Steven Winter Associates, Inc.
Architects and Engineers

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

Telephone (203) 857-0200
Facsimile (203) 852-0741
E-mail: swinter@swinter.com

January 11th, 2010

Local Government Energy Program
Energy audit report

For

Union County Educational Services Commission (UCESC)
Crossroads School & Administrative Offices
45 Cardinal Dr
Westfield, NJ 07090

Project Number: LGEA17

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INTRODUCTION

On July 16th, 2009, Steven Winter Associates, Inc. (SWA) performed an energy audit and assessment of the Crossroads School and Administrative Offices of UCESC building located in Union County, NJ. Current conditions and energy-related information were collected in order to analyze and facilitate the implementation of energy conservation measures for the building.

The Crossroads School and Administrative Offices of UCESC building was completely renovated in 2002 before UCESC moved into the building. The Crossroads School and Administrative Offices of UCESC building is two stories and consists of a total floor area of 28,000 square feet. The school occupies the first floor of the building and the administrative offices occupy the second floor. The Crossroads School employs 60 teachers and 60 students, while the administrative offices include 27-30 employees year round.

Energy data and building information collected in the field were analyzed to determine the baseline energy performance of each building. Using spreadsheet-based calculation methods, SWA estimated the energy and cost savings associated with the installation of each of the recommended energy conservation measures. The findings for the building are summarized in this report.

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

EXECUTIVE SUMMARY

This document contains the energy audit report for the Crossroads School and Administrative Offices of UCESC building located at 45 Cardinal Dr, Westfield, NJ 07090. The Crossroads School and Administrative Offices of UCESC building is a two story building. Based on the field visit performed by Steven Winter Associates (SWA) staff on July 16th, 2009 and the results of a comprehensive energy analysis, this report describes the site's current conditions and recommendations for improvements. Suggestions for measures related to energy conservation and improved comfort are provided in the scope of work. Energy and resource savings are estimated for each measure that results in a reduction of heating, cooling, and electric usage.

In the most recent full year of data collected (March 2008 through March 2009), the UCESC building consumed approximately 512,480 kWh or $94,650 worth of electricity and 25,605 therms or $30,997 worth of natural gas. The average aggregated cost of electricity was calculated to be $0.18/kWh and the annual average aggregated cost of natural gas was calculated to be $1.21/therm. With electricity and gas combined, the building consumed 4309 MMBtus of energy at a total cost of $125,647.

SWA benchmarked Crossroads School and Administrative Offices of UCESC building using the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. The Portfolio Manager could not generate a benchmark score for the building because the floor area consists of 50% school and 50% office space. The benchmark rating is based on the facility's source energy use, level of business activity, and geographical location. The Portfolio Manager is also capable of generating a site energy use intensity number using 2008 as a baseline year.

In order to compare commercial buildings equitably, the *Portfolio Manager* ratings convey the consumption of each type of energy in a single common unit. The EPA uses source energy to represent the total amount of raw fuel required to operate the building. The site energy use intensity for the Crossroads School and Administrative Offices of UCESC building is 166 kBtu/sq.ft/year. After energy efficiency improvements are made, future utility bills can be added to the Portfolio Manager and the site energy use intensity for a different time period can be compared to the year 2008 baseline to track the changes in energy consumption associated with the energy improvements.

SWA recommends a total of 6 Energy Conservation Measures (ECMs) for Crossroads School and Administrative Offices of UCESC building. The total investment cost for these ECMs is **$103,401**. SWA estimates a first year savings of **$19,364** with a simple payback of **5.3 years**. SWA also estimates that Crossroads School and Administrative Offices of UCESC building will be able to reduce their carbon footprint by **183,244 lbs of CO2 annually.** SWA also recommends that UCESC contacts third party energy suppliers in order to negotiate a lower electricity rate. Comparing the current electricity rate to average utility rates of similar type buildings in New Jersey, it may be possible to save up to $0.03/kWh, which would have equated to $15,374 for the past 12 months.

There are various incentives that Crossroads School and Administrative Offices of UCESC building could apply for that could also help lower the cost of installing the ECMs. SWA recommends that the UCESC applies for the NJ SmartStart program through the New Jersey Office of Clean Energy. This incentive can help provide technical assistance for the building in the implementation phase of any energy conservation project.

When pursuing incentives through the SmartStart program, SWA encourages building managers to contact the program provider to obtain more detailed information on the program guidelines and request pre-approval for all planned upgrades. At the time of this report, incentives for lighting vary but replacing T12 lighting with T8 lighting would be eligible for an incentive up to $30 per fixture, pulse start metal halides would be eligible $25 per fixture and occupancy sensors would be eligible for $20 per sensor.

Due to the amount of work that is applicable to the 45 Cardinal Drive building, SWA recommends that UCESC enroll the building in the New Jersey Clean Energy Program's Pay for Performance program. The Pay for Performance program or "P4P" a program set-up to create financial incentives for buildings to do a detailed

building audit and also implement measures that were studied as part of the energy audit. The P4P program currently accepts LGEA participants that are not currently also receiving incentives as part of the Federal block grant program.
For further information on both custom and prescriptive incentives, please visit:

http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/tools-and-resources/equipment-incentives/equi

The New Jersey Clean Energy website also provides information on an upcoming Direct-Install program that would be applicable to this project. The Direct-Install program is aimed at commercial buildings with an average annual demand of less than 200kW. This program is designed to offset up to 80% of the cost of replacing equipment nearing the end of its useful lifecycle with high efficiency alternatives. This program could help offset the cost of replacing the entire heating system. This program has not officially been released but can be followed online at:

http://www.njcleanenergy.com/commercial-industrial/programs/programs

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

SCOPE OF WORK – SUMMARY TABLE

Scope of Work - Summary Table																				
ECM #	ECM description	Cost Source	Est. installed cost, $	Est. incentives, $	Net est. cost with incentives, $	kWh, 1st year savings	kW, demand reduction	therms, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, $	Total 1st year savings, $	Life of measure, years	Est. lifetime energy cost savings, $	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, $	CO_2 reduced, lbs/year
1	Upgrade 29 incandescent lamps to CFLs	RSMeans	$1,572	$0	$1,572	8,256	1.7	0	1.0	$116	$1,602	5	$7,295	1.0	364.1%	72.8%	98.6%	$5,765	14,782
2	Install 6 occupancy sensors	RSMeans	$1,320	$120	$1,200	1,792	0.3	0	0.2	$0	$323	15	$3,796	3.7	216.3%	14.4%	57.2%	$7,003	3,209
3	Upgrade 1 metal halide fixture to Pulse Start Metal Halide	RSMeans	$481	$25	$456	438	0.1	0	0.1	$23	$102	15	$1,198	4.5	162.8%	10.9%	21.1%	$760	784
4	Upgrade 35 fixtures to T8 flourescent fixtures	RSMeans	$6,136	$1,050	$5,086	2,134	0.4	0	0.3	$303	$687	15	$8,085	7.4	59.0%	3.9%	30.9%	$14,040	3,821
5	Reconfigure controls and control optimization	RSMeans	$42,000	$0	$42,000	48,740	10.0	4,964	23.7	$0	$14,780	10	$124,796	2.8	197.1%	19.7%	33.2%	$84,073	141,987
6	Replace second floor windows	RSMeans	$51,892	$0	$51,892	10,730	2.2	-50	1.1	$0	$1,871	25	$31,864	27.7	-38.6%	-1.5%	-0.8%	($19,314)	18,661
	TOTALS		**103,401**	**1,195**	**102,206**	**72,090**	**14.7**	**4,914**	**26.3**	**442**	**19,364**	**-**	**177,035**	**5.3**	**-**	**-**	**-**	**92,327**	**183,244**

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

Carbon Dioxide per unit Electriciy = 1.7905 lbs of CO2/kWh
Carbon Dioxide per unit of Natural Gas = 11.023 lbs of CO2/unit fuel

Average Electric Rate = **0.18** $/kWh
Average Fuel Rate = **1.21** $/therm

A 0.0 electrical demand reduction/month indicates that it is very low/negligible

Total building area= 28,000 sq. ft

1. HISTORIC ENERGY CONSUMPTION

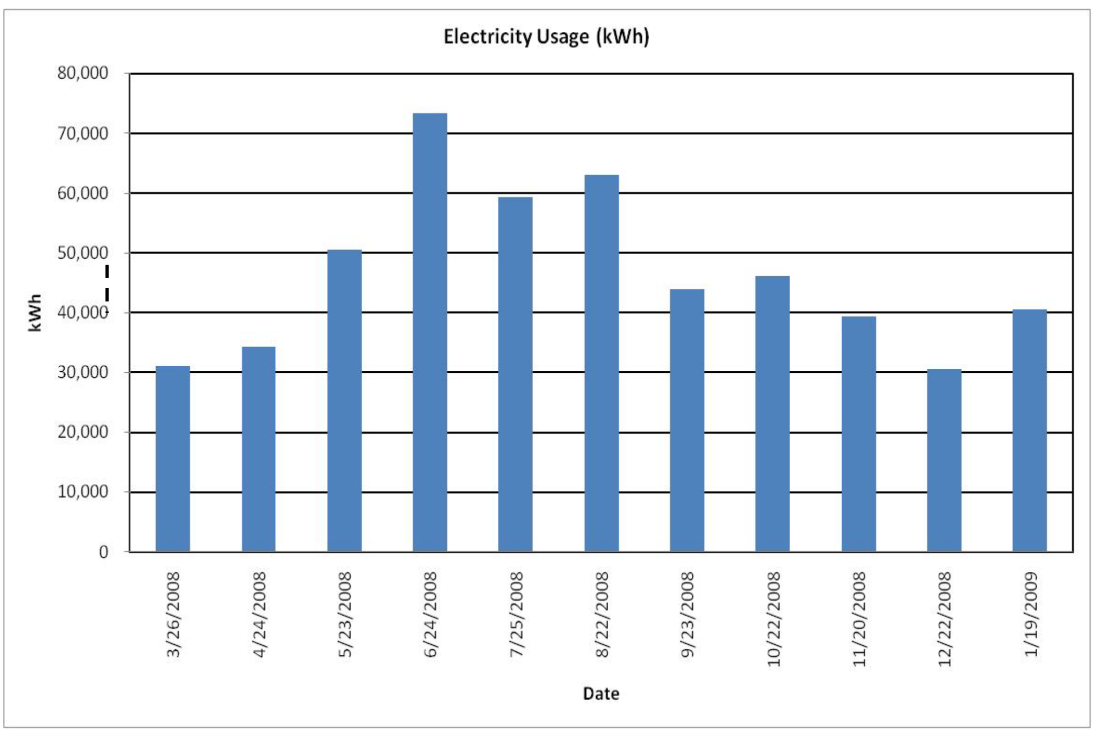
1.1. Energy usage and cost analysis

SWA received and analyzed utility bills from March 2008 through March 2009 that were received from UCESC.

