



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

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

For

***Physical Education 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 Physical Education Building only.

The Physical Education Building houses police academy training facilities/offices besides the indoor pool, gymnasium, basketball court and some additional small offices. The building is two stories consisting of 52,000 square feet. The building is operated on weekdays 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 Physical Education 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 Physical Education 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 Physical Education building consumed 56,646 therms of gas during this period at a total cost of \$77,155.88.

SWA benchmarked the 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 7 Energy Conservation Measures (ECMs) for the Physical Education Building. The total investment cost for these ECMs is **\$206,628**. The total investment cost for these ECMs if maximum incentives are achieved is **\$193,392**. SWA estimates a first year savings of **\$41,096** with a simple payback of **5.0 years**. SWA estimates that implementing the recommended ECMs will reduce the carbon footprint of the Arts building by **252,565 lbs of CO₂ annually**.

There are various incentives that the Physical Education building could apply for that could also help lower the cost of installing the ECMs. SWA recommends that the Physical Education 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 \$2,600 for lighting, up to \$1080 for upgrading lighting controls, \$11,688 for upgrading interior lighting, \$468 for replacing electric DHW heaters and \$300 for installing high efficiency gas heating. The total amount of incentives available for the Physical Education Building is **\$13,236** and the total investment cost if all the incentives are paid to their maximum amount is **\$193,392**.

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

ECM Table without Incentives		Installed Cost		1st year energy savings								Lifetime			Annual Carbon Reduction
ECM#	ECM description	Estimated \$	Source	Electric Savings (kWh)	Unit	Natural Gas Savings (therms)	Unit	Demand	Unit	\$ Savings/year	SPP	LoM	Cost Savings	ROI	(lbs of CO2)
1	Upgrade existing lighting	\$ 35,834	RSMMeans	35,863	kWh	-	therms	4.1	kW	\$ 5,810	6.2	20	\$ 84,858	6.8%	64,213
2	Upgrade interior lighting controls	\$ 11,880	RSMMeans	19,476	kWh	-	therms	0.0	kW	\$ 3,155	3.8	12	\$ 31,034	13.4%	34,871
3	Weather-strip exterior doors	\$ 264	RSMMeans	-	kWh	47	therms	0.0	kW	\$ 76	3.5	10	\$ 643	14.4%	518
4	Replace electric DHW heaters	\$ 12,650	Similar project	18,440	kWh	-862	therms	2.1	kW	\$ 1,462	8.7	25	\$ 24,896	3.9%	23,515
5	Replace pneumatic controls	\$ 104,000	Vendor	11,506	kWh	3,998	therms	1.8	kW	\$ 12,420	8.4	25	\$ 211,532	4.1%	64,671
6	Connect pool to campus HW loop	\$ 35,000	RSMMeans	-	kWh	1,368	therms	0.0	kW	\$ 12,575	2.8	25	\$ 214,171	20.5%	15,079
7	Install demand controlled ventilation (DCV) technology	\$ 7,000	Similar project	15,770	kWh	1,947	therms	1.8	kW	\$ 5,598	1.3	10	\$ 47,272	57.5%	49,698
Total	Total Scope of Work	\$ 206,628	-	101,054	-	6,498		9.7	-	\$ 41,096	5.0		\$ 567,133		252,565

ECM Table including Incentives		Installed Cost		1st year energy savings								Lifetime			Annual Carbon Reduction
ECM#	ECM description	Estimated \$	Source	Electric Savings (kWh)	Unit	Natural Gas Savings (therms)	Unit	Demand	Unit	\$ Savings/year	SPP	LoM	Cost Savings	ROI	(lbs of CO2)
1	Upgrade existing lighting	\$ 24,146	RSMMeans	35,863	kWh	-	therms	4.1	kW	\$ 5,810	4.2	20	\$ 84,858	12.6%	64,213
2	Upgrade interior lighting controls	\$ 10,800	RSMMeans	19,476	kWh	-	therms	0.0	kW	\$ 3,155	3.4	12	\$ 31,034	15.6%	34,871
3	Weather-strip exterior doors	\$ 264	RSMMeans	-	kWh	47	therms	0.0	kW	\$ 76	3.5	10	\$ 643	14.4%	518
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Total	Total Scope of Work	\$ 193,392	-	101,054	-	6,498		9.7	-	\$ 41,096	4.7		\$ 614,406		252,565

