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Local Government Energy Program
Energy Audit Final Report

Franklin Lakes Police Station
490 De Korte Drive, Franklin Lakes, NJ

Project Number: LGEA46

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INTRODUCTION

On December 16, 2009 and January 13, 2010 Steven Winter Associates, Inc. (SWA) performed an energy audit and assessment for the Borough of Franklin Lakes municipal buildings. The audit included a review of the:

- Franklin Lakes Municipal Building
- Franklin Lakes Police Station
- Franklin Lakes Recreational Center
- Franklin Lakes Firehouse (Main)
- Franklin Lakes Firehouse (Southside)
- Franklin Lakes DPW
- Franklin Lakes Ambulance Corps

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

This report addresses the Franklin Lakes Police Station located at 490 De Korte Drive, Franklin Lakes, NJ. The current conditions and energy-related information were collected in order to analyze and facilitate the implementation of energy conservation measures for the building.

The single-story Franklin Lakes Police Station building was built in 1966 with a few minor interior renovations. The building contains offices, patrol areas, interrogation rooms, storage rooms, detention cell, firearm room, conference rooms, bathrooms and a dispatch area. The building consists of 6,720 square feet of conditioned space. The Franklin Lakes Police Station operates 24 hours a day, 7 days a week with approximately 20 officers and staff and up to 30 visitors during the day, and 7 to 8 officers overnight.

The goal of this Local Government Energy Audit (LGEA) is to provide sufficient information to the Borough of Franklin Lakes to make decisions regarding the implementation of the most appropriate and most cost-effective energy conservation measures for the Franklin Lakes Police Station.

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. For projects awarded on or prior to December 31, 2009 the program will subsidize 75% of the cost of the audit. If the net cost of the installed measures recommended by the audit, after applying eligible NJ SmartStart Buildings incentives, exceeds the remaining cost of the audit, then that additional 25% will also be paid by the program. The Board of Public Utilities (BPUs) Office of Clean Energy has assigned TRC Energy Services to administer the Program.

EXECUTIVE SUMMARY

The energy audit performed by Steven Winter Associates (SWA) encompasses the Franklin Lakes Police Station building located at 490 De Korte Drive, Franklin Lakes, NJ. The Franklin Lakes Police Station building is a single-story building with a floor area of 6,720 square feet. The original structure was built in 1966.

Based on the field visits performed by the SWA staff on December 16, 2009 and January 13, 2010 and the results of a comprehensive energy analysis, this report describes the site's current conditions and recommendations for improvements. Suggestions for measures related to energy conservation and improved comfort are provided in the scope of work. Energy and resource savings are estimated for each measure that results in a reduction of heating, cooling and electric usage.

From March 2008 to February 2009 the Franklin Lakes Police Station building consumed 137,772 kWh or $31,908 worth of electricity at an approximate rate of $0.232/kWh, and 2,126 therms or $3,032 worth of natural gas at an approximate rate of $1.426/therm. The joint energy consumption for the building, including both electricity and natural gas, was 683 MMBtu of energy that cost a total of $34,940.

SWA has entered energy information about the Franklin Lakes Police Station building in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* energy benchmarking system. A benchmark score could not be calculated for the facility since it is categorized as a non-eligible "Other-Police Station" space type for which there isn't any rating system available at this time. SWA encourages the Borough of Franklin Lakes to continue entering utility data in *Energy Star Portfolio Manager* in order to track weather normalized source energy use over time. EPA is continually working to expand the available space types.

The Site Energy Use Intensity is 104.0 kBtu/ft^{2}yr compared to the national average of "Other-Police Station" space type of 78.0 kBtu/ft^{2}yr. Implementing this report's recommendations will reduce use by approximately 20.3 kBtu/ft^{2}yr, which when implemented would bring the building's energy consumption on par with the national average. The EUI comparison is based upon a survey of existing buildings of varying usage and therefore the national average for "Other-Police Station" space types is very subjective and is not an absolute indicator of performance. There may be energy procurement opportunities for the Franklin Lakes Police Station building to reduce annual electric costs, which are $11,297 higher, when compared to the average estimated NJ commercial utility rates.

Based on the assessment of the Franklin Lakes Police Station, 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

- Rewire exterior parking lights to avoid short-circuiting and frequent lamp burn-outs
- Install NEMA premium motors when motor replacements for furnace and condenser fans are required due to equipment damage or age

Category II Recommendations: Operations and Maintenance

- Maintain the integrity of the exterior wall and roof insulation by patching any damage or penetrations that may result from weather or age and installing weep holes
- Install a removable, insulated cover (or gravity louvers) for the exhaust fans
- Inspect all roof vents to ensure proper airflow in attic and verify water is draining correctly
- Install wire mesh on any exterior ventilation panels or soffits
- Inspect and patch any missing or loose insulation between drop ceiling and attic
- Maintain downspouts
- Air seal/caulk around all plumbing, electrical, HVAC or structural penetrations, and maintain regularly
- Replace worn weather-stripping where located, especially on exterior doors
- Use Energy Star labeled appliances
- Use smart power electric strips
- Create an energy educational program

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

At this time, SWA highly recommends a total of **five** Energy Conservation Measures (ECMs) for the Franklin Lakes Police Station building, as summarized in the following Table 1. The total investment cost for these ECMs with incentives is **$8,177**. SWA estimates a first-year savings of **$2,384** with a simple payback of **3.4 years**. SWA estimates that implementing the highly recommended ECMs will reduce the carbon footprint of the Franklin Lakes Police Station building by **11,086 lbs of CO_2** which is the equivalent of saving 27 trees to absorb the CO_2. SWA also recommends **four** ECMs with a total first-year savings of $**16,472** as summarized in Table 2.

There are various incentive programs that the Borough of Franklin Lakes could apply for that could also help lower the cost of installing the ECMs, such as the NJ SmartStart program through the New Jersey Office of Clean Energy. This incentive program can help provide technical assistance for the building in the implementation phase of any energy conservation project. A new NJ Clean Power program, Direct Install, could also assist to cover up to 80% of the capital investment for prescriptive measures and is highly recommended.

Renewable ECMs require application approval and negotiations with the utility and proof of performance. There is also a utility-sponsored program that would allow the building to pay for the installation of the PV system through a loan issued by Orange Rockland Electric.

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

Table 1 - Highly Recommended 0-5 Year Payback ECMs																			
ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	est. energy & operating 1st year cost savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO2 reduced, lbs/yr
1a	10 New CFL fixtures to be installed with incentives	RS Means, lit search	510	none at this time	510	2,059	0.4	N/A	1.1	68	546	5	2,730	0.9	435	87	104	1,976	2,820
2	Install Energy Miser on kitchen Drink Vending Machine	USAtech.com	200	none at this time	200	832	0.0	0	0.4	0	193	15	2,304	1.0	1,052	70	488	9,511	1,140
1b	13 New occupancy sensors to be installed with incentives	RS Means, lit search	2,860	260	2,600	2,687	0.6	N/A	1.4	0	623	15	9,352	4.2	260	17	23	4,736	3,681
1c	6 New pulse start metal halide fixtures to be installed with incentives	RS Means, lit search	4,832	150	4,682	2,459	0.5	N/A	1.3	412	983	15	14,743	4.8	215	14	20	6,884	3,368
1d	1 New T8 fixtures to be installed with incentives	RS Means, lit search	215	30	185	56	0.0	N/A	0.0	25	38	15	574	4.8	210	14	19	265	77
	TOTALS		**8,617**	**440**	**8,177**	**8,092**	**1.5**	**0**	**4.2**	**506**	**2,384**		**29,703**	**3.4**	**-**	**-**	**-**	**-**	**11,086**

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, $	est. energy & operating 1st year cost savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO2 reduced, lbs/yr
3	HVAC TAB and Install three Programmable Thermostats	Energy Star Calculator	11,826	none at this time	11,826	2,407	0.8	292	5.6	500	1,476	15	17,615	8.0	112	7	7	2,862	6,720
4	Replace 5 Ton, 8.0 SEER Condenser with SEER 14.5 Condenser	Energy Star Savings calculator	4,057	460	3,597	2,543	0.8	0	1.3	0	590	14	8,260	6.1	130	9.2	13.7	2,276	3,484
5	Install 15 kW Solar Photovoltaic system	Similar Projects	105,000	15,000	90,000	17,700	15	0	9.0	0	14,306	25	255,660	6.3	184	7.4	14.18	52,406	24,249
6	replace one (1) old kitchen refrigerator with an 18 cu ft Energy Star model	Energy Star purchasing and procurement site, similar projects	750	none at this time	750	350	0.1	0	0.2	100	100	12	1,200	7.5	60	5	9	245	480
	TOTALS		**121,633**	**15,460**	**106,173**	**23,000**	**16.7**	**292**	**16.1**	**600**	**16,472**		**282,735**	**6.4**	**-**	**-**	**-**	**-**	**34,932**

1. HISTORIC ENERGY CONSUMPTION

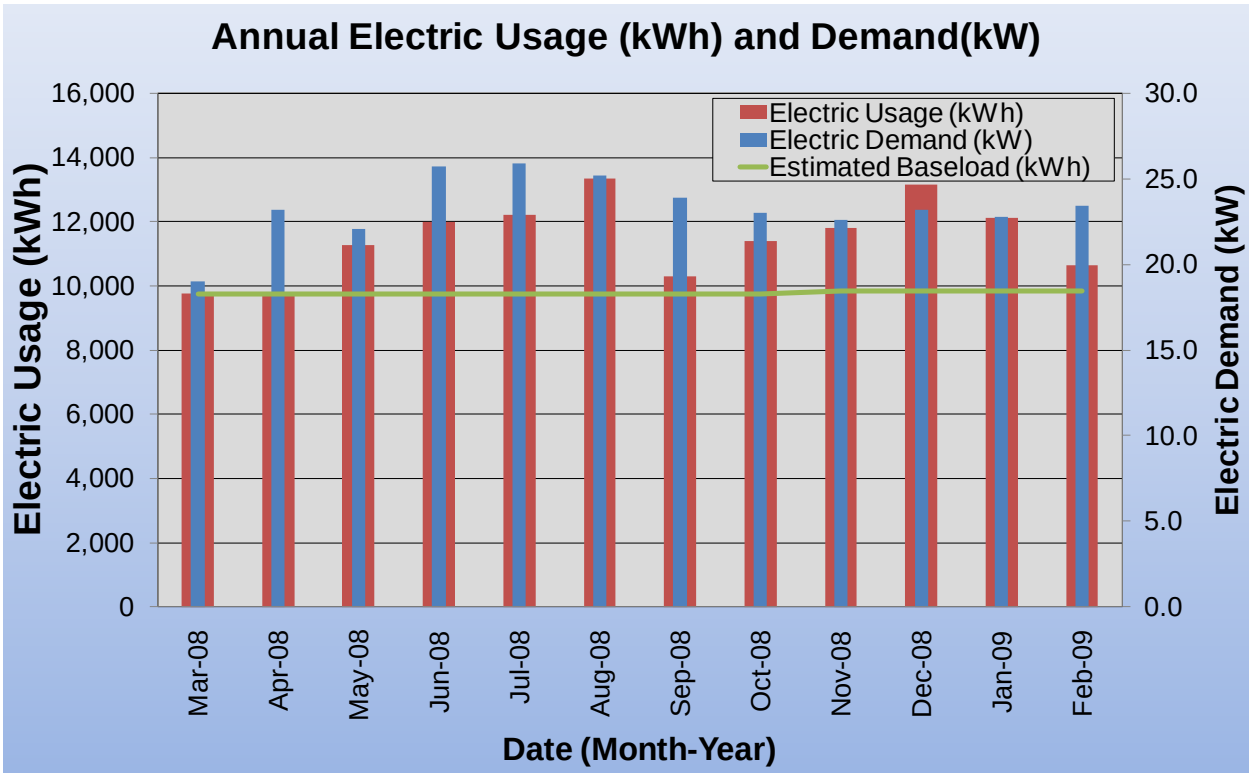
1.1 Energy usage and cost analysis

SWA analyzed utility bills from March 2008 to February 2009 that were received from the utility companies supplying the Franklin Lakes Police Station with electric and natural gas.

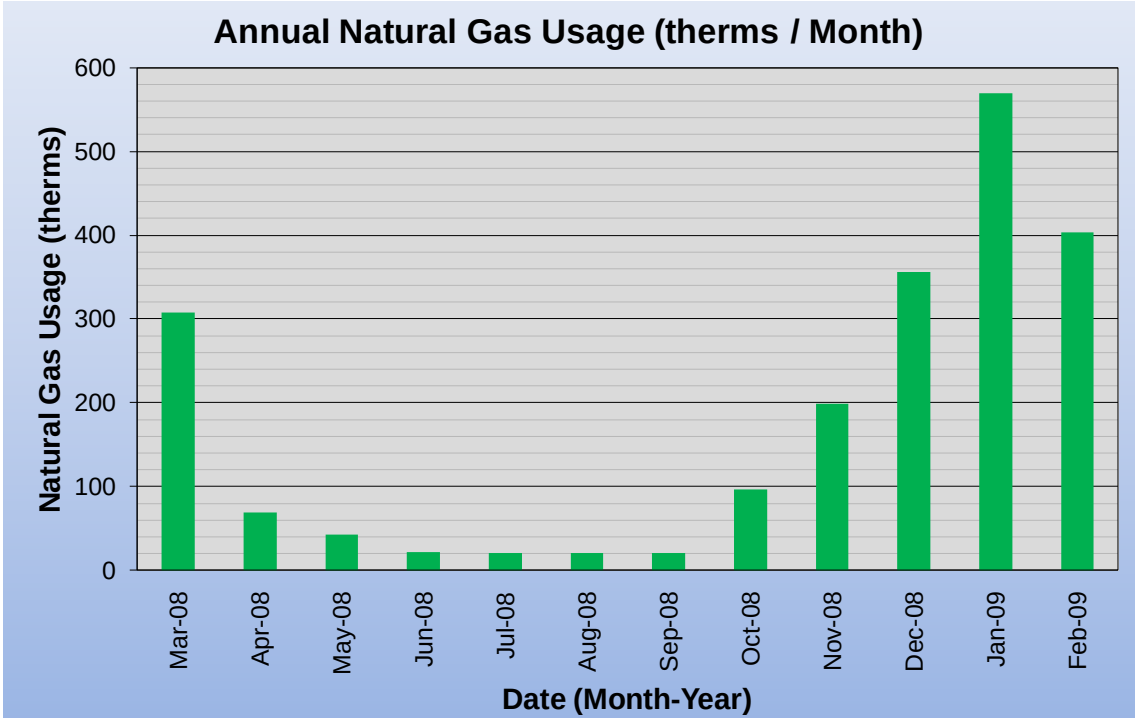
Electricity - The Franklin Lakes Police Station is currently served by one electric meter. The Franklin Lakes Police Station building currently buys electricity from Orange Rockland Electric at **an average rate of $0.232/kWh** based on 12 months of utility bills from March 2008 to February 2009. The Franklin Lakes Police Station building purchased **approximately 137,772 kWh or $31,908 worth of electricity** in the previous year. The average monthly demand was 23.3 kW and the annual peak demand was 25.9 kW.

