



Steven Winter Associates, Inc.
Architects and Engineers

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

Telephone
Facsimile
E-mail:

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

January 20, 2010

**Local Government Energy Program
Energy Audit Final Report**

For

***The Parks and Recreation Garage
Township of Hanover
Whippany, NJ 07981***

Project Number: LGEA14



TABLE OF CONTENTS

INTRODUCTION.....3

EXECUTIVE SUMMARY.....4

1. HISTORIC ENERGY CONSUMPTION.....7

1.1. ENERGY USE AND COST ANALYSIS7

1.2. UTILITY RATE7

1.3. ENERGY BENCHMARKING8

2. FACILITY AND SYSTEMS DESCRIPTION.....8

2.1. BUILDING CHARACTERISTICS8

2.2. BUILDING OCCUPANCY PROFILES.....8

2.3. BUILDING ENVELOPE.....8

2.3.1. EXTERIOR WALLS8

2.3.2. ROOF.....9

2.3.3. BASE9

2.3.4. WINDOWS10

2.3.5. EXTERIOR DOORS10

2.3.6. BUILDING AIR TIGHTNESS11

2.4. HVAC SYSTEMS11

2.4.1. HEATING.....11

2.4.2. COOLING11

2.4.3. VENTILATION.....11

2.4.4. DOMESTIC HOT WATER.....11

2.5. ELECTRICAL SYSTEMS12

2.5.1. LIGHTING12

2.5.2. APPLIANCES AND PROCESS12

2.5.3. ELEVATORS.....13

2.5.4. OTHERS ELECTRICAL SYSTEMS.....13

3. EQUIPMENT LIST.....14

4. ENERGY CONSERVATION MEASURES14

5. RENEWABLE AND DISTRIBUTED ENERGY MEASURES18

5.1. EXISTING SYSTEMS18

5.2. WIND.....18

5.3. SOLAR PHOTOVOLTAIC.....19

5.4. SOLAR THERMAL COLLECTORS.....19

5.5. COMBINED HEAT AND POWER.....19

5.6. GEOTHERMAL19

6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES.....19

6.1. LOAD PROFILES19

6.2. TARIFF ANALYSIS.....20

6.3. ENERGY PROCUREMENT STRATEGIES21

7. METHOD OF ANALYSIS22

7.1. ASSUMPTIONS AND TOOLS22

7.2. DISCLAIMER.....22

APPENDIX A: LIGHTING STUDY.....23

APPENDIX B: THIRD PARTY ENERGY SUPPLIERS (ESCOs).....24

INTRODUCTION

On July 27th, 28th and August 6th Steven Winter Associates, Inc. (SWA) performed an energy audit and assessment for the Township of Hanover. The audit included a review of the Parks and Recreation Garage, Municipal Building, Community Center, Department of Public Works and Monroe Hall. All these buildings are located in Whippany, NJ. A separate energy audit report is issued for each of the referenced buildings.

This report addresses the Parks and Recreation Garage (as known as Black Brook Park) near Ball-field B, in Whippany, NJ 07981. Current conditions and energy-related information were collected in order to analyze and facilitate the implementation of energy conservation measures for the building.

The Parks and Recreation Garage building was built in 1976 and houses a park and recreation satellite office, bathrooms, lockers, garage and concession stand. Several minor upgrades to the infrastructure and mechanical systems have occurred over the years. The building consists of 2,080 square feet of conditioned main space. The building houses approximately 7 staff members at various times during the year and is occupied roughly 20 hours / week.

The building is normally operated daily and staffed around mid-day and some evenings, during the year when ball games take place in the park and nearby sports fields.

There are not any set schedules for the building at this time.

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

EXECUTIVE SUMMARY

The energy audit performed by Steven Winter Associates (SWA) encompasses the Parks and Recreation Garage building located at Black Brook Park, by Ball-field B, Whippany, NJ 07981. The Parks and Recreation Garage building is a one story building with a combined floor area of 2,080 square feet. The building is comprised of several workshop and storage sections and was built in 1976.

Based on the field visits performed by the SWA staff on July 27th, 28th and August 6th, 2009 and the results of a comprehensive energy analysis, this report describes the site's current conditions and recommendations for improvements. Suggestions for measures related to energy conservation and improved comfort are provided in the scope of work. Energy and resource savings are estimated for each measure that results in a reduction of heating, cooling, and electric use.

In the last 12 months, the Parks and Recreation Garage building consumed 49,792 kWh or \$8,675 worth of electricity. The energy consumption for the building was 169 MM-Btus. A few fluctuations showed up for a couple of months on the utility bills which may be due to adjustments between estimated and actual meter readings. The Township of Hanover should demand a full accounting from the energy providers and ask that billings be based only on realistic and actual meter readings.

SWA benchmarked the Parks and Recreation Garage building using the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. The building did not receive a performance rating due to size, nature of activity inside the building and hours occupied.

Based on the assessment of the Parks and Recreation Garage, SWA has separated the investment opportunities into three recommended categories. These are summarized as follows.

Category I Recommendations: Capital Improvements

- The heating equipment such as ceiling hung unit heaters, baseboard heating elements, exhaust fan and small domestic hot water heaters have reached the end of their usable expected life and should be prioritized for replacement as funds become available for keeping the building updated.
- Improve ceiling / roof, envelope and in-between space insulation. Present insulation in the building is minimal to non-existent in many of the spaces.

Category II Recommendations: Operations and Maintenance

- Controls Optimization - SWA recommends that the schedules for all heating equipment and exhaust fan be reviewed and optimized. During periods when the spaces are not occupied, the equipment may be shut-off or controlled to minimize the amount of expended energy. The cost and effort associated with implementation of this recommendation will depend upon the capabilities of the existing building control system. Energy and cost savings associated with this recommendation will vary, depending upon the current occupancy schedules and means of control utilized.
- Weather Stripping / Air Sealing - SWA observed that exterior door weather-stripping in places was beginning to deteriorate. 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.
- Water Efficient Fixtures & Controls - Adding controlled on / off timers on all lavatory faucets is a cost-effective way to reduce domestic hot water demand and save water. Building staff can also easily install faucet aerators and / or low-flow fixtures to reduce water consumption. There are many retrofit options, which can be installed now or incorporated as equipment is replaced. Routine maintenance practices that identify and quickly address water leaks are a low-cost way to save water and energy. Retrofitting with

more efficient water-consumption fixtures / appliances will save both energy and money through reduced energy consumption for water heating, while also decreasing water / sewer bills.