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

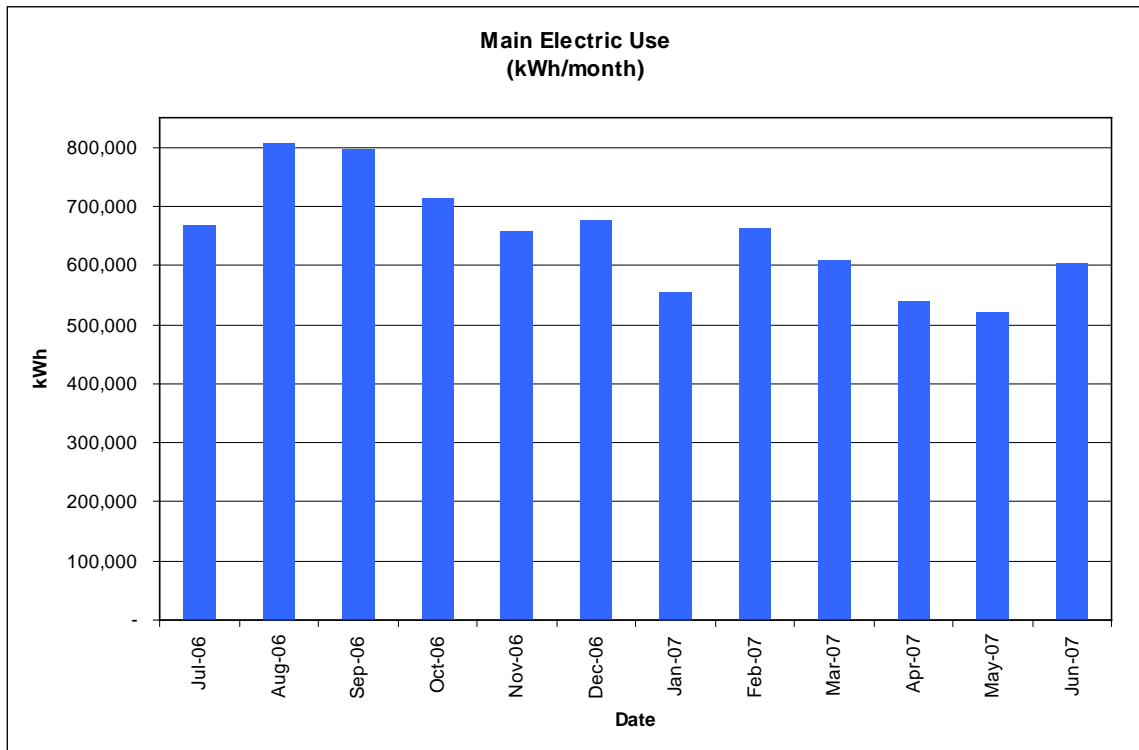
1.1. Energy usage and cost analysis

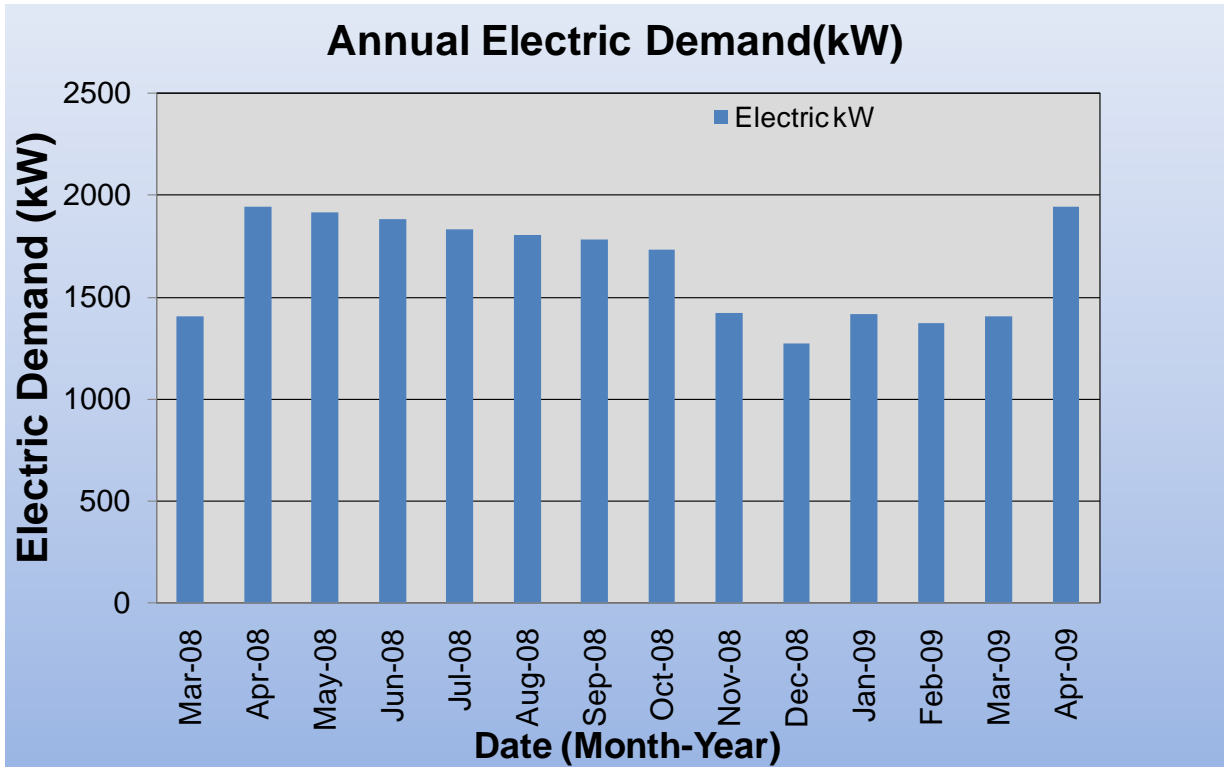
SWA analyzed utility bills from March 2008 through February 2009 that were received from Raritan Valley Community College.

Electricity – The Physical Education 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.

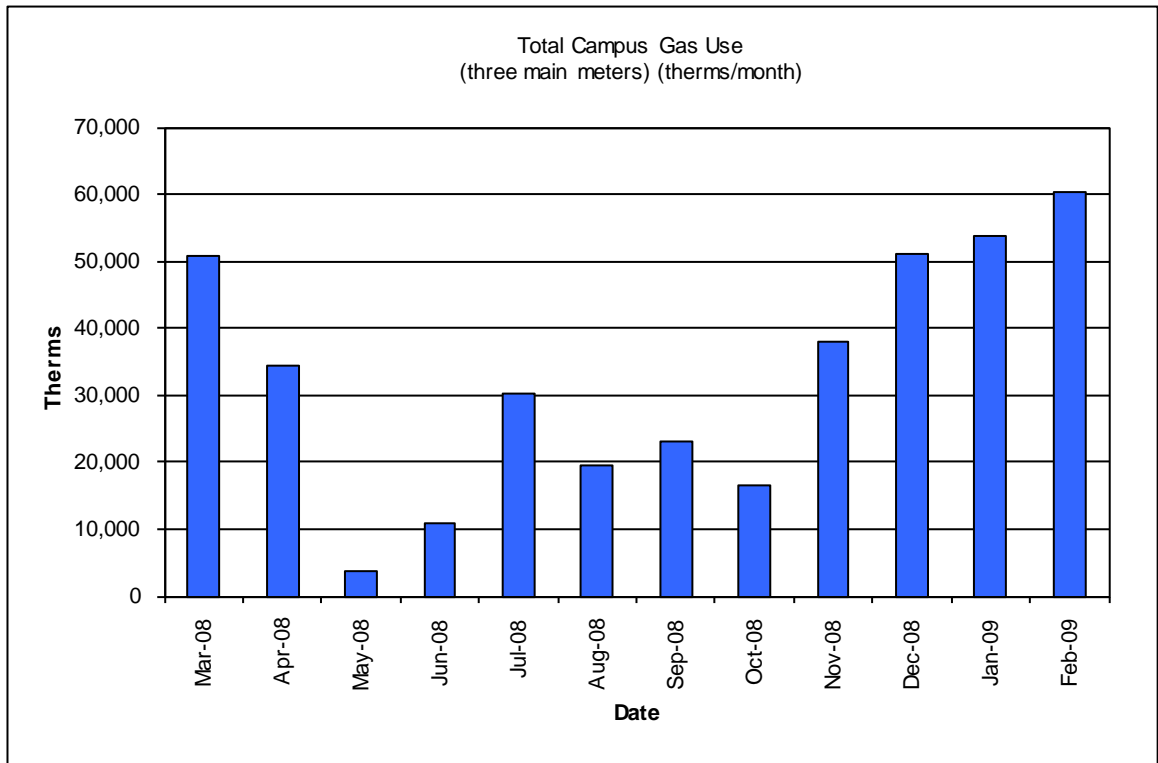
Natural Gas – The Physical Education Building is currently not metered separately for natural gas. The Campus buys natural gas for its three main meters mentioned above from a third-party Energy Service Company (ESCO) via PSE&G at **an average aggregated rate of \$1.36/therm** based on the previous 12 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 Physical Education building alone on pro-rata basis of its square footage. This building consumed **56,646 therms of gas during this period at a total cost of \$77,155.88.**

