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

For

West Building
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.

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 West Building only.

The West Building is currently the newest building on campus and houses classrooms. The building consists of 45,000 square feet and is fully conditioned. The building is operated on weekdays only between the hours of 7am and 10pm.

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.

The West Building is currently not metered separately and receives both electricity and gas from main campus meters. In the most recent year (March 2008-February 2009), the RVCC main electric meter recorded approximately 7,807,991 kWh or $1,224,758.25 worth of electricity. The total amount of gas recorded by the three main gas meters in the campus was 392,183 therms or $534,089.63 worth of natural gas. Since the West building is not metered separately for gas, SWA estimated the amount of gas consumed by this building alone, directly or indirectly, on a pro-rata basis by its square footage. The West building consumed 49,020 therms of gas during this period at a total cost of $66,769.51.

SWA benchmarked the West building as part of the RVCC campus 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 campus. The Portfolio Manager is capable of generating a site energy use intensity number using the 12 months prior to February 2009 as a baseline year. The site energy use intensity for the 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 current year baseline to show changes in energy consumption over time.

SWA recommends a total of 4 Energy Conservation Measures (ECMs) for the West building. The total investment cost for these ECMs is **$22,438**. The total investment cost for these ECMs if maximum incentives are achieved is **$19,888**. SWA estimates a first year savings of **$12,251** with a simple payback of **1.8 years**. SWA estimates that implementing the recommended ECMs will reduce the carbon footprint of the West building by **141,030 lbs of CO_2** annually.

There are various incentives that the West building could apply for that could also help lower the cost of installing the ECMs. SWA recommends that the West building applies for the NJ SmartStart program through the New Jersey Office of Clean Energy. This incentive can help provide technical assistance for the building in the implementation phase of any energy conservation project. 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 $480 for lighting upgrades, up to $920 for upgrading lighting controls and up to $1,150 for replacing the 7.5HP with a premium efficiency motor with VFD controls. Total amount of incentives available for the West Building is **$2,550** and the total investment cost if all the incentives are paid to their maximum amount is **$19,888**.

In addition to state and federal incentive programs, SWA recommends that RVCC to investigate certifying the West Building with the LEED rating system. The West Building is the newest building on campus and already contains high efficiency equipment relative to the other campus buildings. The

LEED rating system is widely recognized and can help merit RVCC for energy efficiency accomplishments.

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

ECM Table without Incentives

ECM#	ECM description	Installed Cost		1st year energy savings							SPP	LoM	Lifetime	ROI	Annual Carbon Reduction (lbs of CO2)
		Estimated $	Source	Electric Savings (kWh)	Unit	Natural Gas Savings (therms)	Unit	Demand	Unit	$ Savings/year			Cost Savings		
1	Weather-strip exterior doors	$ 370	RSMeans	-	kWh	68	therms	0.0	kW	$ 107	3.4	10	$ 907	14.5%	750
2a	Upgrade existing T12 fixtures	$ 10,148	RSMeans	19,891	kWh	-	therms	2.3	kW	$ 3,083	3.3	20	$ 45,032	17.2%	35,615
2b	Upgrade lighting controls	$ 10,120	RSMeans	56,006	kWh	-	therms	0.0	kW	$ 8,681	1.2	12	$ 85,387	62.0%	100,278
3	Replace one 7.5HP motor and install VFD controls	$ 1,800	Similar project	2,450	kWh	-	therms	0.0	kW	$ 380	4.7	10	$ 3,207	7.8%	4,387
Total	**Total Scope of Work**	**$ 22,438**	**-**	**78,347**	**-**	**68**		**2.3**	**-**	**$ 12,251**	**1.8**		**$ 134,533**		**141,030**

ECM Table including Incentives

ECM#	ECM description	Installed Cost		1st year energy savings							SPP	LoM	Lifetime	ROI	Annual Carbon Reduction (lbs of CO2)
		Estimated $	Source	Electric Savings (kWh)	Unit	Natural Gas Savings (therms)		Demand	Unit	$ Savings/year			Cost Savings		
1	Weather-strip exterior doors	$ 370	RSMeans	-	kWh	68	therms	0.0	kW	$ 107	3.4	10	$ 907	14.5%	750
2a	Upgrade existing T12 fixtures	$ 9,668	RSMeans	19,891	kWh	-	therms	2.3	kW	$ 3,083	3.1	20	$ 45,032	18.3%	35,615
2b	Upgrade lighting controls	$ 9,200	RSMeans	56,006	kWh	-	therms	0.0	kW	$ 8,681	1.1	12	$ 85,387	69.0%	100,278
3	Replace one 7.5HP motor and install VFD controls	$ 650	Similar project	2,450	kWh	-	therms	0.0	kW	$ 380	1.7	10	$ 3,207	39.3%	4,387
Total	**Total Scope of Work**	**$ 19,888**	**-**	**78,347**	**-**	**68**		**2.3**	**-**	**$ 12,251**	**1.6**		**$ 134,533**		**141,030**

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

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1. HISTORIC ENERGY CONSUMPTION

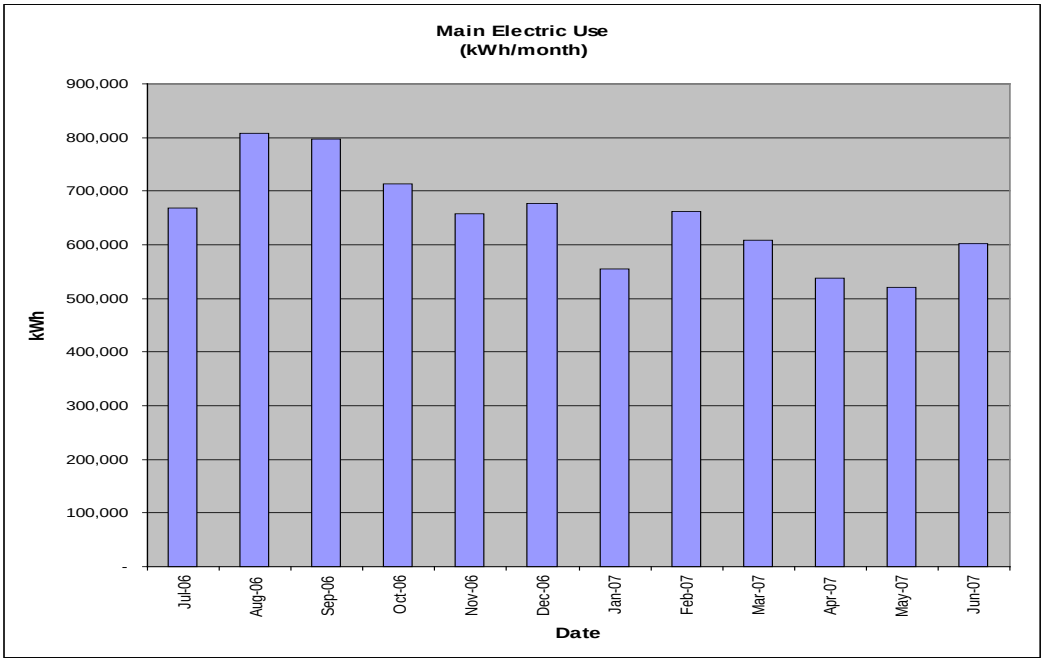
1.1. Energy usage and cost analysis

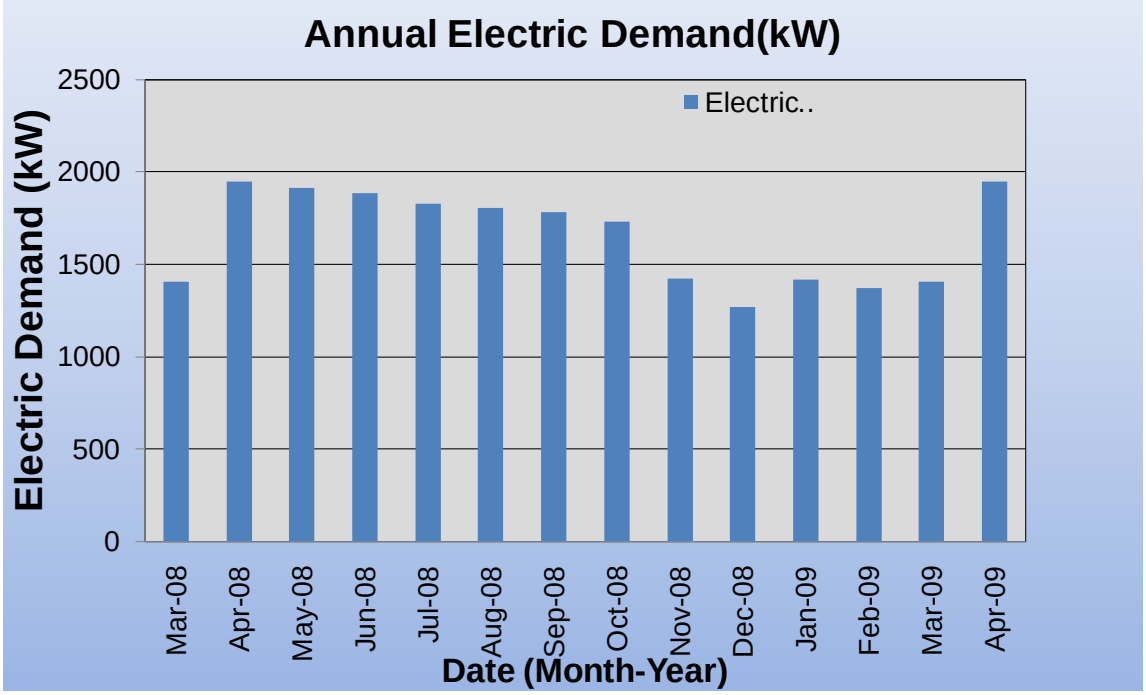
SWA analyzed utility bills from March 2008 through February 2009 that were received from Raritan Valley Community College.

