



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

June 18, 2009

**Local Government Energy Program
Energy audit report
Final; 2/1/2010**

For

*Science Complex
Raritan Valley Community College
North Branch, NJ 08876*

Project Number: LGEA05



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INTRODUCTION

On April 21st, 22nd, 23rd & 24th, 2009; Steven Winter Associates, Inc. (SWA) performed an energy audit and assessment of the Raritan Valley Community College (RVCC) buildings located in North Branch, NJ. Current conditions and energy-related information was collected in order to analyze and facilitate the implementation of energy conservation measures for the building. PDR Associates, SWA's subcontractor for this project, assessed the HVAC, the existing Combined Heat and Power plant and renewable energy systems and provided recommendations for improvement of these systems.

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

There are eleven separate buildings that were evaluated for this energy audit; Somerset Hall, Hunterdon Hall, East Building/Planetarium, College Center, Physical Education Building, Library/Theater, Conference Center (ATCC), Science Building, West Building, Arts Building and also the Child Care Center (CCC) buildings. The buildings were built at different times as the college expanded. Each building is unique in area and also building construction.

Only CCC and Arts building have their individual electric meters; other buildings are connected to the main campus electric meter. Science building has its own gas meter; other buildings that use gas are connected to the main campus gas meter. The campus has a district cooling and heating plant that serves chilled water and hot water to various buildings connected to the campus loop; ATCC, Science building, Arts building, and CCC are not connected to this loop. The gas to the boiler providing hot water to the loop is metered separately. The central plant is also equipped with a cogenerator, the gas for which is metered separately. Hence, there are three main gas meters in the campus that are directly or indirectly connected to the eleven buildings: Main campus gas meter, Boiler plant gas meter, and Cogen gas meter.

The present report is for the Science Complex building only.

The Science Complex building houses mostly laboratories with a few class rooms. The building is a two story building consisting of 25,000 square feet. The building is operated on weekdays between the hours of 7am and 7pm.

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

The energy audit performed by SWA encompasses eleven buildings of various ages and constructions. A report has been generated for each building in order to fully document the existing conditions and recommended Energy Conservation Measures (ECMs). Based on the field visits performed by Steven Winter Associates (SWA) staff on April 21st, 22nd, 23rd and 24th, 2009 and the results of a comprehensive energy analysis, this report describes the site's current conditions and recommendations for improvements. Suggestions for measures related to energy and conservation and improved comfort are provided in the scope of work. Energy and resource savings are estimated for each measure that results in a reduction of heating, cooling and electric usage.

In the most recent year (March 2008-February 2009), the Raritan Valley Community College Science Complex building consumed approximately 93,519 therms or \$152,076.62 worth of natural gas. The Science Complex building is not separately metered for electricity; instead it receives electrical service from the main campus meter as well as most of the other campus buildings. The main campus electrical meter used approximately 7,807,991 kWh or \$1,224,758.25 worth of electricity in the previous year.

SWA benchmarked the Science Complex building using the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. The Portfolio Manager is not currently capable of generating a benchmark score for the building to compare on a national average since the building is part of a larger college campus which shares energy meters. The Portfolio Manager is capable of generating a site energy use intensity number using the previous 12 months of data as a baseline year. The site energy use intensity for the entire RVCC campus is 184 kBtu/sq.ft/year. After energy efficiency improvements are made, future utility bills can be added to the Portfolio Manager and the site energy use intensity of a different time period can be compared to the previous year baseline to show changes in energy consumption over time.

SWA recommends a total of 7 Energy Conservation Measures (ECMs) for Science Complex. The total investment cost for these ECMs is **\$388,742**. The total investment cost for these ECMs if maximum incentives are achieved is **\$387,082**. SWA estimates a first year savings of **\$80,554** with a simple payback of **4.8 years**. SWA estimates that implementing the recommended ECMs will reduce the carbon footprint of the Science Complex by **308,182 lbs of CO₂** annually.

There are various incentives that the Science Complex could apply for that could also help lower the cost of installing the ECMs. SWA recommends that the Science Complex 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. RVCC should consider applying to the New Jersey Clean Energy Pay-for-Performance Program. Additional details are available in the SWA document "Energy Audit Report Summary" for all buildings. There are also prescriptive measure incentives that would pay RVCC up to \$1180 for lighting upgrades and up to \$480 for replacing the DHW boilers with new, condensing-type boilers. The total amount of incentives available for the Science Complex is **\$1660** and the total investment cost if all the incentives are paid to their maximum amount is **\$387,082**.

The following table summarizes the proposed Energy Conservation Measures (ECM) as per their economic relevance:

ECM Table without Incentives															
ECM#	ECM description	Installed Cost		1st year energy savings						SPP	LoM	Lifetime		Annual Carbon Reduction (lbs of CO2)	
		Estimated \$	Source	Electric Savings (kWh)	Unit	Natural Gas Savings (therms)	Unit	Demand	Unit			\$ Savings/year	Cost Savings		ROI
1	Install lighting controls	\$ 15,955	RSMMeans	38,800	kWh	-	therms	0.0	kW	\$ 6,014	2.7	20	\$ 87,841	22.5%	69,472
2	Weather-strip exterior doors	\$ 211	RSMMeans	-	kWh	17	therms	0.0	kW	\$ 27	7.9	20	\$ 392	4.3%	187
3	Connect building to central plant	\$ 230,857	RSMMeans	47,250	kWh	187	therms	85.1	kW	\$ 56,316	4.1	25	\$ 959,134	12.6%	84,601
4	Replace two existing DHW boilers	\$ 9,343	RSMMeans	-	kWh	700	therms	0.0	kW	\$ 1,106	8.4	25	\$ 18,837	4.1%	7,716
5	Retro commissioning	\$ 37,500	Similar project	11,184	kWh	429	therms	0.0	kW	\$ 4,491	8.3	25	\$ 76,494	4.2%	24,754
6	Install air-to-air exchanger	\$ 48,000	Similar project	8,687	kWh	3,334	therms	0.0	kW	\$ 6,614	7.3	25	\$ 112,640	5.4%	52,301
7	Replace 1000Kva transformer	\$ 46,876	RSMMeans	38,621	kWh	-	therms	4.4	kW	\$ 5,986	7.8	32	\$ 118,797	4.8%	69,151
Total	Total Scope of Work	\$ 388,742	-	144,542	-	4,666		89.5	-	\$ 80,554	4.8		\$ 1,374,134		308,182

ECM Table including Incentives															
ECM#	ECM description	Installed Cost		1st year energy savings						SPP	LoM	Lifetime		Annual Carbon Reduction (lbs of CO2)	
		Estimated \$	Source	Electric Savings (kWh)	Unit	Natural Gas Savings (therms)	Unit	Demand	Unit			\$ Savings/year	Cost Savings		ROI
1	Install lighting controls	\$ 14,775	RSMMeans	38,800	kWh	-	therms	0.0	kW	\$ 6,014	2.5	20	\$ 87,841	24.7%	69,472
2	Weather-strip exterior doors	\$ 211	RSMMeans	-	kWh	17	therms	0.0	kW	\$ 27	7.9	20	\$ 392	4.3%	187
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Total	Total Scope of Work	\$ 387,082	-	144,542	-	4,666		89.5	-	\$ 80,554	4.8		\$ 1,374,134		308,182

Definitions:

SPP: Simple Payback (years)

LoM: Life of Measure (years)

ROI: Return on Investment (%)

Assumptions:

Discount rate:

3.2% per DOE FEMP guidelines

Energy price escalation rate:

0% per DOE FEMP guidelines

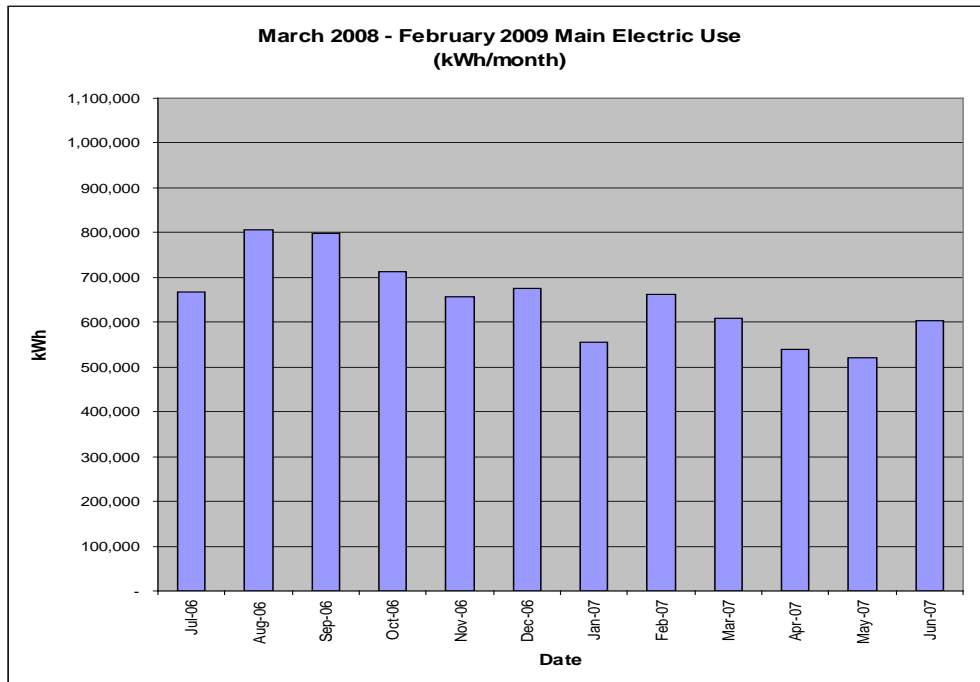
1. HISTORIC ENERGY CONSUMPTION

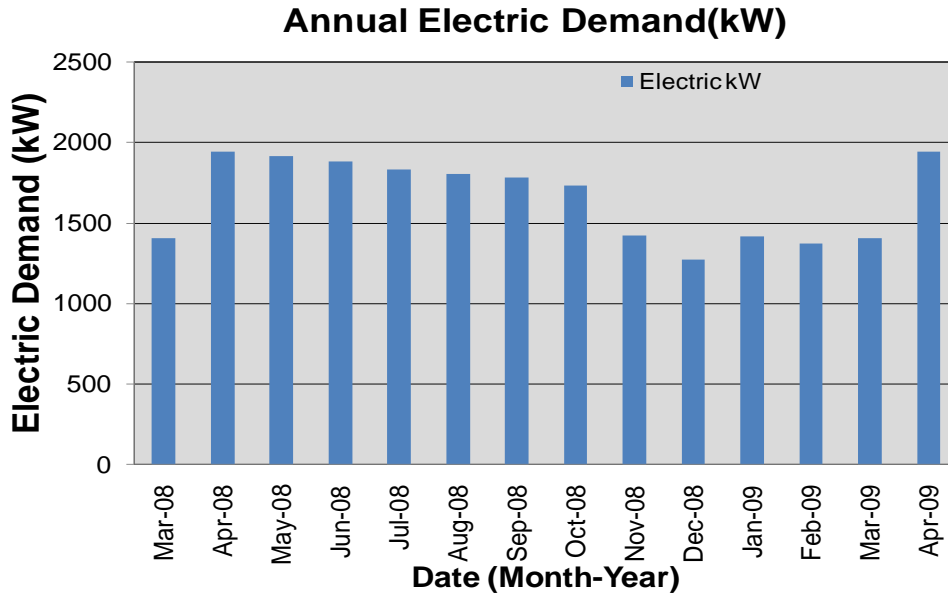
1.1. Energy usage and cost analysis

SWA analyzed utility bills from March 2008 through February 2009 that were received from Raritan Valley Community College.