- Gutters - Installing gutters at the base of the roof will ensure proper drainage from rain and run-off. Gutters should be regularly inspected for clogs from leaves or branches.
- Energy Star labeled appliances such as refrigerators should replace older energy inefficient equipment
- Smart power electric strips with occupancy sensors should be used to power down computer equipment when left unattended for extended periods of time
- Create an educational program that teaches maintenance personnel how to minimize the energy use in the buildings. The US Department of Energy offers free information for hosting energy efficiency educational programs and for more information please visit: <http://www1.eere.energy.gov/education/>

Category III Recommendations: Energy Conservation Measures

At this time, SWA recommends a total of **2** Energy Conservation Measures (ECMs) for the Parks and Recreation Garage building. The total investment cost for these ECMs with incentives is **\$4,400**. SWA estimates a first year savings of **\$1,356** with a simple payback of **3.2 years**. SWA estimates that implementing the recommended ECMs will reduce the carbon footprint of the Parks and Recreation Garage building by **10,660 lbs of CO₂**.

There are various incentives that the Township of Hanover could apply for that could also help lower the cost of installing the ECMs. SWA recommends that the Parks and Recreation Garage building apply for the NJ SmartStart program through the New Jersey Office of Clean Energy. This incentive can help provide technical assistance for the building in the implementation phase of any energy conservation project. Specifically, the building could qualify for \$140 for installing the recommended wall-mounted occupancy sensors. A new NJ Clean Power program, Direct Install, will be rolled out soon and could also assist to cover 80% of the capital investment.

The following tables summarize the proposed Energy Conservation Measures (ECM) and their economic relevance.

PROPOSED													
ECM #	ECM description	Installed Cost		1st year energy savings					SPP	LoM	Lifetime	ROI %	Annual Carbon Reduced (lbs of CO2)
		Estimate \$	Source	Use	Unit	Demand	Unit	Savings / year \$			Cost Savings \$		
1	install programmable thermostats for work spaces	\$3,750	RS Means, Lit Search, Similar Projects	7,469	kWh	31.2	kW	1,301	2.9	12	12,799	20.1	10,232
2.1	replace 1 incandescent lamps to CFL	\$20	RS Means, Lit Search	36	kWh	0.2	kW	6	3.2	7	39	13.4	49
2.2	install 7 occupancy sensors with INCENTIVES (incl. 67% labor)	\$630	RS Means, Lit Search, NJ Clean Energy Program	276	kWh	1.2	kW	48	13.1	20	701	0.6	378
	Total Proposed	\$4,400		7,781	kWh	32	kW	1,356	3.2	13	14,342	17.2	10,660

Definitions:

SPP – Simple Payback (years)

LoM: Life of Measure (years)

ROI: Return on Investment (%)

Assumptions:

Discount Rate: 3.2% per DOE FEMP Guidelines

Energy Price Escalation Rate: 0% per DOE FEMP Guidelines

CONSIDERED													
ECM #	ECM description	Installed Cost		1st year energy savings					SPP	LoM	Lifetime	ROI %	Annual Carbon Reduced (lbs of CO2)
		Estimate \$	Source	Use	Unit	Demand	Unit	Savings / year \$			Cost Savings \$		
2.3	replace bldg. internal lights: T12s to T8s with INCENTIVES (incl. 75% labor)	\$3,700	RS Means, Lit Search, NJ Clean Energy Program	378	kWh	1.6	kW	66	56.3	20	961	-3.7	518

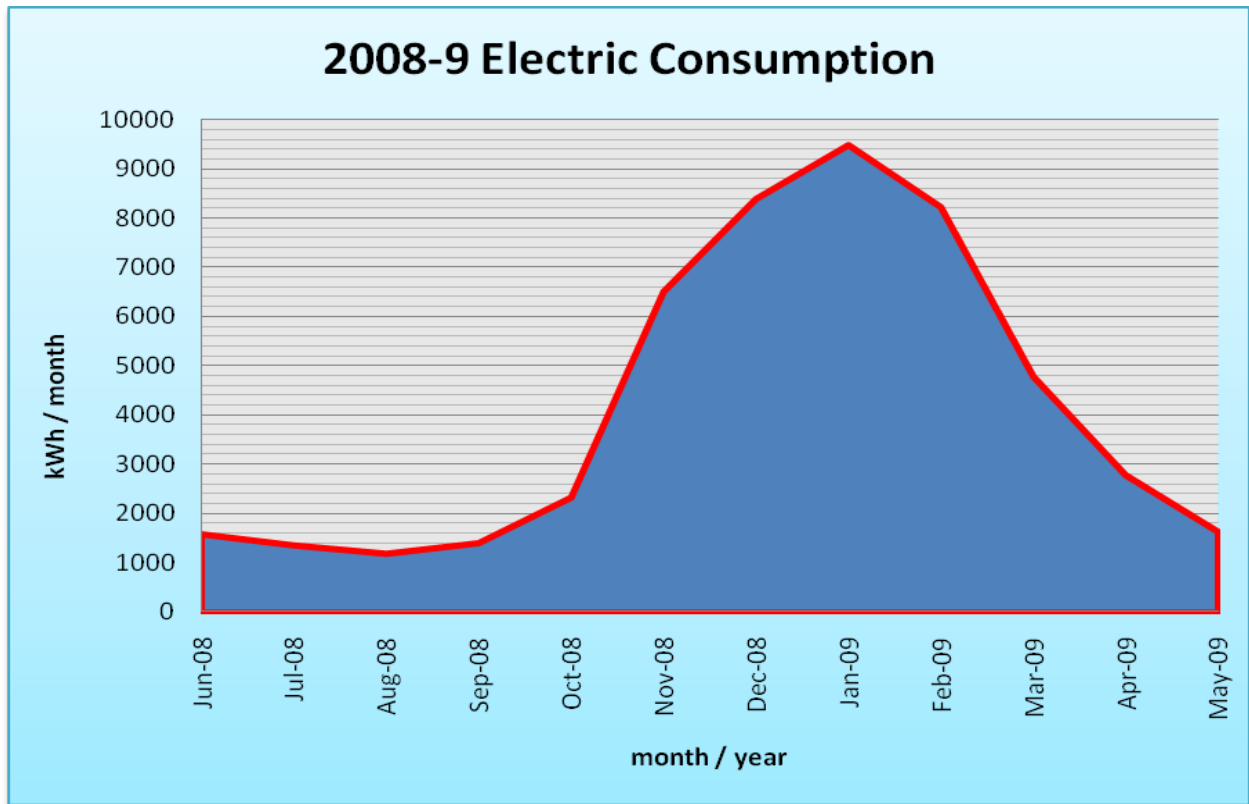
1. HISTORIC ENERGY CONSUMPTION

1.1. Energy use and cost analysis

SWA analyzed utility bills from June 2007 through May 2009 that were received from the utilities supplying the Parks and Recreation Garage building with electric power.