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.

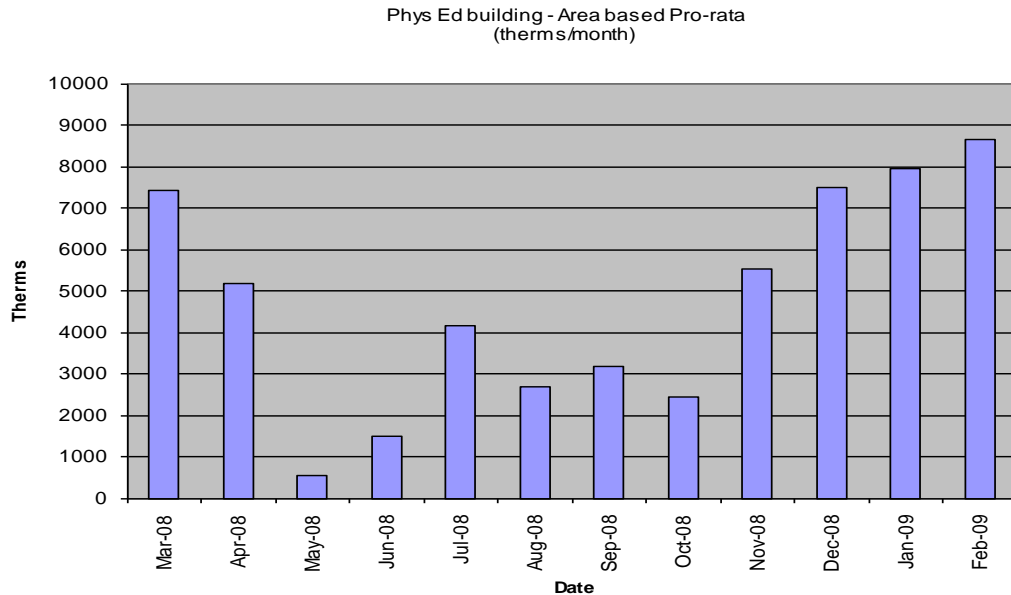




The following chart shows natural gas usage for the Main Campus meter based on utility bills for the 12 month period of March 2008 – February 2009.



Since the Physical Education 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

Electricity is received from the Main Campus electric meter which is purchased from JCP&L at a general service market rate for electricity usage (kWh) with a separate (kW) demand charge. The Main Campus electric meter 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 Physical Education 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 62 for ventilation for acceptable indoor air quality, ASHRAE Standard 55 for thermal comfort, and IESNA Lighting Handbook for lighting quality.

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

EPA Form 5900-16

2. FACILITY AND SYSTEMS DESCRIPTION

2.1. Building Characteristics

The Physical Education Building consists of a two stories with a total area of 52,000 square feet. The building is over 30 years old and houses police academy training facilities/offices besides the indoor pool, gymnasium, basketball court and some additional small offices.

2.2. Building occupancy profiles

The peak occupancy for the Physical Education Building is approximately 100 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 exterior walls consist of 4" face bricks and stone lintels. 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 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 flat roof is constructed of EPDM rubber with stone ballast on tapered rigid insulation over a metal deck. The stone ballast is a light gray color. SWA has determined that it is not cost-effective to replace the roof at this time since the surface is relative new. However, SWA recommends that in the future when the roof is replaced, that a well-insulated roof is installed with an Energy Star reflective surface to cut down on solar heat gain and to reduce the amount of heat loss throughout the building.