Electricity – Science Complex is currently not metered separately for electricity. The Main Campus meter from which the Science Complex receives all incoming electrical service from used **approximately 7,807,991 kWh or \$1,224,758.25** worth of electricity from March 2008 through February 2009. The average aggregated rate from March 2008 through February 2009 was **\$0.155 per kilowatt-hour**. The data also reflected that demand peaked at 1945 kW in April.

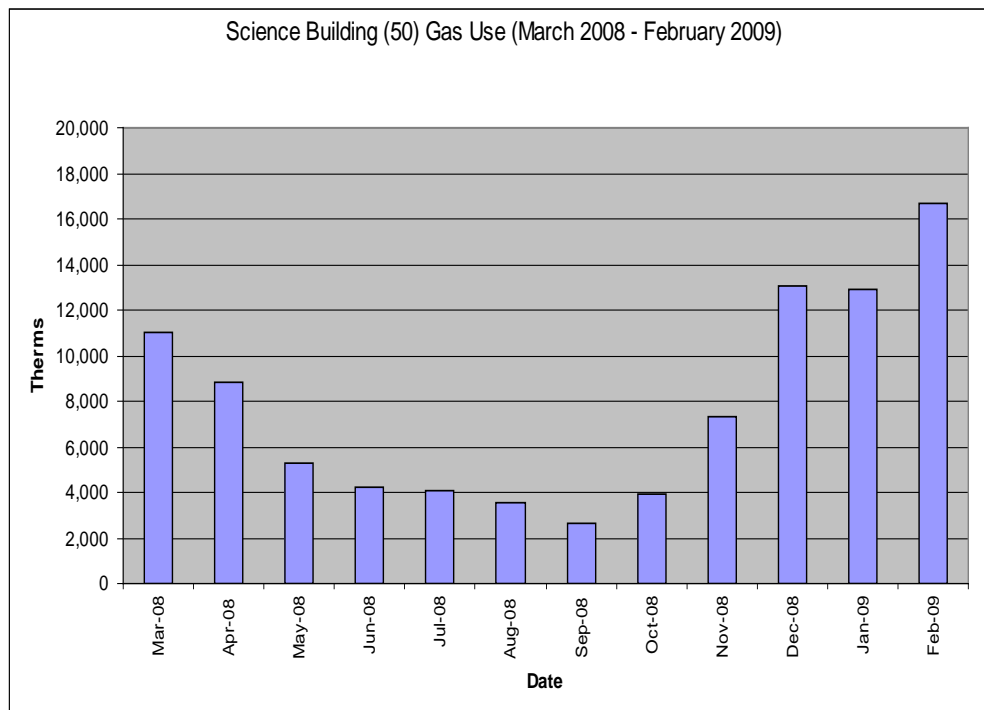
The following charts show electricity usage (kWh) and electricity demand (kW) for the Main Campus electric meter based on utility bills for the 12 month period of March 2008 – February 2009. Please note that March '08 and April '09 demand in kW was estimated the same as March '09 and April '09 demand in kW.





Natural Gas – The Science Complex has one gas meter for all incoming natural gas from PSE&G. In the previous 12 months, the building purchased **approximately 93,519 therms or \$152,076.62** worth of Natural Gas. The average aggregated rate from March 2008 through February 2009 was **\$1.58 per therm**.

The following chart shows natural gas usage for the Science Complex based on utility bills for the previous 12 months.



In the above chart, natural gas usage follows a typical pattern for a cold climate. The heating season, which lasts from approximately October 15th through May 15th shows a general increase in natural gas as the outside temperature drops. Natural gas usage is not needed for space heating; therefore the warmer months show a decreased usage in natural gas. The gas usage for summer months is a base load which is generally used for domestic hot water and other laboratory uses within the building.

1.2. Utility rate

The main campus electric meter currently buys electricity from JCP&L at a general service rate. A general service rate is a typical rate where customers pay for electricity based on kWh usage and the building is currently not charged a separate demand charge. Electricity was billed at an average rate of **\$0.155/kWh**.

The Science Complex gas meter currently buys gas from an Energy Service Company (ESCO) via PSE&G at a general service rate as well. The general service rate with an ESCO charges a market rate for natural gas, while PSE&G charges a separate fee for transmission and delivery. The Science Complex was billed for natural gas at an average aggregated rate of **\$1.58/therm**.

1.3. Energy benchmarking

The Science Complex building information and utility data were entered into the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* energy benchmarking system. The building data could be documented; however, a performance score could not be generated since the building shares a meter as part of the campus. The Energy Star Portfolio Manager currently is not capable of generating a benchmark score for certain building types such as college campuses. SWA has created a Portfolio Manager account for RVCC to access the information. This information can be accessed at: <https://www.energystar.gov/istar/pmpam/>

Username: RaritanValleyCC
Password: RARITANVCC

SWA is also sharing the Portfolio Manager information with TRC Energy Services.



STATEMENT OF ENERGY PERFORMANCE

Raritan VCC

Building ID: 1762814
 For 12-month Period Ending: February 28, 2009¹
 Date SEP becomes ineligible: N/A

Date SEP Generated: June 16, 2009

Facility Raritan VCC 118 Lamington Road Branchburg, NJ 08876	Facility Owner N/A	Primary Contact for this Facility N/A
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Year Built: 1960
 Gross Floor Area (ft²): 423,900

Energy Performance Rating² (1-100) N/A

Site Energy Use Summary³

Electricity (kBtu)	29,225,895
Natural Gas (kBtu) ⁴	48,850,300
Total Energy (kBtu)	78,076,195

Energy Intensity⁵

Site (kBtu/ft ² /yr)	184
Source (kBtu/ft ² /yr)	351

Emissions (based on site energy use)

Greenhouse Gas Emissions (MtCO ₂ e/year)	7,129
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Electric Distribution Utility

Jersey Central Power & Lt Co

National Average Comparison

National Average Site EUI	76
National Average Source EUI	170
% Difference from National Average Source EUI	106%
Building Type	College/University (Campus-Level)

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 Standards⁶ 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 52 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 (28221), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460.

EPA Form 5900-16

2. FACILITY AND SYSTEMS DESCRIPTION

2.1. Building Characteristics

The Science Complex is approximately 10 years old and has an area of 25,000 square feet. The building is mostly two stories with the exception of the West wing auditorium. Since the building was built, there have been some modifications and upgrades. The Science Complex building contains mostly laboratory type classrooms on both levels, administration areas for teachers on the main floor and a dividable single story auditorium type West wing.

2.2. Building occupancy profiles

The peak occupancy for the Science Complex is approximately 250 persons at any given time during weekdays. The maximum code compliant occupancy for this building is 365 persons. The building is typically occupied from 7am to 7pm on weekdays only, throughout the entire year.

2.3. Building envelope

2.3.1. Exterior walls

The exterior wall finish consists of 4" face bricks. There are 6" metal studs spaced 16" on center located on the inside of the exterior wall with continuous 6" of R-19 fiberglass batt insulation between each metal stud. During the site visit and data collection period, SWA performed an infrared scan of the exterior walls. Due to an outside temperature of approximately 66°F, an accurate infrared scan could not be obtained. Typically, a good infrared scan requires a temperature difference of 20°F between the outside (ambient) temperature and indoor temperature. The heating season when the ambient temperature is much cooler than the indoor temperature is the best time to obtain an accurate infrared scan.

2.3.2. Roof

The light colored single ply membrane shed type roof has a continuous ½" slope over the main building and the theater wing. Only 3 inches of rigid foam boards with staggered joints are indicated on the available plans and no additional insulation could be verified in the field. The steel trusses connect directly with the structural steel decking which extends out into an unconditioned soffit and could be a potential source of high thermal conductivity, resulting in energy loss and condensation issues. In the future, if the roof is replaced SWA recommends that a well-insulated roof is installed with an Energy Star reflective surface to cut down on solar heat gain.

2.3.3. Base

The building's base is a 6" concrete slab-on grade and foundation stem wall. A 24" deep by 2" thick under-slab perimeter insulation is indicated on the plans but could not be verified in the field. There were no reported problems with water penetration or moisture.

2.3.4. Windows

The building contains fixed aluminum-framed windows with 1" double-pane glazing. SWA conducted tests on the window panes and was not able to determine if a low-e film coating existed on these windows or not. SWA assumes that the windows have no effective low-e

coating. On the plans, windows are specified insulated, though not verified SWA assumes this to be the case. Currently, the building uses horizontal blinds to alter the amount of natural light that is allowed to enter each room. SWA recommends that whenever windows are to be replaced, to make sure that the most energy efficient windows are always installed and properly air-sealed.

2.3.5. Exterior doors

The exterior doors of the building were observed to have the original weather-stripping which is no longer performing as intended. SWA recommends that the exterior doors of the building, especially the vestibule located at the main entrance, is 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 door will help ensure that the building is kept tight and insulated over time.

2.3.6. Building air tightness

The Science Complex building was observed to be a relatively tight building. There were no major observed deficiencies of air tightness within the building besides the exterior doors.

2.4. HVAC systems

2.4.1. Heating

The Science Complex building is not connected to the existing campus-wide chilled water/hot water loop, even though the building is located within a very short distance of the loop from the Campus Cogeneration plant. SWA was informed by RVCC facility staff that the chilled water and hot water loop valve is located within 25 feet and available for connecting the buildings heating and cooling system for system operation from the central loop utilizing the existing boilers and rooftop units as back-up units. There are two existing atmospheric hot water boilers each with an input of 1470 MBH that are located in the boiler room. These boilers are finned copper gas boilers with an original rated thermal efficiency of 81%. The hot water loop served by these boilers contains two 0.5HP circulating hot water pumps and two 5HP hot water supply pumps with conventional controls. Currently, the atmospheric boilers are not efficient and have a high annual maintenance cost. SWA evaluated and recommends that these atmospheric boilers are removed and the building is connected to the main campus plant. The boiler room also houses Honeywell proprietary controls based on Curtis pneumatic compressed air at about 60 psi. The installed controls are well equipped to run the building efficiently. Controls are set-up by a contractor when they are first installed and rarely diagnosed as the building ages. SWA recommends retro commissioning in order to “tune-up” the existing systems and their components in order to assure that the building is run efficiently.

2.4.2. Cooling

The Science Complex contains three electric rooftop units and one unit on the ground for cooling. Some of these units are 100% outside air and could benefit by incorporating air to air heat exchangers.