Electricity - The Parks and Recreation Garage building is currently served by one electric meter. The Parks and Recreation Garage building currently buys electricity from JCP&L at **an average rate of \$0.174/kWh** based on 12 months of utility bills for mid 2008 to mid 2009. The Parks and Recreation Garage building purchased **approximately 49,792 kWh or \$8,675 worth of electricity** in the previous year. The average monthly demand was 17 kW. Some electric fluctuations may be due to adjustments between estimated and actual meter readings. The Township of Hanover should demand a full accounting from JCP&L and ask that billings be based only on realistic and actual meter readings.

The following chart shows electricity use for the Parks and Recreation Garage building based on utility bills for the 12 month period of mid 2008 to mid 2009. The annual electric use is 169 MM Btus.



1.2. Utility rate

The Parks and Recreation Garage building currently purchases electricity from JCP&L at a general service market rate for electricity use (kWh) with a separate (kW) demand charge. The Parks and Recreation Garage building currently pays an average rate of approximately \$0.174/kWh based on 12 months of utility bills for mid 2008 to mid 2009.

A few unusual utility fluctuations showed up for a couple of months on the utility bills which may be due to adjustments between estimated and actual meter readings. The Township of Hanover should demand a full accounting from the energy providers and ask that billings be based only on realistic and actual meter readings.

1.3. Energy benchmarking

The Parks and Recreation Garage building information and utility data were entered into the U.S. Environmental Protection Agency's (EPA) Energy Star Portfolio Manager Energy benchmarking system. The building did not receive a performance rating due to size, nature of activity inside the building and hours occupied. The Site Energy Use Intensity is 81 kBtu/ft²yr compared to the national average for similar type building consuming 77 kBtu/ft²yr. Implementing this report's recommendations will make the building energy consumption better than the national average.

Per the LGEA program requirements, SWA has assisted the Township of Hanover to create an *Energy Star Portfolio Manager* account and share the Parks and Recreation Garage facilities information to allow future data to be added and tracked using the benchmarking tool. SWA has shared this Portfolio Manager site information with the Township of Hanover (user name of "Hanovertpw" and same password administered by David W. Leo, Assistant Township Engineer for the Township of Hanover) and TRC Energy Services (user name of TRC-LGEA).

2. FACILITY AND SYSTEMS DESCRIPTION

2.1. Building Characteristics

The Parks and Recreation Garage building is single-story structure built in 1976. The building consists of 2,080 square feet of conditioned main space. The Parks and Recreation Garage building, built in 1976 with minor renovations over time consist mostly of a park and recreation satellite office, bathrooms, lockers, garage and concession stand.

2.2. Building occupancy profiles

The occupancy for the Parks and Recreation Garage building is approximately 7 staff members at various times during the year and is occupied roughly 20 hours / week. The building is normally operated daily and staffed around mid-day and some evenings, during the year when ball games take place in the park and nearby sports fields.

2.3. Building envelope

2.3.1. Exterior Walls

The exterior walls consist of 8" CMU blocks with a rough stone-like texture faced split block finish. Due to warm temperature conditions at the time of the field visits, insulation levels could not be verified with help of infrared technology. If desired, the Parks and Recreation Department could contract a separate envelope inspection during cooler months.



Exterior Wall

2.3.2. Roof

According to building maintenance personnel, a new roof was installed in February 2006. The pitched roof areas with dark colored asphalt shingles appeared to be in good condition without any obvious penetrations or signs of leakage. SWA measured 2" of foil-faced fiberglass batt insulation between roof rafters.



Foil faced fiberglass insulation 2 ¼ inch R-7 in roof rafters

Due to warm temperature conditions at the time of the field visits, additional insulation in the roof deck could not be verified with infrared technology. If any portion of the building is renovated or improved as part of a capital improvement plan, SWA recommends verifying insulation and increasing insulation to the roof during construction.

2.3.3. Base

The building's base is a 4" concrete slab-on grade with a perimeter footing. The slab edge or perimeter insulation could not be verified and should be confirmed at the time of the above recommended insulation inspection during cooler months for usable infrared data evaluation. Due to the lack of gutters or decent overhangs on the building, rain run-off is deposited around the perimeter

of the building, settling near the foundation of the building. The result of this run-off is discoloration of the building's façade at the base of the wall assemblies.



Water soaked wall due to lack of gutters or sufficient overhang

2.3.4. Windows

The building contains fixed and casement aluminum-framed windows some with clear, others with polycarbonate cover. The windows original to the building are energy in-efficient. SWA recommends operable commercial blinds, wherever missing, to alter the amount of natural light that is allowed to enter each room in order to improve thermal and / or glare control. Where glare is a concern, the issue could be dealt with by professionally installed retrofit window foils applied to the inside where necessary. A double-pane low-E rating would be of additional benefit for future window replacements.



Fixed and casement windows with polycarbonate cover

2.3.5. Exterior doors

The aluminum framed exterior doors were observed to be in 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 conditioned air that is lost around each door. SWA also

recommends checking the weather-stripping of each door on a regular basis and replacing any broken seals immediately. Tight seals around the doors will help ensure that the building is kept continuously tight and insulated.

The weather-stripping observed at the Parks and Recreation Garage building was intact but worn out in some areas and no longer performing as expected.

2.3.6. Building air tightness

Based on a visual inspection, the Parks and Recreation Garage building would benefit from air sealing all penetrations throughout the structure, including piping, plumbing, ductwork, and electrical penetrations. SWA recommends performing regular maintenance caulking, foaming, and sealing around penetrations, windows, and verifying proper weather-stripping around doors. Air tight building envelopes result in conserving energy while lowering heating and cooling costs.

2.4. HVAC Systems

2.4.1. Heating

In the Parks and Recreation Garage building utility room, refreshments space and workshop areas are heated by electric baseboard heaters, each individually set. The equipment storage area is heated by ceiling mounted electric unit heaters and fans.

2.4.2. Cooling

The Parks and Recreation Garage building is not air conditioned. Any cooling and fresh air circulation is achieved via by cross-currents when opening doors or windows, some by exhaust fans.

2.4.3. Ventilation

One rooftop exhaust fan purges the building air of the Parks and Recreation Garage building.

2.4.4. Domestic Hot Water

There is one small 20 gallon electrically heated Domestic Hot Water unit in the Parks and Recreation Garage building serving the refreshments area and bathroom area.



20 gallon water heater

More efficient water-consuming fixtures and appliances save both energy and money through reduced energy consumption for water heating, as well decreased water and sewer bills. SWA recommends adding controlled on / off timers on all lavatory faucets to reduce domestic hot water demand and save water. Building staff can also easily install faucet aerators and / or low-flow fixtures to reduce hot water consumption. In addition, routine maintenance practices that identify and quickly address water leaks are a low-cost way to save water and energy.