Natural gas - The Franklin Lakes Police Station is currently served by one meter for natural gas. The Franklin Lakes Police Station buys natural gas from PSE&G at **an average aggregated rate of $1.426/therm** based on 12 months of utility bills for March 2008 to February 2009. The Franklin Lakes Police Station purchased **approximately 2,126 therms or $3,032 worth of natural gas** in the previous year.

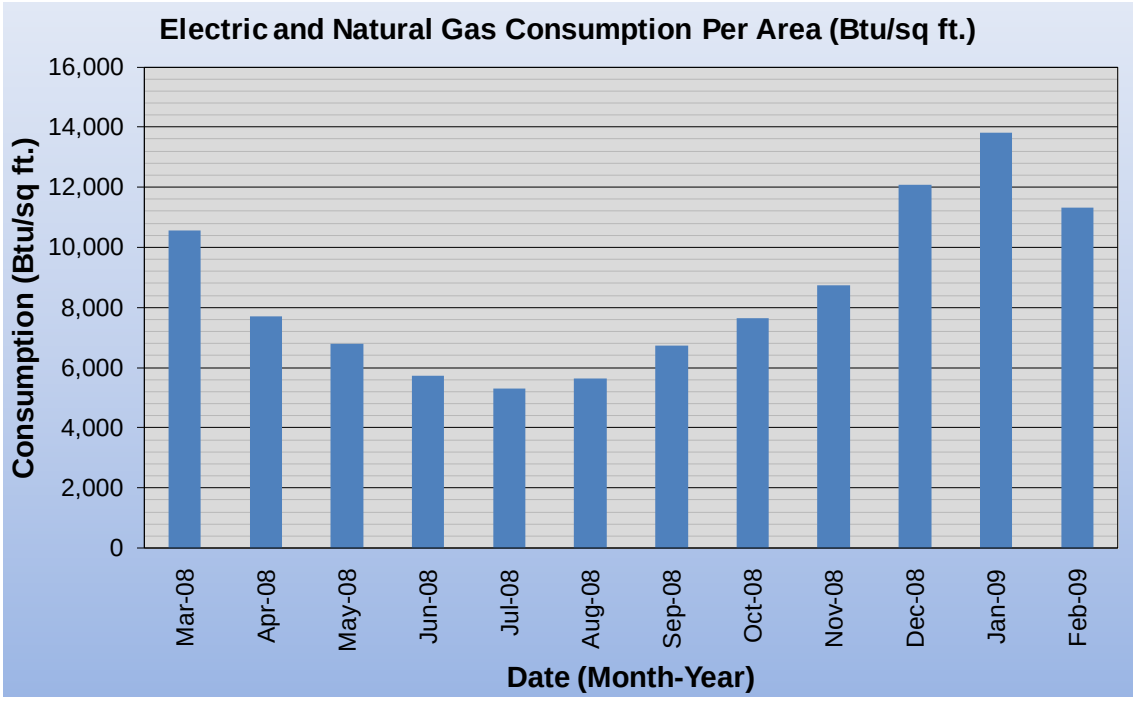
The following chart shows electricity use for the Franklin Lakes Police Station building based on utility bills for the 12 month period of March 2008 to February 2009.



The following chart shows the natural gas consumption for the Franklin Lakes Police Station building based on natural gas bills for the 12 month period of March 2008 to February 2009.

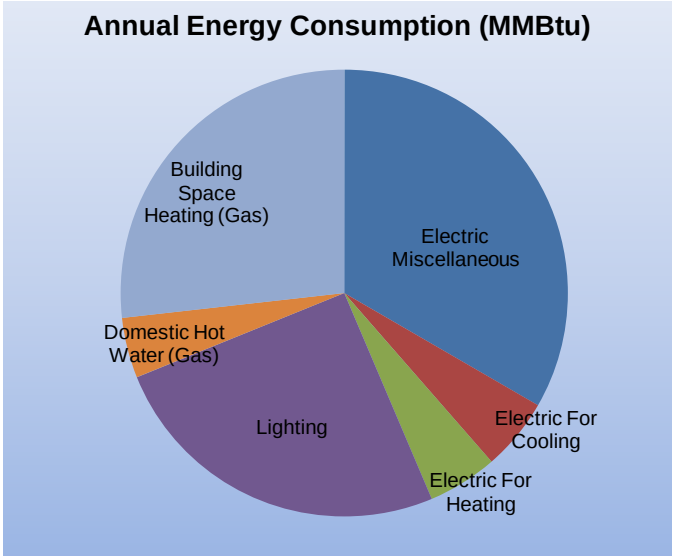


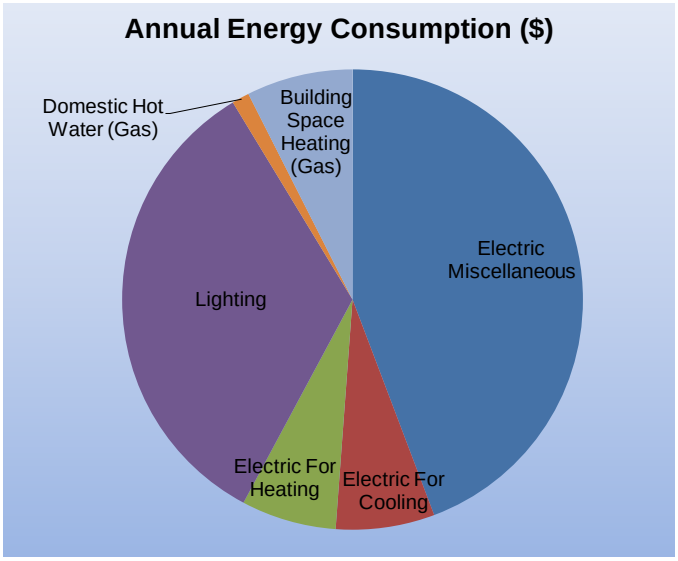
The following chart shows combined natural gas and electric consumption in Btu/sq ft for the Franklin Lakes Police Station building based on utility bills for the 12 month period of March 2008 to February 2009.



The following table and pie charts show energy use for the Franklin Lakes Police Station building based on utility bills for the 12 month period of March 2008 to February 2009. Note: electrical cost at $68 /MMBtu of energy is more than four times as expensive as natural gas at $14/MMBtu.

2008 Annual Energy Consumption/Costs					
	MMBtu	% MMBtu	$	% $	$/MMBtu
Electric Miscellaneous	228	33%	$15,461	44%	68
Electric For Cooling	36	5%	$2,418	7%	68
Electric For Heating	34	5%	$2,326	7%	68
Lighting	172	25%	$11,703	33%	68
Domestic Hot Water (Gas)	30	4%	$425	1%	14
Building Space Heating (Gas)	183	27%	$2,607	7%	14
Totals	683	100%	$34,940	100%	-
Total Electric Usage	470	69%	$31,908	91%	68
Total Gas Usage	213	31%	$3,032	9%	14
Totals	683	100%	$34,940	100%	-





1.2 Utility rate

The Franklin Lakes Police Station building currently purchases electricity from Orange Rockland Electric at a general service market rate for electricity use (kWh) with a separate (kW) demand charge. The Franklin Lakes Police Station building currently pays an average rate of approximately $0.232/kWh based on the 12 months of utility bills of March 2008 to February 2009.

The Franklin Lakes Police Station building currently purchases natural gas supply from the PSE&G at a general service market rate for natural gas (therms). PSE&G also acts as the transport company. There is one gas meter that provides natural gas service to the Franklin

Lakes Police Station building currently. The average aggregated rate (supply and transport) for the meter is approximately $1.426/therm based on 12 months of utility bills for March 2008 to February 2009.

1.3 Energy benchmarking

SWA has entered energy information about the Franklin Lakes Police Station building in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. This Police Station facility is comprised of non-eligible ("Other-Station/Police Station") space type for which there isn't any rating system available at this time. This building type best represents the use of the Police Station, however is not eligible to receive a national energy performance rating at this time.

The Site Energy Use Intensity is 104.0 kBtu/ft^2/yr compared to the national average of a Recreation building using 78.0 kBtu/ft^2/yr. Implementing this report's highly recommended Energy Conservations Measures (ECMs) will reduce use by approximately 4.2 kBtu/sqft yr, with an additional 16.1 kBtu/ft^2/yr from the recommended ECMs. These recommendations therefore reduce the site energy use intensity to 83.7 kBtu/ft^2/yr, which is on par with national average. The EUI comparison is based upon a survey of existing buildings of varying usage and therefore the national average for "Other" space types is very subjective and is not an absolute indicator of performance.

Per the LGEA program requirements, SWA has assisted the Borough of Franklin Lakes to create an *Energy Star Portfolio Manager* account and share the Franklin Lakes Police Station facilities information to allow future data to be added and tracked using the benchmarking tool. SWA has shared this Portfolio Manager information with the Borough of Franklin Lakes (user name of "FranklinLakesBoro" with a password of "FRANKLINLAKES") and TRC Energy Services (user name of TRC-LGEA).

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Borough of Franklin Lakes - Police Station

Building ID: 1976056
For 12-month Period Ending: January 31, 2009[1]
Date SEP becomes ineligible: N/A
Date SEP Generated: February 05, 2010

Facility
Borough of Franklin Lakes - Police Station
490 De Korte Drive
Franklin Lakes, NJ 07417

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 1966
Gross Floor Area (ft²): 6,720

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

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	471,830
Natural Gas (kBtu)[4]	230,323
Total Energy (kBtu)	702,153

Energy Intensity[5]	
Site (kBtu/ft²/yr)	104
Source (kBtu/ft²/yr)	270

Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	58

Electric Distribution Utility
Rockland Electric Co

National Average Comparison	
National Average Site EUI	78
National Average Source EUI	157
% Difference from National Average Source EUI	72%
Building Type	Fire Station/Police Station

Stamp of Certifying Professional

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

Certifying Professional
N/A

Meets Industry Standards[6] **for Indoor Environmental Conditions:**	
Ventilation for Acceptable Indoor Air Quality	**N/A**
Acceptable Thermal Environmental Conditions	**N/A**
Adequate Illumination	**N/A**

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

EPA Form 5900-16

2. FACILITY AND SYSTEMS DESCRIPTION

2.1. Building Characteristics

The Police Station is a single-story structure with basement constructed in 1966. This facility is used as office space and houses the entire Police Department. The first floor includes: the Chief's office, the Captain's office, the Sergeant's office, the Secretary/Records office, desk areas, a Patrol room, the Detective's office, an Interrogation area, an Evidence area, the Traffic Office, the Community Policing office, a Firearms room, a Detention Cell, a Secured Sally-port, a garage, a conference room, a training room, supply areas, bathrooms, a few storage rooms, administrative spaces and a dispatch/command area. The basement includes: a Radio Equipment room, a locker room for 30 officers, a kitchen/lounge, a storage area, a mechanical/utilities room. In recent years there have been additions/renovations to the cell system, rooms were changed and relocated, the shooting range was replaced with offices and a locker room was added. The building consists of a total 6,720 square feet of conditioned space.

2.2. Building occupancy profiles

The Police Department operates 24 hours per day, 7 days per week with approximately 20 officers/staff working during the day plus visitors (up to 30 per day) and 7-8 employees working the overnight shift. The Police Department operates an emergency services communications center in the building.

2.3. Building envelope

2.3.1. Exterior Walls

The exterior walls consist of 8" CMU blocks with a 4" brick veneer façade. The original structure consists of masonry wall construction. The drawings for the original structure do not specifically call for insulation to be installed on the exterior walls.

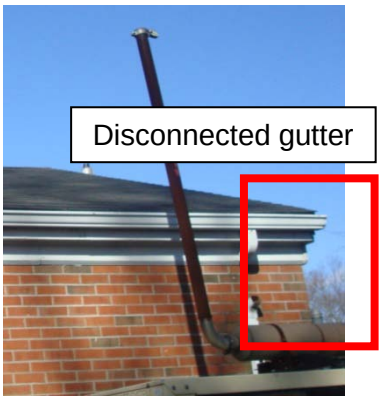
The exterior walls were inspected and found to be in overall acceptable condition except for a few areas where mortar has eroded away from between the brick facade. SWA recommends as part of a capital improvement plan and/or annual maintenance to install weep holes in walls, upgrade flashing and re-point the brick façade as needed, to keep water from migrating inside the exterior walls.

Bottom area of brick façade needing re-pointing

2.3.2. Roof

The Police Station roof is a sloped asphalt shingled roof installed in 2004. There weren't any recently reported roof leaks however some dried ceiling water stain spots were visible. The roof is supported by wood trusses, planks/mostly plywood. The insulation in the attic space above the suspended ceiling (composed of 2 ft x 4 ft Armstrong Tegular ceiling tiles) is rather loose. Birds could enter the attic space via various soffits and side ventilation panels. SWA recommends closing up any large penetrations and wrapping wire meshes on ventilation panels. Batt fiberglass insulation should be consistent and tight throughout the attic.

Ceiling tile water stain; Batt insulation above the drop ceiling



2.3.3. Base

The building's base is a 4" concrete slab in the basement and garage with a perimeter footing. There weren't any reported problems with water seepage through the slab or other issues related to thermal performance or moisture, including the basement. The slab edge or perimeter insulation could not be verified.

2.3.4. Windows

The building contains double-glazed fixed and double-hung wood-framed windows, original to the building. Many of the windows have worn out seals. The window seals are of great concern as infiltration, water, and pests such as the bees are allowed to enter the building. SWA recommends, as part of a capital improvement plan replacing all original windows with newer

models with thermal breaks, dual glazing and a low-e rating. Proper flashing and caulking should be performed upon installation of the new windows.