2.4.3. Ventilation

The Science Complex uses the rooftop air handling units to provide both cooling and fresh air. These units pull in outside air and mix it with return air from the building in order to provide adequate ventilation. When cooling is needed, the units run air over an electrically cooled coil to provide fresh, conditioned air throughout the building. In 2008, RVCC installed an air-to-air heat exchanger and connected it to the rooftop units located on the South side of the building. The air-to-air heat exchanger extracts heat from either exhaust air leaving the building via exhaust fans to temper fresh air entering the air-handling unit or extracts heat from fresh air entering the air-handling unit before it is distributed throughout the building. At RVCC's request, SWA evaluated installing another air-to-air heat exchanger on the North side of the building and connecting it to the other air-handling unit.

2.4.4. Domestic Hot Water

Domestic Hot Water is provided by two A.O Smith natural gas direct-fired hot water storage tanks. These storage tanks each have a storage capacity of 71 gallons.

More efficient hot water appliances will save energy through reduced energy consumption for water heating and money; through reducing water and sewer bills. Energy savings appliances bearing the ENERGY STAR label should be selected to ensure efficiency performance.

2.5. Electrical systems

2.5.1. Lighting

Interior Lighting – Since the Science Complex was built in 2000 and has already had upgrades performed to the building, much of the lighting is efficient and would not be cost-effective to replace at this time. SWA recommends that RVCC continues to purchase energy efficient CFLs as well as T8/T5 lighting with electronic ballasts when lighting is replaced.

There were a few areas of concern when the lighting audit was conducted throughout the building. Room 100 (Physics) and Room 101 (Engineering) both contained occupancy sensor systems that were not working properly. These systems did not allow the lights to turn all the way off and also did not seem to be operated properly by the occupancy sensor. When faculty and maintenance staff was surveyed, it became known that no one actually knew how to operate the system and therefore lights are always left on. SWA recommends having this system replaced with a working occupancy sensor system that is easy to use and allows the lights to turn all the way off.

Based on measurements of lighting levels that were measured for each space, there are no vastly over-lit areas with the exception of the glass entranceway at the front of the building. There were approximately 17 fixtures in the glass entranceway of the Science Complex that all receive natural daylight all day long and do not need to be on. SWA recommends installing a photocell here that would sense lighting levels due to daylight and could turn these lights off when daylight levels were above a specified level.

The fixtures in the building are efficient but the above measures can be implemented to reduce electricity consumption based on controls. The building interior currently uses approximately

1.62 Watts per square foot. See attached lighting schedule for a complete inventory of lighting throughout the building and estimated power consumption.

Exit Lights – The building has all 5W LED exit signs installed. There is not a more cost effective option for exit lights available at this time.

Exterior Lighting – The exterior lighting was surveyed during the building audit. SWA has deemed it not cost effective to replace exterior lighting at this time. All exterior lighting is controlled by a timer located in the boiler room. There is no need for any immediate upgrade of lighting or timer; however, SWA recommends that the building maintenance adjust the timer at least twice per year in order to make sure that the timer stays current with Daylight Savings Time.

2.5.2. Appliances and process

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

2.5.3. Elevators

The Science Complex building is a two-story building and does have a hydraulic elevator installed. There are no cost-effective options for replacing the elevator at this time.

2.5.4. Other electrical systems/transformers

The Science Complex building is equipped with a 1000kVA distribution transformer that is original to the building. This medium-voltage, dry-type transformer steps down the 12.47 kV utility feed to 480-V, 3-phase power for step-down to lower voltages downstream in the facility. Old distribution transformers are already efficient at delivering energy with minimal losses, but because they handle large amounts of electricity, small gains in efficiency (as low as a couple of points) from high efficiency models can yield large energy savings.

3. EQUIPMENT LIST

Building System	Description	Location	Model#	Fuel	Space served	Year Equip Installed	Remaining useful life %
HVAC	RTU-1: Gas fired roof top unit with split cooling; served by 2 condensing units located alongside; 28,000cfm, i/p 1875 MBH, 73 deg F temp rise;100% OA, 2505.4MBH cooling	Roof	McQuay; Model RAH077CLA; S/N FBOUO11200174 02	Elec./Gas	Laboratories	1999	33%
Cooling	CU-1: Condensing unit to RTU-1; 460/60/3; 50hp+60hp compressors; 2hp*6 fans;	Roof	McQuay; Model ACR110AS27; S/N STNUO11200095	Elec.	RTU-1	1999	33%
Cooling	CU-2: Condensing unit to RTU-1; 460/60/3; 50hp+60hp compressors; 2hp*6 fans;	Roof	McQuay; Model ACR110AS27; S/N STNUO11200094	Elec.	RTU-1	1999	33%
HVAC	RTU-2: Gas fired roof top unit with integral compressors for cooling; 23,000cfm, i/p 500MBH, 31 deg F temp rise;6000 cfm OA, 976MBH cooling	Roof	McQuay; Model RPS075CLA; S/N FBOUO11200173 02	Elec./Gas	Offices	1999	33%
HVAC	RTU-3: Gas fired roof top unit with integral coondensing unit built on site for cooling; 8200 cfm, i/p 750MBH, 31 deg F temp rise;100% OA,	Roof	Trane RAH-8000 unit; condenser model RAUCC504NY030BD; S/N C06E04416;Site built by ECSI systems	Elec./Gas	Biotech	2006	80%
HVAC	AC-1: Gas fired unit with integral compressors for cooling; 5200cfm, i/p 500MBH, 31 deg F temp rise;1100 cfm OA, 223MBH cooling	Outside, on grade	McQuay; Model RPS018CSY; S/N FBOUO11200169 00	Elec./Gas	Physical/engg. Labs	1999	33%
Ventilation	HRU - installed at behest of facility staff themselves; serves RTU-3	Roof	Xetex unit; No details available on site	Elec.	Biotech	2007	95%
Ventilation	EF-1,2: Lab exhaust fan combo; 30hp each;27,000CFM;460/60/3		MK Plastic; Model AXJT4450; S/N 12499-1,2	Elec.	Laboratories	1999	0%
Ventilation	EF-3: exhaust fan	Roof	Barry Blower; Model 105 VCR BI CW; S/N 1-02-404730-10-1	Elec.	N/A	1999	50%
Ventilation	EF-4: bathroom exhaust	Roof	Penn Ventilation; Model FX14B, label 59163	Elec.	Bathrooms	1999	50%

Building System	Description	Location	Model#	Fuel	Space served	Year Equip Installed	Remaining useful life %
Ventilation	EF-5,6: Lab exhaust fan combo; 10hp each;	Roof	Plasticair; SWSI 245 (CW); PO066461	Elec.	Biotech	2005	90%
Heating	B-1: Hot water boiler; i/p 1470MBH, o/p 1205 MBH, 1470 lb/hr consumption; c/w Marathon motor mounted circulator /12hp	Mechanical room	RBI, Model 33HB1470NRMIPS; S/N 010226531;Circulator motor model 8VM56C17D2044J	Gas/Elec.	Whole building	1999	50%
Heating	B-2: Hot water boiler; i/p 1470MBH, o/p 1205 MBH, 1470 lb/hr consumption; c/w ITT B&G motor mounted circulator /12hp	Mechanical room	RBI, Model 33HB1470NRMIPS; S/N 010226530;Circulator motor model EQM5A17D58FP	Gas/Elec.	Whole building	1999	50%
Heating	DHW i/p 120MBH, 116.4 gal/hr, 71 gallon tank	Mechanical room	AO Smith, Model BTR 120 110; S/N ML01-1330842-110	Gas	Whole building	1999	0%
Heating	DHW i/p 120MBH, 116.4 gal/hr, 71 gallon tank	Mechanical room	AO Smith, Model BTR 120 110; S/N ML01-1330845-110	Gas	Whole building	1999	0%
Heating	Unit heater, hot water with electric fan, 49.5MBH, 1100 CFM'	Mechanical room	Trane; Model UHSA 070; S/N L01M43450	Elec.	Mechanical room	1999	50%
Ventilation	SF-1:Supply fan to mechanical room, 1/4hp Baldor motor	Mechanical room	Penn, SX155BC	Elec.	Mechanical room	1999	50%
Controls	Air compressor, 2x3/4hp Baldor motors,	Mechanical room	Curtis Toledo, Compressor Model ES-10; S/N AS1080043	Elec.	HVAC system actuators	2004	50%
HVAC	VAV units with reheat coils, approximately 70	Throughout the building	Original Krueger model LMHS	Elec.	Whole building	1999	33%
Generator	300kW generator - no other information available - emergency load only- c/w 300kW resistive load bank	Outside, on grade	Cummins	Elec.	Emergency load	1999	50%
Transformer	1000kVA, 12.47kV, 480/277V 3Ph	Outside, on grade	Name plate N/A	Elec.	Electric service	1999	65%

Note:

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

4. ENERGY CONSERVATION MEASURES

Summary table

ECM#	Description
1	Install lighting controls; Install proper lighting controls according to lighting schedule.
2	Weather-strip exterior doors; weather-stripping will decrease the amount of conditioned air that is lost between the exterior door and frame
3	Connect building to central plant; atmospheric boilers are very inefficient and are associated with high maintenance costs. Connecting the Science Complex building to the main campus plant will save both energy costs as well as maintenance costs.
4	Replace two existing HW boilers; Replace two RBI HW boilers with one condensing boiler.
5	Retro commissioning; retro commissioning allows building systems to be evaluated and then “tuned up” so that they run efficiently according to building specific usage
6	Install air-to-air heat exchanger; installing a heat exchanger will take advantage of heat that is normally wasted through exhaust fans and temper fresh outside air which in turn requires the heating system to work less
7	Replace 1000Kva transformer; replacing with a more efficient transformer will reduce building operating costs and increase savings

ECM#1: Install lighting controls

Description:

On the day of the site visit, SWA talked with building maintenance staff and various tenants and were informed that the occupancy lighting controls in Room 100 (Physics) and Room 101 (Engineering) did not work properly. After testing these controls, SWA determined that these occupancy controls were installed incorrectly and should be replaced.

In addition to the large lecture rooms, SWA also determined that additional lighting controls could be installed in the front glass entrance area of the Science Complex. This area was tested for lighting levels using a light meter. SWA determined that this space was vastly over-lit and could benefit from the installation of photo-cell sensors that would turn off the lights in this area only when daylight levels were sensed at a minimum level.

Further details on the quantity and areas for the occupancy sensors recommendation can be found in Appendix A, Sheet 2. Dual Technology occupancy sensors provide 360° of coverage and use both passive infrared and ultrasonic technologies to sense occupancy.