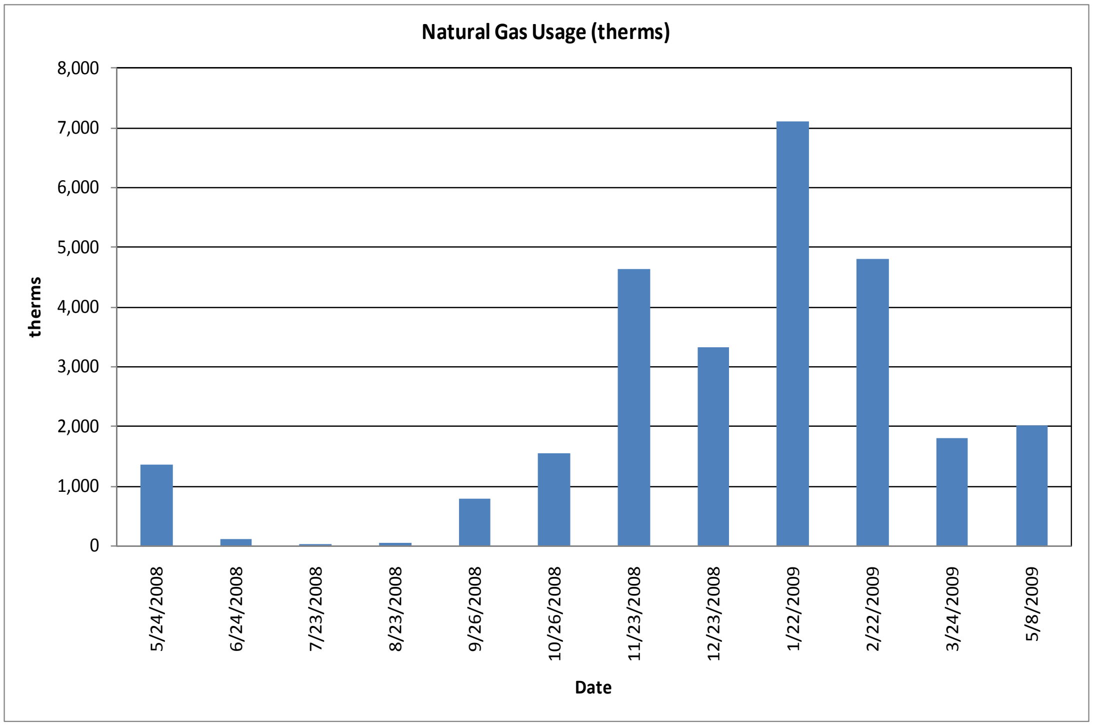
Electricity – The Crossroads School and Administrative Offices of UCESC building has one electric meter for incoming electricity supply. The building purchases electricity from PSE&G at **an average aggregated rate of $0.18/kWh** based on March 2008 through March 2009 electric bills. The building purchased **approximately 512,480 kWh or $94,650 worth of electricity from March 2008 through March 2009.** Based on the same time period, the building also has **an average monthly demand of 161.6 kW and monthly peak demand of 209.6 kW.**

Natural Gas – The Crossroads School and Administrative Offices of UCESC building has one gas meter for incoming natural gas from Elizabethtown Gas. Between March 2008 and March 2009, the building purchased **approximately 25,605 therms or $30,997 worth of natural gas.** To account for the additional costs associated with transportation and delivery fees, an average total gas rate of $1.21 per therm was assumed in this report.

The following chart shows electricity usage for the UCESC Building based on utility bills for the 2008-2009 billing period.



The following chart shows the natural gas usage for the UCESC Building based on utility bills for the year March 2008 to March 2009.



In the above chart, the natural gas usage follows a heating trend as expected. During the summer it is clear that the natural gas usage is very minimal which reflects that heat is not being used and the DHW load is minimal.

1.2. Utility rate

Crossroads School and Administrative Offices of UCESC building currently buys electricity from PSE&G and gas from Elizabethtown Gas at a the general service rate. The general service rate is a typical rate where customers pay for natural gas based on usage and electricity based on usage with the addition of an electrical charge demand. Crossroads School and Administrative Offices of UCESC building uses PSE&G account #15 51 664 193 32 and Elizabethtown Gas account #9564163890, both for the service address of 45 Cardinal Dr, Westfield, NJ. Electricity for the building was billed at an average rate of **$0.18/kWh.** Natural Gas for the building was billed at an average rate of **$2.58/therm.**

1.3. Energy benchmarking

The Crossroads School and Administrative Offices of UCESC building information and utility data were entered into the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. A performance score could not be generated for the building since it consists of 50% school area and 50% office area. SWA has shared the Portfolio Manager account with the UCESC Board and recommends that the UCESC Board maintain the Portfolio Manager account at the link below to allow future data to be added and tracked using the benchmarking tool.

http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE UCESC

Building ID: 1791991
For 12-month Period Ending: February 28, 2009[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: January 06, 2010

Facility
UCESC
45 Cardinal Drive
Westfield, NJ 07090

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 1965
Gross Floor Area (ft²): 28,000

Energy Performance Rating[2] (1-100) 4

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	1,908,579
Natural Gas (kBtu)[4]	2,726,242
Total Energy (kBtu)	4,634,821

Energy Intensity[5]	
Site (kBtu/ft²/yr)	166
Source (kBtu/ft²/yr)	330

Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	436

Electric Distribution Utility
Public Service Elec & Gas Co

National Average Comparison	
National Average Site EUI	83
National Average Source EUI	165
% Difference from National Average Source EUI	100%
Building Type	Office

Stamp of Certifying Professional

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

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

Certifying Professional
N/A

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

The government estimates the average time needed to fill out this form is 6 hours (includes the time for entering energy data, PE facility inspection, and notarizing the SEP) and welcomes suggestions for reducing this level of effort. Send comments (referencing OMB control number) to the Director, Collection Strategies Division, U.S., EPA (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460.

EPA Form 5900-16

2. FACILITY AND SYSTEMS DESCRIPTION

2.1. Building Characteristics

Crossroads School and Administrative Offices of UCESC building was built approximately 45-50 years ago and completely remodeled 9 years ago. The building has two stories above grade and a basement completely below grade with a total floor area of 28,000 square feet. The basement of the building houses the mechanical room, various storage areas, the bus drivers' lounge, and restrooms. The first floor of the building houses the Crossroads School. The Crossroads School is a commissioned school by the State of New Jersey that specializes in children with autism as well as other mental and physical disabilities. The second story houses the UCESC administrative offices, a large conference room, break room, restrooms, the Crossroads School library and two classrooms.

2.2. Building occupancy profiles

The Crossroads School employs 60 teachers and 60 students, while the administrative offices include 27-30 employees year round. The administrative offices are operated during the normal business hours of 8:00am to 5pm. Crossroads School operates from 9am to 3:15pm September through July 31st. According to building drawings, the building has peak occupancy of 523 persons.

2.3. Building envelope

2.3.1. Exterior walls

This steel frame, curtain wall two story building consists of brick veneer over CMU block wall construction on the recessed ground façade and almost full height (90%) window infill panels on the second floor façade. The parapet area around the perimeter of the entire building is covered with a mansard type metal cladding wall panel system. Insulation levels in basement foundation walls or above grade exterior walls could not be verified. Due to warm temperature conditions at the time of the field visits, insulation levels could also not be verified with help of infrared technology.

Overall, exterior and interior wall finishes of the envelope were found to be in age-appropriate, good condition with no major signs of unusual water or air leakage.

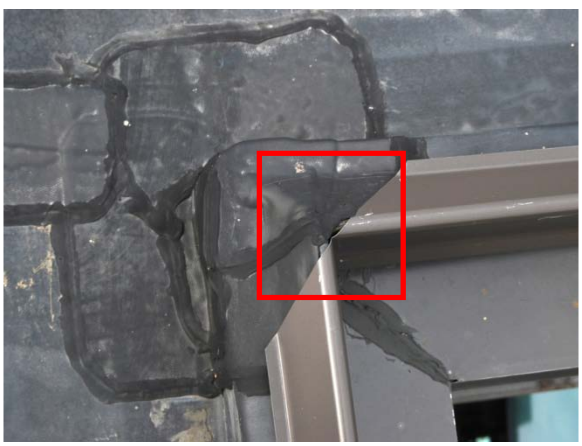
Typical Partial Exterior Elevation

2.3.2. Roof

The flat roof of the building was recently replaced with a dark colored EPDM rubber membrane. The roof surface appeared to be in fair-good condition overall except in some inside corners, lack of attention to detail by the roofing installer was detected. Aluminum flashing in those areas was cut too short, potentially allowing water to enter either the interior side of the steel structure or the parapet wall cavity. There were also signs of water pooling from the AC condensate lines on the mechanical equipment visible, which is common. However, due to the lack of a nearby roof drain, SWA recommends diverting condensate lines to a dedicated drain to avoid potential roof leaks due to pooling. A leak, evident in ceiling tiles on the second floor was mentioned to the inspectors and could possibly be traced back to the mentioned pooling or nearby apparent spillage area. SWA recommends the original roofing contractor to fix the above mentioned corner issues and at the same time investigate the existing roof leak.

A/C Condensate Water Pooling on Dry Day

Apparent Spillage Area



Aluminum Corner Flashing/ EPDM Detail

Close-Up View Shows Leak

Additional roof/ floor related issues: SWA observed 3.5” fiberglass batt insulation located in the plenum area of the building, positioned on top of the second floor dropped ceiling. The building’s exterior envelope projection of the second floor over the ground floor has a potential for creating cold spots on the overhanging second floor area. A separate envelope inspection should be conducted during cooler months. SWA suggests basing further insulation related improvement discussions on the outcome of those future findings.

SWA has determined that adding insulation would not be cost-effective; however, this should be considered as part of a capital improvement plan. Due to the age of the building and work that has been done to the building since it has been operable, insulation levels are not consistent across the building envelope. There are a few key components of the building structure that do not have sufficient levels of insulation. The amount of work required to access these areas to increase insulation levels prohibits these measures from being cost-effective; however, the building will never be able to maintain uniform building temperatures without proper insulation. Provided below are summaries of weak points detected in insulation values.

Roof cavity – Minimal rigid insulation was added to the roof in order to form a sloped drainage plane when the roof surface was recently replaced. Adding rigid insulation would not justify replacing the roof surface again at this time. Blown cellulose insulation could be added above the existing batt insulation in the roof cavity but would not be advised since this cavity contains mechanical ductwork. Also, a polyurethane spray could be applied to the underside of the roof, however due to building and fire codes this is not recommended.

Evidence of existing 3-1/2" Fiberglass Batt ceiling Insulation

Exposed Second Floor Area

Second story cantilever - The 2nd story of the building is cantilevered over the 1st floor by approximately 4 feet. According to building drawings, the insulation located in the floor of the cantilevered space is minimal. The cantilevered space relies mostly on 1" insulated metal soffit to keep cold air out of the building. In addition, the steel beams that are exposed to the outside elements are connected directly to the steel beams that form the major infrastructure of the building. The contact points between the outside beams and the inside beams are not insulated, thus forming a thermal bridge for heat to travel into and out of the building. SWA recommends if the cantilevered areas are accessible for any type of renovation, insulation should be added, approximately R-30. Insulation should be in contact with the 2nd floor in order to reduce heating and cooling losses.

Non-insulated windows – The windows form a large portion of the exterior shell of this building. The windows on the second floor consist of single pane glass set in metal frames. The metal frames of these windows are not insulated and allow heat to freely transfer in and out of the building, in the direction of the coldest temperature. The windows form approximately 90% of the wall area on the second floor and therefore have vastly different insulating R-values then the rest of the wall assembly. Upgrading the windows will result in a large percentage of the comfort issues within the building of being alleviated. See Section 2.3.4 below for more window details.

2.3.3. Base

The building's base is 6" concrete slab, 9 feet below grade, defining the fully conditioned basement. There were no reported problems with water penetration or moisture.

2.3.4. Windows

The windows on the first floor were recently replaced with metal framed double pane low-e windows. The windows appear to be in good condition with no obvious penetrations and sufficient caulking and sealing around the frame.

The windows on the second floor are the original single pane metal framed windows. While the windows appeared to be in fair-good condition with no obvious penetrations or missing caulking around the frame, metal framed windows are inefficient as they do not allow for a thermal break; therefore there is excessive heating / cooling loss due to the metal frames. Furthermore, single pane windows are inefficient and contribute to excessive heating and cooling loss. Some windows have been fitted with a reflective film coating that is ineffective at blocking solar radiation for single pane models. In addition, it was obvious that some windows were missing the reflective film.

According to building staff and tenants, there is a significant problem with temperature distribution on the 2nd floor. A new HVAC system was installed in 2007, followed by hiring a controls contractor in 2008. The 2nd floor still appears to have a problem with temperature distribution and this is thought to be attributed to two things; a lack of proper insulation in the roof cavity and the current quality of windows. Adding insulation at this point would not be cost-effective; however, replacing the windows will solve a majority of the problem alone. SWA recommends that the second floor windows are replaced with double-paned windows with a low-e coating. These windows should also have an insulated frame with a thermal break. The current window type allows for uneven temperatures by allowing excessive amounts of solar radiation to penetrate the building envelope. In addition, the single pane glass surface can change dramatically allowing the surface to be cold during winter and warm during summer.

