW Building	Larger Garage - Under Storage Area	18	4' Linear T12	Magnetic	2	2	Fluorescent	40	8.5	1360	No	No	160
15	DPW	DPW Building	Offices - Lunch Room	-	LED Exit Sign	-	1	1	LED	5	24	120	No	No	5
16	DPW	DPW Building	Offices - Lunch Room	27	4' Linear T12	Magnetic	6	2	Fluorescent	40	8.5	4080	No	Yes	480
17	DPW	DPW Building	Offices - Locker Room	-	LED Exit Sign	-	1	1	LED	5	24	120	No	No	5
18	DPW	DPW Building	Offices - Locker Room	35	4' Linear T12	Magnetic	2	2	Fluorescent	40	8.5	1360	No	Yes	160
19	DPW	DPW Building	Offices - Men's Room	38	4' Linear T12	Magnetic	1	2	Fluorescent	40	8.5	680	No	No	80
20	DPW	DPW Building	Offices - Women's Room	38	4' Linear T12	Magnetic	1	2	Fluorescent	40	8.5	680	No	No	80
21	DPW	DPW Building	Offices - Chart Room	46	4' Linear T12	Magnetic	1	2	Fluorescent	40	8.5	680	No	No	80
22	DPW	DPW Building	Offices - Main Hallway	42	4' Linear T12	Magnetic	4	2	Fluorescent	40	8.5	2720	No	No	320
23	DPW	DPW Building	Offices - Main Hallway	-	Fluorescent Exit Sign	-	2	1	Fluorescent	20	24	960	No	No	40
24	DPW	DPW Building	Offices - Meter Room	40	4' Linear T12	Magnetic	2	2	Fluorescent	40	8.5	1360	No	No	160
25	DPW	DPW Building	Offices - File Room	32	4' Linear T12	Magnetic	1	2	Fluorescent	40	8.5	680	No	No	80
26	DPW	DPW Building	Office Hallway	60	4' Linear T12	Rapid Start	1	2	Fluorescent	45	8.5	765	No	No	90
27	DPW	DPW Building	Office - Receptionist's Office	42	4' Linear T12	Magnetic	2	2	Fluorescent	40	8.5	1360	No	No	160
28	DPW	DPW Building	Office - 2nd Office	46	4' Linear T12	Magnetic	2	2	Fluorescent	40	8.5	1360	No	No	160
29	DPW	DPW Building	Office - Back Office	48	4' Linear T12	Magnetic	2	2	Fluorescent	40	8.5	1360	No	No	160
30	DPW	DPW Building	Office - Back Office	48	4' Linear T12	Magnetic	1	3	Fluorescent	40	8.5	1020	No	No	120

Existing Totals	
Existing Usage (kWh/year)	35,535
Existing Est. Cost (\$/year)	\$ 6,183.03
Office Lighting Total Power (Watts)	2,180
Office Lighting Power Density (W/sqft)	0.44
Garage Lighting Total Power (Watts)	13,573
Garage Lighting Power Density (W/sqft)	1.36