Electricity – The West Building is currently not metered separately for electricity. The Main Campus electric meter currently buys electricity from JCP&L at **an average rate of $.155/kWh** based on the previous 12 months worth of utility bills. The Main Campus electric meter purchased **approximately 7,807,991 kWh or $1,224,758.25 worth of electricity** in the previous year. The data also reflected that demand peaked at 1945 kW in April.

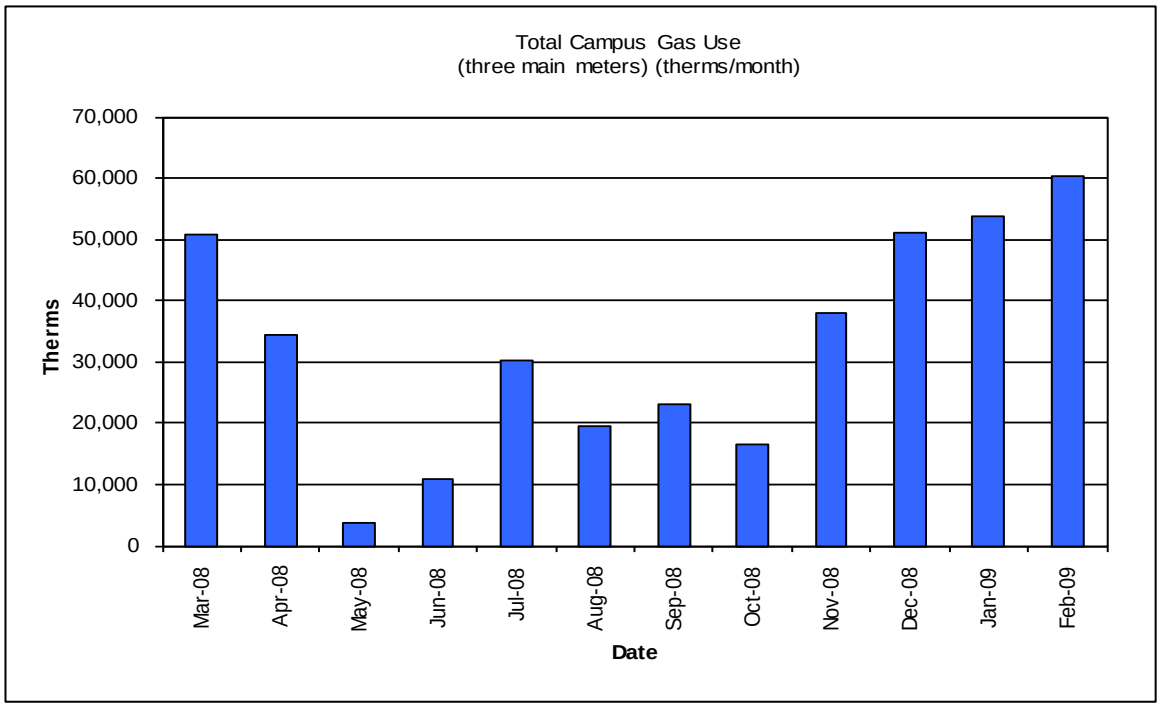
Natural Gas – The West Building is currently not metered separately for natural gas. The Campus buys natural gas for its three main meters mentioned above from a third-party Energy Service Company (ESCO) via PSE&G at **an average aggregated rate of $1.36/therm** based on the previous 12 months worth of utility bills. The three gas meters purchased **approximately 392,183 therms or $534,361.90 worth of natural gas** in the previous year. Since the building is not metered separately for gas, SWA estimated the amount of gas consumed by the West building alone on pro-rata basis of its square footage. This building consumed **49,020** therms of gas during this period at a total cost of **$66,769.51**.

The following chart shows electricity usage and electricity demand (kW) for the Main Campus 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.

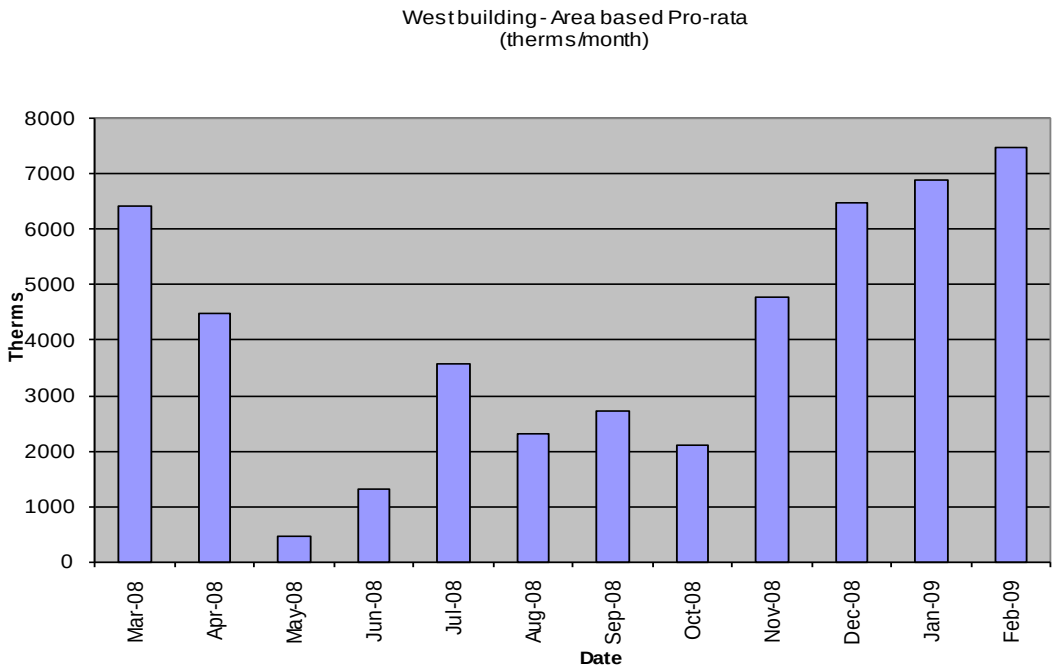




The following chart shows natural gas usage for the Main Campus meter based on utility bills for the 12 month period of March 2008 – February 2009.



Since the West building is not metered separately for gas, SWA estimated the amount of gas consumed by the building alone on pro-rata basis by square footage of various spaces for the 12 month period of March 2008 – February 2009, as follows:



1.2. Utility rate

Utilities are currently not purchased directly for the West building. Electricity is received from the Main Campus electric meter which is purchased at a general service market rate for electric usage (kWh) but is not charged a separate demand charge. The Main Campus meter that provides electricity for the West Building currently pays an average rate of approximately $0.155/kWh based on the previous 12 months of utility bills.

Natural gas is received from the Main Campus gas meter which is purchased at a general service market rate for natural gas (therms). The Campus gas meters that provide natural gas service, directly or indirectly, to the Physical Education building currently pay an average aggregated rate of approximately of **$1.36/therm** based on the previous 12 months of utility bills.

1.3. Energy benchmarking

The West 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.

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Raritan VCC

Building ID: 1762814
For 12-month Period Ending: February 28, 2009[1]
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

Year Built: 1960
Gross Floor Area (ft^2): 423,900

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

Site Energy Use Summary[3]

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

Energy Intensity[5]

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

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	7,129

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.

Certifying Professional
N/A

Meets Industry Standards[6] **for Indoor Environmental Conditions:**

Ventilation for Acceptable Indoor Air Quality	N/A
Acceptable Thermal Environmental Conditions	N/A
Adequate Illumination	N/A

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

EPA Form 5900-16

2. FACILITY AND SYSTEMS DESCRIPTION

2.1. Building Characteristics

The West Building/Academic Learning Center was built in 2007 and is the newest structure on the RVCC campus. The building contains three-stories with a total floor area of 45,000 square feet. The building contains mostly classrooms with the addition of some technology classrooms and office space.

2.2. Building occupancy profiles

The peak occupancy for the West Building is approximately 800 persons at any given time during weekdays. The building is typically occupied from 7am to 10pm on weekdays only, throughout the entire year.