Single Pane Windows on 2nd floor – left window missing film

Some 2nd Floor Windows Missing Window Film

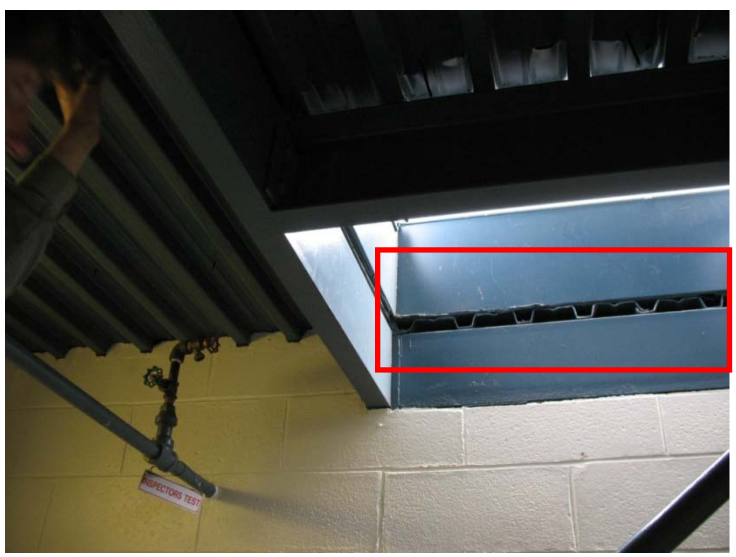
2.3.5. Exterior doors

The entrance ways for the Crossroads School and UCESC administrative office building consists of insulated steel doors set on a metal frame. The frames of these doors are poor insulators and allow expensive, conditioned air to leak out of the building. SWA recommends maintaining weather-stripping around all of the doors of the building in order to prevent conditioned air from leaking outside of the building. Weather-stripping should be checked at least once a year and replaced as soon as signs of deterioration start to show.


Double doors in good condition *Roof access – metal-gasket door*

2.3.6. Building air tightness

The Crossroads School and UCESC administrative office building appeared to have relatively tight building envelope. Regular maintenance should be performed to maintain sufficient seals in order to keep conditioned air from leaking outside the building, such as weather-stripping doors and caulking around window framing. Other penetrations should be sealed with foam or caulk, such as plumbing, HVAC penetrations, and wire penetrations throughout the building. The image below shows the metal door framing to the roof with obvious penetrations between the ceiling and roof. Any trapped heated or cooled air leaks into the building due to this opening in the building envelope.



Penetrations found below the roof deck leading to heating/cooling losses

2.4. HVAC systems

2.4.1. Heating

The Crossroads School and Administrative Offices of UCESC building contains one mechanical room with heating equipment in the basement of the building. The entire heating system was installed in 2007 as part of a major HVAC overhaul for the building. The heating system contains all new components that consist of the most recent technology. There are currently two new Aerco Benchmark condensing boilers that provide heating for the building. These boilers currently service three zones throughout the building. Each zone is associated with its own pump located in the basement. Zone #1 is serviced by Pump #1 and provides hot water to the first floor baseboards as well as a single Carrier convective heating unit in the basement. Zone #2 is serviced by Pump #2 and provides hot water to the second floor baseboards. Zone #3 is serviced by Pump #3 and provides hot water to the first and second floor VAV boxes. Baseboard heating supplies heat to the perimeter of each floor, in part to offset the poor thermal resistance of the original building windows. The VAV box system provides a majority of the heating demands for the core of the building as well as larger perimeter rooms. These VAV boxes also supply cool air from the rooftop unit and are equipped with reheat capabilities. Both the supply and return air system are ducted through the roof cavity. The return air duct system contains a CO2 sensor that determines when the system goes between occupied and unoccupied mode.

Earlier in the cooling season, the controls contractor reduced the supply air set point (supply from the AC unit to the ductwork) from 55°F to 50°F. SWA assumes that this control point might be triggering the VAV reheat to activate. The VAV boxes are equipped with a reheat feature that allows air to be warmed at the box before it enters the room. Essentially, the rooftop unit is over-cooling and dehumidifying air as it is being delivered to the distribution system. This cold, 50°F air enters each VAV box and requires some heat in order to satisfy the thermostatic controls of each space.

In 2008, a controls contractor was hired to help troubleshoot problems with uneven temperature distribution for the building, primarily on the second floor. As part of the HVAC upgrade, Honeywell controls were installed in order to help regulate the HVAC system and to adjust set points and setback temperatures as needed. According to building staff, the entire HVAC system responds to an outdoor reset temperature in order to regulate the system based on outside conditions. Also, the system is supposed to setback at night and on weekends in order to conserve energy when the building has limited or no use. After analyzing utility bills, it appears that the system controls are not properly setting back or responding to reset temperatures. It is unclear whether the system is not setting back due to failure of the control system, improper settings or failure of the CO2 sensor to detect low concentrations of CO2. During the mechanical audit, on a day with outside temperatures reaching over 82°F, one of the boilers were witnessed short-cycling. Since the building contains electric domestic hot water, there should be no baseload on a cooling season day with hot outside air temperatures. The entire HVAC system has undergone startup procedures typical of newly installed equipment. It is obvious that the HVAC system requires some troubleshooting in order to account for building specific conditions. SWA recommends that first the window replacement as well as any other building envelope issues occur first and then the HVAC system is adjusted to meet the heating and cooling loads of the building. If envelope measures are not implemented, the HVAC system should still be re-adjusted to building specific operating conditions, but will need to be re-adjusted yet again if any major envelope issues are undergone in the future.

2.4.2. Cooling

The Crossroads School and Administrative Offices of UCESC building is cooled with a new Trane split AC system. This system contains a large compressor unit as well as a large condenser unit on the rooftop of the building. The size and capacity of the system were not listed on the nameplate or drawings and cannot be accessed through the Carrier website since the system consists of custom components.

The rooftop AC units bring varying amounts of fresh air into the building via the VAV boxes on the first and second floors. The CO2 sensor located in the return air duct helps modulate the outdoor air intake damper for the AC unit. When higher concentrations of CO2 are detected, the damper opens to allow 100% outside air. The entire HVAC system, including both heating and cooling units, are controlled through the same Honeywell control system. The cooling system is subjected to the same issues that the heating system is having. According to building staff, in order to increase cooling, the controls contractors have turned the supply air temperature from the system to the ducts down from 55^{o}F to 50^{o}F. This could be an indicator that the system is not properly balanced.

The current controls contractor for 45 Cardinal Drive has implemented a VAV optimization algorithm for the second floor large conference room. This algorithm constantly alters the static pressure set point based on system operations. The static pressure set point is continuously varied in response to the VAV box damper positions in order to even heating or cooling and also reduce AHU fan energy.

As mentioned above in the Heating Section 2.4.1, SWA recommends that first the window replacement as well as any other building envelope issues occur first and then the HVAC system is adjusted to meet the heating and cooling loads of the building. If envelope measures are not implemented, the HVAC system should still be re-adjusted to building specific operating conditions, but will need to be re-adjusted yet again if any major envelope issues are undergone in the future.

2.4.3. Ventilation

The Crossroads School and UCESC administrative office building uses the rooftop unit to introduce fresh air into the building. Outside air supply is adjusted based on the damper position of the rooftop unit which is controlled by a CO2 sensor located in the return duct of the system. Outside air or a mix of return air with outside air is brought into the building and distributed via ductwork to VAV boxes located on the first and second floors. The Variable Air Volume (VAV) system distributes different volumes of air to each different space depending on operating conditions and depending on ventilation requirements of each space. Toilet and kitchen exhaust fans help remove stale air from the building while also helping induce fresh air through the building envelope.

2.4.4. Domestic Hot Water

Domestic Hot Water for the building is provided by a Rheem electric hot water heater with a maximum input of 6,000W and a storage capacity of 80 gallons. The hot water heater was manufactured in 2004 and has an Energy Factor of 0.86. The Domestic Hot Water supply set point was currently set at 128°F. The system contains hot water recirculation with a Lawler electronic thermostatic mixing valve.

Electric Water Heater

It is not cost-effective to replace the existing water heating equipment with higher efficiency equipment. However, higher efficiency water heating equipment will save energy and should be strongly considered upon replacement of the equipment. Energy saving appliances bearing the ENERGY STAR label should be selected to ensure efficiency performance. Incentives may be available to offset any added costs for the installed equipment.

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 that the aerators in all sinks are retrofitted with low-flow aerators that constrict the volume of water allowed to flow out of the faucets during the time it takes to wash hands, wash dishes, etc. Most of the faucets found in the classrooms had 2.0gpm aerators, while restroom aerators had 0.5gpm aerators. SWA recommends installing 0.5gpm aerators on all faucets in the building. 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 – Most of the lighting within the Crossroads School and UCESC administrative office building consists of efficient T8 lighting with electronic ballasts. There are few areas that need to be updated from T12 lighting with magnetic fixtures to T8 lighting with electronic ballasts, such as the first floor hallway and rear lobby area. SWA also recommends occupancy sensors for all bathrooms and closets throughout the building. Occupancy sensors should also be installed in areas such as the front entrance vestibule that contains lights currently left on during the entire school day. Installing occupancy sensors should help to decrease kWh as lights may be unintentionally left on when unoccupied. Another area that may benefit from occupancy sensors are all storage areas, such as the majority of the basement.

Exit Signs – Exit signs in the Crossroads School and UCESC administrative office building have already been fitted with LED exit signs.

Exterior Lighting – Exterior lighting consists of approximately 29 fixtures equipped with 100W flood lamps. Exterior lighting is controlled by one timer located in the mechanical room in the basement. The timer is set to turn the lights on at 8pm and off at 9pm in the summer and 5pm to 9pm in the winter. SWA recommends that these 100W flood lights are replaced with newer 30W CFL reflective flood lamps that provide a similar quality light while using a fraction of the electrical power.

2.5.2. Appliances and process

Appliances, such as refrigerators, that are over 10 years of age should be replaced with newer efficient models with the Energy Star label. For example, Energy Star refrigerators use as little as 315kwh/hr. When compared to the average electrical consumption of older equipment, Energy Star equipment results in a large savings. Look for the Energy Star label when replacing appliances and equipment, including: 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

Appliances such as televisions, air-conditioners, computers, etc. should all be purchased with energy consumption in mind. Replacing purchased equipment for energy efficiency is most likely not cost-effective but if Energy Star and other energy efficient options are always considered; energy consumption can be maintained throughout the entire use of the building.

Building staff should ensure that all appliances are always shut off when rooms are not in use. Computers and other appliances should be shut down, or at least their screens should be when not in use for extended periods of time.

2.5.3. Elevators

The Crossroads School and Administrative Offices of UCESC building is a two story building and contains a single hydraulic elevator. This elevator is not original to the building and was installed approximately 10 years ago as part of a renovation. There is no recommendation for improvement at this time.

2.5.4. Other electrical systems

The Crossroads School and Administrative Offices of UCESC building contains a GE dry type transformer located in the basement electrical room. This 30 kVA transformer is in good condition and due to its smaller size, would be cost-prohibitive to replace at this time.