2.3.3. Base

The building's base is a 4" concrete slab-on grade and perimeter foundation. No insulation was detected. A considerable portion of the first floor is below grade. 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 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 are aluminum-framed units with no insulating properties or films. The exterior doors of the building were observed to have little or no weather-stripping. 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 Physical Education Building was observed to be a relatively tight building with the exception of the exterior doors. 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 Physical Education Building is fed from existing campus chilled water (CHW) and hot water (HW) loop connection; however, at the time of original design, only HW loop was connected.

The entire Physical Education Building area is heated from the HW loop connection. Forced fan unit heaters and forced air handling units (AHUs), electric duct heaters and ventilators are serving spaces on the first and second floor. SWA recommends that the electric heat units are removed and that all of the heating loads of the building are met by the current hot water loop. SWA also observed that the building currently uses pneumatic controls to control the HVAC system. SWA recommends replacing pneumatic controls with newer DDC controls.

2.4.2. Cooling

The majority of spaces in the Physical Education Building are not cooled presently. Fitness center is cooled by a DX split unit, and offices have their own unitary a/c. AH-4 serving offices, corridor, and locker rooms is planned to incorporate cooling by connecting to the CHW loop. There is no cooling in the gymnasium and pool areas.

2.4.3. Ventilation

The Physical Education Building uses rooftop exhaust fans to induce fresh air into the building spaces; Electric Domestic Hot Water units do not require additional ventilation for combustion air. The pool has two large exhaust fans in the high ceiling of the space that satisfactorily handle the general exhaust and moisture from the space. The gymnasium also has two large exhaust fans in the high ceiling of the space. According to building staff, the gymnasium exhaust fans adequately handle the exhaust from the space.

RVCC is currently renovating an area located on the 2nd floor of the Physical Education building and installing a fitness facility. The ventilation to the gymnasium and fitness facility is set at a continuous design rate and is currently not controlled by any type of sensor. SWA recommends that the air-handling units (AHUs) that provide ventilation to these areas are

controlled using Demand Control Ventilation (DCV). A carbon dioxide sensor can be installed in the return ducts from these areas that call for ventilation only when a set level of carbon dioxide is sense in the return duct.

2.4.4. Domestic Hot Water

Domestic Hot Water is provided by two electric Domestic Hot Water (DHW) heaters with 120 gallon storage capacity. These units are 36kW, 3 phase and have approximately 50% of their remaining life. SWA recommends replacing these electric DHW heaters with one gas-fired condensing DHW boiler that is more efficient.

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 – The Physical Education Building currently consists of different types of lighting by space type. Some areas such as the Facilities office and the second floor South entrance are in the process of being retrofitted with T8 or T5 fixtures. 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 recommends retrofitting gymnasium lighting with newer T5 lighting to provide better quality light as well as lower electricity usage. SWA also recommends installing occupancy sensors in the mechanical rooms as well as the 2nd floor bathrooms. Since mechanical rooms and 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 a mixture of 5W LED exit signs and 20W fluorescent exit signs installed. SWA recommends replacing all fluorescent exit signs with newer LED exit signs.

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 Physical Education 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 Physical Education Building contains no elevator.

2.5.4. Pool

The Physical Education Building houses a pool on the second floor that is currently heated by an atmospheric hot water boiler. SWA recommends that RVCC connects the pool to the main HW campus loop, leaving the existing boiler as a backup for summer operation only. There are also electric pumps that help provide water to the pool and also provide circulation. SWA evaluated the replacement of these pumps and have deemed it is not cost effective to replace the pumps at this time since they still have approximately 85% remaining useful life.

The swimming pool has two large exhaust fans in the high ceiling of the space that satisfactorily handle the general exhaust and moisture from the space.