Window lintel needing calking above it and painting;rotted wood members should be replaced to prevent insect infestation

2.3.5. Exterior doors

The exterior doors were observed to be in relatively good condition except for some missing or worn weather-stripping. SWA recommends that the exterior doors of the building be weather-stripped in order to decrease the amount of expensive conditioned air that is lost around each door. SWA also recommends checking the weather-stripping of each door including the garage area on a regular basis and replacing any broken seals immediately. Tight seals around the doors will help ensure that the building is kept continuously tight and insulated.

2.3.6. Building air tightness

Based on a visual inspection, the Police Station could benefit from tightly sealed doors, ductwork, plumbing and wire penetrations. Any water damage due to condensing un-insulated pipes, condensate lines dripping, plumbing leaks, or roof leaks should be repaired immediately and ceiling tiles should be replaced. Ceiling tiles act as an air barrier containing expensive conditioned air from leaking into ceiling or wall cavities.

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 and windows.

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

The Franklin Lakes Police Station kitchen areas, offices, patrol areas and bathrooms are cooled and heated by a series of direct vented furnaces with outside condensers which heat or cool the air depending on the season and temperature set points. The distribution system is a fully ducted supply and return air system.

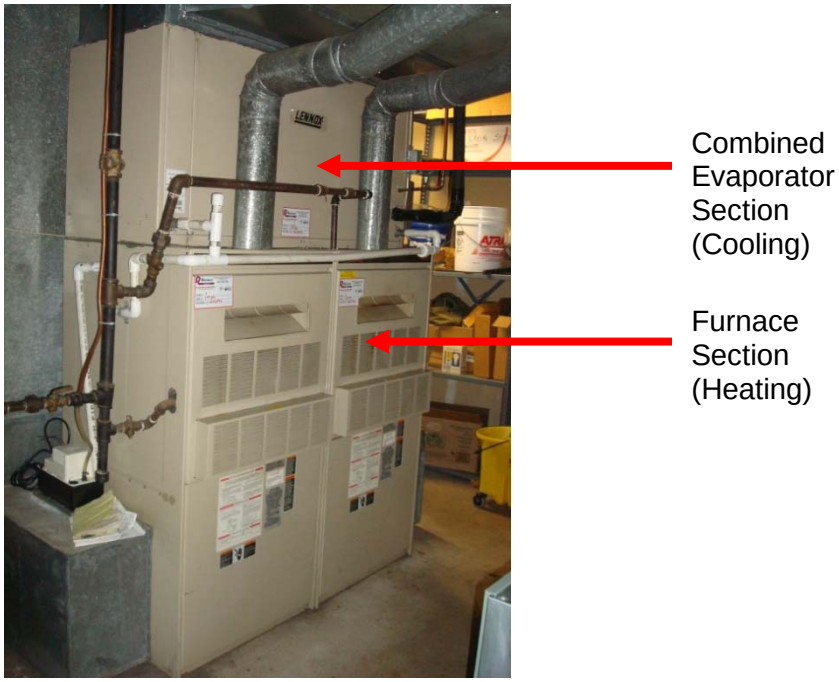
There are considerable thermal comfort concerns with some sections of the building experiencing excessive heat, while others are very cold. The temperature of the air is currently regulated by two manual thermostats, one on the main floor and one in the basement. SWA recommends installing three programmable thermostats with evening setback capabilities and performing HVAC Testing and Balancing on the air distribution system and controls. Doing so would require adjustment to existing ductwork distribution. See Section 4, ECM's, for more details.

1st Floor Manual Thermostats (top), Basement manual thermostat (bottom), set at 68˚F/70˚F

2.4.1 Heating

There are four direct vented natural gas furnaces installed by a combination of Ruud, Climatrol, and Lennox manufacturers. The Climatrol furnace was labeled as an "Emergency Backup" furnace and is beyond its useful life. Building staff indicated that they do not remember the last time this emergency furnace had operated. The total output heating capacity of the units is 260,000 Btu/hr, (NOT including the emergency furnace). Based on benchmark heating design analysis, a typical building requires 30 Btu/hr per square foot heating capacity and the 260,000 Btu/hr heating capacity provides over 38 Btu/hr per square foot heating capacity for the Police Station, so the emergency furnace is in excess. SWA recommends removing the furnace and capping its connection to the HVAC system. The Rudd unit as well as the twin Lennox furnaces

were installed in 2004 and appear in good operating condition. The Lennox twin unit currently has a combined supply air duct serving the 1st floor as well as a combined cooling section. Therefore, in order to have independent control, two variable volume dampers need to be installed downstream of this Lennox twin units. See more details in the ECM section.



Lennox Direct Vented Twin Furnaces in Basement Mechanical Room serving 1st Floor

For direct vented furnaces, the heat of combustion of natural gas is used to heat a mixture of outside air and return air within the heating section and then a supply fan forces the heated air through the constant volume distribution system to occupied spaces.

The garage is heated by a ceiling hung electric heater with 30% remaining useful life.

Due to thermal balancing issues, most office areas are not sufficiently heated, causing occupants to use electric heaters under desks in order to be comfortable in the winter. During the field visit in December 2009, seven electric heaters at approximately 1500 watts each were operating throughout the building to supplement heat.

2.4.2 Cooling

The Franklin Lakes Police Station occupied spaces and bathrooms are cooled by an electric DX split system with the evaporator section contained within the direct vented furnaces. In the evaporator section of the furnaces the R-22 refrigerant absorbs the heat from the air. Two condensers, one Carrier and one Lennox then disperse the heat from the refrigerant to the atmosphere using condenser fans. The total rated cooling capacity of the condensing units is approximately 12.5 Tons. The Carrier condenser, with a rated efficiency of 8 SEER, was installed in 1988 and is at the end of its useful life. SWA recommends replacing the Carrier condenser with a new model having a rated efficiency of at least 14.0 SEER, using premium efficiency fan motors.

Two condensers installed in back of building

2.4.3 Ventilation

The Franklin Lakes Police Station ventilation is achieved by several switch-controlled exhaust fans which serve bathrooms, kitchen, locker rooms and meeting rooms. The exhaust fans were not accessible during the field audit, however the original 1966 drawings indicate that there is one exhaust fan for both bathrooms in on the first floor, “EF-2”, and another fan “EF-3” serving the small patrol bathroom, evidence closet and lab room. Exhaust fans not visible during inspection units are likely mounted on the roof which is sloped and difficult to access. The furnace flue pipe in the basement is piped to a chimney which runs through the building to the roof. The original 1966 HVAC drawings indicate a 1.5 sqft outside air louver in the basement which provides combustion air for the furnace as well as outside air for the HVAC system.

2.4.4 Domestic Hot Water

The domestic hot water (DHW) for the Franklin Lakes Police Station building is provided by a Rheem natural gas-fired heater with 40 gal storage and 38,000 Btu/hr hot water capacity. The heater serves bathrooms, showers and kitchen hot water. The combustion air and flue are piped to the roof. The heater appears in good operating condition and has 50% remaining useful life.

2.5 Electrical systems

2.5.1 Lighting

Interior Lighting - The Franklin Lakes Police Station building currently consists of mostly T8 fixtures with sporadic use of T12 fixtures with magnetic ballasts and incandescent lights. The lights are all controlled by switches. Based on measurements of lighting levels for each space, there are not any vastly over-illuminated areas. SWA recommends replacing T12 fixtures using magnetic ballasts with T8 fixtures using electronic ballasts, which will reduce lamp wattage, ballast wattage and increase lamp lifespan. SWA also recommends replacing the incandescent lights with CFLs and installing occupancy sensors lighting controls to minimize the use of lights in kitchen areas, offices areas and bathrooms. See attached lighting schedule in Appendix A for a complete inventory of lighting throughout the building and estimated power consumption.

Exit Lights - Exit signs were found to be LED type. SWA does not have recommendations for upgrades at this time.

Exterior Lighting - The exterior lighting surveyed during the building audit was found to be a combination of 75 Watt Metal Halide, 175 Watt Metal Halide, High Pressure Sodium and Incandescent lights. SWA recommends replacing the metal halide and high pressure sodium lights with Pulse Start Metal Halide lights which operate at typically 2/3 of the wattage. SWA also recommends replacing the incandescent lamps with screw-in CFL's. Due to suspected short circuiting/wiring issues, SWA recommends rewiring the parking lot lights before replacing with Pulse Start Metal Halide's as a capital investment.

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. 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 drink and snack 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. See section 4, Energy Conservation Measures for details on replacing refrigerators and installing energy vending miser devices.

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, DVDs, stereos, computers, and kitchen appliances often have internal memories or clocks which consume approximately 3-5 watts of electricity when turned off. SWA recommends all computers and all appliances, (other than refrigerators and freezers), be plugged into power strips and turned off each evening just as the lights are turned off. The Franklin Lakes Police Station computers are generally NOT programmed for the power save mode, to shut down after a period of time that they have not been used.

2.5.3 Elevators

The Franklin Lakes Police Station is a single-story building without elevators.

2.5.4 Others electrical systems

There are not currently any other significant energy impacting electrical systems installed at the Franklin Lakes Police Station building other than a Kohler 78 kVA Diesel Generator for emergency power.

3. EQUIPMENT LIST

Building System	Description	Location	Make, Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Cooling	**CU-1 20.9 RLA, 98 LRA, 5 Tons, 8 SEER**	**Back of Bldg**	**CARRIER 38EN060530, 1688E27745**	**Electric**	**Basement**	**1988**	**0%**
Cooling	Coil 1, Evaporator Coil within FURN1	Basement	RUUD	Electric	Basement	2004	60%
Cooling	CU-3 Condensers, 7.5 Tons, 10.5 SEER	Back of Bldg	LENNOX HS29-090-3Y , 5604C02037	Electric	1st Floor	2004	60%
Cooling	Coil 3, Evaporator Coil within FURN 3 & 4	Basement	LENNOX C17-090/1201 , 5604B11393	Electric	1st Floor	2004	60%
Heating/Cooling	FURN1, Direct Vented Furnace, 125,000 btu/hr in, 100,000 btu/hr out, 80% eff., 1800 to 2075 CFM	Basement	RUUD UGPN12EARJR, FUD307F360402972	Natural Gas/Electric	Basement	2004	60%
Heating / Cooling	**FURN2, Direct Vented Furnace, Emergency Backup, 120,000 btu/hr in, 96,000 Btu/hr out, 80% Eff.**	**Basement**	**CLIMATROL 17511204110, 254542**	**Natural Gas / Electric**	**BACK OFFICE, Emergency Backup**	**1979**	**0%**
Heating / Cooling	FURN3, Direct Vented Furnace, 100,000 Btu/hr In, 80,000 Btu/hr out, 80% Eff.	Basement	LENNOX (TWIN) G20Q56E1002, 5892J07716	Natural Gas / Electric	1st Floor	2004	60%
Heating / Cooling	FURN4, Direct Vented Furnace, 100,000 Btu/hr In, 80,000 Btu/hr out, 80% Eff.	Basement	LENNOX (TWIN) G20Q56E1002, 5892907708	Natural Gas / Electric	1st Floor	2004	60%
Domestic Hot Water	Domestic Hot Water Heater 38,000 Btu/hr, 40 Gal, 0.55 Energy Factor	Basement	Rheem 21V40-38 ,RHNG0400A32737	Natural Gas	All Areas	2002	50%
Generator	Diesel Generator w/ John Deere Engine, 62 kW, 78 kVA, 0.8 PF, 100 Gallon Tank	Outside, North	Kohler Diesel Generator / John Deere Engine 60R02J / CD4039T400252 , 189437 / 0654228	Diesel	Emergency Power	2000	30%
Heating	Unit Heater, 100,000 Btu/hr In, 80,000 Btu/hr out, 80% Eff.	Garage	Lennox LF-100A-M , 30648	Electric	Garage	2000	30%
Heating	Seven (7) Electric Heaters, Approx 1500 Watts each	Offices	Holmes (varies) MFH5505	Electric	Offices	NA	NA
Lighting	See details - Appendix A	All Areas		Electric	All Areas	NA	NA

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

4. ENERGY CONSERVATION MEASURES

Based on the assessment of the Franklin Lakes Police Station, SWA has separated the investment opportunities into three recommended categories:

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

Category I Recommendations: Capital Improvements

- Rewire exterior parking lights; staff noted that parking lights burn out very quickly and it is suspected to be due to a short circuit/wiring issue. This may be causing energy usage spikes as well. SWA recommends that the system should be rewired prior to lighting upgrades to avoid excessive lamp replacement and energy waste.

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

Category II Recommendations: Operations and Maintenance

- Thoroughly and evenly insulate space (with batt insulation) and plug all penetrations to the outside. SWA recommends properly maintaining exterior wall and roof insulation in an effort to minimize energy loss.

- Install removable, seasonal, insulated cover (or gravity louvers) for exhaust fans.

- Maintain roofs - SWA recommends regular maintenance to verify water is draining correctly.

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

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

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

- Repair/seal space between drop ceiling and attic – SWA recommends providing additional air-sealing, between the drop ceiling and attic space

- Provide water-efficient fixtures and controls - Adding controlled on/off timers on all lavatory faucets is a cost-effective way to reduce domestic hot water demand and save

water. Building staff can also easily install faucet aerators and/or low-flow fixtures to reduce water consumption. There are many retrofit options, which can be installed now or incorporated as equipment is replaced. Routine maintenance practices that identify and quickly address water leaks are a low-cost way to save water and energy. Retrofitting with more efficient water-consumption fixtures/appliances will save energy through reduced energy consumption for water heating, while also decreasing water/sewer bills.

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

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

- Create an energy educational program - The U.S. Department of Energy offers free information for hosting energy efficiency educational programs and plans. For more information please visit: http://www1.eere.energy.gov/education/.

Category III Recommendations: Energy Conservation Measures - Summary table

ECM#	Description of Highly Recommended 0-5 Year Payback ECMs
1a	Building Lighting Upgrades – Replace Inc with CFL
2	Install Energy Vending Misers
1b	Building Lighting Upgrades – Install Occupancy Sensors
1c	Building Light Upgrades – Replace MH & HPS with Pulse Start Type
1d	Building Lighting Upgrades – Replace T12 with T8
	Description of Recommended 5-10 Year Payback ECMs
3	HVAC TAB & Install Programmable Thermostats
4	Replace 5 Ton Condenser with Energy Star Type
5	Install 15 kW Solar PV System
6	Replace refrigerator with Energy Star Type

ECM# 1a, 1b, 1c, 1d: *Building Lighting Upgrades*

Description:

On the days of the site visits, SWA completed a lighting inventory of the Franklin Lakes Police Station building (see Appendix A). SWA recommends replacing both interior and exterior incandescent lights with compact fluorescent lights. CFLs typically operate at a third of the wattage for the same lumen output and longer life. In addition, SWA recommends adding wall-mounted occupancy sensors to bathrooms, office areas, and kitchen areas which have intermittent occupancy throughout the day. Typically, using occupancy sensors reduces the hours of operation of lights by a third. There is sporadic use of T12 lamps with magnetic ballasts. SWA recommends replacing all T12 magnetic fixtures with T8 electronic fixtures which will decrease wattage and increase lamp life for the same lumen output.