3. EQUIPMENT LIST

Building System	Description	Physical Location	Make/ Model	Fuel	Space served	Estimated Remaining useful life %
Heating	Two (2) Aerco Benchmark 1.5 low N0x steam boilers	Basement mechanical room	Model# BMK 1.5	Natural Gas	Entire building	92%
Heating	Heatfab Saf-T vent CI Plus for boilers	Basement mechanical room	Model# CCA06L9	-	Entire building	92%
Heating	Taco cartridge circulator	Basement mechanical room	Model# 008-BF6-1	Electric	Entire building	80%
Heating	Pump #1 - 3/4HP Taco Pump	Basement mechanical room	Model#FI120652AAH1L08, Model B0680M	Electric	1st Floor Baseboard	80%
Heating	Pump #2 - 3/4HP Taco Pump	Basement mechanical room	Model#B0680M	Electric	2nd Floor Baseboard	80%
Heating	Pump #3 - 1-1/2HP Taco pump, NEMA premium efficiency	Basement mechanical room	Nameplate painted over	Electric	1st:2nd Floor VAV	80%
Heating	Three (3) Honeywell actuators. One actuator per pump	Basement mechanical room	Model# ML7425B3012	Electric	Entire building	80%
Heating	J.L. Wingert Bypass feeder	Basement mechanical room	Model# F-54D	Electric	Entire building	80%
Cooling	Trane AC compressor unit (large split system) - Special unit with hot gas reheat coil and controls for dehumidification. R22, 2x evaporator fan motor (20HP), 1x exhaust fan motor (25 HP)	Rooftop	Trane, Model #WXHB9D0403985DDD9F00A0CE00KL00RT-0060S, Serial #C07H09123	Electric/ Natural Gas	Entire building	92%
Cooling	Trance AC condensor unit (large split system) - 12x condensor fan motor (1 HP ea.)	Rooftop	Trane, Model #RAUCD124BP1020D00005	Electric	Entire building	92%
Ventilation	Penn ventilation exhaust fan, Tag EF2-5, Running	Rooftop	Penn, Model #DX08B	Electric	Entire building	80%
Ventilation	Penn ventilation exhaust fan, Tag EF2-4, Not running	Rooftop	Penn, Model #DX08B	Electric	Entire building	80%
Ventilation	Penn ventilation exhaust fan, Running	Rooftop	Penn, Model #WCC08	Electric	Entire building	80%
Ventilation	Penn ventilation exhaust fan, Tag EF2-2, Running	Rooftop	Penn, Model #DX12B	Electric	Entire building	80%
Ventilation	Penn ventilation exhaust fan, Running	Rooftop	Penn, Model #WCC08	Electric	Entire building	80%
Ventilation	Penn ventilation exhaust fan, Tag EF1-7, Running with a lot of vibration	Rooftop	Penn, Model #DX08B	Electric	Entire building	80%
Domestic Hot Water	One (1) Rheem electric hot water heater. Self-cleaning water heater, Max 6000W, Total 4500/3380W, 80 gallon, 240 V	Basement mechanical room	Rheemglas Fury Model #82V80-2	Electric	Entire building	90%
Domestic Hot Water	Lawler High-low thermostatic mixing valve	Basement mechanical room	Model# 802	Electric	Entire building	80%
Lighting Controls	Tork dial analog timer	Basement mechanical room	Tork	Electric	Entire building	80%
Lighting	See details appendix A	-	-	-	-	-
Electric Distribution	GE 30.0kVA dry type transformer, Type QL, 60 Hz, 3PH, 3.3% 1MP	Basement electrical room	Catalog# 9T23Q3072	Electric	Entire building	30%

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 this building, SWA has separated the investment opportunities into three categories of recommendations:

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

Category I Recommendations: Capital Improvements

- Increase level of insulation at roof– As noted previously, insulation levels should be increased in at the roof. This measure is recommended but is not cost-effective due to the fact that the roof surface was recently replaced. When the roof surface was replaced, minimal levels of rigid insulation were installed underneath the black rubber EPDM surface. These minimal levels of rigid insulation are tapered and are only meant for forming a drainage plane on the roof surface. Since the roof cavity contains ductwork that should be kept within the conditioned building envelope shell, the roof surface is the best area to install additional insulation. Alternatively, polyurethane spray insulation could be applied to the underside of the roof surface but may become an issue with building and fire codes. In addition to insulation added to the ceiling of the roof cavity, the side walls would also have to be insulated to fully isolate the roof cavity.
- Increase level of insulation at cantilevered second floor – As noted previously, the second floor is cantilevered out over the first floor by approximately 4 feet. According to building drawings, this area is poorly insulated and consists of only a 1” insulated metal soffit. The current amount of insulation allows for heat to transfer both in and out of the building, in the direction of the coldest surface. This measure will not be cost-effective due to the amount of work required to access the specific area. SWA recommends this insulation is increased as part of a capital improvement plan, if any improvements require accessing the same cantilevered area.

Category II Recommendations: Operations and Maintenance

- Weather Stripping/Air Sealing - SWA observed that exterior door weather-stripping 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 frame. 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-effect 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-consuming fixtures and appliances will save both energy and money through reduced energy consumption for water heating, while also decreasing water and sewer bills.
- Diverting AC condensate lines on roof – The AC equipment is currently situated near the center of the roof with no nearby roof drains. The condensate lines of the rooftop equipment are allowed to drip freely on the roof surface. There are signs of standing water on the roof surface that have begun to penetrate the new roof surface and have caused leaks in the roof cavity. To avoid further maintenance issues, these condensate lines should be diverted away from the equipment towards the nearest roof drain.

- Repair aluminum flashing/EPDM detail at corners of roof surface – The roof was installed with the corner flashing cut to improper lengths, allowing a gap to exist between the EPDM roof surface and the aluminum corner flashing. This gap can allow water to penetrate the roof surface and work its way through the roof cavity. The original roofing contractor should fix the corner details as well as address any standing water issues.
- Repair penetrations between the ceiling and the roof – Currently, as addressed in Section 2.3.6, there are penetrations formed from the corrugated metal roof material between the roof and the ceiling. These exposed areas allow heated or cooled air to enter the building shell and eventually leak into the building. Spray foam or caulk should be added to form an air barrier as well as a thermal barrier at this specific junction.
- Create an educational program that teaches both students and their teaches how to minimize their energy use in the classroom by using window blinds to allow natural light in or keep unwanted heat out. The US Department of Energy offers free information for hosting energy efficiency educational programs and K-12 lesson plans, for more information please visit: http://www1.eere.energy.gov/education

Category III Recommendations: Energy Conservation Measures

Summary table

ECM#	Description
1	**Upgrade 29 incandescent lamps to CFLs**
2	**Install 5 occupancy sensors**
3	**Upgrade 1 metal halide fixture to Pulse Start Metal Halide**
4	**Upgrade 35 fixtures to T8 fluorescent fixtures**
5	**Reconfigure controls and control optimization**
6	**Replace second floor windows**

ECM#1: *Upgrade 29 incandescent lamps to CFLs*

Description:

The Crossroads School and UCESC administrative office building contains approximately 29 incandescent fixtures that should be upgraded to CFLs. CFL lamps are capable of producing the same quality and intensity of light as an incandescent, using much less power. Typically, lighting manufacturers recommend that a wattage reduction of 3:1 will produce the same lighting power. A complete lighting schedule including occupancy sensors has been attached in Appendix A of this report.

Installation cost:

Estimated installed cost: $1,572
Source of cost estimate: RS *Means*

Economics:

ECM #	ECM description	Cost Source	Est. installed cost, $	Est. incentives, $	Net est. cost with incentives, $	kWh, 1st year savings	kW, demand reduction	therms, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, $	Total 1st year savings, $	Life of measure, years	Est. lifetime energy cost savings, $	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, $	CO_2 reduced, lbs/year
1	Upgrade 29 incandescent lamps to CFLs	RSMeans	$1,572	$0	$1,572	8,256	1.7	0	1.0	$116	$1,602	5	$7,295	1.0	364.1%	72.8%	98.6%	$5,765	14,782

Assumptions: SWA calculated the savings for this measure using information collected during the field visit and analysis of historical utility consumption information.

Rebates/financial incentives:

Currently, there are no incentives associated with this measure.

Options for funding ECM:

This project may benefit from enrolling in either the NJ Pay-for-Performance program or the NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.
http://www.njcleanenergy.com/commercial-industrial/home/home

ECM#2: *Install 6 occupancy sensors*

Description:

The Crossroads School and UCESC administrative office building currently contains many smaller rooms that are used sporadically throughout the day. Some of these rooms such as bathrooms, closets and mechanical rooms can benefit by installing an occupancy sensor. Another area that would also benefit from an occupancy sensor is the front vestibule near the elevator. These lights contain CFL bulbs that are left on all day long, when they can be shut off during the day. It is important that these occupancy sensors are installed in an ideal location, where they can sense any slight motion in the room. Installing occupancy sensors in corners, too close to doorways or at an incorrect height will not allow the sensor to detect motion easily. Each sensor has a delay timer setting that should be adjusted for each room. This delay timer controls how long it will take a light to shut off via the sensor after no motion is detected. It is important that the delay settings are set correct to prevent lights from constantly shutting off when the room is still in use and also to minimize the amount of time that lights are allowed to remain on after all occupants have left a room. SWA recommends installing a total of 5 occupancy sensors throughout the UCESC building. A complete lighting schedule including occupancy sensors has been attached in Appendix A of this report. Savings for sensors are shown by adjusting the runtime hours of applicable light fixtures.

Installation cost:

Estimated installed cost: $1,000
Source of cost estimate: RS *Means*

Economics:

ECM #2																				
ECM #	ECM description	Cost Source	Est. installed cost, $	Est. incentives, $	Net est. cost with incentives, $	kWh, 1st year savings	kW, demand reduction	therms, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, $	Total 1st year savings, $	Life of measure, years	Est. lifetime energy cost savings, $	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, $	CO_2 reduced, lbs/year
2	Install 6 occupancy sensors	RSMeans	$1,320	$120	$1,200	1,792	0.3	0	0.2	$0	$323	15	$3,796	3.7	216.3%	14.4%	57.2%	$7,003	3,209

Assumptions: SWA calculated the savings for this measure using information collected during the field visit and analysis of historical utility consumption information.

Rebates/financial incentives:

NJ Clean Energy – Lighting Controls, Wall mounted ($20 per control).

Maximum incentive amount is $120.

Options for funding ECM:

This project may benefit from enrolling in either the NJ Pay-for-Performance program or the NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.
http://www.njcleanenergy.com/commercial-industrial/home/home

ECM#3: *Upgrade 1 metal halide fixture to Pulse Start Metal Halide*

Description:

The Crossroads School and UCESC administrative office building contains one probe start metal halide exterior light. SWA recommends that this fixture is replaced with a newer, more efficient pulse start metal halide fixture. Pulse start metal halides have a few key advantages over probe start (typical) metal halide fixtures. Pulse start metal halide fixtures do not require a "warm up" or "cool down" period, they last longer than a probe start metal halide and they also do not degrade overtime. A complete lighting schedule including occupancy sensors has been attached in Appendix A of this report

Installation cost:

Estimated installed cost: $456
Source of cost estimate: RS *Means*

Economics:

ECM #3																				
ECM #	ECM description	Cost Source	Est. installed cost, $	Est. incentives, $	Net est. cost with incentives, $	kWh, 1st year savings	kW, demand reduction	therms, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, $	Total 1st year savings, $	Life of measure, years	Est. lifetime energy cost savings, $	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, $	CO_2 reduced, lbs/year
3	Upgrade 1 metal halide fixture to Pulse Start Metal Halide	RSMeans	$481	$25	$456	438	0.1	0	0.1	$23	$102	15	$1,198	4.5	162.8%	10.9%	21.1%	$760	784

Assumptions: SWA calculated the savings for this measure using information collected during the field visit and analysis of historical utility consumption information.

Rebates/financial incentives:

NJ Clean Energy – Prescriptive Lighting Incentive, Incentive based on installing Metal halide w/pulse start ($25 per fixture)
Maximum incentive amount is $25.

Options for funding ECM:

This project may benefit from enrolling in either the NJ Pay-for-Performance program or the NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.

http://www.njcleanenergy.com/commercial-industrial/home/home

ECM#4: *Upgrade 35 fixtures to T8 fluorescent fixtures*

Description:

Most of the lighting within the Crossroads School and UCESC administrative office building consists of efficient T8 lighting with electronic ballasts. There are a few areas that contain T12 fluorescent fixtures with magnetic ballasts, such as the first floor hallway and rear lobby area. SWA recommends replacing each one of these T12 fixtures with equivalent T8 fluorescent fixtures with electronic ballasts. Typically, T8 fluorescent fixtures with electronic ballasts use 30% less energy than equivalent T12 fixtures with magnetic ballasts. In addition, there will be operating costs savings associated with each bulb since T8 fixtures with electronic ballasts have a longer rated lifetime than T12 fixtures with magnetic ballasts. See Appendix A for complete lighting schedule and analysis.