Estimated installed cost: \$15,955

Source of cost estimate: *RS Means*

Economics (without incentives):

Annual Savings				SPP	LoM	Lifetime	ROI	Annual Carbon Reduction (lbs of CO ₂)
Electric Savings (kWh)	Natural Gas Savings (therms)	Demand (kW)	Dollar Savings/year			Cost Savings		
38,800	-	0.0	\$ 6,014	2.7	20	\$ 87,841	22.5%	69,472

Economics (with incentives):

Annual Savings				SPP	LoM	Lifetime	ROI	Annual Carbon Reduction (lbs of CO ₂)
Electric Savings (kWh)	Natural Gas Savings (therms)	Demand (kW)	Dollar Savings/year			Cost Savings		
38,800	-	0.0	\$ 6,014	2.5	20	\$ 87,841	24.7%	69,472

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 – Lighting Controls Incentive, Incentive based on installing wall mounted occupancy sensors (\$20 per control). Maximum incentive amount \$1180.

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: Weather-strip exterior doors

Description:

On the day of the site visit, 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 weather-stripping observed at the Science Complex building still formed a seal but is starting to deteriorate beyond maximum efficient conditions. SWA recommends replacing this weather-stripping.

Installation cost:

Estimated installed cost: \$211
 Source of cost estimate: RS Means

Economics (without incentives):

Annual Savings				SPP	LoM	Lifetime	ROI	Annual Carbon Reduction (lbs of CO ₂)
Electric Savings (kWh)	Natural Gas Savings (therms)	Demand (kW)	Dollar Savings/year			Cost Savings		
-	17	0.0	\$ 27	7.9	20	\$ 392	4.3%	187

Economics (with incentives):

Annual Savings				SPP	LoM	Lifetime	ROI	Annual Carbon Reduction (lbs of CO ₂)
Electric Savings (kWh)	Natural Gas Savings (therms)	Demand (kW)	Dollar Savings/year			Cost Savings		
-	17	0.0	\$ 27	7.9	20	\$ 392	4.3%	187

Assumptions: SWA assumes thermal savings based on heating loads calculated using eQUEST modeling and by conducting the billing analysis. In order to estimate a savings for this measure, SWA assumed in the eQUEST model that each wall with exterior doors would have an infiltration reduction of 5%

Rebates/financial incentives:

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

Options for funding ECM:

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

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

ECM#3: Connect building to central plant

Description:

Currently, the Science Complex uses two 1470 MBH atmospheric boilers to meet the heating needs of the building in winter, and for reheating throughout the year. Atmospheric boilers are inefficient and are also associated with high maintenance costs. The Science Complex is located within 25’ of the main campus HW/CHW lines. Due to the proximity, SWA evaluated and recommends removing the existing atmospheric boilers and connecting the Science Complex entirely to the main campus loop. Currently, this building uses DX cooling from RTU, most being 100% outside air.

Installation cost:

Estimated installed cost: \$230,857
 Source of cost estimate: *RS Means*

Economics (without incentives):

Annual Savings				SPP	LoM	Lifetime	ROI	Annual Carbon Reduction (lbs of CO2)
Electric Savings (kWh)	Natural Gas Savings (therms)	Demand (kW)	Dollar Savings/year			Cost Savings		
47,250	187	85.1	\$ 56,316	4.1	25	\$ 959,134	12.6%	84,601

Economics (with incentives):

Annual Savings				SPP	LoM	Lifetime	ROI	Annual Carbon Reduction (lbs of CO2)
Electric Savings (kWh)	Natural Gas Savings (therms)	Demand (kW)	Dollar Savings/year			Cost Savings		
47,250	187	85.1	\$ 56,316	4.1	25	\$ 959,134	12.6%	84,601

Assumptions: SWA assumes savings based on heating and cooling loads generated with eQUEST. SWA made the following assumptions to calculate kWh savings, therms savings, and dollar savings:

- kWh savings result from shifting cooling from DX to CHW plant. SWA assumed that the efficiency of the cooling system increased from 1.1kW/ton to .6kW/ton, applicable for 3000 hours of yearly cooling needs, and at 60% diversity.
- Heating needs for the building are assumed mostly in winter season, and there is no gain in shifting to HW loop.
- Reheating for building air is assumed to occur in summer and winter seasons. A local boiler is required for summer reheating, considered in ECM#4 next. Winter reheating is currently done by two atmospheric boilers operating at 80% efficiency. By shifting this to the campus HW loop, 4% therms savings will ensue.
- Part kWh reduction will ultimately be shifted to kWh on the central plant. SWA assumed that 20% of this added kWh in the central plant will help fully load the CHP plant. Hence there will be cost savings – since CHP uses natural gas to produce electricity cheaply. Calculated savings are \$7,457 per year.

- Finally, by connecting the heating to the HW loop therms will be shifted from Science gas meter to the Main gas meter. The rate differential between the two meters will save approximately \$9,240 per year.
- Facility personnel advised an operation and maintenance savings to the tune of \$32,000 per year from compressors, blowers, boilers, etc.

Rebates/financial incentives:

There are no incentives available for this measure at this time from New Jersey Clean energy Program (NJCEP).

Options for funding ECM:

This measure could have been applicable for grant from New Jersey Department of Environmental Protection under “Local Government Greenhouse Gas Reduction Grant Program”. The deadline for sending the preliminary application was September 4, 2009 – it was mandatory to send a preliminary application before this date for access to this grant. SWA recommends to visit the following website in future to check for updates on the opening of a second round of grants in 2010:

http://www.state.nj.us/dep/opsc/docs/ghg_grant_guidance.pdf

ECM#4: *Replace two existing HW boilers*

Description:

Currently the Science Complex uses two Hot Water boilers to meet the current space re-heating demands of the building. While these boilers are in good condition, there is newer technology available that performs more efficiently that will ultimately reduce the operating costs of the HW boilers. Further, if this building is connected to the central campus HW loop, this boiler will only be required to reheat in summer season. SWA recommends replacing these boilers with a new condensing boiler that have efficiencies of approximately 95%. Also, the new boiler capacity is estimated to be 750MBH.

Installation cost:

Estimated installed cost: \$9,343
 Source of cost estimate: *RS Means*

Economics (without incentives):

Annual Savings				SPP	LoM	Lifetime	ROI	Annual Carbon Reduction (lbs of CO ₂)
Electric Savings (kWh)	Natural Gas Savings (therms)	Demand (kW)	Dollar Savings/year			Cost Savings		
-	700	0.0	\$ 1,106	8.4	25	\$ 18,837	4.1%	7,716

Economics (with incentives):

Annual Savings				SPP	LoM	Lifetime	ROI	Annual Carbon Reduction (lbs of CO ₂)
Electric Savings (kWh)	Natural Gas Savings (therms)	Demand (kW)	Dollar Savings/year			Cost Savings		
-	700	0.0	\$ 1,106	8.0	25	\$ 18,837	4.5%	7,716

Assumptions: SWA assumes thermal savings based on heating loads calculated using eQUEST modeling and by conducting the billing analysis. SWA estimates that the existing boiler efficiency was 81% and savings are calculated based on installing 95% efficient condensing units.

Rebates/financial incentives:

*NJ Clean Energy – NJ SmartStart Building Equipment Incentive, Incentive is for Gas-fired water heaters >50 gallons (\$1.00-\$2.00 per MBH)
 Maximum incentive amount is \$480.*

Options for funding ECM:

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

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

ECM#5: Retro commissioning

Description:

Currently the Science Complex uses Honeywell proprietary controls to control their building systems. The installed controls are well equipped to run the building efficiently. Controls are set-up by a contractor when they are first installed and rarely diagnosed as the building ages. SWA recommends retro commissioning in order to “tune-up” the existing systems and their components in order to assure that the building is run efficiently.

Installation cost:

Estimated installed cost: \$37,500
 Source of cost estimate: Similar project

Economics (without incentives):

Annual Savings				SPP	LoM	Lifetime	ROI	Annual Carbon Reduction (lbs of CO2)
Electric Savings (kWh)	Natural Gas Savings (therms)	Demand (kW)	Dollar Savings/year			Cost Savings		
11,184	429	0.0	\$ 4,491	8.3	25	\$ 76,494	4.2%	24,754

Economics (with incentives):

Annual Savings				SPP	LoM	Lifetime	ROI	Annual Carbon Reduction (lbs of CO2)
Electric Savings (kWh)	Natural Gas Savings (therms)	Demand (kW)	Dollar Savings/year			Cost Savings		
11,184	429	0.0	\$ 4,491	8.3	25	\$ 76,494	4.2%	24,754

Assumptions: SWA assumes thermal savings based on heating loads calculated using eQUEST modeling and by conducting the billing analysis. SWA assumed that retro commissioning will save up to 5% of heating and cooling costs by accurately adjusting the system. Additionally, SWA assumed 0.5 hour of O&M savings per week.

Rebates/financial incentives:

There are currently no incentives available 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#6: *Install air-to-air heat exchanger*

Description:

The Science Complex uses the rooftop air handling units to provide both cooling and fresh air. These units pull in outside air and mix it with return air from the building in order to provide adequate ventilation. When cooling is needed, the units run air over an electrically cooled coil to provide fresh, conditioned air throughout the building. In 2008, RVCC installed an air-to-air heat exchanger and connected it to the rooftop units located on the South side of the building. The air-to-air heat exchanger extracts heat from either exhaust air leaving the building via exhaust fans to temper fresh air entering the air-handling unit or extracts heat from fresh air entering the air-handling unit before it is distributed throughout the building. At RVCC’s request, SWA evaluated installing another air-to-air heat exchanger on the North side of the building and connecting it to the other air-handling unit. This heat exchanger would connect the exhaust fan #2 to the air intake of AHU #2. This measure would recover thermal sensible heat from the exhaust to pre-heat or pre-cool the air supplied to the air-handler, approximately 6000 cfm..

Installation cost:

Estimated installed cost: \$48,000

Source of cost estimate: Vendor

Economics (without incentives):

Annual Savings				SPP	LoM	Lifetime	ROI	Annual Carbon Reduction (lbs of CO2)
Electric Savings (kWh)	Natural Gas Savings (therms)	Demand (kW)	Dollar Savings/year			Cost Savings		
8,687	3,334	0.0	\$ 6,614	7.3	25	\$ 112,640	5.4%	52,301

Economics (with incentives):

Annual Savings				SPP	LoM	Lifetime	ROI	Annual Carbon Reduction (lbs of CO2)
Electric Savings (kWh)	Natural Gas Savings (therms)	Demand (kW)	Dollar Savings/year			Cost Savings		
8,687	3,334	0.0	\$ 6,614	7.3	25	\$ 112,640	5.4%	52,301

Assumptions: SWA assumes thermal savings based on heating loads calculated using eQUEST modeling and by conducting the billing analysis. SWA assumes an exchanger efficiency of 78%. SWA assumed 16 hours/day operation. kWh savings results in summer, and therms savings in winter.

Rebates/financial incentives:

There are no incentives available for this measure at this time from New Jersey Clean energy Program (NJCEP).