2.5. Electrical systems

2.5.1. Lighting

Interior Lighting - The Parks and Recreation Garage building currently consists of mostly T12 fluorescent fixtures with magnetic ballasts with an area already retrofitted with T8 fixtures. Based on measurements of lighting levels for each space, there are not any vastly over-lighted areas. SWA recommends replacing T12 lighting including magnetic ballasts whenever possible with T8 lighting and electronic ballasts. As this option may not be very cost effective, the changeover could take place as fixtures break down and are taken out of service. SWA also recommends installing occupancy sensors in bathrooms, offices and areas that are occupied only part of the day. Since bathrooms are used sporadically throughout the day and lighting is commonly left on far beyond the necessary hours of operation, SWA recommends installing occupancy sensors with time delay and acoustic capabilities. Typically, occupancy sensors have an adjustable time delay that shuts down the lights automatically if no motion or sound is detected within a set time period. The building also has a number of lights with incandescent bulbs. SWA recommends replacing all incandescent bulbs with CFLs. See attached lighting schedule in Appendix A for a complete inventory of lighting throughout the building and estimated power consumption.

Exit Lights - The building has mostly 16W fluorescent exit signs installed. SWA recommends that any newly installed exit signs be LED type exit signs.

Exterior Lighting - The exterior lighting was surveyed during the building audit: a mix of 175 Watt metal halide, 150 Watt high pressure sodium perimeter lamps. SWA recommends replacing any incandescent lamps with lower energy CFL bulbs. Since this lighting is mainly for Safety as well as for Security, SWA has deemed it not cost effective to replace exterior high pressure sodium lamp lighting at this time. All exterior lighting is controlled by photocells. There is not any immediate need to upgrade this lighting (except for any incandescent) or photocells.

2.5.2. Appliances and process

The Parks and Recreation Garage building refreshments area houses a freezer, refrigerator and electric range to name a few. Appliances, such as refrigerators, that are over 10 years of age should be replaced with newer efficient models with the Energy Star label. For example, Energy Star refrigerators use as little as 315 kWh / year. When compared to the average electrical consumption of older equipment, Energy Star equipment results in a large savings. Energy Star labeled appliances and equipment, include: window air conditioners, 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>.



Refrigerators in Kitchen area

Computers left on in offices 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 use approximately 3-5 watts of electricity when turned off. SWA recommends all computers and all appliances (i.e. fridges, coffee makers, televisions, etc) be plugged in to power strips and turned off each evening just as the lights are turned off. The Parks and Recreation Garage computers are generally programmed for the power save mode, to shut down after a period of time that they have not been used.

Educating the staff is a great way for Parks and Recreation Department to save energy while raising awareness about the importance of energy-efficiency. Prizes and challenges can be used to get employees involved in finding creative ways to reduce and monitor energy usage throughout the building or park. There are many free resources available to help. The US Department of Energy offers free information for hosting energy efficiency educational programs and lesson plans, for more information please visit: <http://www1.eere.energy.gov/education/> . NJ Clean Energy will also be coming out soon with a Teach Program for local government maintenance staff.

2.5.3. Elevators

The Parks and Recreation Garage building is a single story building and therefore does not contain any elevator equipment.

2.5.4. Others electrical systems

There are not currently any other electrical systems installed at the Parks and Recreation Garage building.

3. EQUIPMENT LIST

Inventory

Township of Hanover Black Brook Parks and Recreation Garage							
Building System	Description	Location	Model #	Fuel	Space Served	Equip Age	Estimated Remaining Useful Life %
Heating / Cooling Systems	3 ceiling hung unit heaters	work and equip storage area	Singer 9421, 9423, 9425 - YAR	Electric	Equipment Storage	1976	0% (operating beyond their usable expected life)
Heating / Cooling Systems	6 baseboard electric heaters	utility room, workshop and bathrooms	Singer VCO-242, 4, 5, 6 & 8	Electric	Bathrooms, refreshments and workshop areas	1976	0% (operating beyond their usable expected life)
Ventilation	1 exhaust fan	rooftop	Brundage 810A	Electric	Parks and Recreation Garage building	1976	0% (operating beyond its usable expected life)
Domestic Hot Water	1 small unit	refreshments area	-	Electric	for refreshments, bathrooms	1995	0% (operating beyond its usable expected life)
Lighting	See details - Appendix A	See details - Appendix A	-	Electric	whole building	varies	varies, average 25%

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 Parks and Recreation Garage building, SWA has separated the investment opportunities into three recommended categories:

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

Category I Recommendations: Capital Improvements

- The heating equipment such as ceiling hung unit heaters, baseboard heating elements, exhaust fan and small domestic hot water heaters have reached the end of their usable expected life and should be prioritized for replacement as funds become available for keeping the building updated.

- Improve ceiling / roof, envelope and in-between space insulation. Present insulation in the building is minimal to non-existent in many of the spaces.

Category II Recommendations: Operations and Maintenance

- Controls Optimization - SWA recommends that the schedules for all heating equipment and exhaust fan be reviewed and optimized. During periods when the spaces are not occupied, the equipment may be shut-off or controlled to minimize the amount of expended energy. The cost and effort associated with implementation of this recommendation will depend upon the capabilities of the existing building control system. Energy and cost savings associated with this recommendation will vary, depending upon the current occupancy schedules and means of control utilized.
- Weather Stripping / Air Sealing - SWA observed that exterior door weather-stripping in places was beginning to deteriorate. 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.
- Water Efficient Fixtures & Controls - Adding controlled on / off timers on all lavatory faucets is a cost-effective way to reduce domestic hot water demand and save water. Building staff can also easily install faucet aerators and / or low-flow fixtures to reduce water consumption. There are many retrofit options, which can be installed now or incorporated as equipment is replaced. Routine maintenance practices that identify and quickly address water leaks are a low-cost way to save water and energy. Retrofitting with more efficient water-consumption fixtures / appliances will save both energy and money through reduced energy consumption for water heating, while also decreasing water / sewer bills.
- Gutters - Installing gutters at the base of the roof will ensure proper drainage from rain and run-off. Gutters should be regularly inspected for clogs from leaves or branches.
- Energy Star labeled appliances such as refrigerators should replace older energy inefficient equipment
- Smart power electric strips with occupancy sensors should be used to power down computer equipment when left unattended for extended periods of time
- Create an educational program that teaches maintenance personnel how to minimize the energy use in the buildings. The US Department of Energy offers free information for hosting energy efficiency educational programs and for more information please visit: <http://www1.eere.energy.gov/education/>

Category III Recommendations: Energy Conservation Measures

Summary table

ECM#	Description
1	Upgrade primary space controls to digital programmable controls
2	Upgrade lighting: incandescent to CFLs, occupancy sensors for some of the spaces, Exit fluorescents to LED and T12 magnetic fixtures to T8 electronic fixtures

ECM#1: Upgrade Heating Controls to Digital

Description:

The Parks and Recreation Garage contains a number of electric baseboard and ceiling hung heaters which are roughly controlled at the unit to a low, medium or high setting and / or simply on /off switches. Temperature control in these spaces is controlled with difficulty, mostly in the on / off mode, without setback and poor accuracy. The comfort temperatures in these spaces make it a challenge to keep focused on the work at hand at times, while in the building. These spaces are not setback at night or after-hours and additional energy is used to keep the spaces warm, which would not be expended if controls could be properly operating.