Installation cost:

Estimated installed cost: $5,086
Source of cost estimate: RS *Means*

Economics:

ECM #4																				
ECM #	ECM description	Cost Source	Est. installed cost, $	Est. incentives, $	Net est. cost with incentives, $	kWh, 1st year savings	kW, demand reduction	therms, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, $	Total 1st year savings, $	Life of measure, years	Est. lifetime energy cost savings, $	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, $	CO_2 reduced, lbs/year
4	Upgrade 35 fixtures to T8 flourescent fixtures	RSMeans	$6,136	$1,050	$5,086	2,134	0.4	0	0.3	$303	$687	15	$8,085	7.4	59.0%	3.9%	30.9%	$14,040	3,821

Assumptions: SWA calculated the savings for this measure using information collected during the field visit and analysis of historical utility consumption information.

Rebates/financial incentives:

NJ Clean Energy – Prescriptive Lighting Incentive, Incentive based on installing T5 or T8 lamps with electronic ballasts in existing facilities ($10-$30 per fixture, depending on quantity of lamps).
Maximum incentive amount is $1,050.

Options for funding ECM:

This project may benefit from enrolling in either the NJ Pay-for-Performance program or the NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.
http://www.njcleanenergy.com/commercial-industrial/home/home

ECM#5: *Reconfigure controls and control optimization*

Description:

All of the equipment that has been installed is capable of regulating the energy usage of this building. There are a few issues that need to be addressed with the control system. As a priority, SWA *first* recommends that all building envelope measures as well as measures that affect the HVAC system, are undertaken as a priority. When all building envelope measures are complete, the HVAC control system should be addressed. It is important to realize that envelope and other HVAC measures influence the heating and cooling loads of the building and for this reason, controls should be reconfigured *last.* If no other measures are implemented, it is still recommended that the controls system is reconfigured.

Based on field observations, it appears that the rooftop AC unit is sending air that has been over-cooled and dehumidified to the VAV boxes. In turn, these VAV boxes call for heat in order to warm the air up to meet the thermostat set point. Also during the field audit, one of the boilers was not only operating but short-cycling; indicating quick demands. When other measures are installed first, it is recommended that the control logic of the control system be reset and reconfigured to building specific conditions. The HVAC system and all of its components should be put through a rigorous functional testing to prove that the components of each system interact with each other through a range of different operating conditions.

Based on the eQUEST model that was simulated, the building's energy bills show that the system has a very high usage for the equipment installed. It does not appear that the HVAC system is setting back at night or on the weekends, when usage is at its lowest. Demand-controlled ventilation is installed in the return air duct to help trigger an "unoccupied mode" with the building ventilation system but this does not appear to be working. Without proper setbacks, the building is supplying heating, ventilation and air-conditioning throughout the entire building when not necessary. This should be addressed when the controls are reconfigured.

Installation cost:

Estimated installed cost: $42,000
Source of cost estimate: RS *Means*

Economics:

ECM #5																					
ECM #	ECM description	Cost Source	Est. installed cost, $	Est. incentives, $	Net est. cost with incentives, $	kWh, 1st year savings	kW, demand reduction	therms, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, $	Total 1st year savings, $	Life of measure, years	Est. lifetime energy cost savings, $	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, $	CO_2 reduced, lbs/year
5	Reconfigure controls and control optimization	RSMeans	$42,000	$0	$42,000	48,740	10.0	4,964	23.7	$0	$14,780	10	$124,796	2.8	197.1%	19.7%	33.2%	$84,073	141,987

Assumptions: SWA calculated the savings for this measure using measurements taken the day of the field visit, and billing analysis. SWA assumes that the original system is not setting back on nights and weekends. As part of the control reconfiguration and optimization, SWA assumes that the building set points will be restored to intended conditions. Savings are based on resetting the HVAC operation schedule of the building to 8am-6pm as well as allowing proper cooling parameters to avoid using the VAV reheat when unnecessary.

Rebates/financial incentives:

Currently, there are no incentives associated with this measure.

Options for funding ECM:

This project may benefit from enrolling in either the NJ Pay-for-Performance program or the NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.
http://www.njcleanenergy.com/commercial-industrial/home/home

ECM#6: *Replace second floor windows*

Description:

As mentioned above in Windows Section 2.3.4, the second floor windows are original to the building. These windows are metal-framed with no thermal break and consist of single-paned glass with no low-e coating. There are two major reasons that temperatures are unevenly distributed across the second floor of this building; insulation levels and windows. SWA recommends that the windows on the second story are replaced with metal-framed windows with a thermal break. These windows should contain double-paned, argon-filled glass that also contains a low-e coating. Window replacement can alleviate most of the temperature distribution problems, but increasing levels should still be considered as part of a capital improvement plan. Replacing the windows does not show a positive return-on-investment but is a necessary measure to be implemented for energy efficiency and to realize further energy savings with other HVAC related measures. Replacing windows is also necessary to realize true savings with ECM#5 that deals with reconfiguring controls.

Installation cost:

Estimated installed cost: $51,892
Source of cost estimate: RS *Means*

Economics:

ECM #6																				
ECM #	ECM description	Cost Source	Est. installed cost, $	Est. incentives, $	Net est. cost with incentives, $	kWh, 1st year savings	kW, demand reduction	therms, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, $	Total 1st year savings, $	Life of measure, years	Est. lifetime energy cost savings, $	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, $	CO_2 reduced, lbs/year
6	Replace second floor windows	RSMeans	$51,892	$0	$51,892	10,730	2.2	-50	1.1	$0	$1,871	25	$31,864	27.7	-38.6%	-1.5%	-0.8%	($19,314)	18,661

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

Rebates/financial incentives:

Currently, there are no incentives associated with this measure.

Options for funding ECM:

This project may benefit from enrolling in either the NJ Pay-for-Performance program or the NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.
http://www.njcleanenergy.com/commercial-industrial/home/home

5. RENEWABLE AND DISTRIBUTED ENERGY MEASURES

5.1. Existing systems

There are currently no existing renewable energy systems.

5.2. Solar Photovoltaic

Photovoltaic (PV) technology would not be cost beneficial to this project since there is very little unobstructed Southern exposure.

5.3. Solar Thermal Collectors

Solar thermal collectors are not cost effective for this project and are not recommended due to the low amount of domestic hot water use throughout the building.

5.4. Combined Heat and Power

CHP is not applicable to this project because of the HVAC system type and limited domestic hot water usage.

5.5. Geothermal

Geothermal is not applicable to this project because it would require modifications to the existing heat distribution system, which would not be cost effective.

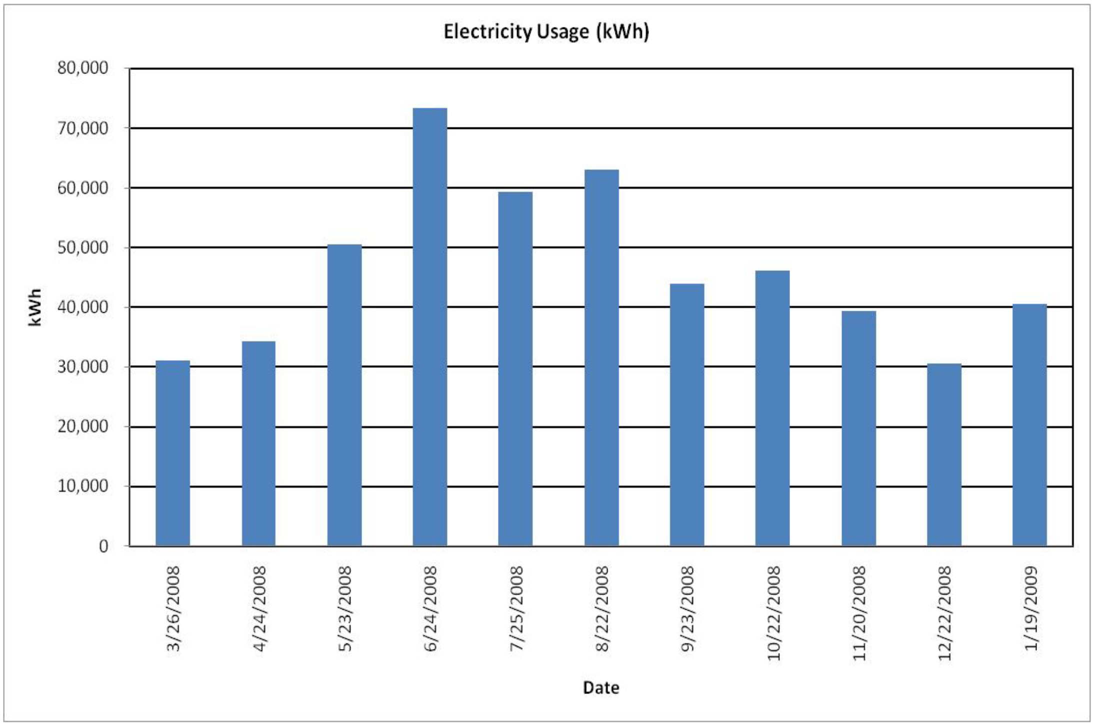
5.6. Wind

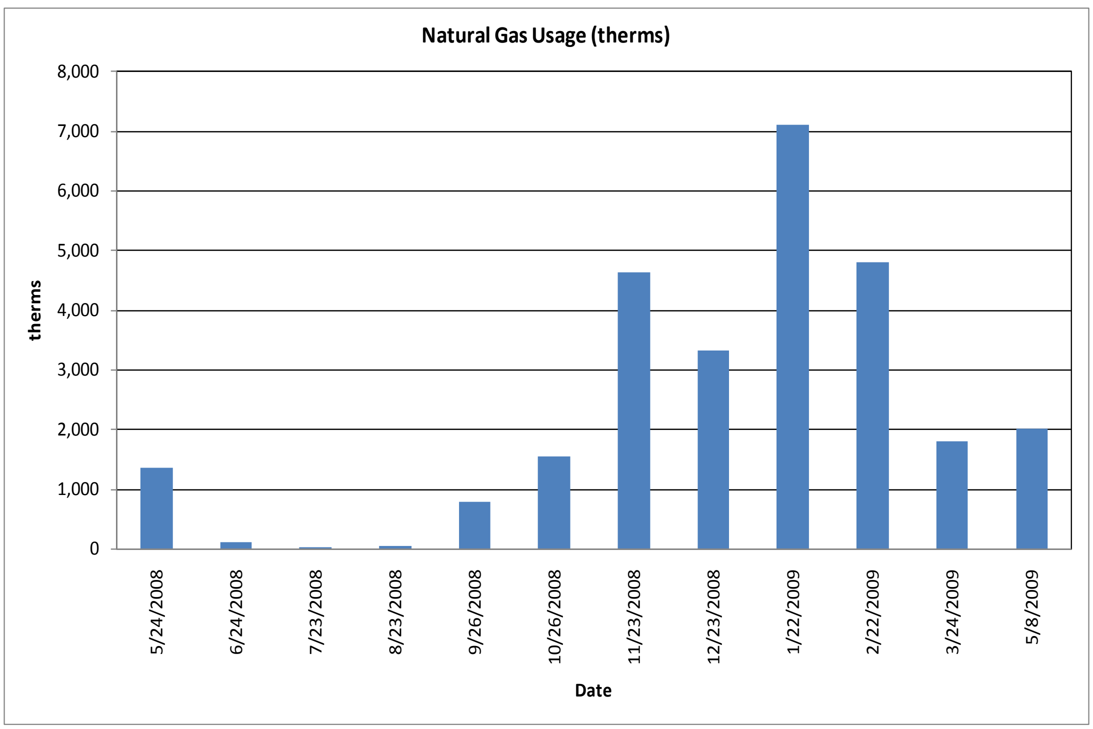
Wind power production is not appropriate for this location because required land is not available for the wind turbine. Also, the available wind energy resource is very low.

6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

6.1. Load profiles

The average electrical peak demand for the previous year was 161.6 kW and the maximum peak demand was 209.6 kW. The electric and gas load profiles for this project are presented in the following charts. The first chart shows electric demand (in kW) for the previous 12 months and the other two charts show electric and gas usage (in kWh), respectively.