Options for funding ECM:

This measure could have been applicable for grant from New Jersey Department of Environmental Protection under “Local Government Greenhouse Gas Reduction Grant Program”. The deadline for sending the preliminary application was September 4, 2009 – it was mandatory to send a preliminary application before this date for access to this grant. SWA recommends to visit the following website in future to check for updates on the opening of a second round of grants in 2010:

http://www.state.nj.us/dep/opsc/docs/ghg_grant_guidance.pdf

ECM#7: Replace 1000Kva transformer

Description:

The recommended measure consists of disconnecting and removing the existing distribution transformer and installing a new unit compliant with DOE’s latest standards of high efficiency transformers. The design should include load calculations and sizing of the new system in order to achieve the best possible efficiency for this application.

Installation cost:

Estimated installed cost: \$46,876
 Source of cost estimate: *RS Means*

Economics (without incentives):

Annual Savings				SPP	LoM	Lifetime	ROI	Annual Carbon Reduction (lbs of CO2)
Electric Savings (kWh)	Natural Gas Savings (therms)	Demand (kW)	Dollar Savings/year			Cost Savings		
38,621	0.0	4.4	\$ 5,986	7.8	32	\$ 118,797	4.8%	69,151

Economics (with incentives):

Annual Savings				SPP	LoM	Lifetime	ROI	Annual Carbon Reduction (lbs of CO2)
Electric Savings (kWh)	Natural Gas Savings (therms)	Demand (kW)	Dollar Savings/year			Cost Savings		
38,621	0.0	4.4	\$ 5,986	7.8	32	\$ 118,797	4.8%	69,151

Assumptions: SWA calculated the savings for this measure using measurements taken the day of the field visit and using the billing analysis. SWA based calculations on the results of an electric survey that was performed last September at the building. Results of this 7-day monitoring period were provided by RVCC. Because the period of measurement is a representative sample of the overall yearly electric usage from the electric bills, we pro-rated the 7-day measured electric usage to estimate the current yearly electric consumption of the building. Savings are calculated based on the efficiency performance of a new, high efficiency model (source DOE/EERE) sized to the existing capacity. While this assumption is conservative, re-sizing the equipment could lead to achieving further savings.

Rebates/financial incentives:

There are no incentives available for this measure at this time from New Jersey Clean energy Program (NJCEP).

Options for funding ECM:

This measure could have been applicable for grant from New Jersey Department of Environmental Protection under “Local Government Greenhouse Gas Reduction Grant Program”. The deadline for sending the preliminary application was September 4, 2009 – it was mandatory to send a preliminary application before this date for access to this grant. SWA recommends to visit the following website in future to check for updates on the opening of a second round of grants in 2010:

http://www.state.nj.us/dep/opsc/docs/ghg_grant_guidance.pdf

5. RENEWABLE AND DISTRIBUTED ENERGY MEASURES

5.1. Existing systems

There are currently no existing renewable energy systems.

5.2. Solar Photovoltaic

Solar Photovoltaic (PV) technology is not applicable for this project because the campus cannot be net metered due to an existing CHP system. Without net metering, the incentives available are considerably reduced and do not justify the investment.

5.3. Solar Thermal Collectors

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

5.4. Combined Heat and Power

CHP is not applicable for this building because of existing campus-wide CHP unit already in place

5.5. Geothermal

Geothermal is not applicable because of the current HVAC systems supplying the building.

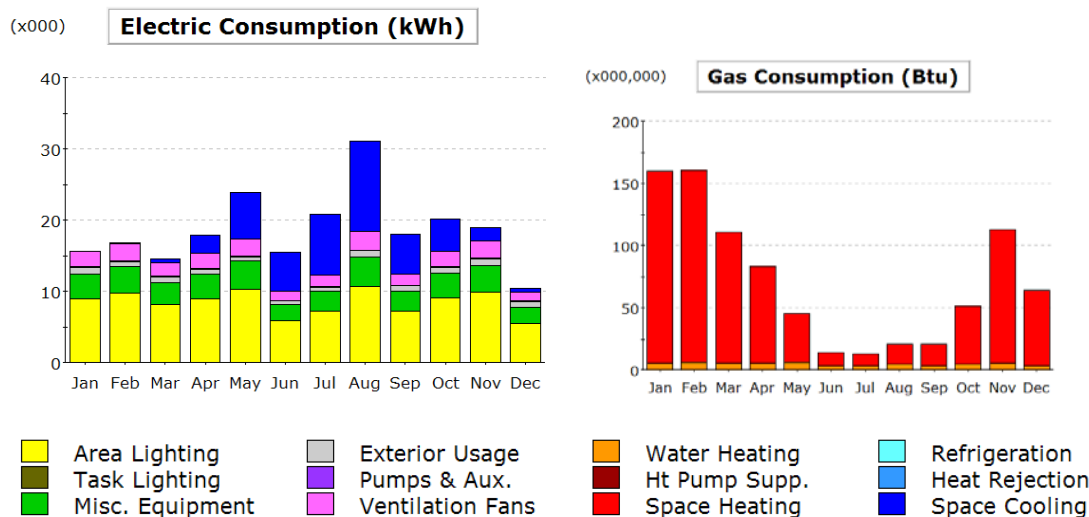
5.6. Wind

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

6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

6.1. Load profiles

In 2007, a power survey was conducted at the Science Complex building by Trace Electrical Services and Testing. The survey was conducted by installing power recording meters for seven days at various buildings on campus. The Science Complex was surveyed from September 18th, 2007 through September 25th, 2007. The results of the test revealed that the Science Complex had a peak demand of 274.0 kW at 2:50pm on September 20th, 2007. Over the seven-day period, there was a cumulative power usage of 29.390 MWh or approximately 4198.571 kWh per day. An accurate load profile could not be determined from utility bills since this building is not metered separately, however a load profile can be estimated from the eQUEST model of the building. Below are the charts from eQUEST that simulate an electric and natural gas profile.



6.2. Tariff analysis

Currently, electricity is provided to the Science Complex through the Main Campus electric meters. Natural gas is purchased for the main campus meter from an ESCO and is provided through PSE&G at a general service rate. Electricity is purchased for the main campus meter from JCP&L at a general service rate. The general service rate for electricity charges a market-rate price based on usage and the RVCC billing does not breakdown demand costs. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year.

The Science Complex currently buys natural gas from a third-party ESCO via PSE&G at a general service rate. When purchasing natural gas from an ESCO, the building is charged a market-rate cost for natural gas (in therms) based on usage. In addition, PSE&G also charges a transmission and delivery charge in addition to the market rate usage. The Science Complex currently pays an average aggregated rate of **\$1.58/therm** for natural gas.

6.3. Energy Procurement strategies

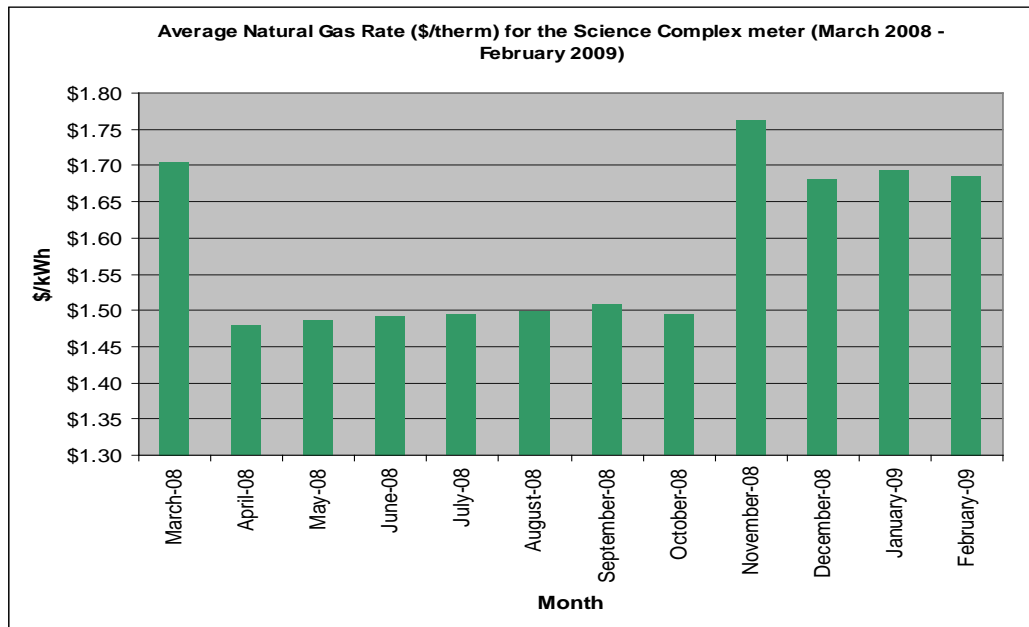
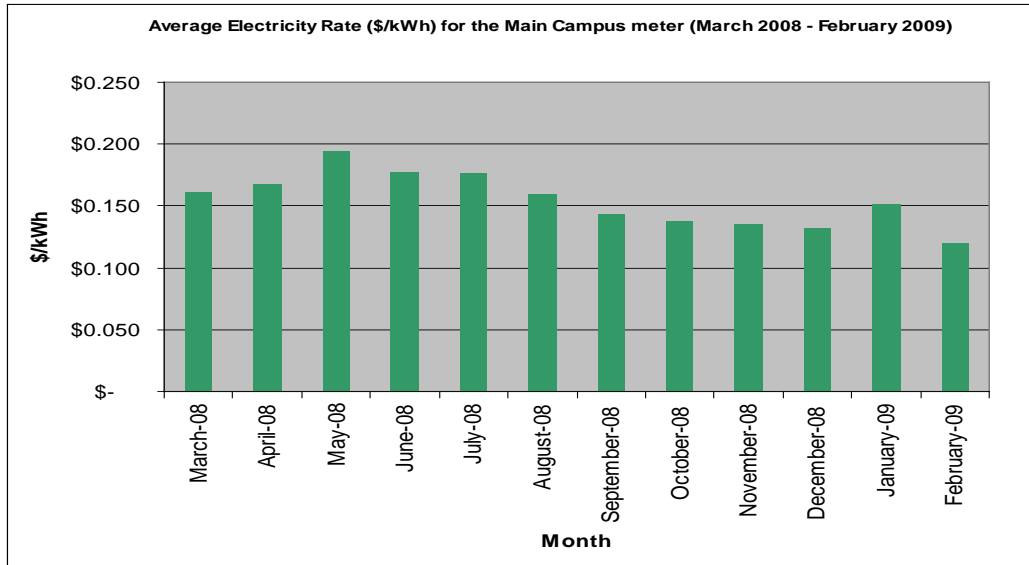
The Science Complex is separately metered for natural gas which already uses an Energy Services Company (ESCO) that acts as a third party energy supplier. Electricity is received from the main campus electric meter directly from JCP&L and no ESCO is used. SWA analyzed the utility rate for electricity over the previous 12 months. Electric billing analysis shows fluctuations of 39% over the most recent 12 month period. SWA recommends that RVCC explore the opportunity of purchasing electricity from an ESCO in order to reduce electric rate fluctuation and ultimately reduce the annual cost of energy for the College Center. Some of these fluctuations may have been caused by adjustments between estimated and actual meter readings; others may be due to unusually high and escalating energy costs in 2008. The average estimated NJ commercial utility rates for electric and gas are \$0.150/kWh and \$1.550/therm respectively. Science Complex annual utility costs are \$3,213.58 higher for electric, and \$2,938.28 higher for gas, for a total for \$6,151.86 higher when compared to the average estimated NJ commercial utility rates.