For exterior applications, SWA recommends replacing Metal Halide (MH) lights and high pressure sodium lights with pulse-start Metal Halide fixtures. The pulse start lamps produce higher light output both initially and over time, operate more efficiently, produce whiter light, and turn on and re-strike faster. Due to these characteristics, energy savings can be realized via a one-to-one substitution of lower-wattage systems. Due to frequent parking lights burn-out, it is recommended to rewire the parking light power connections before lamp replacement. Labor in all these installations was evaluated using prevailing electrical contractor wages. The Borough of Franklin Lakes may decide to perform this work with in-house resources from the Maintenance Department.

Installation cost:
Estimated installed cost: $7,977 (includes approx. $3,500 labor)
Source of cost estimate: RS *Means; Published and established costs, NJ Clean Energy Program; Quoted bids*

Economics (Some of the options considered with incentives):

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, $	est. 1st year cost savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO2 reduced, lbs/yr
10 New CFL fixtures to be installed with incentives	RS Means, lit search	510	none at this time	510	2,059	0.4	0.0	1.0	68	546	5	2,730	0.9	435	87	104	1,976	2,820
13 New occupancy sensors to be installed with incentives	RS Means, lit search	2,860	260	2,600	2,687	0.6	0.0	1.4	0	623	15	9,352	4.2	260	17	23	4,736	3,681
6 New pulse start metal halide fixtures to be installed with incentives	RS Means, lit search	4,832	150	4,682	2,459	0.5	0.0	1.2	412	983	15	14,743	4.8	215	14	20	6,884	3,368
1 New T8 fixtures to be installed with incentives	RS Means, lit search	215	30	185	56	0.0	0.0	0.1	25	38	15	574	4.8	210	14	19	265	77
TOTALS		**8,417**	**440**	**7,977**	**7,260**	**1.5**	**0.0**	**3.7**	**506**	**2,191**		**27,398**	**3.6**				**13,861**	**9,947**

Assumptions: SWA calculated the savings for this measure using lighting cost and lifespan database and occupancy schedule for lighting usage.

Rebates/financial incentives:
NJ Clean Energy – Occupancy Sensor Wall Mounted - $20 per fixture, Total $260; T12 to T8 - $30/fixture - Total $30; Metal Halide to Pulse Start - $25/fixture - $150 total

Options for funding the Lighting 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: *Install Energy Vending Misers*

Description:

The Police Station building has a beverage vending machine located in the basement, in the kitchen area. Energy vending miser devices are now available for conserving energy with these vending machines and coolers. There is not a need to purchase new machines to reduce operating costs and greenhouse gas emissions. When equipped with the vending miser devices, refrigerated beverage vending machines use less energy and are comparable in daily energy performance to new ENERGY STAR qualified machines. Vending miser devices incorporate innovative energy-saving technology into small plug-and-play devices that installs in minutes, either on the wall or on the vending machine. Vending miser devices use a Passive Infrared Sensor (PIR) to power down the machine when the surrounding area is vacant; Monitor the room's temperature; automatically repower the cooling system at one- to three-hour intervals, independent of sales and ensure that the product stays cold.

Installation cost:

Estimated installed cost: $200 ($50 labor included)
Source of cost estimate: www.usatech.com *and established costs*

Economics (without incentives):

ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
Install Energy Miser on kitchen Drink Vending Machine	USAtech.com	200	none at this time	200	832	0.0	0.0	0.4	0.0	193	15	2,304	1.0	1,052	70	488	9,511	1,140

Assumptions: SWA assumes energy savings based modeling calculator found at www.usatech.com

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

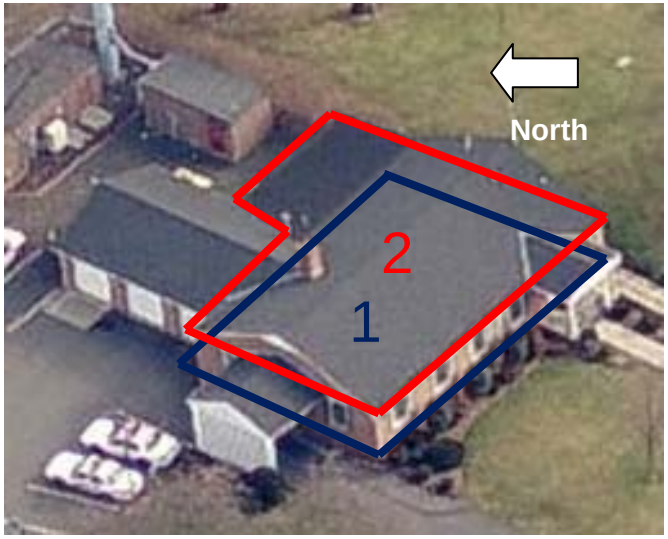
ECM#3: *HVAC TAB & Installing Programmable Thermostats*

Description:

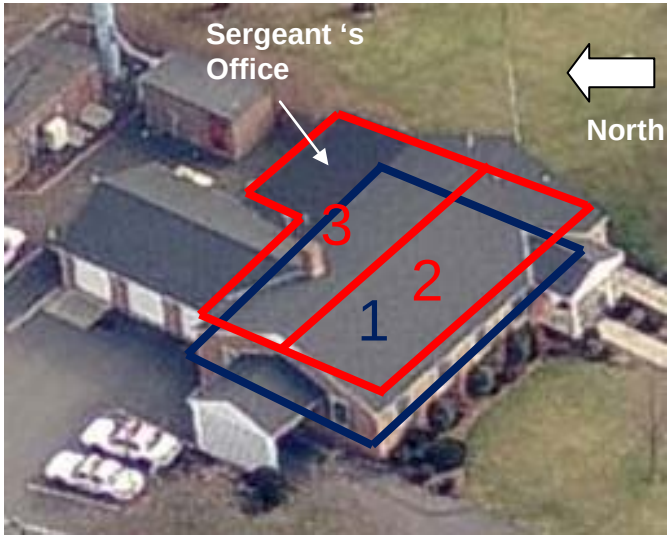
The Police Department building has two manual thermostats controlling the temperature of 6,720 square feet of occupied space and the air distribution system is currently constant volume. The building usage is highly variable. At least half of the main floor is occupied 24 hours a day for patrol duty while the other section of the main floor are office areas used eight hours a day. The kitchen areas, locker rooms and bathrooms in the basement are used intermittently at all hours. The HVAC system must be set up to accommodate the needs of this complex occupancy schedule.

The current controls based on two manual thermostats, one for the basement and one for the 1st floor have not been effective. There are significant thermal comfort issues expressed by occupants, evident by the use of electric unit heaters in seven different locations to supplement heat in the winter. Therefore, SWA recommends Testing and Balancing (TAB) of the HVAC system and controls and installing three programmable thermostats to control each furnace and allow for evening setbacks. The testing and balancing contractor may discover that the best solution is to install a variable volume air distribution system if the constant volume air system is not adequate for the configuration and use of the building. This potential cost is not included in the financial analysis.

The photos below represent the existing and proposed thermal zone allocations; red zones are on the main floor, blue zones are on the basement floor.



Existing manual thermostat zones – two



Proposed programmable thermostat zones– three

The proposed Zone 1 thermostat would control the operation of Furnace 1; Zone 2 and 3 thermostats would control Furnace 3 and 4, (see equipment list in Section 3 for details). Furnace 3 and 4 have separated heating sections and a combined cooling section making it difficult for them to operate independently based on thermostat settings. Therefore variable volume air dampers should be installed in the ductwork serving each zone on the first floor to control the amount of air to each zone based on temperature setpoint.

With the programmable zones separated, the HVAC contractor can adjust ductwork volume dampers to balance the flow to far reaching areas of the distribution system. The Sergeant's office, for example, is located in the Northeast corner of the building with two exterior walls and was found to be 57˚F on the day of the field audit despite local thermostats set above 68˚F, therefore the air distribution to the sergeant's office is one of the main areas to be investigated.

The intention of this measure is an overall reduction in both heating and cooling energy costs as well as increased occupant comfort and the elimination of using energy-wasting and potentially unsafe electric heaters in offices.

Installation cost:
Estimated installed cost: $8,826 (including $8,124 labor for TAB and installing thermostats)
Source of cost estimate: *Energy Star Calculator and Similar Projects*

Economics:

ECM description	Source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
HVAC TAB and Install three Programmable Thermostats & VAV	Energy Star Calculator	11,826	none at this time	11,826	2,407	0.8	292	5.6	500	1,476	15	17,615	8.0	112	7	7	2,862	6,720

Assumptions:
- TAB contracting - $1.25/sq ft, totaling $8,400
- Installed cost per programmable thermostat - $142, totaling $426
- Installed cost for two Variable air volume boxes $3,000
- Annual energy consumption savings of 13% heating and 16% cooling based on six hours Daytime set back and six hours Nighttime setback to 62˚F (heating) and 82˚F (cooling)
- Annual savings of 10.5 kW for 100 full load hours a year due to eliminating use of electric space heaters

- Operational savings of $500 due to a reduction in thermal complaints

Rebates/financial incentives:
There are currently no incentives for this measure at this time.

ECM#4: Replace 5 Ton Condenser with 14.5 SEER Condenser

Description:

The one component of the cooling system that is beyond useful life is the Carrier 5 Ton outdoor condensing unit which had a rated efficiency of 8.0 SEER. This component of the split DX cooling system can easily be replaced and tied into the existing cooling system, and there are models readily available with a much higher seasonal efficiency.

SWA recommends replacing the condenser with a 5 Ton, 14.5 SEER, Energy Star rated condenser. Below is the economic comparison of replacing with a conventional condenser (10.0 SEER), and the incremental difference of replacing with an EnergyStar rated condenser with over 14.0 SEER.

Installation cost:

Estimated installed cost: $4,057 (labor included $1,500)
Source of cost estimate: Similar projects, Energy Star Savings Calculator

Economics (with incentives):

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, $	est. energy & operating 1st year cost savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO2 reduced, lbs/yr
Replace 5 Ton, 8.0 SEER Condenser with Conventional Condenser, 10.0 SEER	Energy Star Savings calculator	3,501	0	3,501	1,509	0.5	0	0.8	0	350	14	4,900	10.0	40	3	NA	-58	2,067
Incremental cost difference to Replace Condenser with 14.5 SEER Units	Energy Star Savings calculator	556	460	96	1,034	0.3	0	0.5	0	240	14	3,360	0.4	3,400	243	250	2,265	1,417
Replace 5 Ton, 8.0 SEER Condenser with SEER 14.5 Condenser	**Energy Star Savings calculator**	**4,057**	**460**	**3,597**	**2,543**	**0.8**	**0**	**1.3**	**0**	**590**	**14**	**8,260**	**6.1**	**130**	**9**	**14**	**2,206**	**3,484**

Assumptions: SWA estimated costs based on RS Means, and Energy Star Savings calculator for 8.0 SEER condenser to a 10.0 SEER condenser, and then to a 14.5 SEER Condenser with billing rate based on utility bills.

Rebates/financial incentives:
NJ Clean Energy – Unitary HVAC < 5.4 Ton & 14.0 SEER - $92/ton: $460 total

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

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 15 kW PV system*

Description:

Currently, the Franklin Lakes Police Station building does not use any renewable energy systems. Renewable energy systems such as photovoltaic panels can be mounted on the building roof facing south 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 Borough of Franklin Lakes further review installing a 15 kW 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. The Borough of Franklin Lakes may consider applying for a grant and/or engage a PV generator/leaser who would install the PV system and then sell the power at a reduced rate. Orange Rockland Electric provides the ability to buy SRECs at $600/MWh or best market offer.

The size of the system was determined using the amount of roof surface area as a limiting factor, as well as the facilities annual base load. A PV system could be installed on a portion of the sloped roof that faces South or West. 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 15 kW system needs approximately 122 panels which would take up 1,300 square feet. Below is an ideal location to install the panels; south/southwest exposure with very little shade.

Installation cost:

Estimated installed cost: $90,000 (labor included at $3/Watt, totaling $45,000)
Source of cost estimate: Similar projects

Economics (with incentives):

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 cost savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
Install 15 kW Solar Photovoltaic system	Similar Projects	105,000	15,000	90,000	17,700	15.0	0.0	9.0	0.0	14,306	25	255,660	6.3	184	7.4	14	279,962	31,692

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:

NJ Clean Energy - Renewable Energy Incentive Program, Incentive based on $1.00/watt Solar PV application for systems 15 kW or less. Incentive amount for this application is $15,000 for the Franklin Lakes Police Station.

NJ Clean Energy - Solar Renewable Energy Certificate Program. Each time a solar electric system generates 1,000kWh (1MWh) of electricity, a SREC is issued which can then be sold or traded separately from the power. The buildings must also become net-metered in order to earn SRECs as well as sell power back to the electric grid. A total of $10,200/year, based on $600/SREC, has been incorporated in the above costs for the Police Department for a period of 15 years, however it requires proof of performance, application approval and negotiations with the utility. http://www.njcleanenergy.com/renewable-energy/programs/renewable-energy-incentive-program

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 #6: *Replace Old Refrigerator with Energy Star Model*

Description:

On the day of the site visit, SWA observed that there is an old refrigerator in the basement kitchen area which is at the end of its useful life. Appliances, such as refrigerators, that are over 10 years of age should be replaced with newer efficient models with the Energy Star label. SWA recommends replacing the existing refrigerator with an 18.0 cu. ft. top freezer Energy Star refrigerator rated at least 20% less than the maximum federal refrigerator energy use standard as per NAECA. Besides saving energy, the replacement will also keep the kitchen and other areas cooler.