Electricity Usage (kWh)
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
kWh
3/26/2008
4/24/2008
5/23/2008
6/24/2008
7/25/2008
8/22/2008
9/23/2008
10/22/2008
11/20/2008
12/22/2008
1/19/2009
Date


Natural Gas Usage (therms)
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
therms
5/24/2008
6/24/2008
7/23/2008
8/23/2008
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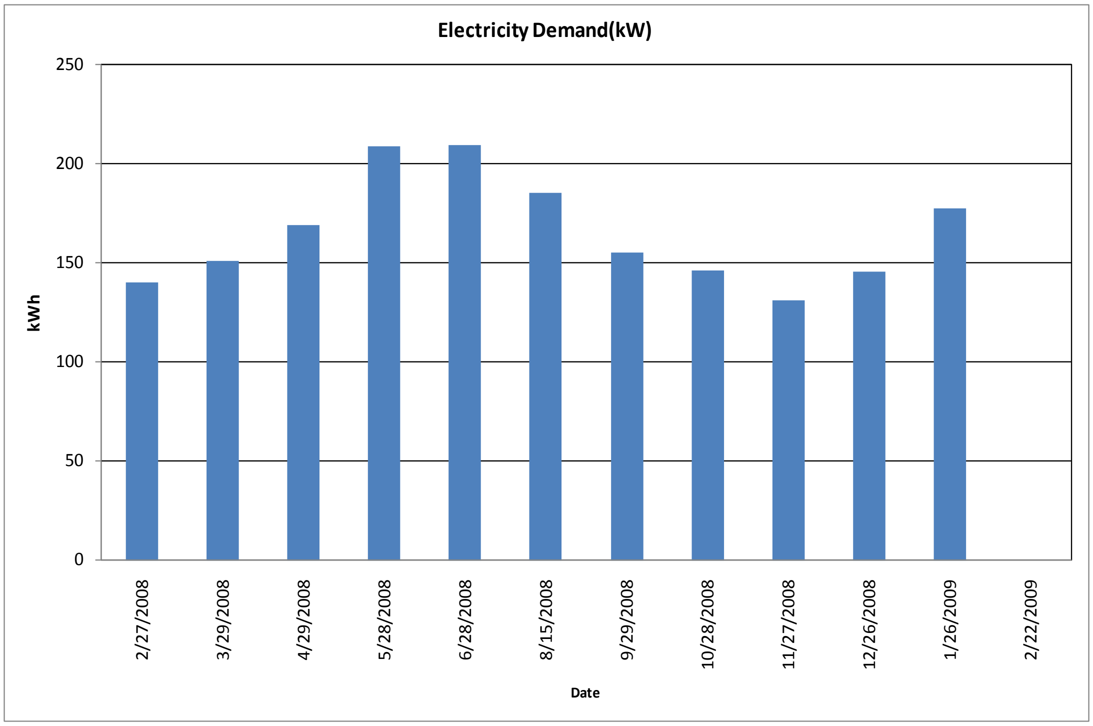
3/24/2009
5/8/2009
Date



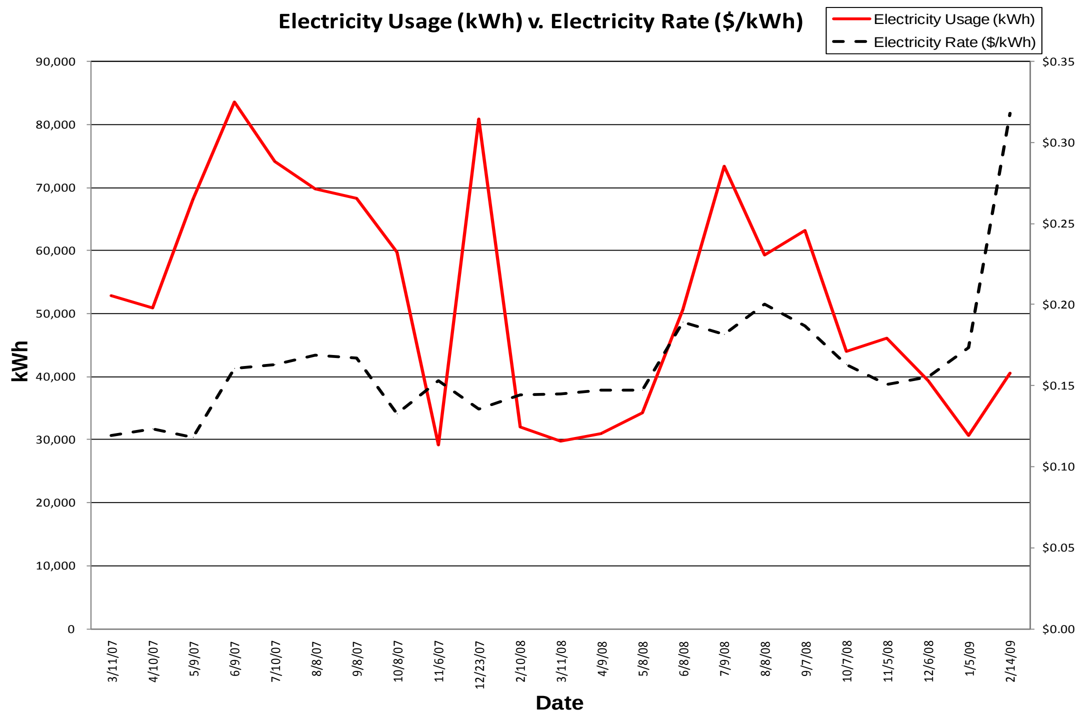
6.2. Tariff analysis

The Crossroads School and Administrative Offices of UCESC building currently buys electricity from PSE&G at the general service rate, which charges customers based on the market rate of electricity usage as well as monthly peak demand. Gas is purchased from Elizabethtown Gas at the general service rate which charges customers based on the market rate of natural gas usage. General Service rates are appropriate for this building due to its size.

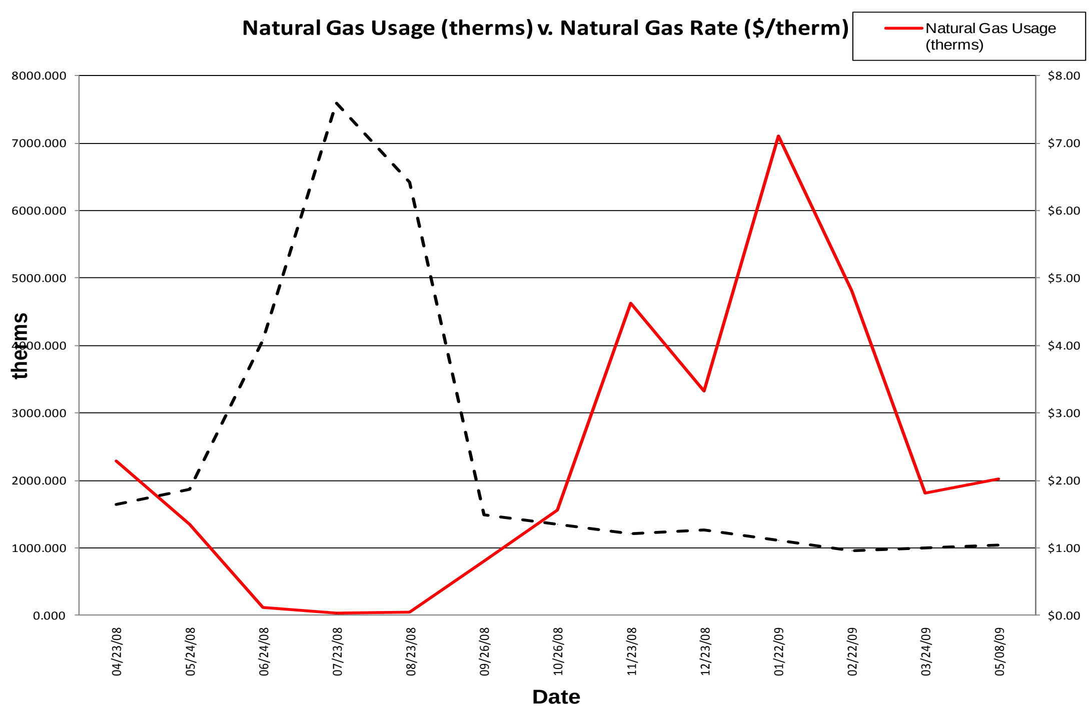
6.3. Energy Procurement strategies

Billing analysis shows price fluctuations of over 20% over the course of the year for the building electrical and natural gas accounts. Customers that have a large variation in monthly billing rates can often reduce the costs associated with energy procurement by selecting a third party energy supplier. Contact the NJ Energy Choice Program for further information on Energy Services Companies (ESCOs) that can act as third party energy suppliers. Purchasing electricity from an ESCO can reduce electric rate fluctuation and ultimately reduce the annual cost of energy for the school. Appendix B contains a complete list of third party energy suppliers.

Currently, New Jersey commercial buildings of similar type pay $0.150/kWh for electricity and $1.55/therm for natural gas. Currently, the electricity rate for the 45 Cardinal Drive building is $0.18/kWh which means there is a potential cost savings of $15,374 per year. The current natural gas rate for the 45 Cardinal Drive building is $1.21/therm which is currently better than the average rate. A large cost savings potential exists, however this involves contacting third party suppliers and negotiating utility rates. SWA recommends that UCESC further explore opportunities of purchasing electricity from third party energy suppliers in order to reduce rate fluctuation and ultimately reduce the annual cost of energy for the 45 Cardinal Drive building. Appendix B contains a complete list of third party energy suppliers for UCESC service area. USESC may want to consider partnering with other school districts, municipalities, townships and communities to aggregate 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.



Electricity prices reflect electricity usage



Natural gas prices fluctuate as expected with usage

The building may be eligible for enrollment in a Demand Response Program because the minimum electric demand each month does greatly exceeds 50 kW, which is the typical threshold for considering this option.