Location in Building	Fixture Type	Ballast Type	No. of Fixtures	No. of Lamps	Watts/Lamp	Hrs/Day	Energy Use (Watt hours/day)	Controls	Fixture Type	Ballast Type	No. of Fixtures	No. of Lamps	Watts/Lamp	Hrs/Day	Energy Use (Watt hours/day)	Controls	Total Power (Watts)
Garage	Fluorescent Exit Sign	-	2	1	20	24	960	None	LED Exit Sign	-	2	1	5	24	240	None	10
Carpenter's Room	4' Linear T8	Magnetic	1	4	32	8.5	1088	Switch	4' Linear T8	Electronic	1	4	32	8.5	1088	Switch	128
Sign Shop	4' Linear T12	Magnetic	1	4	40	8.5	1360	Switch	4' Linear T8	Electronic	1	4	32	8.5	952	Switch	128
Smaller Garage	Fluorescent Exit Sign	-	2	1	20	24	960	None	LED Exit Sign	-	2	1	5	24	240	None	10
Smaller Garage	LED Exit Sign	-	1	1	5	24	120	None	LED Exit Sign	-	1	1	5	24	120	None	5
Workshop area	8' Linear T12	Magnetic	4	2	95	8.5	6460	Switch	8' Linear T8	Electronic	4	2	59	8.5	4012	Switch	472
Smaller Garage	8' Linear T12	Magnetic	2	2	95	8.5	3230	Switch	8' Linear T8	Electronic	2	2	59	8.5	2006	Switch	236
Smaller Garage	4' Linear T12	Magnetic	1	4	40	8.5	1360	Switch	4' Linear T8	Electronic	1	4	32	8.5	952	Switch	128
Smaller Garage	Metal Halide - MH400/U	-	6	1	400	8.5	20400	Switch	MH400/U	-	6	1	400	8.5	20400	Switch	2400
Larger Garage	8' Linear T12	Magnetic	5	2	95	8.5	8075	Switch	8' Linear T8	Electronic	5	2	59	8.5	5015	Switch	590
Larger Garage	Metal Halide - MH400/U	-	20	1	400	8.5	68000	Switch	MH400/U	-	20	1	400	8.5	68000	Switch	8000
Larger Garage	LED Exit Sign	-	2	1	5	24	240	None	LED Exit Sign	-	2	1	5	24	240	None	10
Large Garage - Storage shed	8' Linear T12	Magnetic	2	2	95	8.5	3230	Switch	8' Linear T8	Electronic	2	2	59	8.5	2006	Switch	236
Larger Garage - Under Storage Area	4' Linear T12	Magnetic	2	2	40	8.5	1360	Switch	4' Linear T8	Electronic	2	2	32	8.5	952	Switch	128
Offices - Lunch Room	LED Exit Sign	-	1	1	5	24	120	None	LED Exit Sign	-	1	1	5	24	120	None	5
Offices - Lunch Room	4' Linear T12	Magnetic	6	2	40	8.5	4080	Switch	4' Linear T8	Electronic	6	2	32	8.5	2856	Switch	384
Offices - Locker Room	LED Exit Sign	-	1	1	5	24	120	None	LED Exit Sign	-	1	1	5	24	120	None	5
Offices - Locker Room	4' Linear T12	Magnetic	2	2	40	8.5	1360	Switch	4' Linear T8	Electronic	2	2	32	8.5	952	Switch	128
Offices - Men's Room	4' Linear T12	Magnetic	1	2	40	8.5	680	Switch	4' Linear T8	Electronic	1	2	32	8.5	476	Switch	64
Offices - Women's Room	4' Linear T12	Magnetic	1	2	40	8.5	680	Switch	4' Linear T8	Electronic	1	2	32	8.5	381	Switch	64
Offices - Chart Room	4' Linear T12	Magnetic	1	2	40	8.5	680	Switch	4' Linear T8	Electronic	1	2	32	4	179	Occ. Sensor	64
Offices - Main Hallway	4' Linear T12	Magnetic	4	2	40	8.5	2720	Switch	4' Linear T8	Electronic	4	2	32	8.5	1904	Switch	256
Offices - Main Hallway	Fluorescent Exit Sign	-	2	1	20	24	960	None	LED Exit Sign	-	2	1	5	24	240	None	10
Offices - Meter Room	4' Linear T12	Magnetic	2	2	40	8.5	1360	Switch	4' Linear T8	Electronic	2	2	32	4	358	Occ. Sensor	128
Offices - File Room	4' Linear T12	Magnetic	1	2	40	8.5	680	Switch	4' Linear T8	Electronic	1	2	32	4	179	Occ. Sensor	64
Office Hallway	4' Linear T12	Rapid Start	1	2	45	8.5	765	Switch	4' Linear T8	Electronic	1	2	32	8.5	536	Switch	64
Office - Receptionist's Office	4' Linear T12	Magnetic	2	2	40	8.5	1360	Switch	4' Linear T8	Electronic	2	2	32	4	358	Occ. Sensor	128
Office - 2nd Office	4' Linear T12	Magnetic	2	2	40	8.5	1360	Switch	4' Linear T8	Electronic	2	2	32	4	358	Occ. Sensor	128
Office - Back Office	4' Linear T12	Magnetic	2	2	40	8.5	1360	Switch	4' Linear T8	Electronic	2	2	32	4	358	Occ. Sensor	128
Office - Back Office	4' Linear T12	Magnetic	1	3	40	8.5	1020	Switch	4' Linear T8	Electronic	1	3	32	4	269	Occ. Sensor	96

Existing Totals		
Existing Usage (kWh/year)		35,535
Existing Est. Cost (\$/year)	\$	6,183.03
Office Lighting Total Power (Watts)	\$	2,180.00
Office Lighting Power Density (W/sqft)		0.44
Garage Lighting Total Power (Watts)		13,573
Garage Lighting Power Density (W/sqft)	\$	1.36

Proposed Totals		
Proposed Usage (kWh/year)		30,242
Proposed Est. Cost (\$/year)	\$	5,262.03
Office Lighting Total Power (Watts)		1,716
Office Lighting Power Density (W/sqft)		0.34
Garage Lighting Total Power (Watts)		12,481
Garage Lighting Power Density (W/sqft)		1.25
Proposed Savings (kWh/year)		5,293
Proposed Cost Savings (\$/year)	\$	920.99

**Appendix B: eQUEST model**