Installation cost:

Estimated installed cost: $750 (includes $50/ unit labor)
Source of cost estimate: *Energy Star purchasing and procurement site, similar projects*

Economics:

Refrigerator Replacement Cost Comparison																		
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, $	est. energy & operating 1st year cost savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO2 reduced, lbs/yr
Replace (1) old kitchen refrigerator with an 18 cu ft model in kind	Energy Star purchasing and procurement site, similar projects	700	0	700	50	0.0	0	0.0	50	62	12	739	11.4	91	8	1	-87	69
Incremental difference to replace (1) old kitchen refrigerator with an 18 cu ft Energy Star model	Energy Star purchasing and procurement site, similar projects	50	0	50	300	0.1	0	0.2	50	120	12	1,435	0.4	3,970	331	239	1,140	411
Replace one (1) old kitchen refrigerator with an 18 cu ft Energy Star model	**Energy Star purchasing and procurement site, similar projects**	**750**	**0**	**750**	**350**	**0.1**	**0**	**0.2**	**100**	**100**	**12**	**1,200**	**7.5**	**60**	**5**	**9**	**29**	**480**

Assumptions: SWA calculated the savings for this measure using current billing rate and Energy Star database calculator for energy consumption savings.

Rebates/financial incentives:

NJ Clean Energy – No incentives at this time are offered by the state of NJ for this energy conservation measure.

Options for funding the Lighting 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 aren't currently any existing renewable energy systems.

5.2 Wind

There aren't any recommendations for this renewable energy source at this time due to lack of necessary wind conditions in this region.

5.3 Solar Photovoltaic

Please see the above recommended ECM# 5.

5.4 Solar Thermal Collectors

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

5.5 Combined Heat and Power

CHP is not applicable for this building because of HVAC system types (forced air) and intermittent domestic hot water use.

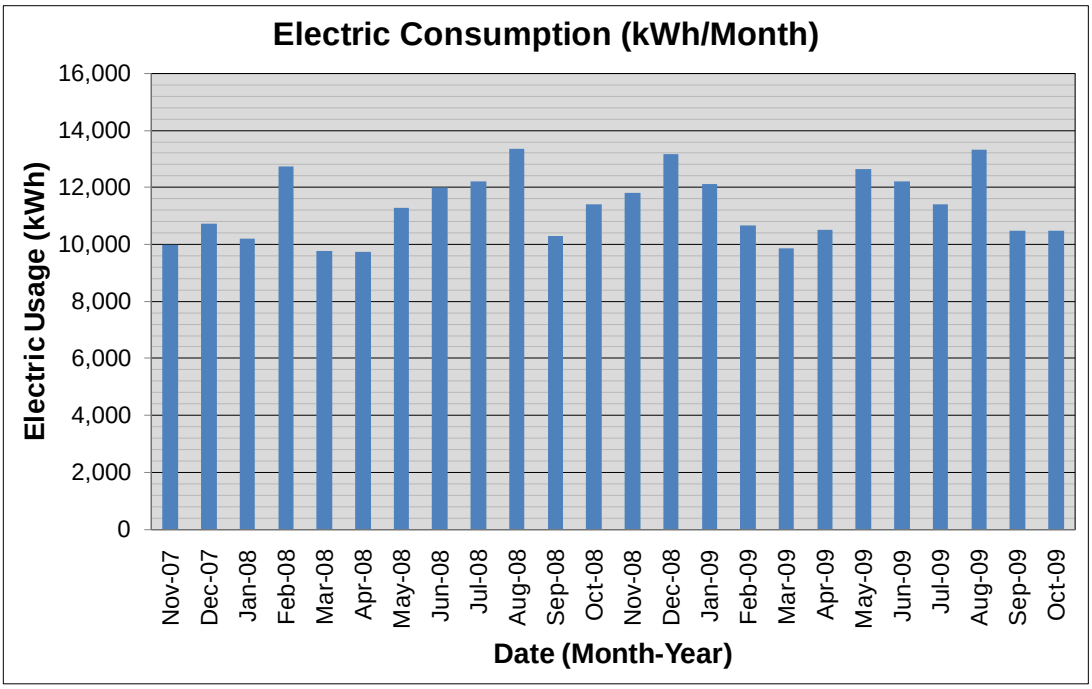
5.6 Geothermal

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

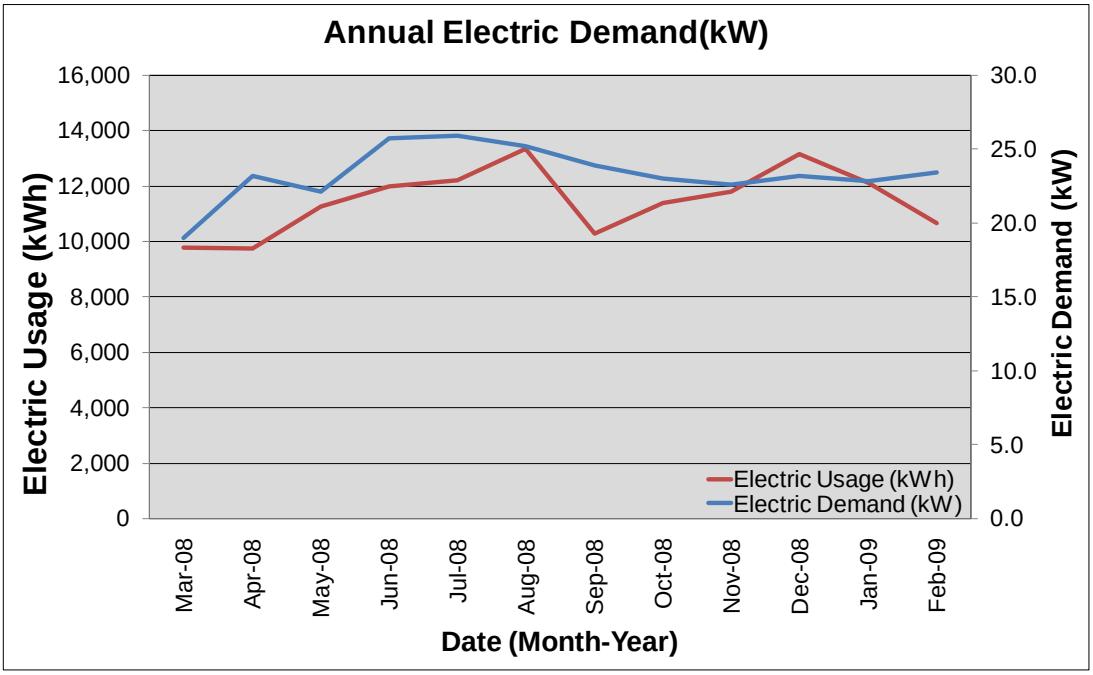
6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

6.1 Load profiles

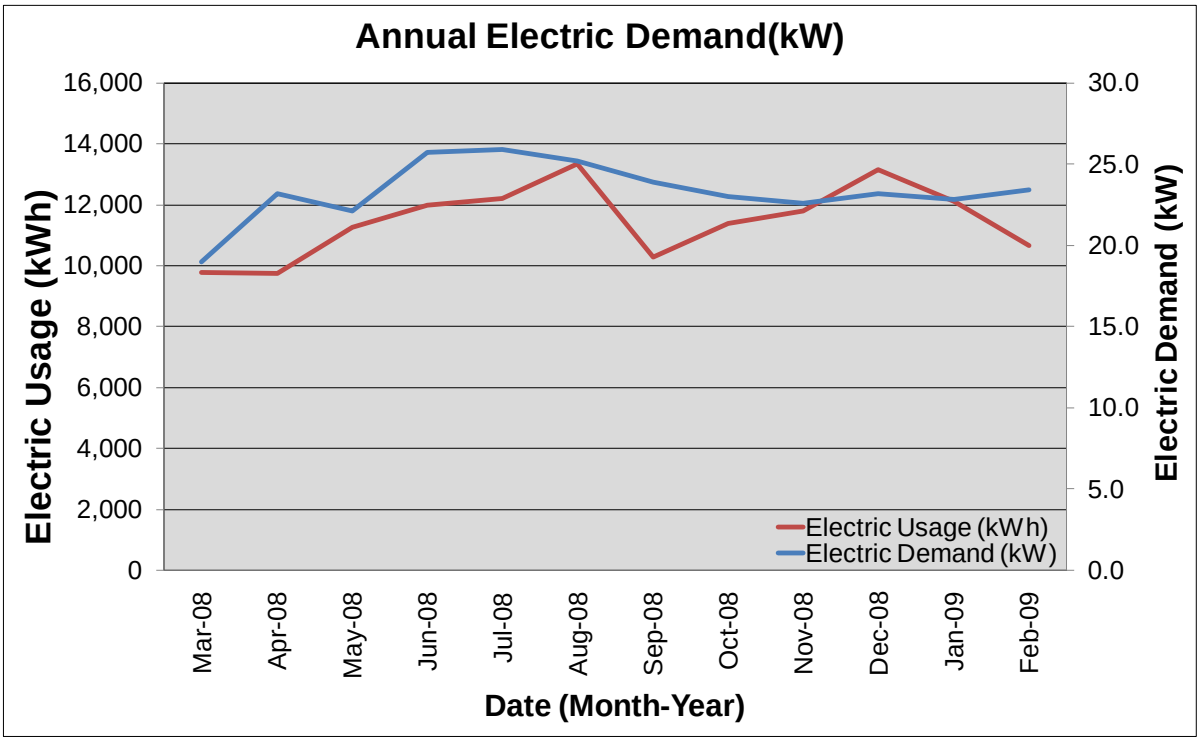
The following are charts that show the electric and natural gas load profiles for the Franklin Lakes Police Station.

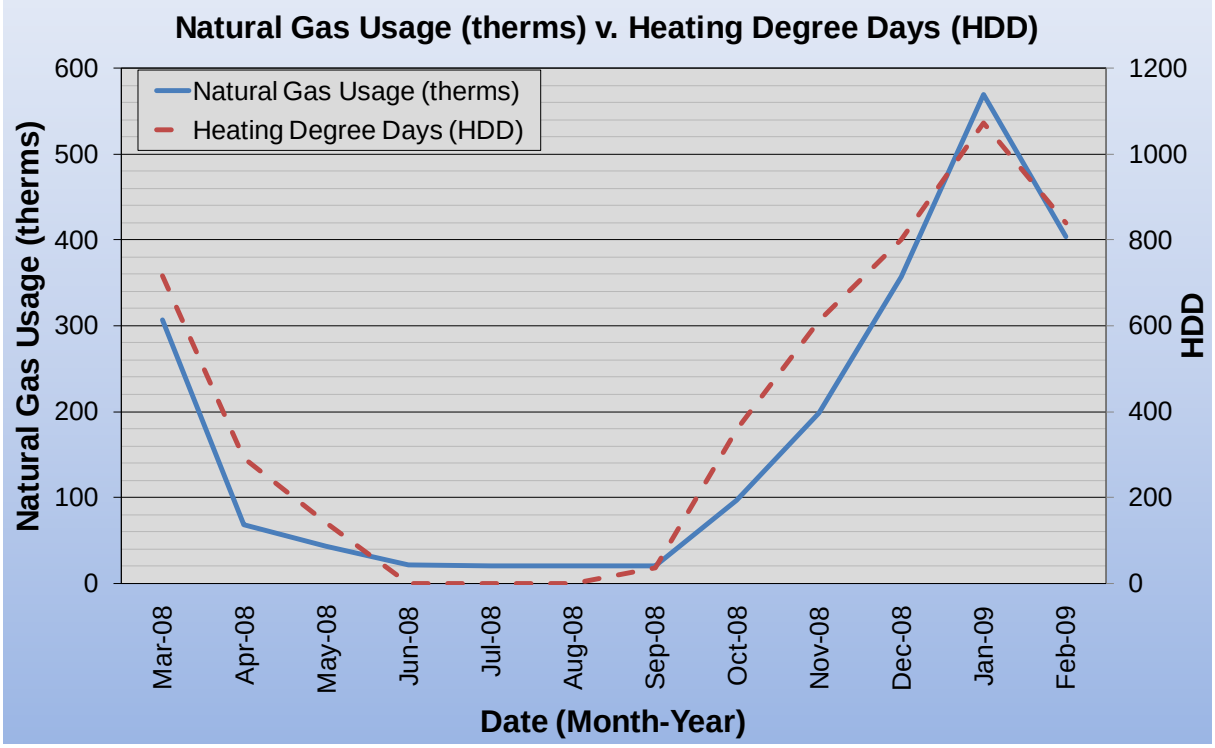


Also, note on the following chart how the electrical demand peaks follow the electrical consumption.



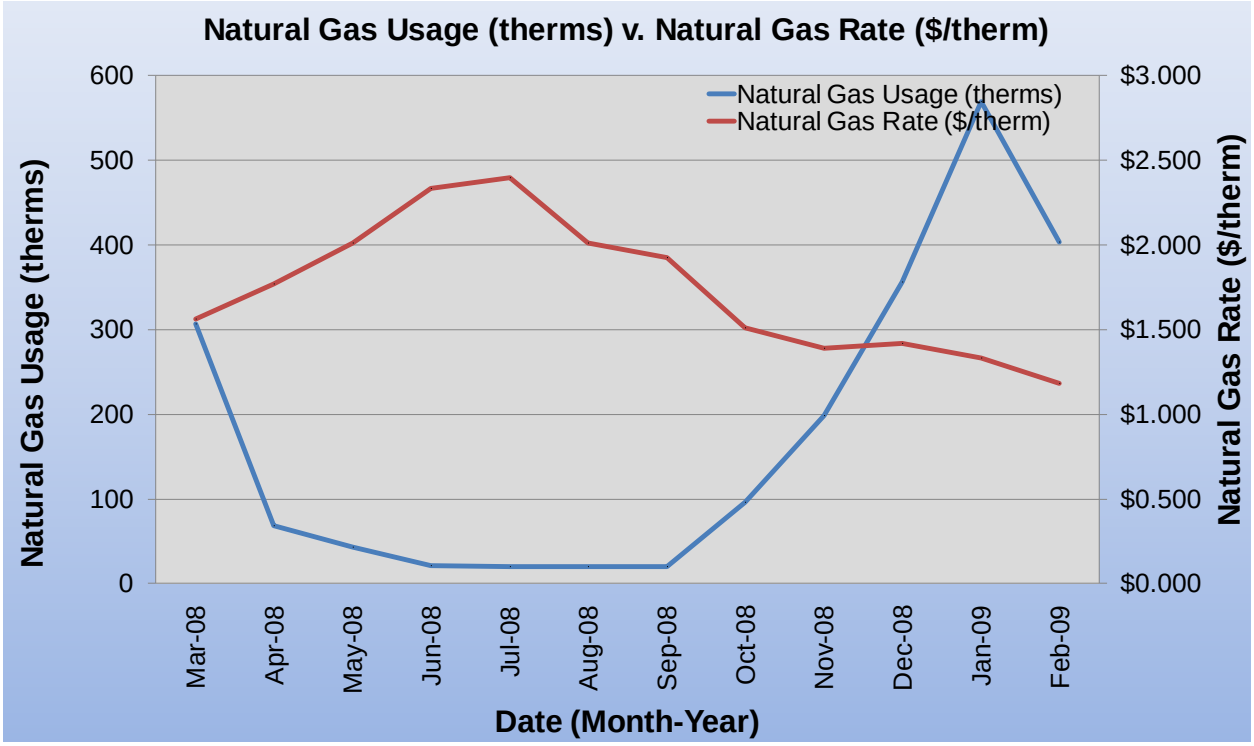
The following is a chart of the natural gas annual load profile for the building, peaking in the coldest months of the year as well as a chart showing natural gas consumption following the "heating degree days" curve.