7. METHOD OF ANALYSIS

7.1. Assumptions and methods

Energy modeling method:	Spreadsheet-based calculation methods
Cost estimates:	RS Means 2009 (Facilities Maintenance & Repair Cost Data)
	RS Means 2009 (Building Construction Cost Data)
	RS Means 2009 (Mechanical Cost Data)
	Note: 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**	**Utility Rm**	**Parabolic**	**E**	**4'T8**	**16**	**4**	**32**	**S**	**2**	**261**	**13**	**2,061**	**1,178**	**C**	**Parabolic**	**4'T8**	**E**	**OS**	**16**	**4**	**32**	**1.5**	**261**	**13**	**2,061**	**883**	**0**	**294**	**294**
2	B	Utility Rm	Exit Sign	N	LED	3	1	5	S	24	365	1	16	158	N/A	Exit Sign	LED	N	S	3	1	5	24	365	1	16	158	0	0	0
3	B	Admin. Office	Parabolic	E	4'T8	2	4	32	S	8	261	13	269	589	N/A	Parabolic	4'T8	E	S	2	4	32	8	261	13	269	589	0	0	0
4	B	Bathroom Women	Parabolic	E	4'T8	1	2	32	S	2	261	6	70	37	N/A	Parabolic	4'T8	E	S	1	2	32	2	261	6	70	37	0	0	0
5	B	Bathroom Men	Parabolic	E	4'T8	1	2	32	S	10	261	6	70	183	N/A	Parabolic	4'T8	E	S	1	2	32	10	261	6	70	183	0	0	0
6	B	Lounge Busdr.	Parabolic	E	4'T8	3	4	32	S	2	261	13	397	221	N/A	Parabolic	4'T8	E	S	3	4	32	2	261	13	397	221	0	0	0
7	B	Closet Off Lounge	Parabolic	E	4'T8	1	2	32	S	5	261	6	70	91	N/A	Parabolic	4'T8	E	S	1	2	32	5	261	6	70	91	0	0	0
8	B	B 04	Parabolic	E	4'T8	11	4	32	S	5	261	13	1,421	2,024	N/A	Parabolic	4'T8	E	S	11	4	32	5	261	13	1,421	2,024	0	0	0
9	B	B 05	Parabolic	E	4'T8	1	4	32	S	11	261	13	141	405	N/A	Parabolic	4'T8	E	S	1	4	32	11	261	13	141	405	0	0	0
10	B	Stair 2	Parabolic	E	4'T8	1	4	32	S	5	261	13	141	184	N/A	Parabolic	4'T8	E	S	1	4	32	5	261	13	141	184	0	0	0
11	B	B 01	Parabolic	E	4'T8	1	2	32	S	11	261	6	70	201	N/A	Parabolic	4'T8	E	S	1	2	32	11	261	6	70	201	0	0	0
12	B	Elevator	Parabolic	E	4'T8	1	6	32	N	12	261	18	210	658	N/A	Parabolic	4'T8	E	N	1	6	32	12	261	18	210	658	0	0	0
13	GF	Lobby	Screw-in	E	CFL	7	2	13	S	12	261	0	182	570	N/A	Screw-in	CFL	E	S	7	2	13	12	261	0	182	570	0	0	0
14	GF	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
15	**GF**	**Hallway**	**Parabolic**	**E**	**4'T12**	**4**	**2**	**40**	**S**	**12**	**261**	**15**	**335**	**1,190**	**T8**	**Parabolic**	**4'T8**	**E**	**S**	**4**	**2**	**32**	**12**	**261**	**6**	**262**	**877**	**313**	**0**	**313**
16	GF	Hallway	Exit Sign	N	LED	3	1	5	S	24	365	1	16	158	N/A	Exit Sign	LED	N	S	3	1	5	24	365	1	16	158	0	0	0
17	**GF**	**Hallway**	**Parabolic**	**E**	**4'T12**	**27**	**2**	**40**	**S**	**9**	**261**	**15**	**2,175**	**6,025**	**T8**	**Parabolic**	**4'T8**	**E**	**S**	**27**	**2**	**32**	**9**	**261**	**6**	**1,734**	**4,440**	**1,586**	**0**	**1,586**
18	GF	Hallway	Exit Sign	N	LED	6	1	5	S	24	365	1	31	315	N/A	Exit Sign	LED	N	S	6	1	5	24	365	1	31	315	0	0	0
19	**GF**	**Rear Lobby**	**Parabolic**	**E**	**4'T12**	**4**	**2**	**40**	**S**	**9**	**261**	**15**	**335**	**893**	**T8**	**Parabolic**	**4'T8**	**E**	**S**	**4**	**2**	**32**	**9**	**261**	**6**	**262**	**658**	**235**	**0**	**235**
20	GF	Rear 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
21	**GF**	**Teachers Lounge**	**Parabolic**	**E**	**4'T8**	**6**	**3**	**32**	**S**	**9**	**193**	**10**	**586**	**1,105**	**C**	**Parabolic**	**4'T8**	**E**	**OS**	**6**	**3**	**32**	**6.75**	**193**	**10**	**586**	**829**	**0**	**276**	**276**
22	GF	Janitor Clo.	Parabolic	E	4'T8	1	2	32	S	9	193	6	70	122	N/A	Parabolic	4'T8	E	S	1	2	32	9	193	6	70	122	0	0	0
23	GF	Bathroom	Parabolic	E	4'T8	1	2	32	S	9	193	6	70	122	N/A	Parabolic	4'T8	E	S	1	2	32	9	193	6	70	122	0	0	0
24	GF	Closet 121	Parabolic	E	4'T8	1	2	32	S	9	193	6	70	122	N/A	Parabolic	4'T8	E	S	1	2	32	9	193	6	70	122	0	0	0
25	GF	Kitchen 118	Parabolic	E	4'T8	2	3	32	S	9	193	10	202	368	N/A	Parabolic	4'T8	E	S	2	3	32	9	193	10	202	368	0	0	0
26	**GF**	**off Kitchen 119**	**Parabolic**	**E**	**4'T8**	**9**	**3**	**32**	**S**	**9**	**193**	**10**	**874**	**1,657**	**C**	**Parabolic**	**4'T8**	**E**	**OS**	**9**	**3**	**32**	**6.75**	**193**	**10**	**874**	**1,243**	**0**	**414**	**414**
27	**GF**	**off Kitchen 116**	**Parabolic**	**E**	**4'T8**	**9**	**3**	**32**	**S**	**9**	**193**	**10**	**874**	**1,657**	**C**	**Parabolic**	**4'T8**	**E**	**OS**	**9**	**3**	**32**	**6.75**	**193**	**10**	**874**	**1,243**	**0**	**414**	**414**
28	GF	Bathroom	Parabolic	E	4'T8	1	2	32	S	9	193	6	70	122	N/A	Parabolic	4'T8	E	S	1	2	32	9	193	6	70	122	0	0	0
29	GF	Bathroom	Parabolic	E	4'T8	1	2	32	S	9	193	6	70	122	N/A	Parabolic	4'T8	E	S	1	2	32	9	193	6	70	122	0	0	0
30	GF	Classroom 120	Parabolic	E	4'T8	4	2	32	S	9	193	6	262	486	N/A	Parabolic	4'T8	E	S	4	2	32	9	193	6	262	486	0	0	0
31	GF	Classroom 119	Parabolic	E	4'T8	4	2	32	S	9	193	6	262	486	N/A	Parabolic	4'T8	E	S	4	2	32	9	193	6	262	486	0	0	0
32	GF	Classroom 111	Parabolic	E	4'T8	8	3	32	S	9	193	10	778	1,473	N/A	Parabolic	4'T8	E	S	8	3	32	9	193	10	778	1,473	0	0	0
33	GF	Bathroom	Parabolic	E	4'T8	1	2	32	S	9	193	6	70	122	N/A	Parabolic	4'T8	E	S	1	2	32	9	193	6	70	122	0	0	0
34	GF	Classroom 110	Parabolic	E	4'T8	8	3	32	S	9	193	10	778	1,473	N/A	Parabolic	4'T8	E	S	8	3	32	9	193	10	778	1,473	0	0	0
35	GF	Classroom 109	Parabolic	E	4'T8	8	3	32	S	9	193	10	778	1,473	N/A	Parabolic	4'T8	E	S	8	3	32	9	193	10	778	1,473	0	0	0
36	GF	Classroom 108	Parabolic	E	4'T8	8	3	32	S	9	193	10	778	1,473	N/A	Parabolic	4'T8	E	S	8	3	32	9	193	10	778	1,473	0	0	0
37	GF	Classroom 106	Parabolic	E	4'T8	7	3	32	S	9	193	10	682	1,289	N/A	Parabolic	4'T8	E	S	7	3	32	9	193	10	682	1,289	0	0	0
38	GF	Classroom 105	Parabolic	E	4'T8	9	3	32	S	9	193	10	874	1,657	N/A	Parabolic	4'T8	E	S	9	3	32	9	193	10	874	1,657	0	0	0