SWA recommends that the RVCC further explore opportunities of purchasing both natural gas and electricity from ESCOs in order to reduce rate fluctuation and ultimately reduce the annual cost of

energy for the campus. Appendix C contains a complete list of third party energy suppliers for the service area.

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

RVCC is already enrolled in a Demand Response Program and Emergency Programs through a contract agreement with Enernoc. Prior to any curtailment or emergency events, temperature setpoints are decreased by a couple of degrees to “boost” the building thermal loads. This system allows RVCC to receive additional revenues from these energy programs without any disruption in occupants comfort.



7. METHOD OF ANALYSIS

7.1. Assumptions and tools

Energy modeling tool: eQUEST V3.6

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

RS Means 2009 (Building Construction Cost Data)

RS Means 2009 (Mechanical Cost Data)

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

7.2. Disclaimer

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

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

Appendix A: Lighting study (Sheet 1 – Existing lights)

Existing Lighting Conditions																
#	Building	Level/Floor	Location in Building	Measured Lighting Level in Footcandles	Fixture Type	Ballast Type	No. of Fixtures	No. of Lamps	Type of Lamp	Watts/Lamp	Hrs/Day	Energy Use (Watt hours/day)	Controls	Daylighting possible?	Power (Watts)	
1	Science Wing	First Floor	Hallway	17	Plug-in CFL	-	17	2	CFL	18	12	7344	Manual	No	612	
2	Science Wing	First Floor	Hallway	-	LED Exit Sign	-	3	1	LED	5	24	360	None	No	15	
3	Science Wing	First Floor	Hallway	17	36" linear T8	electronic	3	2	fluorescent	25	12	1800	Manual	No	150	
4	Science Wing	First Floor	Hallway	17	12" linear T5	electronic	3	2	fluorescent	8	12	576	Manual	No	48	
5	Science Wing	First Floor	Hallway/Entrance	293	12" linear T5	electronic	3	2	fluorescent	8	12	576	Manual	Yes	48	
6	Science Wing	First Floor	Hallway/Entrance	293	Plug-in CFL	-	11	2	fluorescent	18	12	4752	Manual	Yes	396	
7	Science Wing	First Floor	Hallway/Entrance	293	33.4" linear T5	electronic	2	2	fluorescent	20	12	960	Manual	Yes	80	
8	Science Wing	First Floor	Hallway/Entrance	2500	Hanging Fixture - 32W CFL	electronic	1	3	CFL	32	12	1152	Manual	Yes	96	
9	Science Wing	First Floor	Room 104	120	4' linear T8	electronic	6	2	fluorescent	32	12	4608	Manual	Yes	384	
10	Science Wing	First Floor	Room 100 - Physics	40	4' linear T8	electronic	24	3	fluorescent	32	20	46080	Occupancy	No	2304	
11	Science Wing	First Floor	Room 100 - Physics	40	Plug-in CFL	-	22	2	CFL	18	20	15840	Occupancy	No	792	
12	Science Wing	First Floor	Room 101 - Engineering	41	4' linear T8	electronic	24	3	fluorescent	32	20	46080	Occupancy	No	2304	
13	Science Wing	First Floor	Room 101 - Engineering	41	Plug-in CFL	-	22	2	CFL	18	20	15840	Occupancy	No	792	
14	Science Wing	First Floor	Mechanical Room	10, 75	4' linear T8	electronic	10	2	fluorescent	32	12	7680	Manual	No	640	
15	Science Wing	First Floor	Room 129 - Microbiology	124	4' linear T8	electronic	18	3	fluorescent	32	12	20736	Manual	No	1728	
16	Science Wing	First Floor	Room 129 - Microbiology	124	Plug-in CFL	-	21	2	CFL	21	2	1764	Manual	No	882	
17	Science Wing	First Floor	Room 133	52	4' linear T8	electronic	2	2	fluorescent	32	12	1536	Manual	No	128	
18	Science Wing	First Floor	Room 132	63	4' linear T8	electronic	2	2	fluorescent	32	12	1536	Manual	No	128	
19	Science Wing	First Floor	Room 131	60	4' linear T8	electronic	2	2	fluorescent	32	12	1536	Manual	No	128	
20	Science Wing	First Floor	Cold Room	85	4' linear T12	electronic	2	2	fluorescent	40	12	1920	Manual	No	160	
21	Science Wing	First Floor	Room 128 - Prep Area	120	4' linear T8	electronic	12	2	fluorescent	32	12	9216	Manual	No	768	
22	Science Wing	First Floor	Room 127 - General Biology	138	4' linear T8	electronic	18	3	fluorescent	32	12	20736	Manual	No	1728	
23	Science Wing	First Floor	Room 127 - General Biology	138	Plug-in CFL	-	9	2	CFL	18	12	3888	Manual	No	324	
24	Science Wing	First Floor	Room 126 - Prep Area	125	4' linear T8	electronic	12	2	fluorescent	32	12	9216	Manual	No	768	
25	Science Wing	First Floor	Room 125 - General Biology	121	4' linear T8	electronic	18	3	fluorescent	32	12	20736	Manual	Yes	1728	
26	Science Wing	First Floor	Room 125 - General Biology	121	Plug-in CFL	-	9	2	CFL	18	12	3888	Manual	No	324	
27	Science Wing	First Floor	Room 120 - Botany Lab	115	4' linear T8	electronic	18	3	fluorescent	32	12	20736	Manual	No	1728	
28	Science Wing	First Floor	Room 120 - Botany Lab	115	Plug-in CFL	electronic	10	2	fluorescent	18	12	4320	Manual	No	360	
29	Science Wing	First Floor	Storage (next to Botany Lab)	145	4' linear T8	electronic	13	2	fluorescent	32	12	9984	Manual	No	832	
30	Science Wing	First Floor	Small room next to above storage	85	4' linear T8	electronic	5	2	fluorescent	32	12	3840	Manual	No	320	
31	Science Wing	First Floor	Room 118 - Anatomy Lab	132	4' linear T8	electronic	17	3	fluorescent	32	12	19584	Manual	No	1632	
32	Science Wing	First Floor	Room 116	67	4' linear T8	electronic	2	3	fluorescent	32	12	2304	Manual	No	192	
33	Science Wing	First Floor	Room 115	95	4' linear T8	electronic	2	3	fluorescent	32	12	2304	Manual	No	192	
34	Science Wing	First Floor	Room 114	56	4' linear T8	electronic	2	3	fluorescent	32	12	2304	Manual	No	192	
35	Science Wing	First Floor	Room 113	65	4' linear T8	electronic	2	3	fluorescent	32	12	2304	Manual	No	192	
36	Science Wing	First Floor	Room 112	64	4' linear T8	electronic	2	3	fluorescent	32	12	2304	Manual	No	192	
37	Science Wing	First Floor	Administrative Offices	69	4' linear T8	electronic	16	3	fluorescent	32	12	18432	Manual	No	1536	
38	Science Wing	First Floor	Electrical Room	83	4' linear T8	electronic	1	2	fluorescent	32	12	768	Manual	No	64	
39	Science Wing	First Floor	Men's Room	36	4' linear T8	electronic	4	1	fluorescent	32	12	1536	Manual	No	128	
40	Science Wing	First Floor	Men's Room	36	Plug-in CFL	-	6	2	fluorescent	18	12	2592	Manual	No	216	
41	Science Wing	First Floor	Janitor's Closet (next to Men's Room)	57	4' linear T8	electronic	1	2	fluorescent	32	12	768	Manual	No	64	
42	Science Wing	First Floor	Women's Room	36	4' linear T8	electronic	4	1	fluorescent	32	12	1536	Manual	No	128	
43	Science Wing	First Floor	Women's Room	36	Plug-in CFL	-	6	2	fluorescent	18	12	2592	Manual	No	216	
44	Science Wing	Second Floor	Receiving	44	4' linear T8	electronic	4	2	fluorescent	32	12	3072	Manual	No	256	
45	Science Wing	Second Floor	Electrical Room	72	4' linear T8	electronic	3	2	fluorescent	32	12	2304	Manual	No	192	
46	Science Wing	Second Floor	Room 221 - Instrument Room	73	4' linear T8	electronic	8	2	fluorescent	32	12	6144	Manual	No	512	