SWA proposes that the Parks and Recreation Garage replace the existing rough unit setting knobs with strategically placed programmable wall mounted and tampering secure thermostats that will greatly improve the control and heat energy expended in the spaces. SWA also recommends that the 1976 vintage heaters be replaced as they break down, since they are beyond their usable expected life. As new systems are installed, they should be commissioned to follow a preset schedule as agreed and designed.

Installation cost:

Estimated installed cost: \$3,750

Source of cost estimate: Similar projects

Economics (without incentives):

ECM description	Installed Cost		1st year energy savings					SPP	LoM	Lifetime	ROI %	Annual Carbon Reduced (lbs of CO2)
	Estimate \$	Source	Use	Unit	Demand	Unit	Savings / year \$			Cost Savings \$		
install programmable thermostats for work spaces	\$3,750	RS Means, Lit Search, Similar Projects	7,469	kWh	31.2	kW	1,301	2.9	12	12,799	20.1	10,232

Assumptions: Since the utility bills have some accounting fluctuations, it is difficult to determine the energy used for heating the Parks and Recreation Garage. SWA estimated the heating energy usage from the electricity bills. SWA assumed typical heating savings of 15% for scheduled setbacks and controls. Estimated programmable thermostats costs / installation are based on similar project.

Rebates / financial incentives:

There are currently no incentives for this measure at this time.

Options for funding ECM:

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

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

ECM#2: Upgrade existing lighting

Description:

On the day of the site visit, SWA completed a lighting inventory of the Parks and Recreation Garage building (see Appendix A). The existing lighting consists of many T12 fluorescent fixtures with magnetic ballasts, and incandescent lights. Some of the lights in the Parks and Recreation Garage appear to have been partially upgraded recently to T8 fixtures and LED lighted Exit signs. SWA has performed an evaluation of upgrading all the T12 magnetic ballast fixtures to T8 electronic ballast fixtures, incandescent bulbs to CFLs and installing occupancy sensors in work spaces that may be left unoccupied a considerable amount of time throughout the day. The labor in all these installations was evaluated using prevailing electrical contractor wages. The Parks and Recreation Garage may decide to perform this work with in-house resources from its Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor, to gain savings. SWA recommends at a minimum that any incandescent bulbs be replaced with CFLs, and occupancy sensors be installed in a number of work spaces. See Appendix A for recommendations.

Installation cost:

Estimated installed cost: \$650

Source of cost estimate: *RS Means; Published and established costs*

Economics (Some of the options considered with incentives):

ECM description	Installed Cost		1st year energy savings					SPP	LoM	Lifetime	ROI %	Annual Carbon Reduced (lbs of CO2)
	Estimate \$	Source	Use	Unit	Demand	Unit	Savings / year \$			Cost Savings \$		
replace 1 incandescent lamps to CFL	\$20	RS Means, Lit Search	36	kWh	0.2	kW	6	3.2	7	39	13.4	49
install 7 occupancy sensors with INCENTIVES (incl. 67% labor)	\$630	RS Means, Lit Search, NJ Clean Energy Program	276	kWh	1.2	kW	48	13.1	20	701	0.6	378
Total Proposed	\$650		312	kWh	1	kW	54	12.0	20	781	1.0	427

Economics (Option with incentives considered that do not appear cost effective):

ECM description	Installed Cost		1st year energy savings					SPP	LoM	Lifetime	ROI %	Annual Carbon Reduced (lbs of CO2)
	Estimate \$	Source	Use	Unit	Demand	Unit	Savings / year \$					
replace building internal lights: T12s to T8s with INCENTIVES (incl. 75% labor)	\$3,700	RS Means, Lit Search, NJ Clean Energy Program	378	kWh	1.6	kW	66	56.3	20	961	-3.7	518

Assumptions: SWA calculated the savings for this measure using measurements taken the day of the field visit and using the billing analysis.

Rebates/financial incentives:

*NJ Clean Energy - Wall Mounted occupancy sensors (\$20 per control)
Maximum incentive amount is \$140.*

NJ Clean Energy – Prescriptive Lighting Incentive, Incentive based on installing T5 or T8 lamps with electronic ballasts in existing facilities (\$10-\$30 per fixture, depending on quantity of lamps). Maximum incentive amount is \$600.

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 are currently no existing renewable energy systems.

5.2. Wind

Description:

Wind power production would not be applicable for the Parks and Recreation Garage location, because the thermal winds generated in the area are blocked by park trees and the area in general is not very windy.

5.3. Solar Photovoltaic

Description:

A Solar Photovoltaic power production system would not be applicable for the Parks and Recreation Garage location, because the general area is shady and blocked by park trees.

5.4. Solar Thermal Collectors

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

5.5. Combined Heat and Power

Description:

CHP is not applicable for this building because there is no available gas service and it is costly to bring to the building at this time.

5.6. Geothermal

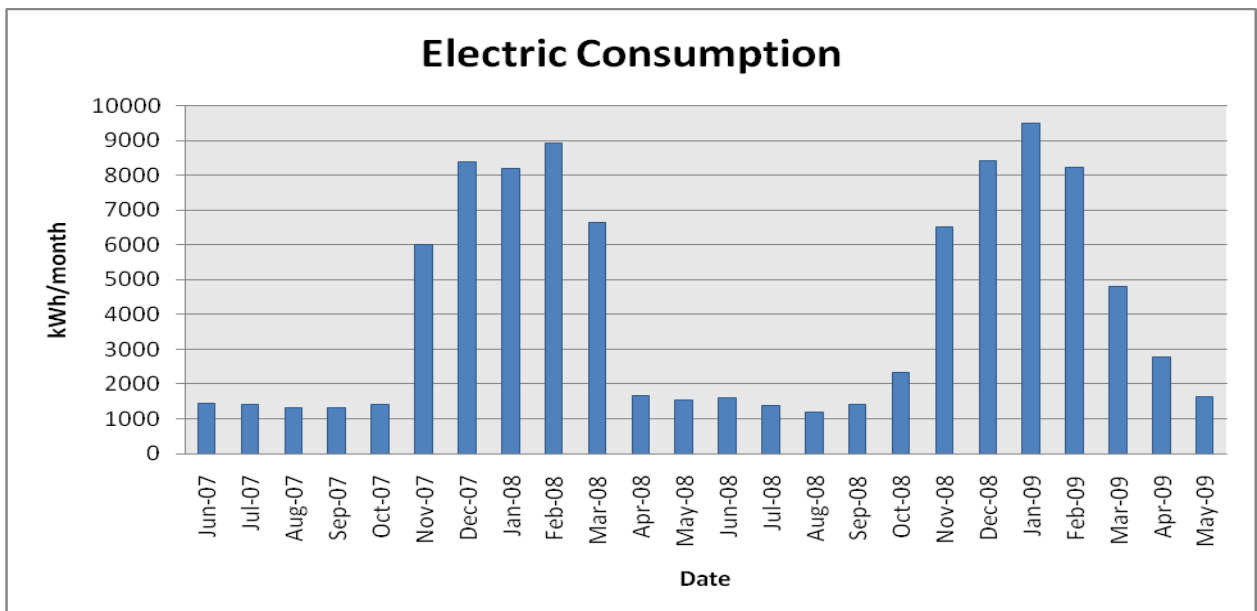
Description:

Geothermal is not applicable for this building because it would not be cost effective to change to a geothermal system at this location.

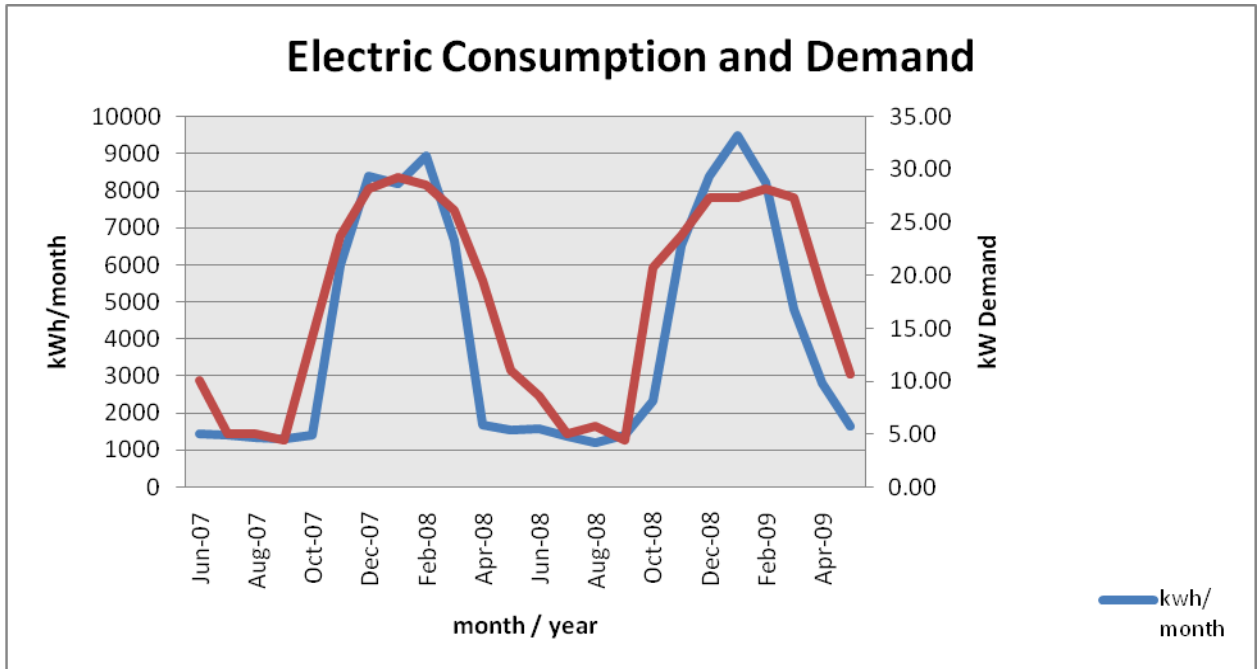
6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

6.1. Load profiles

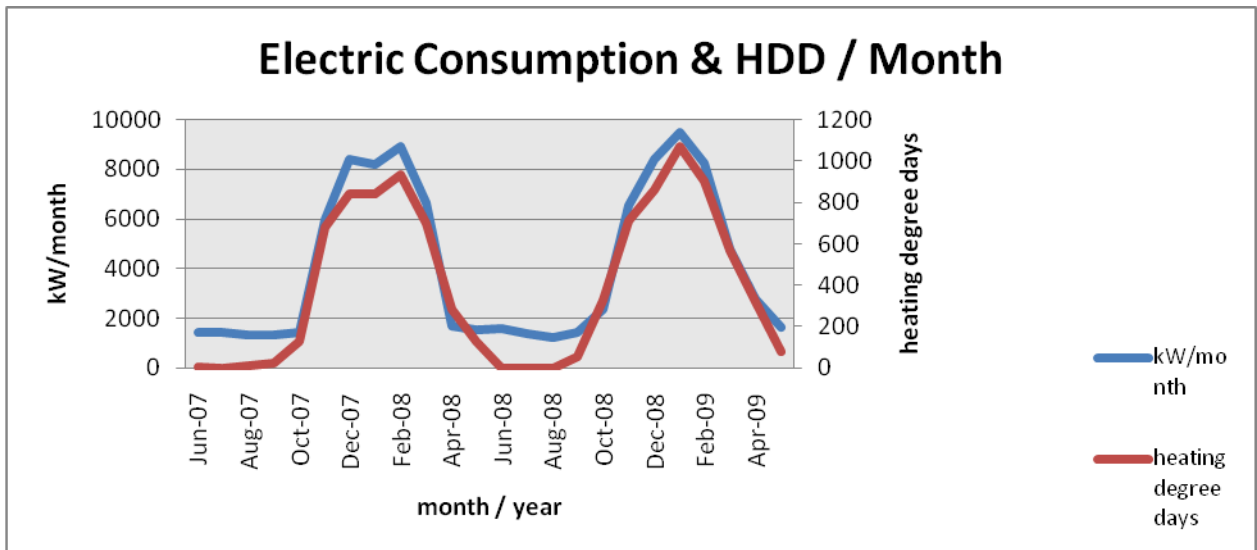
The following are charts that show the annual electric load profiles for the Parks and Recreation Garage building.



Also, note below how the electrical Demand peaks follow the electrical consumption peaks.



The following is a chart of the electric annual load profile for the building, peaking in the coldest months of the year and a chart showing electric heating consumption mimicking the “heating degree days” curve.