2.3. Building envelope

2.3.1. Exterior walls

The West Building's exterior walls are constructed of 8" CMU blocks under either a metal panel finish or split face block veneer. The walls seem to be insulated on the outside of the CMU face with a continuous 1" rigid board and partially insulated inside with fiberglass batts where the 3-1/2" metal studs occur. The exterior walls consist of 4" face bricks. There are 6" metal studs spaced 16" on center located on the inside of the exterior wall with 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 66ºF, an accurate infrared scan could not be obtained. Typically, a good infrared scan requires a temperature difference of 20ºF 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 West Building consists of a modified bitumen flat roof with parapets around the perimeter. The rigid insulation is tapered with a minimum thickness of 3" and is constructed over structural metal decking. On the day of the site visit, SWA inspected the roof and observed no major deficiencies. SWA recommends that if the roof is ever replaced that a well-insulated roof is installed with a light-colored 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 perimeter foundation. There were no reported problems with water penetration or moisture.

2.3.4. Windows

The double glass paned windows are fixed aluminum-framed units with no insulating properties or films. Currently, the West 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 are aluminum-framed with no insulating properties or films. Exterior doors 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 are 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 West Building was observed to be a relatively tight building. There were no major observed deficiencies of air tightness within the building.

2.4. HVAC systems

2.4.1. Heating

The West Building is currently connected to the existing campus-wide chilled water/hot water loop that is supplied from the Cogeneration plant. There are no combustion heating appliances located within the West Building; instead either chilled water or hot water is supplied to air handling unit located on the roof and to the various VAV units. These air handling units contain electric fans that blow across the water loops to provide space heating and cooling to the building. The basement of the building houses secondary pumps to help circulate water from the main loop to the rooftop in case of a pressure drop. These two secondary hot water pumps are 7.5HP and are never used since there is a very small pressure drop from the campus-wide loop to the building.

2.4.2. Cooling

The West Building is connected to the existing campus-wide chilled water loop that is supplied from the Cogeneration plant. The building is cooled the same way that it is heated. The rooftop air handling units contain electric fans that blow across a chilled water loop to condition the space for cooling. The basement of the building also houses secondary pumps for the chilled water loop in case of a pressure drop from the main plant. These two secondary chilled water pumps are 7.5HP and are never used since there is a very small pressure drop from the campus-wide loop to the building. The West building does contain a small Mitsubishi condenser on the roof to supply DX cooling to the air handler unit in the server room on the 3rd floor.

2.4.3. Ventilation

The West Building contains one large rooftop heat recovery unit that contain Yaskawa VFD controls. These units contain an electric powered fan that either blows across the chilled water coil or hot water coil inside depending on the season. These units also pull fresh air from the outside in order to provide adequate ventilation throughout the entire building.

2.4.4. Domestic Hot Water

Domestic Hot Water is provided by one electric 50 gallon storage heater.

2.5. Electrical systems

2.5.1. Lighting

Interior Lighting – Since the West building was built approximately 2 years ago, the majority of lighting throughout the building is efficient and not cost-effective to replace at this time. However, it appears that T-12 fluorescent lighting with magnetic ballasts is installed in the stairwells and should be updated with efficient T-8 fixtures with electronic ballasts. Based on measurements of lighting levels that were measured for each space, there are no vastly over-lit areas. SWA recommends replacing all T12 lighting including magnetic ballasts with T8 lighting and electronic ballasts. SWA also recommends installing occupancy sensors in all of the bathrooms. Since bathrooms are used sporadically throughout the day and are commonly left on for beyond the necessary hours of operation, SWA recommends installing occupancy sensors with a time delay. Typically occupancy sensors have an adjustable time delay that shuts down the lights automatically if no motion is detected within a set time period. 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 West 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 West Building is made-up of three stories and contains a hydraulic elevator. There are currently no cost-effect improvements that can be made to the elevator system.

2.5.4. Others electrical systems

There are currently no other electrical systems installed at this building.

3. EQUIPMENT LIST

Building System	Description	Location	Model#	Fuel	Space served	Year Equip Installed	Remaining useful life %
Cooling	Chilled water pump, 340gpm, 50'head; 7.5hp Baldor motor, 200V, 22.3A, 1770 rpm,	Mech Room	ITT Bell & Gosset, model 1510 BF, S/N CO27545-02 J60	Elec.	Whole Bldg.	2007	90%
Cooling	Chilled water pump, 340gpm, 50'head; 7.5hp Baldor motor, 200V, 22.3A, 1770 rpm,	Mech Room	ITT Bell & Gosset, model 1510 BF, S/N CO27545-01 J60	Elec.	Whole Bldg.	2007	90%
Heating	Hot water pump, 232gpm, 75'head; 7.5hp Baldor motor, 200V, 22.3A, 1770 rpm,	Mech Room	ITT Bell & Gosset, model 1510 BF, S/N CO27641-01 J60	Elec.	Whole Bldg.	2007	90%
Heating	Hot water pump, 232gpm, 75'head; 7.5hp Baldor motor, 200V, 22.3A, 1770 rpm,	Mech Room	ITT Bell & Gosset, model 1510 BF, S/N CO27641-02 J60	Elec.	Whole Bldg.	2007	90%
Ventilation	Heat recovery unit, c/w VFD, 208/3/60; 3*40hp evaporator fans, 2*15hp power exhaust fans, 2*0.25hp wheel fan; MCA 467, R-22	Roof	Aaon, model RL-190-8-0-NZOQ-000; S/N 200612-BLCU00318	Elec.	Whole Bldg.	2007	90%
Ventilation	Bathroom exhaust fan; 3/4hp motor, 1800 rpm, 208/3/60	Roof	Jen & Fan, model DB 1619DP, S/N B 39587	Elec.	Bathrooms	2007	90%
Cooling	Condensing unit, 230-208/1/60; MCA=20; R410A	Roof	Sanyo, model CL1872, S/N 0040882	Elec.	Server room	2007	90%
Cooling	Condensing unit, 230-208/1/60; MCA=20; R410A	Roof	Sanyo, model CL1872, S/N 0041082	Elec.	Server room	2007	90%
Heating	DHW, 50 gallons tank, 9kW, 208/1/60, 43.3A,	Mech Room	AO Smith, Model DRE 52 920, S/N K06M006046	Elec.	Whole Bldg.	2007	90%

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	Weather-strip exterior doors; weather-stripping will decrease the amount of conditioned air that is lost between the exterior door and frame
2a	Upgrade existing T12 fixtures that contain magnetic ballasts with T8 fixtures with electronic ballasts; see appendix A
2b	Upgrade interior lighting controls; see appendix A
3	Replace one 7.5HP motor and install VFD controls; Replace one standard efficiency motor installed on chilled water pump with a premium efficiency motor with VFD controls

ECM#1: *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 West building was intact but worn out in some areas and no longer performing as expected.

Installation cost:

Estimated installed cost: $370
Source of cost estimate: RS *Means*

Economics (without incentives):

Annual Savings						Lifetime		
Electric Savings (kWh)	Natural Gas Savings (therms)	Demand (kW)	Dollar Savings/year	SPP	LoM	Cost Savings	ROI	Annual Carbon Reduction (lbs of CO2)
-	68	0.0	$ 107	3.4	10	$ 907	14.5%	750

Economics (with incentives):

Annual Savings						Lifetime		
Electric Savings (kWh)	Natural Gas Savings (therms)	Demand (kW)	Dollar Savings/year	SPP	LoM	Cost Savings	ROI	Annual Carbon Reduction (lbs of CO2)
-	68	0.0	$ 107	3.4	10	$ 907	14.5%	750

Assumptions: SWA calculated the savings for this measure using measurements taken the day of the field visit and using the billing analysis. SWA calculated savings using eQUEST and assuming that infiltration would be reduce by 5% on any wall that included an exterior door that needed weather-stripping.

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#2a: *Upgrade interior lighting*

Description:

On the day of the site visit, SWA completed a lighting inventory of the West building on the RVCC campus. Since this building is the newest on campus, most of the lighting was up-to-date and would not be cost-effective to replace. There were approximately 12 fixtures in the stairwells of the West building that still had T12 fixtures with magnetic ballasts. SWA recommends replacing these T12 fixtures with T8 fixtures that include electronic ballasts. See Appendix A, Sheet 2 for complete lighting retrofit details.

Installation cost:

Estimated installed cost: $10,148
Source of cost estimate: RS *Means*

Economics (without incentives):

Annual Savings						Lifetime		
Electric Savings (kWh)	Natural Gas Savings (therms)	Demand (kW)	Dollar Savings/year	SPP	LoM	Cost Savings	ROI	Annual Carbon Reduction (lbs of CO2)
19,891	-	2.3	$ 3,083	3.3	20	$ 45,032	14.6%	35,615

Economics (with incentives):

Annual Savings						Lifetime		
Electric Savings (kWh)	Natural Gas Savings (therms)	Demand (kW)	Dollar Savings/year	SPP	LoM	Cost Savings	ROI	Annual Carbon Reduction (lbs of CO2)
19,891	-	2.3	$ 3,083	3.1	20	$ 45,032	18.3%	35,615

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 – 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 $360.