6.2 Tariff analysis

Currently, natural gas is provided to the Franklin Lakes Police Station via one gas meter with the PSE&G acting as the supply and also the transport company. Gas is provided by PSE&G at a general service rate. The suppliers' general service rate for natural gas charges a market-rate price based on use, and the Franklin Lakes Police Station building billing does not break down demand costs for all periods. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year. The high gas price per therm fluctuations in the summer may be due to low use caps for the non-heating months as seen in June and July. Thus the building pays for fixed costs such as meter reading charges during the summer months.



The Franklin Lakes Police Station building is direct-metered and currently purchases electricity from Orange Rockland Electric at a general service rate. The general service rate for electric charges are market-rate based on use, and the Franklin Lakes Police Station building billing does show a breakdown of demand costs.

Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year. Typically, the electricity rates decrease during the cooling months when more electricity is used by the condensers for cooling such as May through July.

6.3 Energy Procurement strategies

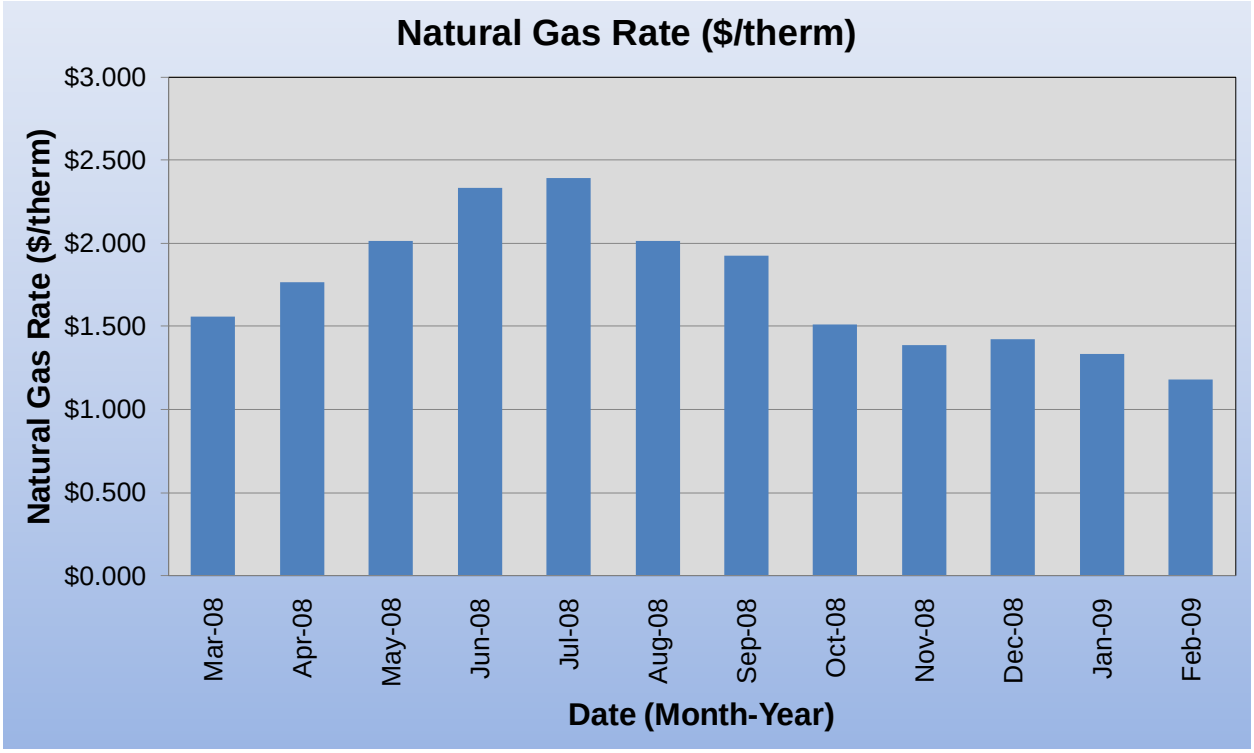
The Franklin Lakes Police Station building receives natural gas via one incoming meter with PSE&G service for supply and transport. There is not an ESCO engaged in the process. An Energy Services Company (ESCO) is a consultancy group that engages in a performance-based contract with a client firm to implement measures to reduce energy consumption and costs in a technically and financially viable manner.

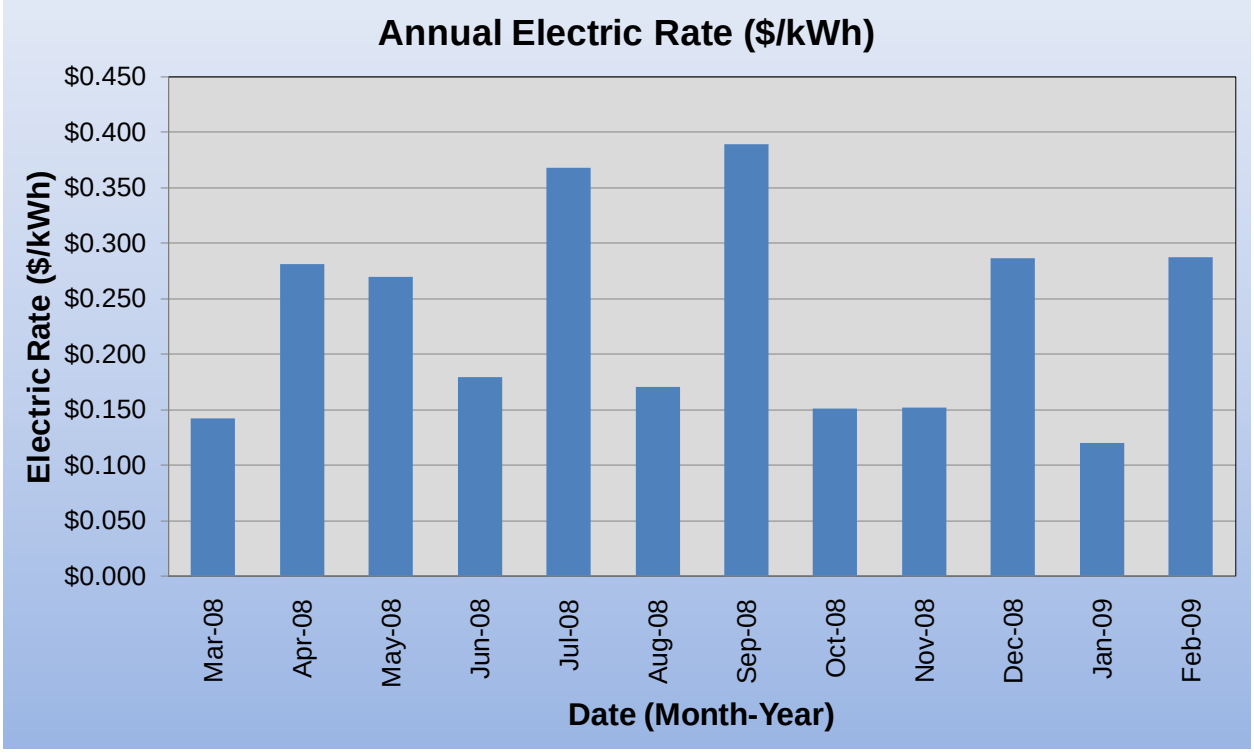
Electricity is purchased via one incoming meter directly for the main Franklin Lakes Police Station building from Orange Rockland Electric without an ESCO. SWA analyzed the utility rate for natural gas and electricity supply over an extended period. Electric bill analysis shows fluctuations up to 73% over the most recent 12 month period. Natural gas bill analysis shows fluctuations up to 51% over the most recent 12 month period. Some of these fluctuations may be due to unusually high and recent escalating energy costs. The average estimated NJ commercial utility rates for electric and gas are $0.150/kWh and $1.550/therm respectively. The Franklin Lakes Police Station building annual electric costs are $11,297 higher when compared to the average estimated NJ commercial utility rates.

SWA recommends that the Borough of Franklin Lakes further explore opportunities of purchasing electricity from ESCOs in order to reduce rate fluctuation and ultimately reduce the annual cost of energy for the Franklin Lakes Police Station. Appendix B contains a complete list of third party energy suppliers for the Borough of Franklin Lakes service area. The Borough of Franklin Lakes may also want to consider partnering with other school districts, municipalities, townships and communities to aggregate a substantial electric and natural gas use for better leveraging in negotiations with ESCOs and of improving the pricing structures. This sort of activity is happening in many parts of the country and in New Jersey.

The Franklin Lakes Police Station building would not be eligible for enrollment in a Demand Response Program because there isn't the capability at this time (without a large capital investment) to shed a minimum of 150 kW electric demand when requested by the utility during peak demand periods, which is the typical threshold for considering this option. Demand Response could be an option in the future when the Borough of Franklin Lakes may install a large enough back-up emergency generator.

The following charts show the Franklin Lakes Police Station building monthly spending per unit of energy from March 2008 to February 2009.





7. METHOD OF ANALYSIS

7.1 Assumptions and tools

Energy modeling tool: established/standard industry assumptions

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 Study

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	B	Meeting Rm ()	Recessed	E	4'T8	6	4	32	S	9	365	13	846	2,779	C	Recessed	4'T8	E	OS	6	4	32	7	365	13	846	2084	0	695	695
2	B	Lunch Rm ()	Recessed	E	4'T8	2	4	32	S	9	365	13	282	926	C	Recessed	4'T8	E	OS	2	4	32	7	365	13	282	695	0	232	232
3	B	Men's Locker Room ()	Recessed	E	4'T8	2	4	32	S	9	365	13	282	926	C	Recessed	4'T8	E	OS	2	4	32	7	365	13	282	695	0	232	232
4	B	Bathroom Men ()	Recessed	E	4'T8	3	4	32	S	9	365	13	423	1,390	C	Recessed	4'T8	E	OS	3	4	32	7	365	13	423	1042	0	347	347
5	B	Bathroom Men ()	Screw-in	N	Inc	3	1	60	S	9	365	0	180	591	CFL	Screw-in	CFL	N	OS	3	1	20	7	365	0	60	148	394	49	443
6	B	Hallway ()	Exit Sign	N	LED	1	1	5	N	16	365	1	6	35	N/A	Exit Sign	LED	N	N	1	1	5	16	365	1	6	35	0	0	0
7	B	Hallway ()	Recessed	E	4'T8	2	4	32	S	16	365	13	282	1,647	N/A	Recessed	4'T8	E	S	2	4	32	16	365	13	282	1647	0	0	0
8	B	Hallway ()	4'u-shape	E	4'T8	3	2	32	S	16	365	6	210	1,226	N/A	4'U-Shape	4'T8	E	S	3	2	32	16	365	6	210	1226	0	0	0
9	B	Staircase ()	Recessed	E	2'T8	2	2	17	S	16	365	3	74	432	N/A	Recessed	2'T8	E	S	2	2	17	16	365	3	74	432	0	0	0
10	B	Mechanical Rm ()	Recessed	E	4'T8	2	2	32	S	2	365	6	140	102	C	Recessed	4'T8	E	OS	2	2	32	2	365	6	140	77	0	26	26
11	B	Office ()	Recessed	E	4'T8	2	4	32	S	9	365	13	282	926	C	Recessed	4'T8	E	OS	2	4	32	7	365	13	282	695	0	232	232
12	B	Men's Locker Room ()	Recessed	E	4'T8	2	4	32	S	9	365	13	282	926	C	Recessed	4'T8	E	OS	2	4	32	7	365	13	282	695	0	232	232
13	B	Office ()	Recessed	E	4'T8	2	4	32	S	9	365	13	282	926	C	Recessed	4'T8	E	OS	2	4	32	7	365	13	282	695	0	232	232
14	B	Office ()	Recessed	E	4'T8	2	4	32	S	9	365	13	282	926	C	Recessed	4'T8	E	OS	2	4	32	7	365	13	282	695	0	232	232
15	1	chief office ()	Recessed	E	4'T8	4	4	32	S	9	365	13	564	1,853	N/A	Recessed	4'T8	E	S	4	4	32	9	365	13	564	1853	0	0	0
16	1	liuteant office ()	Recessed	E	4'T8	6	4	32	S	9	365	13	846	2,779	N/A	Recessed	4'T8	E	S	6	4	32	9	365	13	846	2779	0	0	0
17	1	captain office ()	Recessed	E	4'T8	4	4	32	S	9	365	13	564	1,853	N/A	Recessed	4'T8	E	S	4	4	32	9	365	13	564	1853	0	0	0
18	1	patrol area ()	Recessed	E	4'T8	4	4	32	S	24	365	13	564	4,941	N/A	Recessed	4'T8	E	S	4	4	32	24	365	13	564	4941	0	0	0
19	1	secretary office ()	Recessed	E	4'T8	4	4	32	S	9	365	13	564	1,853	N/A	Recessed	4'T8	E	S	4	4	32	9	365	13	564	1853	0	0	0
20	1	detention ()	Recessed	E	4'T8	4	4	32	S	9	365	13	564	1,853	N/A	Recessed	4'T8	E	S	4	4	32	9	365	13	564	1853	0	0	0
21	1	cell ()	Screw-in	N	inc	2	1	60	S	9	365	0	120	394	CFL	Screw-in	CFL	N	S	2	1	20	9	365	0	40	131	263	0	263
22	1	front desk ()	Recessed	E	4'T8	4	4	32	S	24	365	13	564	4,941	N/A	Recessed	4'T8	E	S	4	4	32	24	365	13	564	4941	0	0	0
23	1	sergeant office ()	Recessed	E	4'T8	4	4	32	S	9	365	13	564	1,853	N/A	Recessed	4'T8	E	S	4	4	32	9	365	13	564	1853	0	0	0
24	1	lobby ()	4'u-shape	E	4'T8	2	2	32	S	24	365	6	140	1,226	N/A	4'U-Shape	4'T8	E	S	2	2	32	24	365	6	140	1226	0	0	0
25	1	lobby ()	Exit Sign	N	led	1	1	5	S	24	365	1	6	53	N/A	Exit Sign	LED	N	S	1	1	5	24	365	1	6	53	0	0	0
26	1	lobby ()	Recessed	E	4't8	5	4	32	S	24	365	13	705	6,176	N/A	Recessed	4'T8	E	S	5	4	32	24	365	13	705	6176	0	0	0
27	1	Bathroom Men ()	Recessed	E	4'T8	2	1	32	S	9	365	3	70	230	C	Recessed	4'T8	E	OS	2	1	32	7	365	3	70	172	0	57	57
28	1	bathroom woMen ()	Recessed	E	4'T8	2	1	32	S	9	365	3	70	230	C	Recessed	4'T8	E	OS	2	1	32	7	365	3	70	172	0	57	57
29	1	evidence ()	Recessed	E	4'T12	1	1	40	S	9	365	12	52	171	T8	Recessed	4'T8	E	S	1	1	32	9	365	3	35	115	56	0	56
30	1	garage ()	Recessed	E	4'T8	3	4	32	S	9	365	13	423	1,390	N/A	Recessed	4'T8	E	S	3	4	32	9	365	13	423	1390	0	0	0
31	1	Hallway ()	Recessed	E	4't8	5	4	32	S	16	365	13	705	4,117	N/A	Recessed	4'T8	E	S	5	4	32	16	365	13	705	4117	0	0	0
32	1	Hallway ()	exit sign	N	led	2	1	5	N	16	365	1	12	70	N/A	Exit Sign	LED	N	N	2	1	5	16	365	1	12	70	0	0	0
33	1	patrol bathroom ()	Screw-in	N	inc	2	2	60	S	9	365	0	240	788	CFL	Screw-in	CFL	N	OS	2	2	20	7	365	0	80	197	526	66	591
34	Ext	Exterior ()	Screw-in	N	mh	1	2	75	T	16	365	38	188	1,098	PSMH	Screw-in	PSMH	N	T	1	2	50	16	365	22	122	712	385	0	385
35	Ext	Exterior ()	Screw-in	N	HPS	2	1	100	MS	16	365	25	250	1,460	PSMH	Screw-in	PSMH	N	MS	2	1	65	16	365	14	158	923	537	0	537
36	Ext	Exterior ()	Screw-in	N	HPS	2	2	100	MS	16	365	50	500	2,920	PSMH	Screw-in	PSMH	N	MS	2	2	65	16	365	28	316	1845	1075	0	1075
37	Ext	Exterior ()	Screw-in	N	mh	1	1	175	T	16	365	44	219	1,279	PSMH	Screw-in	PSMH	N	T	1	1	115	16	365	25	140	818	461	0	461
38	Ext	Exterior ()	Screw-in	N	inc	3	1	75	T	16	365	0	225	1,314	CFL	Screw-in	CFL	N	T	3	1	25	16	365	0	75	438	876	0	876
39	Ext	Exterior ()	Screw-in	N	cfl	3	1	32	T	16	365	0	96	561	N/A	Screw-in	CFL	N	T	3	1	32	16	365	0	96	561	0	0	0
Totals:						**107**	**106**	**1,609**				**459**	**12,668**	**59,161**						**107**	**106**	**1,276**			**382**	**11,720**	**51,901**	**4,573**	**2,687**	**7,260**