39	GF	Classroom 104	Parabolic	E	4'T8	9	3	32	S	9	193	10	874	1,657	N/A	Parabolic	4'T8	E	S	9	3	32	9	193	10	874	1,657	0	0	0
40	GF	Bathroom	Parabolic	E	4'T8	1	2	32	S	9	193	6	70	122	N/A	Parabolic	4'T8	E	S	1	2	32	9	193	6	70	122	0	0	0
41	GF	Classroom 103	Parabolic	E	4'T8	8	3	32	S	9	193	10	778	1,473	N/A	Parabolic	4'T8	E	S	8	3	32	9	193	10	778	1,473	0	0	0
42	GF	Classroom 102	Parabolic	E	4'T8	7	3	32	S	9	193	10	682	1,289	N/A	Parabolic	4'T8	E	S	7	3	32	9	193	10	682	1,289	0	0	0
43	GF	Classroom 101	Parabolic	E	4'T8	6	3	32	S	9	193	10	586	1,105	N/A	Parabolic	4'T8	E	S	6	3	32	9	193	10	586	1,105	0	0	0
44	GF	Admin. Office	Parabolic	E	4'T8	2	3	32	S	9	193	10	202	368	N/A	Parabolic	4'T8	E	S	2	3	32	9	193	10	202	368	0	0	0
45	GF	Admin. Office	Parabolic	E	4'T8	3	3	32	S	9	193	10	298	552	N/A	Parabolic	4'T8	E	S	3	3	32	9	193	10	298	552	0	0	0
46	GF	Admin. Office	Parabolic	E	4'T8	4	3	32	S	9	193	10	394	736	N/A	Parabolic	4'T8	E	S	4	3	32	9	193	10	394	736	0	0	0
47	GF	Admin. Office 114	Parabolic	E	4'T8	5	3	32	S	9	193	10	490	921	N/A	Parabolic	4'T8	E	S	5	3	32	9	193	10	490	921	0	0	0
48	GF	Admin. Office 113	Parabolic	E	4'T8	1	3	32	S	9	193	10	106	184	N/A	Parabolic	4'T8	E	S	1	3	32	9	193	10	106	184	0	0	0
49	GF	Admin. Office 113	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
50	**GF**	**Treatment Room 113**	**Parabolic**	**E**	**4'T8**	**5**	**3**	**32**	**S**	**9**	**193**	**10**	**490**	**921**	**C**	**Parabolic**	**4'T8**	**E**	**OS**	**5**	**3**	**32**	**6.75**	**193**	**10**	**490**	**690**	**0**	**230**	**230**
51	GF	Treatment Room 113	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
52	GF	Admin. Office 112	Parabolic	E	4'T8	3	3	32	S	9	261	10	298	747	N/A	Parabolic	4'T8	E	S	3	3	32	9	261	10	298	747	0	0	0
53	2	Classroom 219	Parabolic	E	4'T8	6	4	32	S	11	261	13	781	2,429	N/A	Parabolic	4'T8	E	S	6	4	32	11	261	13	781	2,429	0	0	0
54	2	Classroom 218	Parabolic	E	4'T8	6	4	32	S	2	261	13	781	442	N/A	Parabolic	4'T8	E	S	6	4	32	2	261	13	781	442	0	0	0
55	2	Classroom 218	Exit Sign	N	LED	2	1	5	S	24	365	1	11	105	N/A	Exit Sign	LED	N	S	2	1	5	24	365	1	11	105	0	0	0
56	2	Conf rm 222	Parabolic	E	4'T8	37	4	32	S	11	261	13	4,749	14,978	N/A	Parabolic	4'T8	E	S	37	4	32	11	261	13	4,749	14,978	0	0	0
57	2	Conf rm 222	Exit Sign	N	LED	2	1	5	S	24	365	1	11	105	N/A	Exit Sign	LED	N	S	2	1	5	24	365	1	11	105	0	0	0
58	2	Janitor Clo.	2'U-shape	E	2'T8	1	2	18	S	2	261	5	41	21	N/A	2'U-shape	2'T8	E	S	1	2	18	2	261	5	41	21	0	0	0
59	2	Cafeteria 223	Parabolic	E	4'T8	7	4	32	S	5	261	13	909	1,288	N/A	Parabolic	4'T8	E	S	7	4	32	5	261	13	909	1,288	0	0	0
60	2	Storage 224	Parabolic	E	4'T8	2	4	32	S	5	261	13	269	368	N/A	Parabolic	4'T8	E	S	2	4	32	5	261	13	269	368	0	0	0
61	2	Bathroom Women	Parabolic	E	4'T8	1	4	32	S	5	261	13	141	184	N/A	Parabolic	4'T8	E	S	1	4	32	5	261	13	141	184	0	0	0
62	2	Bathroom Men	Parabolic	E	4'T8	1	4	32	S	10	261	13	141	368	N/A	Parabolic	4'T8	E	S	1	4	32	10	261	13	141	368	0	0	0
63	2	Meeting Room 206	Parabolic	E	4'T8	12	4	32	S	10	261	13	1,549	4,416	N/A	Parabolic	4'T8	E	S	12	4	32	10	261	13	1,549	4,416	0	0	0
64	2	Admin. Office 205	Parabolic	E	4'T8	6	4	32	S	10	261	13	781	2,208	N/A	Parabolic	4'T8	E	S	6	4	32	10	261	13	781	2,208	0	0	0
65	2	Admin. Office 204	Parabolic	E	4'T8	6	4	32	S	10	261	13	781	2,208	N/A	Parabolic	4'T8	E	S	6	4	32	10	261	13	781	2,208	0	0	0
66	2	Admin. Office 203	Parabolic	E	4'T8	9	4	32	S	10	261	13	1,165	3,312	N/A	Parabolic	4'T8	E	S	9	4	32	10	261	13	1,165	3,312	0	0	0
67	2	Admin. Office 202	Parabolic	E	4'T8	3	4	32	S	10	261	13	397	1,104	N/A	Parabolic	4'T8	E	S	3	4	32	10	261	13	397	1,104	0	0	0
68	2	Admin. Office 201	Parabolic	E	4'T8	3	4	32	S	10	261	13	397	1,104	N/A	Parabolic	4'T8	E	S	3	4	32	10	261	13	397	1,104	0	0	0
69	2	Admin. Office 221	Parabolic	E	4'T8	3	4	32	S	10	261	13	397	1,104	N/A	Parabolic	4'T8	E	S	3	4	32	10	261	13	397	1,104	0	0	0
70	2	Admin. Office 220	Parabolic	E	4'T8	8	4	32	S	10	261	13	1,037	2,944	N/A	Parabolic	4'T8	E	S	8	4	32	10	261	13	1,037	2,944	0	0	0
71	2	Admin. Office 228	Parabolic	E	4'T8	4	4	32	S	10	261	13	525	1,472	N/A	Parabolic	4'T8	E	S	4	4	32	10	261	13	525	1,472	0	0	0
72	2	Admin. Office 227	Parabolic	E	4'T8	4	4	32	S	10	261	13	525	1,472	N/A	Parabolic	4'T8	E	S	4	4	32	10	261	13	525	1,472	0	0	0
73	2	Admin. Office 226	Parabolic	E	4'T8	4	4	32	S	10	261	13	525	1,472	N/A	Parabolic	4'T8	E	S	4	4	32	10	261	13	525	1,472	0	0	0
74	2	Admin. Office 217	Parabolic	E	4'T8	2	4	32	S	10	261	13	269	736	N/A	Parabolic	4'T8	E	S	2	4	32	10	261	13	269	736	0	0	0
75	2	Admin. Office 216	Parabolic	E	4'T8	8	4	32	S	10	261	13	1,037	2,944	N/A	Parabolic	4'T8	E	S	8	4	32	10	261	13	1,037	2,944	0	0	0
76	2	Admin. Office 215	Parabolic	E	4'T8	6	4	32	S	10	261	13	781	2,208	N/A	Parabolic	4'T8	E	S	6	4	32	10	261	13	781	2,208	0	0	0
77	2	Admin. Office 214	Parabolic	E	4'T8	6	4	32	S	2	261	13	781	442	N/A	Parabolic	4'T8	E	S	6	4	32	2	261	13	781	442	0	0	0
78	2	Admin. Office 213	Parabolic	E	4'T8	3	4	32	S	10	261	13	397	1,104	N/A	Parabolic	4'T8	E	S	3	4	32	10	261	13	397	1,104	0	0	0
79	2	Storage 212	Parabolic	E	4'T8	1	4	32	S	10	261	13	141	368	N/A	Parabolic	4'T8	E	S	1	4	32	10	261	13	141	368	0	0	0
80	2	Admin. Office 299	Parabolic	E	4'T8	4	4	32	S	10	261	13	525	1,472	N/A	Parabolic	4'T8	E	S	4	4	32	10	261	13	525	1,472	0	0	0
81	2	Admin. Office 210	Parabolic	E	4'T8	6	4	32	S	10	261	13	781	2,208	N/A	Parabolic	4'T8	E	S	6	4	32	10	261	13	781	2,208	0	0	0
82	2	Admin. Office 210	Parabolic	E	4'T8	6	4	32	S	10	261	13	781	2,208	N/A	Parabolic	4'T8	E	S	6	4	32	10	261	13	781	2,208	0	0	0
83	2	Admin. Office 208	Parabolic	E	4'T8	6	4	32	S	11	261	13	781	2,429	N/A	Parabolic	4'T8	E	S	6	4	32	11	261	13	781	2,429	0	0	0
84	2	Admin. Office 207	Parabolic	E	4'T8	6	4	32	S	11	261	13	781	2,429	N/A	Parabolic	4'T8	E	S	6	4	32	11	261	13	781	2,429	0	0	0
85	2	Hallway	2'U-shape	E	2'T8	32	2	18	S	3	261	5	1,157	1,027	N/A	2'U-shape	2'T8	E	S	32	2	18	3	261	5	1,157	1,027	0	0	0
86	**2**	**Hallway**	**Screw-in**	**N**	**CFL**	**4**	**2**	**13**	**S**	**8**	**261**	**0**	**104**	**217**	**C**	**Screw-in**	**CFL**	**N**	**OS**	**4**	**2**	**13**	**2**	**261**	**0**	**104**	**54**	**0**	**163**	**163**
87	2	Hallway	Exit Sign	N	LED	10	1	5	S	24	365	1	51	526	N/A	Exit Sign	LED	N	S	10	1	5	24	365	1	51	526	0	0	0
88	**Ext**	**Exterior**	**Exterior**	**N**	**MH**	**1**	**1**	**250**	**T**	**12**	**365**	**63**	**313**	**1,371**	**PSMH**	**Exterior**	**PSMH**	**N**	**T**	**1**	**1**	**175**	**12**	**365**	**38**	**213**	**933**	**438**	**0**	**438**
89	Ext	Exterior	Exterior	N	CFL	1	1	13	T	12	365	0	13	57	N/A	Exterior	CFL	N	T	1	1	13	12	365	0	13	57	0	0	0
90	**Ext**	**Exterior**	**Exterior**	**N**	**Inc**	**29**	**1**	**100**	**T**	**12**	**365**	**0**	**2,900**	**12,702**	**CFL**	**Exterior**	**CFL**	**N**	**T**	**29**	**1**	**35**	**12**	**365**	**0**	**1,015**	**4,446**	**8,256**	**0**	**8,256**
		Totals:				**497**	**262**	**2,835**				**889**	**48,956**	**118,243**						**497**	**262**	**2,671**				**46,384**	**105,623**	**10,828**	**1,792**	**12,620**

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

Appendix B: Third Party Energy Suppliers (ESCOs)

Third Party Electric Suppliers for PSEG Service Territory	Telephone & Web Site
Hess Corporation	(800) 437-7872
1 Hess Plaza	www.hess.com
Woodbridge, NJ 07095	
American Powernet Management, LP	(877) 977-2636
437 North Grove St.	www.americanpowernet.com
Berlin, NJ 08009	
BOC Energy Services, Inc.	(800) 247-2644
575 Mountain Avenue	www.boc.com
Murray Hill, NJ 07974	
Commerce Energy, Inc.	(800) 556-8457
4400 Route 9 South, Suite 100	www.commerceenergy.com
Freehold, NJ 07728	
ConEdison Solutions	(888) 665-0955
535 State Highway 38	www.conedsolutions.com
Cherry Hill, NJ 08002	
Constellation NewEnergy, Inc.	(888) 635-0827
900A Lake Street, Suite 2	www.newenergy.com
Ramsey, NJ 07446	
Credit Suisse, (USA) Inc.	(212) 538-3124
700 College Road East	www.creditsuisse.com
Princeton, NJ 08450	
Direct Energy Services, LLC	(866) 547-2722
120 Wood Avenue, Suite 611	www.directenergy.com
Iselin, NJ 08830	
FirstEnergy Solutions	(800) 977-0500
300 Madison Avenue	www.fes.com
Morristown, NJ 07926	
Glacial Energy of New Jersey, Inc.	(877) 569-2841
207 LaRoche Avenue	www.glacialenergy.com
Harrington Park, NJ 07640	
Metro Energy Group, LLC	(888) 536-3876
14 Washington Place	www.metroenergy.com
Hackensack, NJ 07601	
Integrys Energy Services, Inc.	(877) 763-9977
99 Wood Ave, South, Suite 802	www.integrysenergy.com
Iselin, NJ 08830	
Liberty Power Delaware, LLC	(866) 769-3799
Park 80 West Plaza II, Suite 200	www.libertypowercorp.com
Saddle Brook, NJ 07663	
Liberty Power Holdings, LLC	(800) 363-7499
Park 80 West Plaza II, Suite 200	www.libertypowercorp.com
Saddle Brook, NJ 07663	
Pepco Energy Services, Inc.	(800) 363-7499
112 Main St.	www.pepco-services.com
Lebanon, NJ 08833	
PPL EnergyPlus, LLC	(800) 281-2000
811 Church Road	www.pplenergyplus.com
Cherry Hill, NJ 08002	
Sempra Energy Solutions	(877) 273-6772
581 Main Street, 8th Floor	www.semprasolutions.com
Woodbridge, NJ 07095	
South Jersey Energy Company	(800) 756-3749
One South Jersey Plaza, Route 54	www.southjerseyenergy.com
Folsom, NJ 08037	
Sprague Energy Corp.	(800) 225-1560
12 Ridge Road	www.spragueenergy.com
Chatham Township, NJ 07928	
Strategic Energy, LLC	(888) 925-9115
55 Madison Avenue, Suite 400	www.sel.com
Morristown, NJ 07960	
Suez Energy Resources NA, Inc.	(888) 644-1014
333 Thornall Street, 6th Floor	www.suezenergyresources.com
Edison, NJ 08837	
UGI Energy Services, Inc.	(856) 273-9995
704 East Main Street, Suite 1	www.ugienergyservices.com
Moorestown, NJ 08057	

Third Party Gas Suppliers for Elizabethtown Gas Co. Service Territory	Telephone & Web Site
Cooperative Industries	(800) 628-9427
412-420 Washington Avenue	www.cooperativenet.com
Belleville, NJ 07109	
Direct Energy Services, LLC	(866) 547-2722
120 Wood Avenue, Suite 611	www.directenergy.com
Iselin, NJ 08830	
Gateway Energy Services Corp.	(800) 805-8586
44 Whispering Pines Lane	www.gesc.com
Lakewood, NJ 08701	
UGI Energy Services, Inc.	(856) 273-9995
704 East Main Street, Suite 1	www.ugienergyservices.com
Moorestown, NJ 08057	
Great Eastern Energy	(888) 651-4121
116 Village Riva, Suite 200	www.greateastern.com
Princeton, NJ 08540	
Glacial Energy of New Jersey, Inc.	(877) 569-2841
207 LaRoche Avenue	www.glacialenergy.com
Harrington Park, NJ 07640	
Hess Corporation	(800) 437-7872
1 Hess Plaza	www.hess.com
Woodbridge, NJ 07095	
Intelligent Energy	(800) 724-1880
2050 Center Avenue, Suite 500	www.intelligentenergy.org
Fort Lee, NJ 07024	
Metromedia Energy, Inc.	(877) 750-7046
6 Industrial Way	www.metromediaenergy.com
Eatontown, NJ 07724	
MxEnergy, Inc.	(800) 375-1277
510 Thornall Street, Suite 270	www.mxenergy.com
Edison, NJ 08837	
NATGASCO (Mitchell Supreme)	(800) 840-4427
532 Freeman Street	www.natgasco.com
Orange, NJ 07050	
Pepco Energy Services, Inc.	(800) 363-7499
112 Main Street	www.pepco-services.com
Lebanon, NJ 08833	
PPL EnergyPlus, LLC	(800) 281-2000
811 Church Road	www.pplenergyplus.com
Cherry Hill, NJ 08002	
South Jersey Energy Company	(800) 756-3749
One South Jersey Plaza, Route 54	www.southjerseyenergy.com
Folsom, NJ 08037	
Sprague Energy Corp.	(800) 225-1560
12 Ridge Road	www.spragueenergy.com
Chatham Township, NJ 07928	
Woodruff Energy	(800) 557-1121
73 Water Street	www.woodruffenergy.com
Bridgeton, NJ 08302	