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#2b: *Upgrade interior lighting controls*

Description:

Currently, the West Building lighting is mostly controlled by manual switches. In most areas, lights are on from 7 am through 10 pm; in other areas, lights may be switched off by people owning responsibility for these areas, such as janitor owns responsibility for the janitor rooms. SWA performed an evaluation of installing occupancy sensors in large spaces, offices and bathrooms that may be left unoccupied a considerable amount of time throughout the day. Further details on the quantity and areas for the occupancy sensors recommendation be found in Appendix A, Sheet 3. Dual Technology occupancy sensors provide 360° of coverage and use both passive infrared and ultrasonic technologies to sense occupancy.

Installation cost:

Estimated installed cost: $10,120
Source of cost estimate: RS *Means*

Economics (without incentives):

Annual Savings						Lifetime		
Electric Savings (kWh)	Natural Gas Savings (therms)	Demand (kW)	Dollar Savings/year	SPP	LoM	Cost Savings	ROI	Annual Carbon Reduction (lbs of CO2)
56,006	-	-	$ 8,681	1.2	12	$ 85,387	62.0%	100,278

Economics (with incentives):

Annual Savings						Lifetime		
Electric Savings (kWh)	Natural Gas Savings (therms)	Demand (kW)	Dollar Savings/year	SPP	LoM	Cost Savings	ROI	Annual Carbon Reduction (lbs of CO2)
56,006	-	-	$ 8,681	1.1	12	$ 85,387	69.0%	100,278

Assumptions: SWA calculated the savings for this measure using reduced hours of operation after the installation of occupancy sensors; please see Appendix A, Sheet 3, for the new hours/day assumed.

Rebates/financial incentives:

NJ Clean Energy - Wall Mounted occupancy sensors ($20 per control)
Maximum incentive amount is $2,550.

Options for funding ECM:

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

ECM#3: *Replace one 7.5HP motor and install VFD controls*

Description:

On the day of the site visit, SWA observed that there were 7.5HP motors installed on each of 4 pumps connected to the main campus water loops. Two pumps are responsible for boosting water pressure for the chilled water loop within the building and the other two pumps are responsible for boosting water pressure for the hot water loop within the building. SWA observed that these pumps are used mainly as secondary pumps and it would not be cost-effective to retrofit motors on each pump. Instead, SWA recommends replacing a 7.5HP motor on one of the chilled water pumps with a NEMA premium efficiency motor with VFD controls. Increasing the controls capability and motor efficiency for this pump will save electricity that is consumed when operating the pump.

Installation cost:

Estimated installed cost: $1,800
Source of cost estimate: Similar Project

Economics (without incentives):

Annual Savings						Lifetime		
Electric Savings (kWh)	Natural Gas Savings (therms)	Demand (kW)	Dollar Savings/year	SPP	LoM	Cost Savings	ROI	Annual Carbon Reduction (lbs of CO2)
2,450	-	0.0	$ 380	4.7	10	$ 3,207	7.8%	4,387

Economics (with incentives):

Annual Savings						Lifetime		
Electric Savings (kWh)	Natural Gas Savings (therms)	Demand (kW)	Dollar Savings/year	SPP	LoM	Cost Savings	ROI	Annual Carbon Reduction (lbs of CO2)
2,450	-	0.0	$ 380	1.7	10	$ 3,207	39.3%	4,387

Assumptions: SWA assumes electrical savings based on heating loads calculated using eQUEST modeling and by conducting the billing analysis.

Rebates/financial incentives:

NJ Clean Energy – Premium Motors incentive, Incentive based on installing a Three-phase motor ($45-$700 per motor).
Maximum incentive amount is $700.

NJ Clean Energy – Variable Frequency Drives incentive, based on installing VFD controls ($60 per HP).
Maximum incentive amount is $450.

Options for funding ECM:

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

5. 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 for this building because it would not be cost effective to change to a geothermal system.

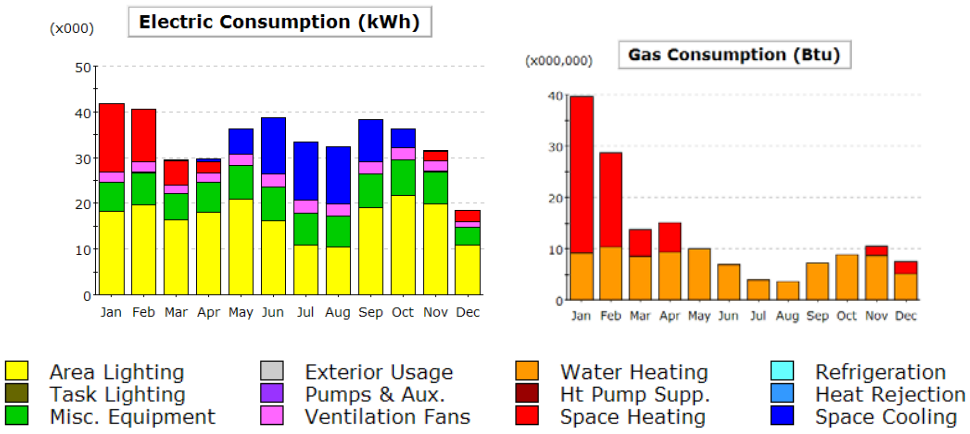
5.6. Wind

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 West 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 West building was surveyed from September 25th, 2007 through October 2nd, 2007. The results of the test revealed that the West building had a peak demand of 89.999 kW at 4:44pm on October 1st, 2007. Over the seven-day period, there was a cumulative power usage of 9.9241 MWh or approximately 1417.729 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, natural gas and electricity is provided to the West Building through the Main Campus gas and 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. The general service rate for natural gas 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. Typically, the natural gas prices increase during the heating months when natural gas is used by the rooftop air-handling units.

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.