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

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

Proposed Lighting Summary Table			
Total Surface Area (SF)	6,720		
Average Power Cost ($/kWh)	0.2320		
Exterior Lighting	**Existing**	**Proposed**	**Savings**
Exterior Annual Consumption (kWh)	8,632	5,297	**3,335**
Exterior Power (watts)	1,478	907	**571**
Total Lighting	**Existing**	**Proposed**	**Savings**
Annual Consumption (kWh)	50,530	46,604	**7,260**
Lighting Power (watts)	11,190	10,813	**377**
Lighting Power Density (watts/SF)	1.67	1.61	**0.06**
Estimated Cost of Fixture Replacement ($)	5,557		
Estimated Cost of Controls Improvements ($)	2,860		
Total Consumption Cost Savings ($)	**2,191**		

Appendix B

Third Party Energy Suppliers (ESCOs)

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

Third Party Electric Suppliers for Orange Rockland Service Territory	Telephone & Web Site
BOC Energy Services, Inc. 575 Mountain Avenue Murray Hill, NJ 07974	(800) 247-2644 www.boc.com
Direct Energy Services, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com
Glacial Energy of New Jersey, Inc. 207 LaRoche Avenue Harrington Park, NJ 07640	(877) 569-2841 www.glacialenergy.com
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07097	(800) 437-7872 www.hess.com
Liberty Power Holdings, LLC Park 80 West, Plaza II, Suite 200 Saddle Brook, NJ 07663	(866) 769-03799 www.libertypowercorp.com
Sempra Energy Solutions 581 Main Street, 8th Floor Woodbridge, NJ 07095	(877) 273-6772 www.semprasolutions.com
Strategic Energy, LLC 55 Madison Avenue, Suite 400 Morristown, NJ 07960	(888) 925-9115 www.sel.com
Suez Energy Resources NA, Inc. 333 Thornal Street, 6th Floor Edison, NJ 08837	(888) 999-8374 www.suezenergyresources.com

PSE&G NATURAL GAS SERVICE TERRITORY Last Updated: 06/15/09		
Cooperative Industries 412-420 Washington Avenue Belleville, NJ 07109 800-6BUYGAS (6-289427) www.cooperativenet.com	**Direct Energy Services, LLP** 120 Wood Avenue, Suite 611 Iselin, NJ 08830 866-547-2722 www.directenergy.com	**Dominion Retail, Inc.** 395 Highway 170 - Suite 125 Lakewood, NJ 08701 866-275-4240 http://retail.dom.com
Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701 800-805-8586 www.gesc.com	**UGI Energy Services, Inc. d/b/a GASMARK** 704 East Main Street, Suite 1 Moorestown, NJ 080113 856-273-9995 www.ugienergyservices.com	**Great Eastern Energy** 116 Village Riva, Suite 200 Princeton, NJ 08540 888-651-4121 www.greateastern.com
Hess Energy, Inc. One Hess Plaza Woodbridge, NJ 07095 800-437-7872 www.hess.com	**Hudson Energy Services, LLC** 871 Route 17 South Ridgewood, NJ 07450 877- Hudson 9 www.hudsonenergyservices.com	**Intelligent Energy** 2050 Center Avenue, Suite 500 Fort Lee, NJ 07024 800-724-1880 www.intelligentenergy.org
Keil & Sons 1 Bergen Blvd. Fairview, NJ 07002 1-877-Systrum www.systrumenergy@aol.com	**Metromedia Energy, Inc.** 6 Industrial Way Eatontown, NJ 07724 877-750-7046 www.metromediaenergy.com	**Metro Energy Group, LLC** 14 Washington Place Hackensack, NJ 07601 888-113-Metro www.metroenergy.com
MxEnergy, Inc. 510 Thornall Street, Suite 270 Edison, NJ 088327 800-375-1277 www.mxenergy.com	**NATGASCO (Mitchell Supreme)** 1132 Freeman Street Orange, NJ 07050 800-840-4GAS www.natgasco.com	**Pepco Energy Services, Inc.** 112 Main Street Lebanon, NJ 08833 800-363-7499 www.pepco-services.com
PPL EnergyPlus, LLC 811 Church Road - Office 105 Cherry Hill, NJ 08002 800-281-2000 www.pplenergyplus.com	**Sempra Energy Solutions** The Mac-Cali Building 581 Main Street, 8th fl. Woodbridge, NJ 07095 877-273-6772 800-2 SEMPRA www.semprasolutions.com	**South Jersey Energy Company** One South Jersey Plaza, Route 54 Folsom, NJ 08037 800-756-3749 www.sjindustries.com/sje.htm
Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 011328 800-225-1560 www.spragueenergy.com	**Stuyvesant Energy LLC** 10 West Ivy Lane, Suite 4 Englewood, NJ 07631 800-646-64113 www.stuyfuel.com	**Woodruff Energy** 73 Water Street Bridgeton, NJ 08302 800-5113-1121 www.woodruffenergy.com

Appendix C: Glossary and Method of Calculations

Net ECM Cost: The net ECM cost is the cost experienced by the customer, which is typically the total cost (materials + labor) of installing the measure minus any available incentives. Both the total cost and the incentive amounts are expressed in the summary for each ECM.

Annual Energy Cost Savings (AECS): This value is determined by the audit firm based on the calculated energy savings (kWh or Therm) of each ECM and the calculated energy costs of the building.

Lifetime Energy Cost Savings (LECS): This measure estimates the energy cost savings over the lifetime of the ECM. It can be a simple estimation based on fixed energy costs. If desired, this value can factor in an annual increase in energy costs as long as the source is provided.

Simple Payback: This is a simple measure that displays how long the ECM will take to break-even based on the annual energy and maintenance savings of the measure.

ECM Lifetime: This is included with each ECM so that the owner can see how long the ECM will be in place and whether or not it will exceed the simple payback period. Additional guidance for calculating ECM lifetimes can be found below. This value can come from manufacturer's rated lifetime or warranty, the ASHRAE rated lifetime, or any other valid source.

Operating Cost Savings (OCS): This calculation is an annual operating savings for the ECM. It is the difference in the operating, maintenance, and / or equipment replacement costs of the existing case versus the ECM. In the case where an ECM lifetime will be longer than the existing measure (such as LED lighting versus fluorescent) the operating savings will factor in the cost of replacing the units to match the lifetime of the ECM. In this case or in one where one-time repairs are made, the total replacement / repair sum is averaged over the lifetime of the ECM.

Return on Investment (ROI): The ROI is expresses the percentage return of the investment based on the lifetime cost savings of the ECM. This value can be included as an annual or lifetime value, or both.

Net Present Value (NPV): The NPV calculates the present value of an investment's future cash flows based on the time value of money, which is accounted for by a discount rate (assumes bond rate of 3.2%).

Internal Rate of Return (IRR): The IRR expresses an annual rate that results in a break-even point for the investment. If the owner is currently experiencing a lower return on their capital than the IRR, the project is financially advantageous. This measure also allows the owner to compare ECMs against each other to determine the most appealing choices.

Gas Rate and Electric Rate ($/therm and $/kWh): The gas rate and electric rate used in the financial analysis is the total annual energy cost divided by the total annual energy usage for the 12 month billing period studied. The graphs of the monthly gas and electric rates reflect the total monthly energy costs divided by the monthly usage, and display how the average rate fluctuates throughout the year. The average annual rate is the only rate used in energy savings calculations.

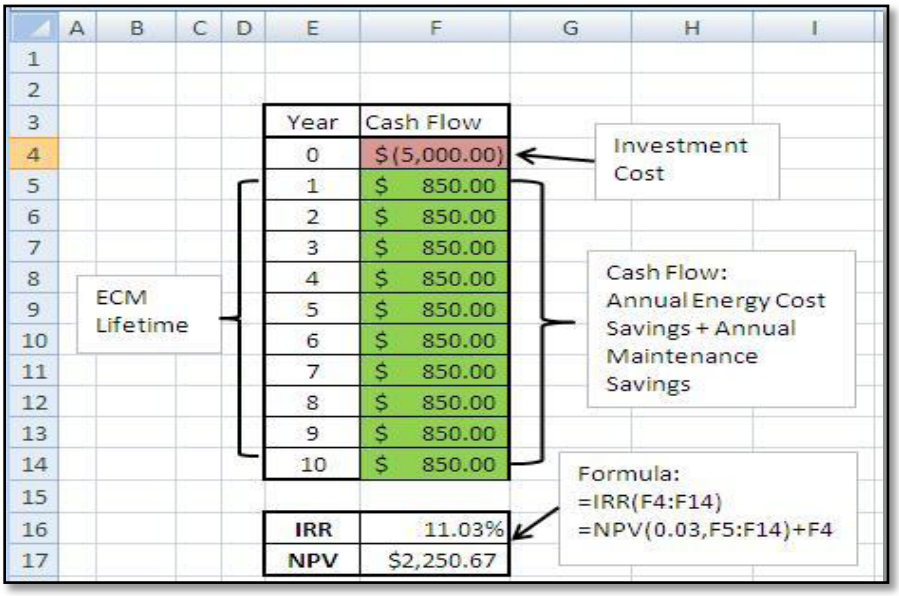
Calculation References

Term	Definition
ECM	Energy Conservation Measure
AOCS	Annual Operating Cost Savings
AECS	Annual Energy Cost Savings
LOCS*	Lifetime Operating Cost Savings
LECS	Lifetime Energy Cost Savings
LCS	Lifetime Cost Savings
NPV	Net Present Value
IRR	Internal Rate of Return
DR	Discount Rate
Net ECM Cost	Total ECM Cost – Incentive
LECS	AECS X ECM Lifetime
AOCS	LOCS / ECM Lifetime
LCS	LOCS+LECS
Simple Payback	Net ECM Cost / (AECS + AOCS)
Lifetime ROI	(LECS + LOCS – Net ECM Cost) / Net ECM Cost
Annual ROI	(Lifetime ROI / Lifetime) = [(AECS + OCS) / Net ECM Cost – (1 / Lifetime)]

* The lifetime operating cost savings are all avoided operating, maintenance, and/or component replacement costs over the lifetime of the ECM. This can be the sum of any annual operating savings, recurring or bulk (i.e. one-time repairs) maintenance savings, or the savings that comes from avoiding equipment replacement needed for the existing measure to meet the lifetime of the ECM (e.g. lighting change outs).