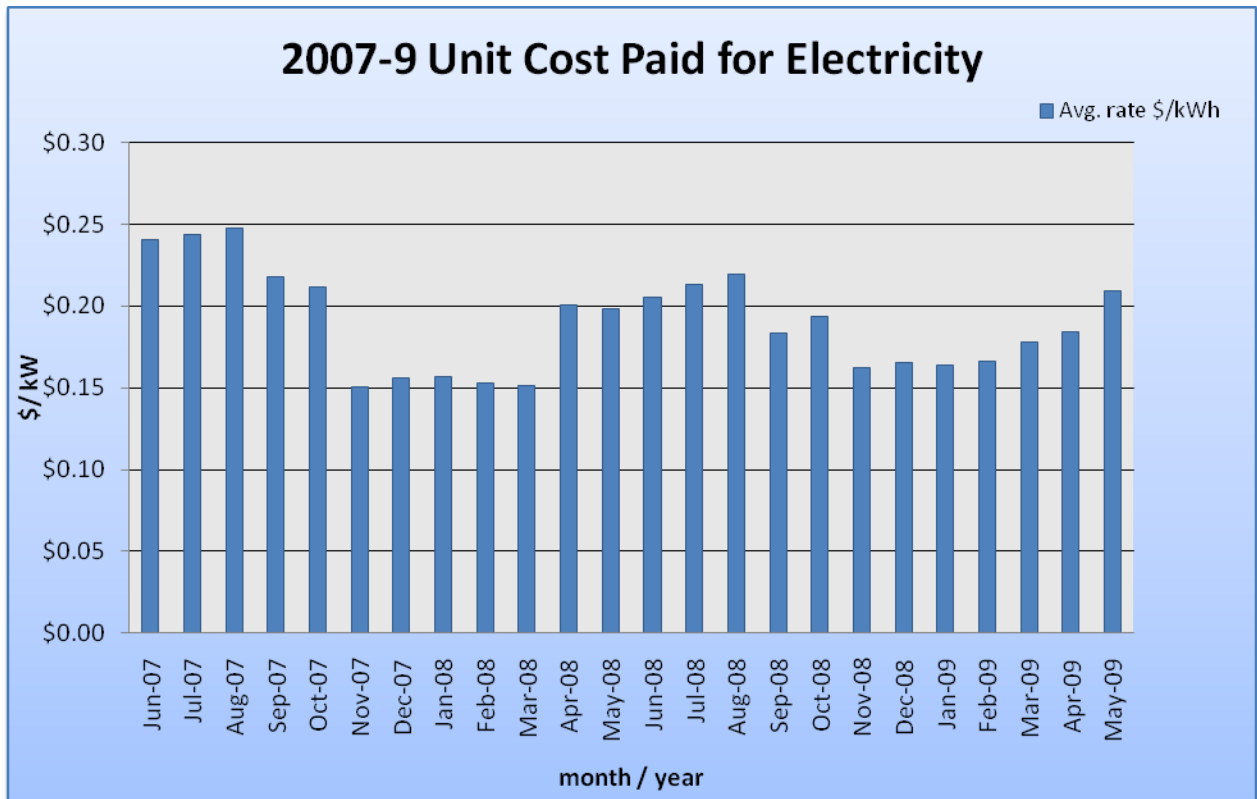
6.2. Tariff analysis

The Parks and Recreation Garage building is direct-metered (via one main meter) and currently purchases electricity from JCP&L at a general service rate. The general service rate for electric charges are market-rate based on use and the Parks and Recreation Garage 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 prices increase during the cooling months when electricity is used by air-handling units. The Parks and Recreation Garage does not use air conditioning during the summer months and uses electric heating during the winter months. The Township of Hanover should demand / receive a proper monthly billing based on actual readings from all energy suppliers.

6.3. Energy Procurement strategies

The Parks and Recreation Garage does not have natural gas service. Electricity is purchased directly for the Parks and Recreation Garage from JCP&L without an ESCO. There isn't 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 which reduce energy consumption and costs in a technically and financially viable manner. SWA analyzed the utility rate for electricity supply over an extended period. Electric bill analysis shows fluctuations up to 35% over the most recent 12 month period. Some of these fluctuations may have been caused by adjustments between estimated and actual meter readings, others may be due to unusual high and escalating energy costs in 2008. The average estimated NJ commercial utility rates for electric is \$0.150/kWh. This building's annual utility costs are \$1,197 higher for electric when compared to the average estimated NJ commercial utility rates. SWA recommends that the Township of Hanover further explore opportunities of purchasing electricity from ESCOs in order to reduce rate fluctuation and ultimately reduce the annual cost of energy for the Parks and Recreation Garage. Appendix B contains a complete list of third party energy suppliers for the Township of Hanover service area. The Township of Hanover may want to consider partnering with other school districts, municipalities, townships and communities to aggregate a substantial electric 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 following charts show the Parks and Recreation Garage monthly \$/kW spending for energy in 2008.



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

Parks and Recreation Garage Existing Lighting Conditions														Proposed Lighting											
#	Bldg	Fir	Location in Building	Measured Lighting Level in Foot-candles	Fixture Type	Ballast Type	No. of Fixtures	No. of Lamps	Type of Lamp	Watts /Lamp	Hrs/ Day	Energy Use (Watt hours / day)	Controls	Day-lighting possible ?	Fixture Type	Ballast Type	No. of Fixtures	No. of Lamps	Type of Lamp	Watts/ Lamp	Hrs/ Day	Energy Use (Watt hours/ day)	Controls	Total Power (Watts)	further W-hr/day reduction with occupancy sensors
1	BBP	1	Bathroom Women	5	T12 4'	M	2	2	F	34	8	1088	S	n	T8 4'	E	2	2	F	32	8	816	S	128	204
2	BBP	1	Bathroom Men	5	T12 4'	M	2	2	F	34	8	1088	S	n	T8 4'	E	2	2	F	32	8	816	S	128	204
3	BBP	1	work shop	20	T12 4'	M	6	2	F	34	4	1632	S	n	T8 4'	E	6	2	F	32	4	1224	S	384	306
4	BBP	1	workshop	20	T12 8'	M	2	2	F	68	4	1088	S	n	T8 4'	E	4	2	F	64	4	816	S	512	204
5	BBP	1	storage rm	10	T8 4'	E	2	2	F	32	4	512	S	n	T8 4'	E	2	2	F	32	4	512	S	128	128
6	BBP	1	office	20	T12 4'	M	3	4	F	34	4	1632	S	n	T8 4'	E	3	4	F	32	4	1224	S	384	306
7	BBP	1	storage rm	5	incand	-	1	1	I	60	4	240	S	n	CFL	-	1	1	CFL	15	4	60	S	15	
8	BBP	1	office	-	T12 2'	M	2	1	F	18	4	144	S	n	T8 2'	E	2	1	F	16	4	108	S	32	27
9	BBP	1	janitor's closet	5	T12 4'	M	1	2	F	34	1	68	S	n	T8 4'	E	1	2	F	32	1	51	S	64	
10	BBP	1	kitchen	5	T12 4'	M	2	4	F	34	3	816	S	n	T8 4'	E	2	4	F	32	3	612	S	256	
11	BBP	1	bldg lighting	ext	sodium halide	-	4	1	HPS	150	12	7200	photo-cell	N/A	sodium halide	-	4	1	150	12	12	7200	photo-cell	48	
12	BBP	1	parking	ext	metal halide	-	2	1	MH	175	12	4200	photo-cell	N/A	metal halide	-	2	1	175	12	12	4200	photo-cell	24	
				TOTALS exterior									11,400												
				TOTALS interior									8,308												
				annual consumption (kWh)									5,823												
				estimated cost (\$/year)									\$1,013												
				Black Brook Park bldg total light power (Watt)									2,874												
				Black Brook Park Bldg light power density (Watt/sq ft)									1.38												
				Proposed Annual Savings (kWh)									690												
				Proposed Annual Cost Savings (\$)									\$120												
				Proposed Investment (\$)									\$4,350												
				surface area (sq ft)									2,080												