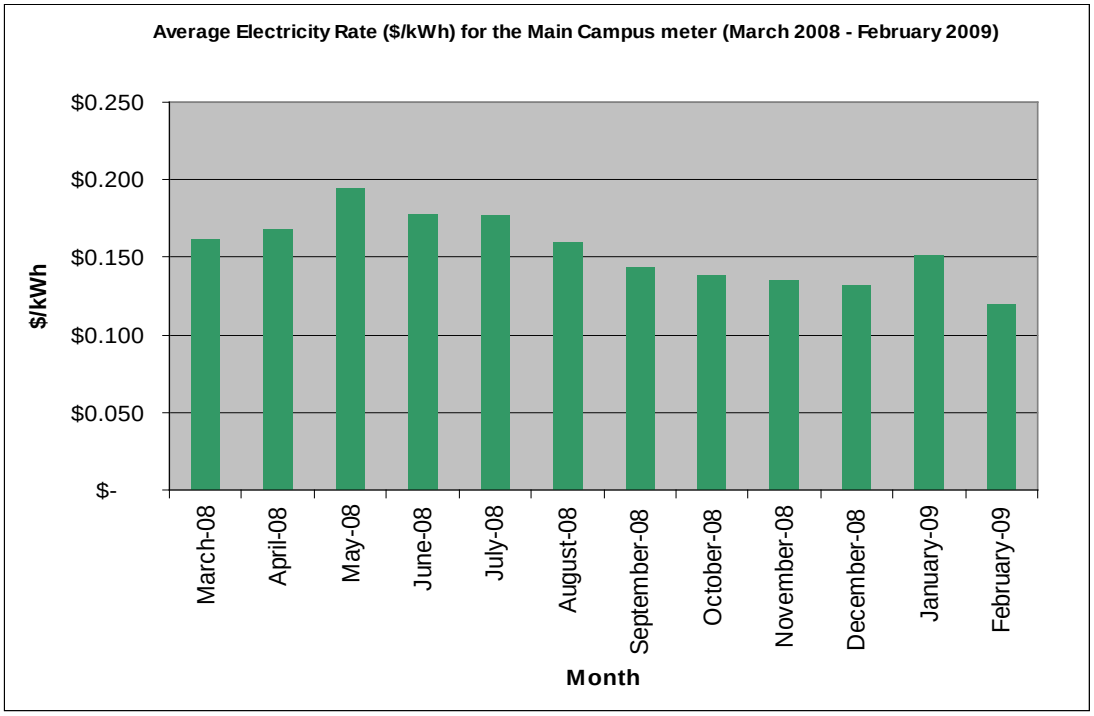
6.3. Energy Procurement strategies

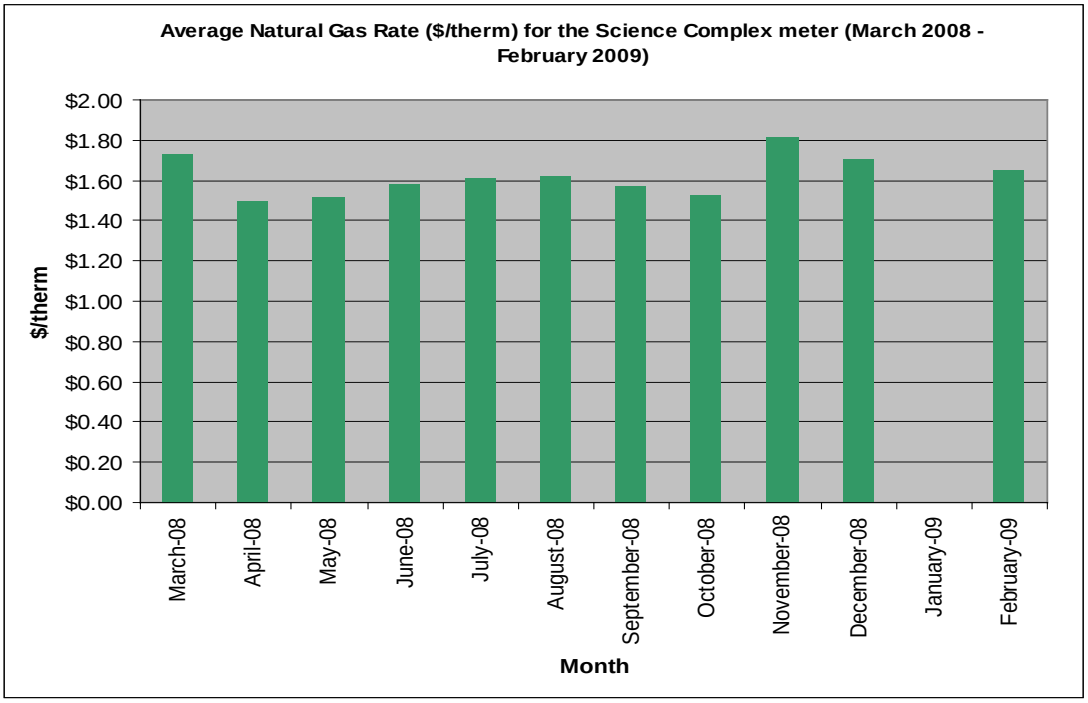
The West Building receives natural gas from the main campus meter which already uses an Energy Services Company (ESCO) that acts as a third party energy supplier. Additionally, it receives part of its electricity generated by CHP, and hence consumes some gas indirectly. Further, it is connected to the campus hot water loop, which is heated by gas metered at the central boiler.. 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 bill analysis shows fluctuations of 39% over the most recent 12 month period. Some of these fluctuations may have been caused by adjustments between estimated and actual meter readings; others may be due to 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. The West building annual utility costs are $6,042.07 higher for electric 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?	Total Power (Watts)
1	West Building	First	Stair 1 including vestibule and landing	24	4' linear T12	magnetic	3	1	Fluorescent	40	15	1800	Switch	No	120
2	West Building	First	Storage	21	4' linear T8	electronic	5	3	Fluorescent	32	2	960	Bi-level	No	480
3	West Building	First	Room 110A	64	4' linear T8	electronic	10	3	Fluorescent	32	12	11520	Switch	No	960
4	West Building	First	Room 110A	63	4' linear T8	electronic	4	2	Fluorescent	32	12	3072	Switch	No	256
5	West Building	First	Room 109A	67	4' linear T8	electronic	12	3	Fluorescent	32	12	13824	Switch	No	1152
6	West Building	First	Room 108A	53	4' linear T8	electronic	12	3	Fluorescent	32	12	13824	Switch	No	1152
7	West Building	First	Room 107A	46	4' linear T8	electronic	10	3	Fluorescent	32	12	11520	Switch	No	960
8	West Building	First	Room 106A	42	4' linear T8	electronic	10	3	Fluorescent	32	12	11520	Switch	No	960
9	West Building	First	Men's Room	36	4' linear T8	electronic	3	2	Fluorescent	32	15	2880	Switch	No	192
10	West Building	First	Men's Room	36	13W CFL	-	1	1	CFL	13	15	195	Switch	No	13
11	West Building	First	Women's Room	36	4' linear T8	electronic	3	2	Fluorescent	32	15	2880	Switch	No	192
12	West Building	First	Women's Room	36	13W CFL	-	1	1	CFL	13	15	195	Switch	No	13
13	West Building	First	Corridor	19	4' linear T8	electronic	10	2	Fluorescent	32	15	9600	Switch	No	640
14	West Building	1st/2nd/3rd Floors	Stairs and Vestibule	15	4' linear T12	magnetic	9	1	Fluorescent	40	15	5400	Switch	No	360
15	West Building	Second	Corridor	17	4' linear T8	electronic	19	2	Fluorescent	32	15	18240	Switch	No	1216
16	West Building	Second	Corridor	17	13W CFL	-	1	1	CFL	13	15	195	Switch	No	13
17	West Building	Second	Men's Room	42	4' linear T8	electronic	3	2	Fluorescent	32	15	2880	Switch	No	192
18	West Building	Second	Men's Room	42	13W CFL	-	1	1	CFL	13	15	195	Switch	No	13
19	West Building	Second	Women's Room	42	4' linear T8	electronic	3	2	Fluorescent	32	15	2880	Switch	No	192
20	West Building	Second	Women's Room	42	13W CFL	-	1	1	CFL	13	15	195	Switch	No	13
21	West Building	Second	Room W214	32	4' linear T8	electronic	16	3	Fluorescent	32	12	18432	Switch	No	1536
22	West Building	Second	Room W219 - Lounge	36	13W CFL	-	9	1	CFL	13	12	1404	Switch	No	117
23	West Building	Second	Room W219 - Lounge	36	13W CFL	-	9	1	CFL	13	2	234	Switch	No	117
24	West Building	Second	Room W219 - Lounge	36	13W CFL	-	5	2	CFL	13	12	1560	Switch	No	130
25	West Building	Second	Room W211 - Video Edit	73	4' linear T8	electronic	6	3	Fluorescent	32	12	6912	Switch	No	576
26	West Building	Second	MIS Help Desk	53	4' linear T8	electronic	6	3	Fluorescent	32	12	6912	Switch	No	576
27	West Building	Second	Room W205 - Multimedia	34	4' linear T8	electronic	10	3	Fluorescent	32	12	11520	Switch	No	960
28	West Building	Second	Room W205 - Multimedia	34	13W CFL	-	1	1	CFL	13	12	156	Switch	No	13
29	West Building	Second	Room W220	35	4' linear T8	electronic	3	2	Fluorescent	32	12	2304	Switch	No	192
30	West Building	Second	Room W220	35	13W CFL	-	16	2	CFL	13	12	4992	Switch	No	416
31	West Building	Second	Room W222	52	4' linear T8	electronic	26	3	Fluorescent	32	12	29952	Switch	No	2496
32	West Building	Second	Room W210 - Computer Lab	42	4' linear T8	electronic	12	3	Fluorescent	32	12	13824	Switch	No	1152
33	West Building	Second	Room W210 - Computer Lab	42	4' linear T8	electronic	4	1	Fluorescent	32	12	1536	Switch	No	128
34	West Building	Second	Room W212	45	4' linear T8	electronic	14	3	Fluorescent	32	12	16128	Switch	No	1344
35	West Building	Second	Room W213 - Computer Graphics	53	4' linear T8	electronic	16	3	Fluorescent	32	12	18432	Switch	No	1536
36	West Building	Second	Room W213	65	4' linear T8	electronic	2	2	Fluorescent	32	12	1536	Switch	No	128
37	West Building	Third	Corridor	22	4' linear T8	electronic	11	2	Fluorescent	32	15	10560	Switch	No	704
38	West Building	Third	Corridor	22	13W CFL	-	1	2	CFL	13	15	390	Switch	No	26
39	West Building	Third	Men's Room	31	4' linear T8	electronic	11	2	Fluorescent	32	15	10560	Switch	No	704
40	West Building	Third	Men's Room	31	13W CFL	-	1	1	CFL	13	15	195	Switch	No	13
41	West Building	Third	Women's Room	31	4' linear T8	electronic	3	2	Fluorescent	32	15	2880	Switch	No	192
42	West Building	Third	Women's Room	31	13W CFL	-	1	2	Fluorescent	13	15	390	Switch	No	26
43	West Building	Third	Student Lounge	34	13W CFL	-	15	2	Fluorescent	13	15	5850	Switch	No	390
44	West Building	Third	Room W311 - Computer Lab	56	4' linear T8	electronic	10	3	Fluorescent	32	12	11520	Switch	No	960
45	West Building	Third	Room W310 - Computer Lab	57	4' linear T8	electronic	8	3	Fluorescent	32	12	9216	Switch	No	768
46	West Building	Third	Room W309 - Computer Lab	63	4' linear T8	electronic	10	3	Fluorescent	32	12	11520	Switch	No	960
47	West Building	Third	Room W308 - Computer Lab	53	4' linear T8	electronic	16	3	Fluorescent	32	12	18432	Switch	No	1536
48	West Building	Third	Room W306 - Computer Lab	57	4' linear T8	electronic	10	3	Fluorescent	32	12	11520	Switch	No	960
49	West Building	Third	Room W306 - Computer Lab	57	4' linear T8	electronic	4	2	Fluorescent	32	12	3072	Switch	No	256
50	West Building	Third	Room W307	45	4' linear T8	electronic	14	3	Fluorescent	32	12	16128	Switch	No	1344
51	West Building	Third	Room W307	45	4' linear T8	electronic	4	2	Fluorescent	32	12	3072	Switch	No	256
52	West Building	Third	Office Corridor	17	13W CFL	-	16	1	CFL	13	12	2496	Switch	No	208
53	West Building	Third	Room W325 - Office	43	4' linear T8	electronic	2	3	Fluorescent	32	12	2304	Switch	No	192
54	West Building	Third	Room W324 - Office	45	4' linear T8	electronic	2	3	Fluorescent	32	12	2304	Switch	No	192
55	West Building	Third	Room W329 - Work Room	46	4' linear T8	electronic	3	3	Fluorescent	32	12	3456	Switch	No	288
56	West Building	Third	Offices	52	4' linear T8	electronic	12	3	Fluorescent	32	12	13824	Switch	No	1152