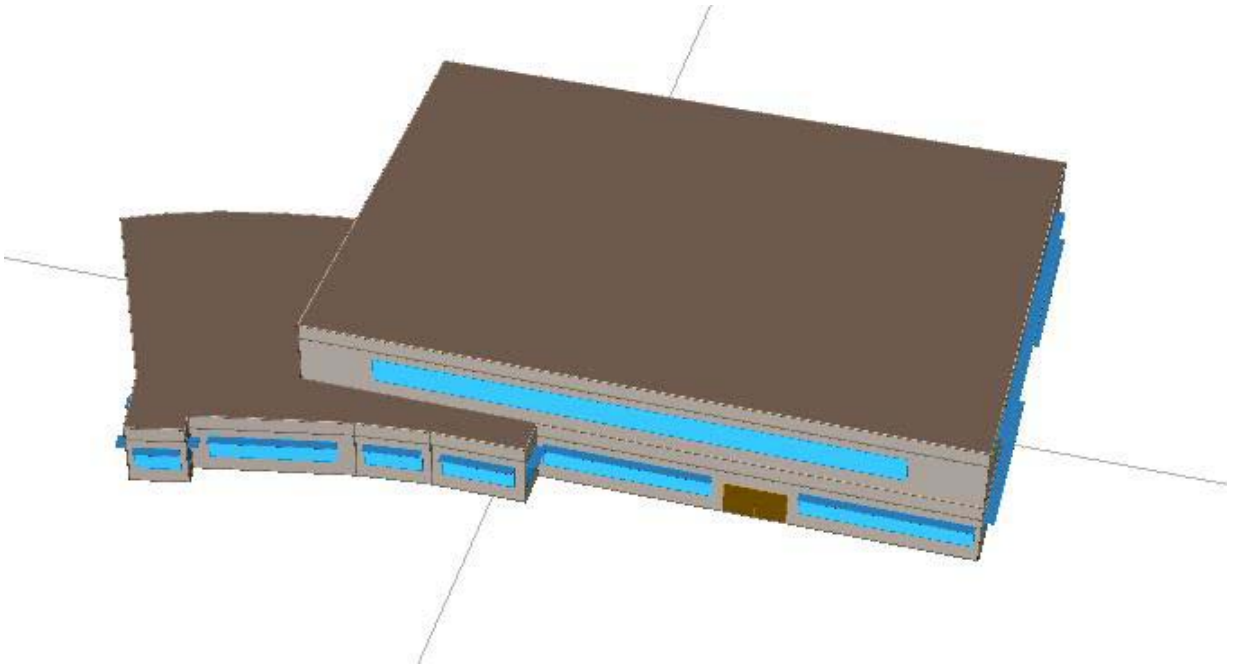
47	Science Wing	Second Floor	Room 220 - Organic Chemistry	82	4' linear T8	electronic	14	3	fluorescent	32	12	16128	Manual	No	1344
48	Science Wing	Second Floor	Room 220 - Organic Chemistry	82	Plug-in CFL	-	8	2	fluorescent	18	12	3456	Manual	No	288
49	Science Wing	Second Floor	Room 219 - General Chemistry	56	4' linear T8	electronic	16	3	fluorescent	32	12	18432	Manual	No	1536
50	Science Wing	Second Floor	Room 219 - General Chemistry	56	Plug-in CFL	-	9	2	fluorescent	18	12	3888	Manual	No	324
51	Science Wing	Second Floor	Balance Room	92	4' linear T8	electronic	8	2	fluorescent	32	12	6144	Manual	No	512
52	Science Wing	Second Floor	Storage Room (next to Room 219)	103	4' linear T8	electronic	10	2	fluorescent	32	12	7680	Manual	No	640
53	Science Wing	Second Floor	Storage Room (next to Room 215)	180	4' linear T8	electronic	2	2	fluorescent	32	12	1536	Manual	No	128
54	Science Wing	Second Floor	Room 215 - General Chemistry	67	4' linear T8	electronic	18	3	fluorescent	32	12	20736	Manual	No	1728
55	Science Wing	Second Floor	Room 215 - General Chemistry	67	Plug-in CFL	-	10	2	fluorescent	18	12	4320	Manual	No	360
56	Science Wing	Second Floor	Hallway	-	LED Exit Sign	-	4	1	LED	5	24	480	Manual	No	20
57	Science Wing	Second Floor	Hallway	38	Plug-in CFL	-	24	2	fluorescent	18	12	10368	Manual	No	864
58	Science Wing	Second Floor	Hallway	38	Hanging Fixture - 32W CFL	-	3	1	fluorescent	32	12	1152	Manual	No	96
59	Science Wing	Second Floor	Stairs (East)	50	Plug-in CFL	-	1	2	fluorescent	18	12	432	Manual	Yes	36
60	Science Wing	Second Floor	Stairs (East)	50	4' linear T8	electronic	3	1	fluorescent	32	12	1152	Manual	Yes	96
61	Science Wing	Second Floor	Stairs (East)	-	LED Exit Sign	-	1	1	LED	5	24	120	Manual	Yes	5
62	Science Wing	Second Floor	Room 212 - Materials Lab	60	4' linear T8	electronic	15	3	fluorescent	32	12	17280	Manual	Yes	1440
63	Science Wing	Second Floor	Room 212 - Materials Lab	60	Plug-in CFL	-	10	2	-	18	12	4320	Manual	Yes	360
64	Science Wing	Second Floor	Storage (next to room 212)	50	4' linear T8	electronic	2	3	fluorescent	32	12	2304	Manual	No	192
65	Science Wing	Second Floor	Room 210 - Dispensing Lab	54	4' linear T8	electronic	3	3	fluorescent	32	12	3456	Manual	No	288
66	Science Wing	Second Floor	Room 201	62	4' linear T8	electronic	11	3	fluorescent	32	12	12672	Manual	No	1056
67	Science Wing	Second Floor	Room 201	62	Plug-in CFL	-	12	2	fluorescent	18	12	5184	Manual	No	432
68	Science Wing	Second Floor	Room 202	86	4' linear T8	electronic	2	3	fluorescent	32	12	2304	Manual	No	192
69	Science Wing	Second Floor	Room 203	86	4' linear T8	electronic	2	3	fluorescent	32	12	2304	Manual	No	192
70	Science Wing	Second Floor	Room 204	64	4' linear T8	electronic	2	3	fluorescent	32	12	2304	Manual	No	192
71	Science Wing	Second Floor	Room 205	68	4' linear T8	electronic	2	3	fluorescent	32	12	2304	Manual	No	192
72	Science Wing	Second Floor	Room 206	72	4' linear T8	electronic	2	3	fluorescent	32	12	2304	Manual	No	192
73	Science Wing	Second Floor	Room 207	62	4' linear T8	electronic	2	3	fluorescent	32	12	2304	Manual	No	192
74	Science Wing	Second Floor	Room 208	64	4' linear T8	electronic	2	3	fluorescent	32	12	2304	Manual	No	192
75	Science Wing	Second Floor	Men's Room	48	4' linear T8	electronic	2	1	fluorescent	32	12	768	Manual	No	64
76	Science Wing	Second Floor	Men's Room	48	Plug-in CFL	-	3	1	fluorescent	18	12	648	Manual	No	54
77	Science Wing	Second Floor	Women's Room	48	4' linear T8	electronic	2	1	fluorescent	32	12	768	Manual	No	64
78	Science Wing	Second Floor	Women's Room	48	Plug-in CFL	-	3	1	fluorescent	18	12	648	Manual	No	54
79	Science Wing	Second Floor	Janitor's Closet (next to Men's Room)	53	4' linear T8	electronic	1	2	fluorescent	32	12	768	Manual	No	64
80	Science Wing	Second Floor	Storage (next to Women's Room)	23	4' linear T8	electronic	2	2	fluorescent	32	12	1536	Manual	No	128
81	Science Wing	Second Floor	Ceiling above 1st floor Entrance	30	Hanging Fixture - 32W CFL	-	1	3	CFL	32	12	1152	Manual	No	96
82	Science Wing	Second Floor	2nd floor Entrance Area	30	Plug-in CFL	-	3	2	fluorescent	18	12	1296	Manual	No	108
83	Science Wing	Second Floor	Stairs (West)	226	4' linear T8	electronic	3	1	fluorescent	32	12	1152	Manual	Yes	96

Appendix A: Lighting study (Sheet 2 – Proposed lighting controls)

Proposed Lighting Conditions, including controls																
#	Building	Level/Floor	Location in Building	Measured Lighting Level in Footcandles	Fixture Type	Ballast Type	No. of Fixtures	No. of Lamps	Type of Lamp	Watts/Lamp	Hrs/Day	Energy Use (Watt hours/day)	Controls	Daylighting possible?	Power (Watts)	
1	Science Wing	First Floor	Hallway	17	Plug-in CFL	-	17	2	CFL	18	12	7344	Manual	No	612	
2	Science Wing	First Floor	Hallway	-	LED Exit Sign	-	3	1	LED	5	24	360	None	No	15	
3	Science Wing	First Floor	Hallway	17	36" linear T8	electronic	3	2	fluorescent	25	12	1800	Manual	No	150	
4	Science Wing	First Floor	Hallway	17	12" linear T5	electronic	3	2	fluorescent	8	12	576	Manual	No	48	
5	Science Wing	First Floor	Hallway/Entrance	293	12" linear T5	electronic	3	2	fluorescent	8	4	192	Photosensor	Yes	48	
6	Science Wing	First Floor	Hallway/Entrance	293	Plug-in CFL	-	11	2	fluorescent	18	4	1584	Photosensor	Yes	396	
7	Science Wing	First Floor	Hallway/Entrance	293	33.4" linear T5	electronic	2	2	fluorescent	20	4	320	Photosensor	Yes	80	
8	Science Wing	First Floor	Hallway/Entrance	2500	Hanging Fixture - 32W CFL	electronic	1	3	CFL	32	4	384	Photosensor	Yes	96	
9	Science Wing	First Floor	Room 104	120	4' linear T8	electronic	6	2	fluorescent	32	10	3840	Photosensor	Yes	384	
10	Science Wing	First Floor	Room 100 - Physics	40	4' linear T8	electronic	24	3	fluorescent	32	12	27648	Occupancy	No	2304	
11	Science Wing	First Floor	Room 100 - Physics	40	Plug-in CFL	-	22	2	CFL	18	12	9504	Occupancy	No	792	
12	Science Wing	First Floor	Room 101 - Engineering	41	4' linear T8	electronic	24	3	fluorescent	32	12	27648	Occupancy	No	2304	
13	Science Wing	First Floor	Room 101 - Engineering	41	Plug-in CFL	-	22	2	CFL	18	12	9504	Occupancy	No	792	
14	Science Wing	First Floor	Mechanical Room	10, 75	4' linear T8	electronic	10	2	fluorescent	32	6	3840	Occupancy	No	640	
15	Science Wing	First Floor	Room 129 - Microbiology	124	4' linear T8	electronic	18	3	fluorescent	32	10	17280	Occupancy	No	1728	
16	Science Wing	First Floor	Room 129 - Microbiology	124	Plug-in CFL	-	21	2	CFL	21	10	8820	Occupancy	No	882	
17	Science Wing	First Floor	Room 133	52	4' linear T8	electronic	2	2	fluorescent	32	10	1280	Occupancy	No	128	
18	Science Wing	First Floor	Room 132	63	4' linear T8	electronic	2	2	fluorescent	32	10	1280	Occupancy	No	128	
19	Science Wing	First Floor	Room 131	60	4' linear T8	electronic	2	2	fluorescent	32	10	1280	Occupancy	No	128	
20	Science Wing	First Floor	Cold Room	85	4' linear T12	electronic	2	2	fluorescent	40	10	1600	Occupancy	No	160	
21	Science Wing	First Floor	Room 128 - Prep Area	120	4' linear T8	electronic	12	2	fluorescent	32	10	7680	Occupancy	No	768	
22	Science Wing	First Floor	Room 127 - General Biology	138	4' linear T8	electronic	18	3	fluorescent	32	10	17280	Occupancy	No	1728	
23	Science Wing	First Floor	Room 127 - General Biology	138	Plug-in CFL	-	9	2	CFL	18	10	3240	Occupancy	No	324	
24	Science Wing	First Floor	Room 126 - Prep Area	125	4' linear T8	electronic	12	2	fluorescent	32	10	7680	Occupancy	No	768	
25	Science Wing	First Floor	Room 125 - General Biology	121	4' linear T8	electronic	18	3	fluorescent	32	10	17280	Photosensor	Yes	1728	
26	Science Wing	First Floor	Room 125 - General Biology	121	Plug-in CFL	-	9	2	CFL	18	10	3240	Occupancy	No	324	
27	Science Wing	First Floor	Room 120 - Botany Lab	115	4' linear T8	electronic	18	3	fluorescent	32	10	17280	Occupancy	No	1728	
28	Science Wing	First Floor	Room 120 - Botany Lab	115	Plug-in CFL	electronic	10	2	fluorescent	18	10	3600	Occupancy	No	360	
29	Science Wing	First Floor	Storage (next to Botany Lab)	145	4' linear T8	electronic	13	2	fluorescent	32	10	8320	Occupancy	No	832	
30	Science Wing	First Floor	Small room next to above storage	85	4' linear T8	electronic	5	2	fluorescent	32	10	3200	Occupancy	No	320	
31	Science Wing	First Floor	Room 118 - Anatomy Lab	132	4' linear T8	electronic	17	3	fluorescent	32	10	16320	Occupancy	No	1632	
32	Science Wing	First Floor	Room 116	67	4' linear T8	electronic	2	3	fluorescent	32	10	1920	Occupancy	No	192	
33	Science Wing	First Floor	Room 115	95	4' linear T8	electronic	2	3	fluorescent	32	10	1920	Occupancy	No	192	
34	Science Wing	First Floor	Room 114	56	4' linear T8	electronic	2	3	fluorescent	32	10	1920	Occupancy	No	192	
35	Science Wing	First Floor	Room 113	65	4' linear T8	electronic	2	3	fluorescent	32	10	1920	Occupancy	No	192	
36	Science Wing	First Floor	Room 112	64	4' linear T8	electronic	2	3	fluorescent	32	10	1920	Occupancy	No	192	
37	Science Wing	First Floor	Administrative Offices	69	4' linear T8	electronic	16	3	fluorescent	32	12	18432	Manual	No	1536	
38	Science Wing	First Floor	Electrical Room	83	4' linear T8	electronic	1	2	fluorescent	32	10	640	Occupancy	No	64	
39	Science Wing	First Floor	Men's Room	36	4' linear T8	electronic	4	1	fluorescent	32	10	1280	Occupancy	No	128	
40	Science Wing	First Floor	Men's Room	36	Plug-in CFL	-	6	2	fluorescent	18	10	2160	Occupancy	No	216	
41	Science Wing	First Floor	Janitor's Closet (next to Men's Room)	57	4' linear T8	electronic	1	2	fluorescent	32	10	640	Occupancy	No	64	
42	Science Wing	First Floor	Women's Room	36	4' linear T8	electronic	4	1	fluorescent	32	10	1280	Occupancy	No	128	
43	Science Wing	First Floor	Women's Room	36	Plug-in CFL	-	6	2	fluorescent	18	10	2160	Occupancy	No	216	
44	Science Wing	Second Floor	Receiving	44	4' linear T8	electronic	4	2	fluorescent	32	12	3072	Manual	No	256	
45	Science Wing	Second Floor	Electrical Room	72	4' linear T8	electronic	3	2	fluorescent	32	10	1920	Occupancy	No	192	
46	Science Wing	Second Floor	Room 221 - Instrument Room	73	4' linear T8	electronic	8	2	fluorescent	32	10	5120	Occupancy	No	512	