Legend: BBP - Black Brook Park bldg; M - magnetic; E - electronic; F - fluorescent; I or incand - incandescent; CFL - compact fluorescent lamp; HPS - high pressure sodium; MH - Metal Halide; S - on/off switch

Appendix B: Third Party Energy Suppliers (ESCOs)

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

JCP&L ELECTRICAL SERVICE TERRITORY		
Last Updated: 06/15/09		
<p>Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095 (800) 437-7872 www.hess.com</p>	<p>BOC Energy Services, Inc. 575 Mountain Avenue Murray Hill, NJ 07974 (800) 247-2644 www.boc.com</p>	<p>Commerce Energy, Inc. 4400 Route 9 South, Suite 100 Freehold, NJ 07728 (800) 556-8457 www.commerceenergy.com</p>
<p>Constellation NewEnergy, Inc. 900A Lake Street, Suite 2 Ramsey, NJ 07446 (888) 635-0827 www.newenergy.com</p>	<p>Direct Energy Services, LLC 120 Wood Avenue Suite 611 Iselin, NJ 08830 (866) 547-2722 www.directenergy.com</p>	<p>FirstEnergy Solutions Corp. 300 Madison Avenue Morristown, NJ 07962 (800) 977-0500 www.fes.com</p>
<p>Glacial Energy of New Jersey, Inc. 207 LaRoche Avenue Harrington Park, NJ 07640 (877) 569-2841 www.glacialenergy.com</p>	<p>Integritys Energy Services, Inc. 99 Wood Ave, South, Suite 802 Iselin, NJ 08830 (877) 763-9977 www.integritysenergy.com</p>	<p>Liberty Power Delaware, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663 (866) 769-3799 www.libertypowercorp.com</p>
<p>Liberty Power Holdings, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663 (866) 769-3799 www.libertypowercorp.com</p>	<p>Pepco Energy Services, Inc. 112 Main St. Lebanon, NJ 08833 (800) ENERGY-9 (363-7499) www.pepco-services.com</p>	<p>PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002 (800) 281-2000 www.pplenergyplus.com</p>
<p>Sempra Energy Solutions The Mac-Cali Building 581 Main Street, 8th Floor Woodbridge, NJ 07095 (877) 273-6772 www.semprasolutions.com</p>	<p>South Jersey Energy Company One South Jersey Plaza Route 54 Folsom, NJ 08037 (800) 800-756-3749 www.southjerseyenergy.com</p>	<p>Suez Energy Resources NA, Inc. 333 Thornall Street 6th Floor Edison, NJ 08837 (888) 644-1014 www.suezenergyresources.com</p>
<p>UGI Energy Services, Inc. 704 East Main Street Suite 1 Moorestown, NJ 08057 (856) 273-9995 www.ugienergyservices.com</p>		

PSE&G NATURAL GAS SERVICE TERRITORY

Last Updated: 06/15/09

<p>Cooperative Industries 412-420 Washington Avenue Belleville, NJ 07109 800-6BUYGAS (6-289427) www.cooperativenet.com</p>	<p>Direct Energy Services, LLP 120 Wood Avenue, Suite 611 Iselin, NJ 08830 866-547-2722 www.directenergy.com</p>	<p>Dominion Retail, Inc. 395 Highway 170 - Suite 125 Lakewood, NJ 08701 866-275-4240 http://retail.dom.com</p>
<p>Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701 800-805-8586 www.gesc.com</p>	<p>UGI Energy Services, Inc. d/b/a GASMARK 704 East Main Street, Suite 1 Moorestown, NJ 08057 856-273-9995 www.ugienergyservices.com</p>	<p>Great Eastern Energy 116 Village Riva, Suite 200 Princeton, NJ 08540 888-651-4121 www.greateastern.com</p>
<p>Hess Energy, Inc. One Hess Plaza Woodbridge, NJ 07095 800-437-7872 www.hess.com</p>	<p>Hudson Energy Services, LLC 545 Route 17 South Ridgewood, NJ 07450 877- Hudson 9 www.hudsonenergyservices.com</p>	<p>Intelligent Energy 2050 Center Avenue, Suite 500 Fort Lee, NJ 07024 800-724-1880 www.intelligentenergy.org</p>
<p>Keil & Sons 1 Bergen Blvd. Fairview, NJ 07002 1-877-Systrum www.systrumenergy@aol.com</p>	<p>Metromedia Energy, Inc. 6 Industrial Way Eatontown, NJ 07724 877-750-7046 www.metromediaenergy.com</p>	<p>Metro Energy Group, LLC 14 Washington Place Hackensack, NJ 07601 888-53-Metro www.metroenergy.com</p>
<p>MxEnergy, Inc. 510 Thornall Street, Suite 270 Edison, NJ 088327 800-375-1277 www.mxenergy.com</p>	<p>NATGASCO (Mitchell Supreme) 532 Freeman Street Orange, NJ 07050 800-840-4GAS www.natgasco.com</p>	<p>Pepco Energy Services, Inc. 112 Main Street Lebanon, NJ 08833 800-363-7499 www.pepco-services.com</p>
<p>PPL EnergyPlus, LLC 811 Church Road - Office 105 Cherry Hill, NJ 08002 800-281-2000 www.pplenergyplus.com</p>	<p>Sempra Energy Solutions The Mac-Cali Building 581 Main Street, 8th fl. Woodbridge, NJ 07095 877-273-6772 800-2 SEMBRA www.semprasolutions.com</p>	<p>South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037 800-756-3749 www.sjindustries.com/sje.htm</p>
<p>Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 07928 800-225-1560 www.spragueenergy.com</p>	<p>Stuyvesant Energy LLC 10 West Ivy Lane, Suite 4 Englewood, NJ 07631 800-646-6457 www.stuyfuel.com</p>	<p>Woodruff Energy 73 Water Street Bridgeton, NJ 08302 800-557-1121 www.woodruffenergy.com</p>