Appendix A: Lighting study (Sheet 2 – Proposed lights)

Proposed Lighting Conditions															
#	Building	Level/Floor	Location in Building	Measured Lighting Level in Footcandles	Fixture Type	Ballast Type	No. of Fixtures	No. of Lamps	Type of Lamp	Watts/Lamp	Hrs/Day	Energy Use (Watt hours/day)	Controls	Daylighting possible?	Total Power (Watts)
1	**West Building**	**First**	**Stair 1 including vestibule and landing**	**24**	**4' linear T8**	**electronic**	**3**	**1**	**Fluorescent**	**32**	**15**	**1440**	**Switch**	**No**	**96**
2	West Building	First	Storage	21	4' linear T8	electronic	5	3	Fluorescent	32	2	960	Bi-level	No	480
3	West Building	First	Room 110A	64	4' linear T8	electronic	10	3	Fluorescent	32	12	11520	Switch	No	960
4	West Building	First	Room 110A	63	4' linear T8	electronic	4	2	Fluorescent	32	12	3072	Switch	No	256
5	West Building	First	Room 109A	67	4' linear T8	electronic	12	3	Fluorescent	32	12	13824	Switch	No	1152
6	West Building	First	Room 108A	53	4' linear T8	electronic	12	3	Fluorescent	32	12	13824	Switch	No	1152
7	West Building	First	Room 107A	46	4' linear T8	electronic	10	3	Fluorescent	32	12	11520	Switch	No	960
8	West Building	First	Room 106A	42	4' linear T8	electronic	10	3	Fluorescent	32	12	11520	Switch	No	960
9	**West Building**	**First**	**Men's Room**	**36**	**4' linear T8**	**electronic**	**3**	**2**	**Fluorescent**	**32**	**8**	**1536**	**Switch**	**No**	**192**
10	**West Building**	**First**	**Men's Room**	**36**	**13W CFL**	**-**	**1**	**1**	**CFL**	**13**	**8**	**104**	**Switch**	**No**	**13**
11	**West Building**	**First**	**Women's Room**	**36**	**4' linear T8**	**electronic**	**3**	**2**	**Fluorescent**	**32**	**8**	**1536**	**Switch**	**No**	**192**
12	**West Building**	**First**	**Women's Room**	**36**	**13W CFL**	**-**	**1**	**1**	**CFL**	**13**	**8**	**104**	**Switch**	**No**	**13**
13	West Building	First	Corridor	19	4' linear T8	electronic	10	2	Fluorescent	32	15	9600	Switch	No	640
14	**West Building**	**1st/2nd/3rd Floors**	**Stairs and Vestibule**	**15**	**4' linear T8**	**electronic**	**9**	**1**	**Fluorescent**	**32**	**15**	**4320**	**Switch**	**No**	**288**
15	West Building	Second	Corridor	17	4' linear T8	electronic	19	2	Fluorescent	32	15	18240	Switch	No	1216
16	West Building	Second	Corridor	17	13W CFL	-	1	1	CFL	13	15	195	Switch	No	13
17	**West Building**	**Second**	**Men's Room**	**42**	**4' linear T8**	**electronic**	**3**	**2**	**Fluorescent**	**32**	**8**	**1536**	**Switch**	**No**	**192**
18	**West Building**	**Second**	**Men's Room**	**42**	**13W CFL**	**-**	**1**	**1**	**CFL**	**13**	**8**	**104**	**Switch**	**No**	**13**
19	**West Building**	**Second**	**Women's Room**	**42**	**4' linear T8**	**electronic**	**3**	**2**	**Fluorescent**	**32**	**8**	**1536**	**Switch**	**No**	**192**
20	**West Building**	**Second**	**Women's Room**	**42**	**13W CFL**	**-**	**1**	**1**	**CFL**	**13**	**8**	**104**	**Switch**	**No**	**13**
21	West Building	Second	Room W214	32	4' linear T8	electronic	16	3	Fluorescent	32	12	18432	Switch	No	1536
22	West Building	Second	Room W219 - Lounge	36	13W CFL	-	9	1	CFL	13	12	1404	Switch	No	117
23	West Building	Second	Room W219 - Lounge	36	13W CFL	-	9	1	CFL	13	2	234	Switch	No	117
24	West Building	Second	Room W219 - Lounge	36	13W CFL	-	5	2	CFL	13	12	1560	Switch	No	130
25	West Building	Second	Room W211 - Video Edit	73	4' linear T8	electronic	6	3	Fluorescent	32	12	6912	Switch	No	576
26	West Building	Second	MIS Help Desk	53	4' linear T8	electronic	6	3	Fluorescent	32	12	6912	Switch	No	576
27	West Building	Second	Room W205 - Multimedia	34	4' linear T8	electronic	10	3	Fluorescent	32	12	11520	Switch	No	960
28	West Building	Second	Room W205 - Multimedia	34	13W CFL	-	1	1	CFL	13	12	156	Switch	No	13
29	West Building	Second	Room W220	35	4' linear T8	electronic	3	2	Fluorescent	32	12	2304	Switch	No	192
30	West Building	Second	Room W220	35	13W CFL	-	16	2	CFL	13	12	4992	Switch	No	416
31	West Building	Second	Room W222	52	4' linear T8	electronic	26	3	Fluorescent	32	12	29952	Switch	No	2496
32	West Building	Second	Room W210 - Computer Lab	42	4' linear T8	electronic	12	3	Fluorescent	32	12	13824	Switch	No	1152
33	West Building	Second	Room W210 - Computer Lab	42	4' linear T8	electronic	4	1	Fluorescent	32	12	1536	Switch	No	128
34	West Building	Second	Room W212	45	4' linear T8	electronic	14	3	Fluorescent	32	12	16128	Switch	No	1344
35	West Building	Second	Room W213 - Computer Graphics	53	4' linear T8	electronic	16	3	Fluorescent	32	12	18432	Switch	No	1536
36	West Building	Second	Room W213	65	4' linear T8	electronic	2	2	Fluorescent	32	12	1536	Switch	No	128
37	West Building	Third	Corridor	22	4' linear T8	electronic	11	2	Fluorescent	32	15	10560	Switch	No	704
38	West Building	Third	Corridor	22	13W CFL	-	1	2	CFL	13	15	390	Switch	No	26
39	**West Building**	**Third**	**Men's Room**	**31**	**4' linear T8**	**electronic**	**11**	**2**	**Fluorescent**	**32**	**8**	**5632**	**Switch**	**No**	**704**
40	**West Building**	**Third**	**Men's Room**	**31**	**13W CFL**	**-**	**1**	**1**	**CFL**	**13**	**8**	**104**	**Switch**	**No**	**13**
41	**West Building**	**Third**	**Women's Room**	**31**	**4' linear T8**	**electronic**	**3**	**2**	**Fluorescent**	**32**	**8**	**1536**	**Switch**	**No**	**192**
42	**West Building**	**Third**	**Women's Room**	**31**	**13W CFL**	**-**	**1**	**2**	**Fluorescent**	**13**	**8**	**208**	**Switch**	**No**	**26**
43	West Building	Third	Student Lounge	34	13W CFL	-	15	2	Fluorescent	13	15	5850	Switch	No	390
44	West Building	Third	Room W311 - Computer Lab	56	4' linear T8	electronic	10	3	Fluorescent	32	12	11520	Switch	No	960
45	West Building	Third	Room W310 - Computer Lab	57	4' linear T8	electronic	8	3	Fluorescent	32	12	9216	Switch	No	768
46	West Building	Third	Room W309 - Computer Lab	63	4' linear T8	electronic	10	3	Fluorescent	32	12	11520	Switch	No	960
47	West Building	Third	Room W308 - Computer Lab	53	4' linear T8	electronic	16	3	Fluorescent	32	12	18432	Switch	No	1536
48	West Building	Third	Room W306 - Computer Lab	57	4' linear T8	electronic	10	3	Fluorescent	32	12	11520	Switch	No	960
49	West Building	Third	Room W306 - Computer Lab	57	4' linear T8	electronic	4	2	Fluorescent	32	12	3072	Switch	No	256
50	West Building	Third	Room W307	45	4' linear T8	electronic	14	3	Fluorescent	32	12	16128	Switch	No	1344
51	West Building	Third	Room W307	45	4' linear T8	electronic	4	2	Fluorescent	32	12	3072	Switch	No	256
52	West Building	Third	Office Corridor	17	13W CFL	-	16	1	CFL	13	12	2496	Switch	No	208
53	West Building	Third	Room W325 - Office	43	4' linear T8	electronic	2	3	Fluorescent	32	12	2304	Switch	No	192
54	West Building	Third	Room W324 - Office	45	4' linear T8	electronic	2	3	Fluorescent	32	12	2304	Switch	No	192
55	West Building	Third	Room W329 - Work Room	46	4' linear T8	electronic	3	3	Fluorescent	32	12	3456	Switch	No	288
56	West Building	Third	Offices	52	4' linear T8	electronic	12	3	Fluorescent	32	12	13824	Switch	No	1152