Excel NPV and IRR Calculation

In Excel, function =IRR (values) and =NPV(rate, values) are used to quickly calculate the IRR and NPV of a series of annual cash flows. The investment cost will typically be a negative cash flow at year 0 (total cost - incentive) with years 1 through the lifetime receiving a positive cash flow from the annual energy cost savings and annual maintenance savings. The calculations in the example below are for an ECM that saves $850 annually in energy and maintenance costs (over a 10 year lifetime) and takes $5,000 to purchase and install after incentives:



Solar PV ECM Calculation

There are several components to the calculation:

Costs:	Material of PV system including panels, mounting and net-metering + Labor
Energy Savings:	Reduction of kWh electric cost for life of panel, 25 years
Incentive 1:	NJ Renewable Energy Incentive Program (REIP), for systems of size 50kW or less, $1/Watt incentive subtracted from installation cost
Incentive 2:	Solar Renewable Energy Credits (SRECs) – Market-rate incentive. Calculations assume $600/Megawatt hour consumed per year for a maximum of 15 years; added to annual energy cost savings for a period of 15 years. (Megawatt hour used is rounded to nearest 1,000 kWh)
Assumptions:	A Solar Pathfinder device is used to analyze site shading for the building and determine maximum amount of full load operation based on available sunlight. When the Solar Pathfinder device is not implemented, amount of full load operation based on available sunlight is assumed to be 1,180 hours in New Jersey.

Total lifetime PV energy cost savings =
kWh produced by panel * [$/kWh cost * 25 years + $600/Megawatt hour /1000 * 15 years]

ECM and Equipment Lifetimes

Determining a lifetime for equipment and ECM's can sometimes be difficult. The following table contains a list of lifetimes that the NJCEP uses in its commercial and industrial programs. Other valid sources are also used to determine lifetimes, such as the DOE, ASHRAE, or the manufacturer's warranty.

Lighting is typically the most difficult lifetime to calculate because the fixture, ballast, and bulb can all have different lifetimes. Essentially the ECM analysis will have different operating cost savings (avoided equipment replacement) depending on which lifetime is used.

When the bulb lifetime is used (rated burn hours / annual burn hours), the operating cost savings is just reflecting the theoretical cost of replacing the existing case bulb and ballast over the life of the recommended bulb. Dividing by the bulb lifetime will give an annual operating cost savings.

When a fixture lifetime is used (e.g. 15 years) the operating cost savings reflects the avoided bulb and ballast replacement cost of the existing case over 15 years minus the projected bulb and ballast replacement cost of the proposed case over 15 years. This will give the difference of the equipment replacement costs between the proposed and existing cases and when divided by 15 years will give the annual operating cost savings.

New Jersey Clean Energy Program Commercial & Industrial Lifetimes

Measure	Life Span
Commercial Lighting — New	15
Commercial Lighting — Remodel/Replacement	15
Commercial Custom — New	18
Commercial Chiller Optimization	18
Commercial Unitary HVAC — New - Tier 1	15
Commercial Unitary HVAC — Replacement - Tier 1	15
Commercial Unitary HVAC — New - Tier 2	15
Commercial Unitary HVAC — Replacement Tier 2	15
Commercial Chillers — New	25
Commercial Chillers — Replacement	25
Commercial Small Motors (1-10 HP) — New or Replacement	20
Commercial Medium Motors (11-75 HP) — New or Replacement	20
Commercial Large Motors (76-200 HP) — New or Replacement	20
Commercial VSDs — New	15
Commercial VSDs — Retrofit	15
Commercial Comprehensive New Construction Design	18
Commercial Custom — Replacement	18
Industrial Lighting — New	15
Industrial Lighting — Remodel/Replacement	15
Industrial Unitary HVAC — New - Tier 1	15
Industrial Unitary HVAC — Replacement - Tier 1	15
Industrial Unitary HVAC — New - Tier 2	15
Industrial Unitary HVAC — Replacement Tier 2	15
Industrial Chillers — New	25
Industrial Chillers — Replacement	25
Industrial Small Motors (1-10 HP) — New or Replacement	20
Industrial Medium Motors (11-75 HP) — New or Replacement	20
Industrial Large Motors (76-200 HP) — New or Replacement	20
Industrial VSDs — New	15
Industrial VSDs — Retrofit	15
Industrial Custom — Non-Process	18
Industrial Custom — Process	10
Small Commercial Gas Furnace — New or Replacement	20
Small Commercial Gas Boiler — New or Replacement	20
Small Commercial Gas DHW — New or Replacement	10
C&I Gas Absorption Chiller — New or Replacement	25
C&I Gas Custom — New or Replacement (Engine Driven Chiller)	25
C&I Gas Custom — New or Replacement (Gas Efficiency Measures)	18
O&M savings	3
Compressed Air (GWh participant)	8

Appendix D: Incentive Programs

New Jersey Clean Energy Pay for Performance

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

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

For further information, please see: http://www.njcleanenergy.com/commercial-industrial/programs/pay-performance/existing-buildings .

Direct Install 2010 Program

Direct Install is a division of the New Jersey Clean Energy Programs' 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. See all applicable DI measures on the following pages.

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 at the website listed below.

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.

Utility Sponsored Programs

Check with your local utility companies for further opportunities that may be available.

Federal and State Sponsored Programs

Other federal and state sponsored funding opportunities may be available, including BLOCK and R&D grant funding. For more information, please check http://www.dsireusa.org/.

LIGHTING

Proposed Fixture
2' T8 1-lamp with EB
2' T8 2-lamp with EB
2' T8 3-lamp with EB
2' T8 4-lamp with EB
4' T8 1-lamp with EB
4' T8 2-lamp with EB
4' T8 3-lamp with EB
4' T8 4-lamp with EB
2' T8 1-lamp with EB plus reflector
4' T8 1-lamp with EB plus reflector
4' T8 2-lamp with EB plus reflector
4' T8 3-lamp with EB plus reflector
8' T8 2-lamp with EB
4' T8 4-lamp with EB plus reflector
4' T8 6-lamp with EB plus reflector
8' T8 2-lamp with EB plus reflector
2' T8 U-Lamp with EB
4' T8 2-lamp w/ HPEB
4' T8 2-lamp w/ HPEB plus reflector
4' T8 4-lamp w/ HPEB
4' T8 4-lamp w/ HPEB plus reflector
54T5HO 2-lamp and fixture
54T5HO 3-lamp and fixture
T8 3-lamp fixture with EB & reflector
T8 4-lamp fixture with EB & reflector
54T5HO 4-lamp and fixture
5W CF Screw-in Quad Lamp
5W CF Screw-in Torpedo or R20 Lamp
CF 7-1L SCREW IN CFL
CF 9-1L SCREW IN CFL
CF 13-1L SCREW IN CFL
CF 18-1L SCREW IN CFL
CF 22-1L SCREW IN CFL
CF 26-1L SCREW IN CFL
CF 28-1L SCREW IN CFL
CF 32-1L SCREW IN CFL
CF 36-1L SCREW IN CFL
CF 42-1L SCREW IN CFL
CF 7-1L SCREW IN CFL DIMMABLE
CF 18-1L SCREW IN CFL DIMMABLE
CF 23-1L SCREW IN CFL DIMMABLE
18W CIRCLINE w/ dome
32W CIRCLINE w/ dome
40W CIRCLINE w/ dome
58W CIRCLINE w/ dome
28W CF Exterior Floodlight w/PE
1 LAMP T5 HIGH BAY HO FIXTURE
2 LAMP T5 HIGH BAY HO FIXTURE
3 LAMP T5 HIGH BAY HO FIXTURE
4 LAMP T5 HIGH BAY HO FIXTURE
5 LAMP T5 HIGH BAY HO FIXTURE
6 LAMP T5 HIGH BAY HO FIXTURE
MH PS (320 W) RETRO.
MH PS (250W) RETRO.
MH PS (200 W) RETRO.
MH PS (175 W) RETRO.
NEW MH PS (320 W) FIXTURE
NEW MH PS (250 W) FIXTURE
NEW MH PS (200 W) FIXTURE
NEW MH PS (175 W) FIXTURE
42W Halogen Lamp (12 V System)
50W Halogen Lamp (12 V System)
65W Halogen Lamp (12 V System)
LED Exit Sign Retrofit Kit
LED Universal Exit Sign
LED EXIT Sign w/ Batt. Backup

LIGHTING CONTROLS

Proposed Sensor
Occ. Sensor Ceiling Mount (line volt)
Occ. Sensor Ceiling Mount (low volt)
Dual Tech. Occ.Sens Ceiling (line v)
Dual Tech. Occ.Sens Ceiling (low v)
Occ. Sens. Wall/Corner Mount (line v)
Occ. Sens. Wall/Corner Mount (low v)
Dual Tech Occ.Sens Wall/Corner (line v)
Dual Tech Occ.Sens Wall/Corner (low v)
Occupancy Sensor Wall Switch
Dual Tech Occ. Sensor Wall Switch
Occ.Sensor for High Bay Fixtures
Photocell Control w/ Dimmable Balast
Programmable Time Clock
Add'l Power Pack (a.k.a. Relay)

VFDS

Lookup
VFD for 1 HP Motor
VFD for 1.5 HP Motor
VFD for 2 HP Motor
VFD for 3 HP Motor
VFD for 5 HP Motor
VFD for 7.5 HP Motor
VFD for 10 HP Motor

GAS MEASURES

Measure Description
Low Intensity IR Heating Unit (Gas)
Gas-Fired Furnace
Gas-Fired Boiler

HVAC & HW CONTROLS

Equipment Type
Outside Economizer
Demand Control Ventilation
Programmable Thermostats

Pipe Wrap

0.75
1
1.25
1.5
2
2.5
3
4
6
8

MOTORS

Motor Description
Open Drip Proof - 1200 RPM - 5 HP
Open Drip Proof - 1200 RPM - 7.5 HP
Open Drip Proof - 1200 RPM - 10 HP
Open Drip Proof - 1800 RPM - 1.5 HP
Open Drip Proof - 1800 RPM - 2 HP
Open Drip Proof - 1800 RPM - 3 HP
Open Drip Proof - 1800 RPM - 5 HP
Open Drip Proof - 1800 RPM - 7.5 HP
Open Drip Proof - 1800 RPM - 10 HP
Open Drip Proof - 3600 RPM - 7.5 HP
Open Drip Proof - 3600 RPM - 10 HP
Enclosed, Fan-Cooled - 1200 RPM - 2 HP
Enclosed, Fan-Cooled - 1200 RPM - 3 HP
Enclosed, Fan-Cooled - 1200 RPM - 5 HP
Enclosed, Fan-Cooled - 1200 RPM - 7.5 HP
Enclosed, Fan-Cooled - 1200 RPM - 10 HP
Enclosed, Fan-Cooled - 1800 RPM - 3 HP
Enclosed, Fan-Cooled - 1800 RPM - 5 HP
Enclosed, Fan-Cooled - 1800 RPM - 7.5 HP
Enclosed, Fan-Cooled - 1800 RPM - 10 HP
Enclosed, Fan-Cooled - 3600 RPM - 7.5 HP
Enclosed, Fan-Cooled - 3600 RPM - 10 HP

OIL/PROPANE MEASURES

Measure /Capacity (Btus)
Oil-Fired Furnace
60,001 to 80,000
80,001 to 100,000
100,001 to 120,000
120,001 to 140,000
Propane-Fired Furnace
25,000 to 40,000
40,001 to 60,000
60,001 to 80,000
80,001 to 100,000
100,001 to 120,000
120,001 to 140,000
Oil-Fired Boiler
75,000 to 100,000
100,001 to 150,000
150,001 to 225,000
225,001 to 300,000
300,001 to 400,000
400,001 to 500,000
Propane-Fired Boiler
75,000 to 100,000
100,001 to 150,000
150,001 to 225,000
225,001 to 300,000
300,001 to 400,000
400,001 to 500,000

HOT WATER MEASURES
Low-flow Showerhead
Low-flow faucet aerators
Low-flow Kitchen Pre-Rinse Spray Valves

Fuel Economizer Control

Models	For Use with	Fuel	For HVAC Sizes	
IntelliCon-HW+	Resid. Hot Water Sys	Oil/Gas	<300	kBTU/hr
IntelliCon-LCH	Lt. Comm. Hot Water Sys.	Oil/Gas	300-2500	kBTU/hr
IntelliCon-CHW	Comm. Hot Water Sys.	Oil/Gas	>2500	kBTU/hr
IntelliCon-LCS	Lt. Comm. Steam Boilers	Oil/Gas	<2500	kBTU/hr
IntelliCon-CHS	Comm. Steam Boiler Sys.	Oil/Gas	>2500	kBTU/hr
IntelliCon-FA	Res/Comm. Forced Air Heat Sys.	Oil/Gas	all sizes	
IntelliCon-AC	Resid. Central AC	Electric	0-5	tons
IntelliCon-CAC	Comm. Central AC	Electric	>5	tons
IntelliCon-RU	Refrigeration Units	Electric	all sizes	

REFRIGERATION

Measure Description
Evaporator/Compressor Controller for one Cooler
Incremental Cost for each additional Cooler
First Cooler/Freezer Door Heater Control
Incremental Cost for each additional Cooler/Freezer Heater Circuit

PACKAGED HVAC

Equipment Type
2.5-Ton Packaged Unitary A/C (Elec.)
3-Ton Packaged Unitary A/C (Elec.)
4-Ton Packaged Unitary A/C (Elec.)
5-Ton Packaged Unitary A/C (Elec.)
7.5-Ton Packaged Unitary A/C (Elec.)
10-Ton Packaged Unitary A/C (Elec.)
12-Ton Packaged Unitary A/C (Elec.)
15-Ton Packaged Unitary A/C (Elec.)
2.5-Ton Packaged Unit (Elec. AC/Gas Heat)
3-Ton Packaged Unit (Elec. AC/Gas Heat)
4-Ton Packaged Unit (Elec. AC/Gas Heat)
5-Ton Packaged Unit (Elec. AC/Gas Heat)
7.5-Ton Packaged Unit (Elec. AC/Gas Heat)
10-Ton Packaged Unit (Elec. AC/Gas Heat)
12-Ton Packaged Unit (Elec. AC/Gas Heat)
15-Ton Packaged Unit (Elec. AC/Gas Heat)
2-Ton Electric Split System A/C
2.5-Ton Electric Split System A/C
3-Ton Electric Split System A/C
4-Ton Electric Split System A/C
5-Ton Electric Split System A/C
7.5-Ton Electric Split System A/C
2-Ton Air Source Heat Pump
2.5-Ton Air Source Heat Pump
3-Ton Air Source Heat Pump
4-Ton Air Source Heat Pump
5-Ton Air Source Heat Pump
7.5-Ton Air Source Heat Pump
2.5-Ton Water Source Heat Pump
3-Ton Water Source Heat Pump
4-Ton Water Source Heat Pump
5-Ton Water Source Heat Pump
7.5-Ton Water Source Heat Pump