47	Science Wing	Second Floor	Room 220 - Organic Chemistry	82	4' linear T8	electronic	14	3	fluorescent	32	10	13440	Occupancy	No	1344	
48	Science Wing	Second Floor	Room 220 - Organic Chemistry	82	Plug-in CFL	-	8	2	fluorescent	18	10	2880	Occupancy	No	288	
49	Science Wing	Second Floor	Room 219 - General Chemistry	56	4' linear T8	electronic	16	3	fluorescent	32	10	15360	Occupancy	No	1536	
50	Science Wing	Second Floor	Room 219 - General Chemistry	56	Plug-in CFL	-	9	2	fluorescent	18	10	3240	Occupancy	No	324	
51	Science Wing	Second Floor	Balance Room	92	4' linear T8	electronic	8	2	fluorescent	32	12	6144	Manual	No	512	
52	Science Wing	Second Floor	Storage Room (next to Room 219)	103	4' linear T8	electronic	10	2	fluorescent	32	10	6400	Occupancy	No	640	
53	Science Wing	Second Floor	Storage Room (next to Room 215)	180	4' linear T8	electronic	2	2	fluorescent	32	10	1280	Occupancy	No	128	
54	Science Wing	Second Floor	Room 215 - General Chemistry	67	4' linear T8	electronic	18	3	fluorescent	32	10	17280	Occupancy	No	1728	
55	Science Wing	Second Floor	Room 215 - General Chemistry	67	Plug-in CFL	-	10	2	fluorescent	18	10	3600	Occupancy	No	360	
56	Science Wing	Second Floor	Hallway	-	LED Exit Sign	-	4	1	LED	5	24	480	Manual	No	20	
57	Science Wing	Second Floor	Hallway	38	Plug-in CFL	-	24	2	fluorescent	18	12	10368	Manual	No	864	
58	Science Wing	Second Floor	Hallway	38	Hanging Fixture - 32W CFL	-	3	1	fluorescent	32	12	1152	Manual	No	96	
59	Science Wing	Second Floor	Stairs (East)	50	Plug-in CFL	-	1	2	fluorescent	18	10	360	Photosensor	Yes	36	
60	Science Wing	Second Floor	Stairs (East)	50	4' linear T8	electronic	3	1	fluorescent	32	10	960	Photosensor	Yes	96	
61	Science Wing	Second Floor	Stairs (East)	-	LED Exit Sign	-	1	1	LED	5	10	50	Manual	No	5	
62	Science Wing	Second Floor	Room 212 - Materials Lab	60	4' linear T8	electronic	15	3	fluorescent	32	10	14400	Photosensor	Yes	1440	
63	Science Wing	Second Floor	Room 212 - Materials Lab	60	Plug-in CFL	-	10	2	-	18	10	3600	Photosensor	Yes	360	
64	Science Wing	Second Floor	Storage (next to room 212)	50	4' linear T8	electronic	2	3	fluorescent	32	10	1920	Occupancy	No	192	
65	Science Wing	Second Floor	Room 210 - Dispensing Lab	54	4' linear T8	electronic	3	3	fluorescent	32	12	3456	Manual	No	288	
66	Science Wing	Second Floor	Room 201	62	4' linear T8	electronic	11	3	fluorescent	32	10	10560	Occupancy	No	1056	
67	Science Wing	Second Floor	Room 201	62	Plug-in CFL	-	12	2	fluorescent	18	10	4320	Occupancy	No	432	
68	Science Wing	Second Floor	Room 202	86	4' linear T8	electronic	2	3	fluorescent	32	10	1920	Occupancy	No	192	
69	Science Wing	Second Floor	Room 203	86	4' linear T8	electronic	2	3	fluorescent	32	10	1920	Occupancy	No	192	
70	Science Wing	Second Floor	Room 204	64	4' linear T8	electronic	2	3	fluorescent	32	10	1920	Occupancy	No	192	
71	Science Wing	Second Floor	Room 205	68	4' linear T8	electronic	2	3	fluorescent	32	10	1920	Occupancy	No	192	
72	Science Wing	Second Floor	Room 206	72	4' linear T8	electronic	2	3	fluorescent	32	10	1920	Occupancy	No	192	
73	Science Wing	Second Floor	Room 207	62	4' linear T8	electronic	2	3	fluorescent	32	10	1920	Occupancy	No	192	
74	Science Wing	Second Floor	Room 208	64	4' linear T8	electronic	2	3	fluorescent	32	10	1920	Occupancy	No	192	
75	Science Wing	Second Floor	Men's Room	48	4' linear T8	electronic	2	1	fluorescent	32	10	640	Occupancy	No	64	
76	Science Wing	Second Floor	Men's Room	48	Plug-in CFL	-	3	1	fluorescent	18	10	540	Occupancy	No	54	
77	Science Wing	Second Floor	Women's Room	48	4' linear T8	electronic	2	1	fluorescent	32	10	640	Occupancy	No	64	
78	Science Wing	Second Floor	Women's Room	48	Plug-in CFL	-	3	1	fluorescent	18	10	540	Occupancy	No	54	
79	Science Wing	Second Floor	Janitor's Closet (next to Men's Room)	53	4' linear T8	electronic	1	2	fluorescent	32	10	640	Occupancy	No	64	
80	Science Wing	Second Floor	Storage (next to Women's Room)	23	4' linear T8	electronic	2	2	fluorescent	32	10	1280	Occupancy	No	128	
81	Science Wing	Second Floor	Ceiling above 1st floor Entrance	30	Hanging Fixture - 32W CFL	-	1	3	CFL	32	12	1152	Manual	No	96	
82	Science Wing	Second Floor	2nd floor Entrance Area	30	Plug-in CFL	-	3	2	fluorescent	18	12	1296	Manual	No	108	
83	Science Wing	Second Floor	Stairs (West)	226	4' linear T8	electronic	3	1	fluorescent	32	10	960	Photosensor	Yes	96	
Totals			Interior Lighting Total Watts	40416	Watts											
Existing Usage (kWh/year)			192,059	Interior Lighting Power Density (W/sqft)	1.62	W/sqft										
Proposed Usage (kWh/year)			153,258													
Existing Est. Cost (\$/year)			\$ 29,769.09													
Proposed Est. Cost (\$/year)			\$ 23,755.05	Interior Lighting Total Watts	40416	watts										
Total kWh savings			38,800	Interior Lighting (W/sqft)	1.62	W/sqft										
Total \$ Savings			\$ 6,014.04													

Appendix B: eQUEST model



Appendix C: 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. 1135 Mountain Avenue Murray Hill, NJ 011374 (800) 247-2644 www.boc.com</p>	<p>Commerce Energy, Inc. 4400 Route 9 South, Suite 100 Freehold, NJ 07728 (800) 556-84113 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 0113113 (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>Integrays Energy Services, Inc. 99 Wood Ave, South, Suite 802 Iselin, NJ 08830 (877) 763-9977 www.integraysenergy.com</p>	<p>Strategic Energy, LLC 55 Madison Avenue, Suite 400 Morristown, NJ 011360 (888) 925-9115, www.sel.com</p>
<p>Liberty Power Holdings, LLC Park 80 West, Plaza II, Suite 200 Saddle Brook, NJ 07663 (866) 769-31139 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 080113 (856) 273-9995 www.ugienergyservices.com</p>	<p>American Powernet Management, LP 437 North Grove St. Berlin, NJ 08009 (800) 437-7872 www.hess.com</p>	<p>ConEdison Solutions Cherry Tree, Corporate Center 1135 State Highway 38 Cherry Hill, NJ 08002 (888) 625-0955 www.conedsolutions.com</p>
<p>Credit Suisse, (USA) Inc. 700 College Road East Princeton, NJ 08450 212-1138-3124 www.creditsuisse.com</p>	<p>Sprague Energy Corp. 12 Ridge Road Chatham Township NJ 011328 (800) 225-1560 www.spragueenergy.com</p>	

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<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 080113 856-273-9995 www.ugienergyservices.com</p>	<p>Great Eastern Energy 116 Village Riva, Suite 200 Princeton, NJ 08540 888-651-4121 www.greataeastern.com</p>
<p>Hess Energy, Inc. One Hess Plaza Woodbridge, NJ 07095 800-437-7872 www.hess.com</p>	<p>Hudson Energy Services, LLC 871 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 888-113-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) 1132 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 SEMPRA 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 011328 800-225-1560 www.spragueenergy.com</p>	<p>Stuyvesant Energy LLC 10 West Ivy Lane, Suite 4 Englewood, NJ 07631 800-646-64113 www.stuyfuel.com</p>	<p>Woodruff Energy 73 Water Street Bridgeton, NJ 08302 800-5113-1121 www.woodruffenergy.com</p>