Totals		
Existing Usage (kWh/year)		142,094
Proposed Usage (kWh/year)		137,084
Existing Est. Cost ($/year)	$	22,024.53
Proposed Est. Cost ($/year)	$	21,248.04
Total kWh savings		19,891
Total $ Savings	$	3,083.11

Interior Lighting Total Watts	31633	Watts
Interior Lighting Power Density (W/sqft)	0.70	W/sqft

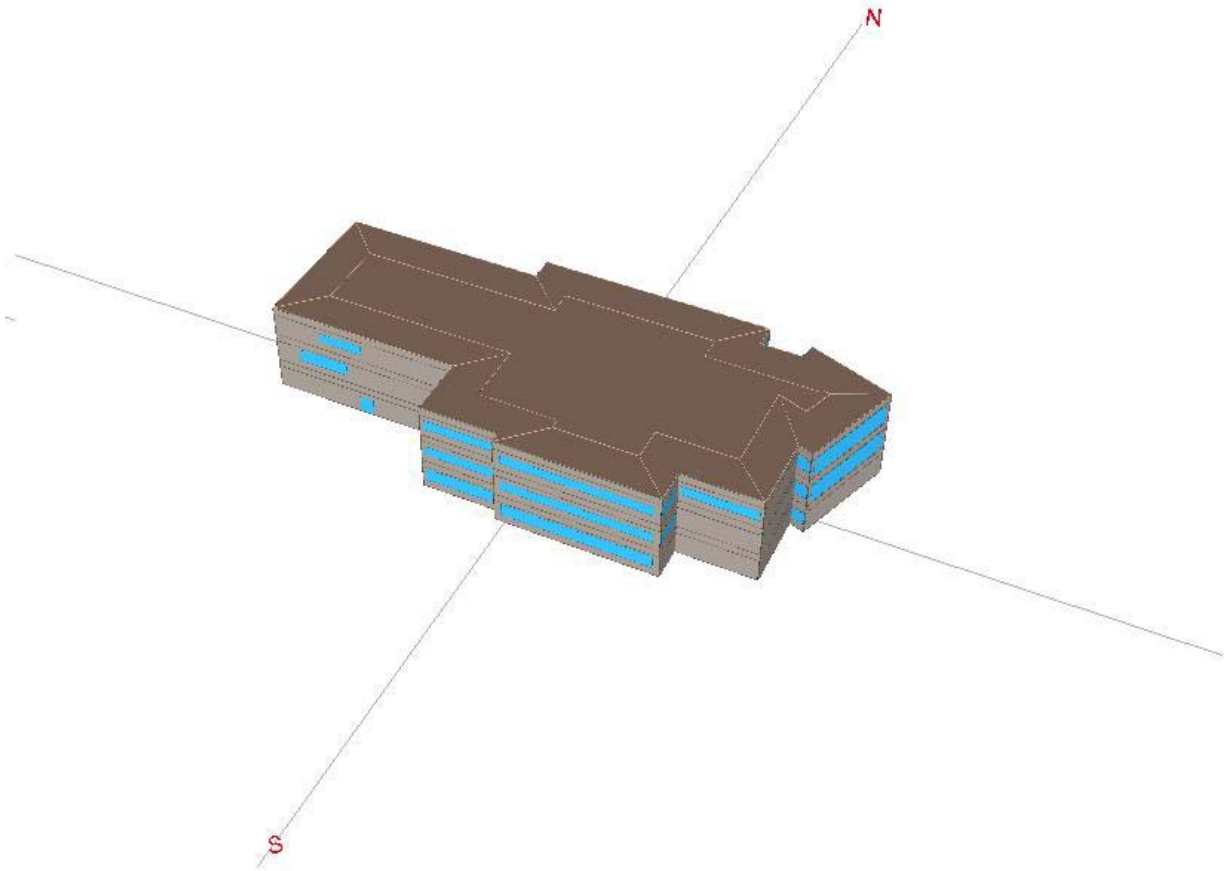
Proposed		
Interior Lighting Total Watts	31537	watts
Interior Lighting (W/sqft)	0.70	W/sqft

Appendix A: Lighting study (Sheet 3 – Proposed lighting controls)

Proposed Lighting Conditions with 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	number of new occupancy sensors	Daylighting possible?	Total Power (Watts)
1	**West Building**	**First**	**1 including vestibule and lar**	**24**	**4' linear T8**	**electronic**	**3**	**1**	**Fluorescent**	**32**	**12**	**1152**	**Occ sensor**	**1**	**No**	**96**
2	West Building	First	Storage	21	4' linear T8	electronic	5	3	Fluorescent	32	2	960	Bi-level		No	480
3	West Building	First	Room 110A	64	4' linear T8	electronic	10	3	Fluorescent	32	10	9600	**Occ sensor**	**1**	No	960
4	West Building	First	Room 110A	63	4' linear T8	electronic	4	2	Fluorescent	32	10	2560	**Occ sensor**	**1**	No	256
5	West Building	First	Room 109A	67	4' linear T8	electronic	12	3	Fluorescent	32	10	11520	**Occ sensor**	**1**	No	1152
6	West Building	First	Room 108A	53	4' linear T8	electronic	12	3	Fluorescent	32	10	11520	**Occ sensor**	**1**	No	1152
7	West Building	First	Room 107A	46	4' linear T8	electronic	10	3	Fluorescent	32	10	9600	**Occ sensor**	**1**	No	960
8	West Building	First	Room 106A	42	4' linear T8	electronic	10	3	Fluorescent	32	10	9600	**Occ sensor**	**1**	No	960
9	**West Building**	**First**	**Men's Room**	**36**	**4' linear T8**	**electronic**	**3**	**2**	**Fluorescent**	**32**	**6**	**1152**	**Occ sensor**	**1**	**No**	**192**
10	**West Building**	**First**	**Men's Room**	**36**	**13W CFL**	**-**	**1**	**1**	**CFL**	**13**	**8**	**104**	**Switch**		**No**	**13**
11	**West Building**	**First**	**Women's Room**	**36**	**4' linear T8**	**electronic**	**3**	**2**	**Fluorescent**	**32**	**6**	**1152**	**Occ sensor**	**1**	**No**	**192**
12	**West Building**	**First**	**Women's Room**	**36**	**13W CFL**	**-**	**1**	**1**	**CFL**	**13**	**8**	**104**	**Switch**		**No**	**13**
13	West Building	First	Corridor	19	4' linear T8	electronic	10	2	Fluorescent	32	12	7680	**Occ sensor**	**1**	No	640
14	**West Building**	**1st/2nd/3rd Floors**	**Stairs and Vestibule**	**15**	**4' linear T8**	**electronic**	**9**	**1**	**Fluorescent**	**32**	**12**	**3456**	**Occ sensor**	**1**	**No**	**288**
15	West Building	Second	Corridor	17	4' linear T8	electronic	19	2	Fluorescent	32	12	14592	**Occ sensor**	**1**	No	1216
16	West Building	Second	Corridor	17	13W CFL	-	1	1	CFL	13	15	195	Switch		No	13
17	**West Building**	**Second**	**Men's Room**	**42**	**4' linear T8**	**electronic**	**3**	**2**	**Fluorescent**	**32**	**6**	**1152**	**Occ sensor**	**1**	**No**	**192**
18	**West Building**	**Second**	**Men's Room**	**42**	**13W CFL**	**-**	**1**	**1**	**CFL**	**13**	**8**	**104**	**Switch**		**No**	**13**
19	**West Building**	**Second**	**Women's Room**	**42**	**4' linear T8**	**electronic**	**3**	**2**	**Fluorescent**	**32**	**6**	**1152**	**Occ sensor**	**1**	**No**	**192**
20	**West Building**	**Second**	**Women's Room**	**42**	**13W CFL**	**-**	**1**	**1**	**CFL**	**13**	**8**	**104**	**Switch**		**No**	**13**
21	West Building	Second	Room W214	32	4' linear T8	electronic	16	3	Fluorescent	32	10	15360	**Occ sensor**	**1**	No	1536
22	West Building	Second	Room W219 - Lounge	36	13W CFL	-	9	1	CFL	13	10	1170	**Occ sensor**	**1**	No	117
23	West Building	Second	Room W219 - Lounge	36	13W CFL	-	9	1	CFL	13	2	234	Switch		No	117
24	West Building	Second	Room W219 - Lounge	36	13W CFL	-	5	2	CFL	13	10	1300	**Occ sensor**	**1**	No	130
25	West Building	Second	Room W211 - Video Edit	73	4' linear T8	electronic	6	3	Fluorescent	32	10	5760	**Occ sensor**	**1**	No	576
26	West Building	Second	MIS Help Desk	53	4' linear T8	electronic	6	3	Fluorescent	32	10	5760	**Occ sensor**	**1**	No	576
27	West Building	Second	Room W205 - Multimedia	34	4' linear T8	electronic	10	3	Fluorescent	32	10	9600	**Occ sensor**	**1**	No	960
28	West Building	Second	Room W205 - Multimedia	34	13W CFL	-	1	1	CFL	13	12	156	**Occ sensor**	**1**	No	13
29	West Building	Second	Room W220	35	4' linear T8	electronic	3	2	Fluorescent	32	10	1920	**Occ sensor**	**1**	No	192
30	West Building	Second	Room W220	35	13W CFL	-	16	2	CFL	13	10	4160	**Occ sensor**	**1**	No	416
31	West Building	Second	Room W222	52	4' linear T8	electronic	26	3	Fluorescent	32	10	24960	**Occ sensor**	**1**	No	2496
32	West Building	Second	Room W210 - Computer Lab	42	4' linear T8	electronic	12	3	Fluorescent	32	10	11520	**Occ sensor**	**1**	No	1152
33	West Building	Second	Room W210 - Computer Lab	42	4' linear T8	electronic	4	1	Fluorescent	32	10	1280	**Occ sensor**	**1**	No	128
34	West Building	Second	Room W212	45	4' linear T8	electronic	14	3	Fluorescent	32	10	13440	**Occ sensor**	**1**	No	1344
35	West Building	Second	Room W213 - Computer Graphics	53	4' linear T8	electronic	16	3	Fluorescent	32	10	15360	**Occ sensor**	**1**	No	1536
36	West Building	Second	Room W213	65	4' linear T8	electronic	2	2	Fluorescent	32	10	1280	**Occ sensor**	**1**	No	128
37	West Building	Third	Corridor	22	4' linear T8	electronic	11	2	Fluorescent	32	12	8448	**Occ sensor**	**1**	No	704
38	West Building	Third	Corridor	22	13W CFL	-	1	2	CFL	13	15	390	Switch		No	26
39	**West Building**	**Third**	**Men's Room**	**31**	**4' linear T8**	**electronic**	**11**	**2**	**Fluorescent**	**32**	**6**	**4224**	**Occ sensor**	**1**	**No**	**704**
40	**West Building**	**Third**	**Men's Room**	**31**	**13W CFL**	**-**	**1**	**1**	**CFL**	**13**	**8**	**104**	**Switch**		**No**	**13**
41	**West Building**	**Third**	**Women's Room**	**31**	**4' linear T8**	**electronic**	**3**	**2**	**Fluorescent**	**32**	**6**	**1152**	**Occ sensor**	**1**	**No**	**192**
42	**West Building**	**Third**	**Women's Room**	**31**	**13W CFL**	**-**	**1**	**2**	**Fluorescent**	**13**	**8**	**208**	**Switch**		**No**	**26**
43	West Building	Third	Student Lounge	34	13W CFL	-	15	2	Fluorescent	13	12	4680	**Occ sensor**	**1**	No	390
44	West Building	Third	Room W311 - Computer Lab	56	4' linear T8	electronic	10	3	Fluorescent	32	10	9600	**Occ sensor**	**1**	No	960
45	West Building	Third	Room W310 - Computer Lab	57	4' linear T8	electronic	8	3	Fluorescent	32	10	7680	**Occ sensor**	**1**	No	768
46	West Building	Third	Room W309 - Computer Lab	63	4' linear T8	electronic	10	3	Fluorescent	32	10	9600	**Occ sensor**	**1**	No	960
47	West Building	Third	Room W308 - Computer Lab	53	4' linear T8	electronic	16	3	Fluorescent	32	10	15360	**Occ sensor**	**1**	No	1536
48	West Building	Third	Room W306 - Computer Lab	57	4' linear T8	electronic	10	3	Fluorescent	32	10	9600	**Occ sensor**	**1**	No	960
49	West Building	Third	Room W306 - Computer Lab	57	4' linear T8	electronic	4	2	Fluorescent	32	10	2560	**Occ sensor**	**1**	No	256
50	West Building	Third	Room W307	45	4' linear T8	electronic	14	3	Fluorescent	32	10	13440	**Occ sensor**	**1**	No	1344
51	West Building	Third	Room W307	45	4' linear T8	electronic	4	2	Fluorescent	32	10	2560	**Occ sensor**	**1**	No	256
52	West Building	Third	Office Corridor	17	13W CFL	-	16	1	CFL	13	10	2080	**Occ sensor**	**1**	No	208
53	West Building	Third	Room W325 - Office	43	4' linear T8	electronic	2	3	Fluorescent	32	10	1920	**Occ sensor**	**1**	No	192
54	West Building	Third	Room W324 - Office	45	4' linear T8	electronic	2	3	Fluorescent	32	10	1920	**Occ sensor**	**1**	No	192
55	West Building	Third	Room W329 - Work Room	46	4' linear T8	electronic	3	3	Fluorescent	32	10	2880	**Occ sensor**	**1**	No	288
56	West Building	Third	Offices	52	4' linear T8	electronic	12	3	Fluorescent	32	10	11520	**Occ sensor**	**1**	No	1152
														46		

Totals	
Proposed Usage with existing controls (kWh/year)	137,084
Proposed Usage with new controls (kWh/year)	81,078
Total kWh savings	56,006
Total annual $ Savings	$ 8,680.90

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		
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095 (800) 437-7872 www.hess.com	**BOC Energy Services, Inc.** 1135 Mountain Avenue Murray Hill, NJ 011374 (800) 247-2644 www.boc.com	**Commerce Energy, Inc.** 4400 Route 9 South, Suite 100 Freehold, NJ 07728 (800) 556-84113 www.commerceenergy.com
Constellation NewEnergy, Inc. 900A Lake Street, Suite 2 Ramsey, NJ 07446 (888) 635-0827 www.newenergy.com	**Direct Energy Services, LLC** 120 Wood Avenue Suite 611 Iselin, NJ 08830 (866) 547-2722 www.directenergy.com	**FirstEnergy Solutions Corp.** 300 Madison Avenue Morristown, NJ 0113113 (800) 977-0500 www.fes.com
Glacial Energy of New Jersey, Inc. 207 LaRoche Avenue Harrington Park, NJ 07640 (877) 569-2841 www.glacialenergy.com	**Integrys Energy Services, Inc.** 99 Wood Ave, South, Suite 802 Iselin, NJ 08830 (877) 763-9977 www.integrysenergy.com	**Strategic Energy, LLC** 55 Madison Avenue, Suite 400 Morristown, NJ 011360 (888) 925-9115, www.sel.com
Liberty Power Holdings, LLC Park 80 West, Plaza II, Suite 200 Saddle Brook, NJ 07663 (866) 769-31139 www.libertypowercorp.com	**Pepco Energy Services, Inc.** 112 Main St. Lebanon, NJ 08833 (800) ENERGY-9 (363-7499) www.pepco-services.com	**PPL EnergyPlus, LLC** 811 Church Road Cherry Hill, NJ 08002 (800) 281-2000 www.pplenergyplus.com
Sempra Energy Solutions The Mac-Cali Building 581 Main Street, 8th Floor Woodbridge, NJ 07095 (877) 273-6772 www.semprasolutions.com	**South Jersey Energy Company** One South Jersey Plaza Route 54 Folsom, NJ 08037 (800) 800-756-3749 www.south jerseyenergy.com	**Suez Energy Resources NA, Inc.** 333 Thornall Street 6th Floor Edison, NJ 08837 (888) 644-1014 www.suezenergyresources.com
UGI Energy Services, Inc. 704 East Main Street, Suite 1 Moorestown, NJ 080113 (856) 273-9995 www.ugienergyservices.com	**American Powernet Management, LP** 437 North Grove St. Berlin, NJ 08009 (800) 437-7872 www.hess.com	**ConEdison Solutions** Cherry Tree, Corporate Center 1135 State Highway 38 Cherry Hill, NJ 08002 (888) 625-0955 www.conedsolutions.com
Credit Suisse, (USA) Inc. 700 College Road East Princeton, NJ 08450 212-1138-3124 www.creditsuisse.com	**Sprague Energy Corp.** 12 Ridge Road Chatham Township NJ 011328 (800) 225-1560 www.spragueenergy.com	

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