2.5.5. Other 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 %
Ventilation	EF: Mushroom type roof ventilator	Roof	Dayton, model 4YY11, S/N 10881466 0705	Elec.	N/A	1973	0%
Cooling	Condensing Unit, 460/3/60, 7.4MCA - 2 stage	Roof	Carrier, model 09DK-028-600; S/N 0301F57601	Elec.	Fitness center	1999	35%
Cooling	Indoor unit for CU above	Level 3 Mechanical room	Carrier, name plate N/A	Elec.	Fitness center	1999	50%
H/V	AH4: Currently being replaced - 10300cfm, 100%OA, 20hp fan	Level 3 Mechanical room	Carrier, model 27B41004T-109, S/N 7415 42084	Elec.	Locker room, offices, and corridor	1973	0%
H/V	AH2: High ceiling mounted, 14400cfm, 4800cfm OA, 15hp Leland Faraday motor	Level 3 Mechanical room	Carrier; name plate N/A	Elec.	East end of gymnasium	1973	0%
H/V	AH1: 23150cfm, 100%OA, 15hp, WEQ motor,	Level 3 Mechanical room	Carrier, model 27BA1303T-109; S/N 7415 42081	Elec.	Pool	1973	0%
H/V	AH3: High ceiling mounted, 14400cfm, 4800cfm OA, 15hp motor	Level 3 Mechanical room	Carrier; name plate N/A	Elec.	West end of gymnasium	1973	0%
Ventilation	EF8: 10540 cfm, general exhaust	Level 3 Mechanical room	Trane, M series Climate change AH, s/n K04G97504	Elec.	Whole building	2006	85%
Controls	Air compressor, 2x1.5hp motors, Dayton; tank 150psi @450deg F	Level 3 mechanical room	Curtis Toledo, Compressor Model ES-20; S/N AG091313	Elec.	HVAC system actuators	1997	0%
Heating	Unit heater, ceiling mounted, hot water, 1/2hp motor	Level 3 Mechanical room	Trane, Model S-CU, s/n 31-01422	Elec.	Level 3 Mechanical room	1973	0%
Heating	P-1,2: Hot water pumps connected; 415 gpm, 55 ft head; 7.5 hp motors; P2 being replaced currently - n/a at site	Mechanical room D	Crane, Model 4121, s/n 30700999	Elec.	AH systems, RAC, CH-College center and Physical bldg.	1973	0%
Heating	Hot water heat exchanger used as preheater to DHW; 150psi @ 200 deg F; Not used anymore; qty 2	Mechanical room D	Southern Abrasives, 286, S/N 231-2, and 291-1	None	DHW	1973	0%
Heating	DHW tank, 119.9 gallons, 480/3/60, 36kW total	Mechanical room D	Rheem, Model 6E747A, S/N VG 1099E00411	Elec.	Whole building	2001	50%
Heating	DHW tank, 119.9 gallons, 480/3/60, 36kW total	Mechanical room D	Rheem, Model 6E747A, S/N nameplate missing	Elec.	Whole building	2001	50%

Building System	Description	Location	Model#	Fuel	Space served	Year Equip Installed	Remaining useful life %
Heating	Pool heating boiler, direct vented, category 1, 120/1/60; 400MBH i/p, 335 o/p, c/w 1/4hp Armstrong circulator	Pool Mechanical room	Lochinvar, Model CHN401, S/N 1987992	Elec.	Pool heating	2008 (the date of mfr is old - approx. 10 years old)	50%
Cooling	P4: chilled water pump for College bldg., 702gpm, 230/460-1-60, new Reliance electric 25hp high eff. Motor	Pool Mechanical room	Crane, model 4121, s/n 070095	Elec.	College center	1973	0%
HVAC	P5,7: scheduled water pump, 345gpm, 74'head, 10hp motor (old)	Pool Mechanical room	Crane, model 4121, s/n 0730999, and 50700999	Elec.	Scheduled water service	1973	0%
Heating	P6: 230 gpm, 64'head, 7.5hp motor	Pool Mechanical room	Crane, model 4111, s/n 20700999	Elec.	Reheat coil	1973	0%
Heating	P8,9: Boiler heater pumps, 85gpm, 30' head,3hp, 208-230/1/60, 78.5% eff.	Pool Mechanical room	Crane, model G-830-A, s/n 6046-5A	Elec.	Boiler heater	1973	0%

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

SWA considered the following improvements:

Capital Improvement Measures

- Most of the air handling equipment along with return fans was installed in 1973 and is past its service life. SWA recommends replacing systems AHU 1,2,3,&4 along with the return air fans. The energy savings will be marginal compared to the cost of replacement, which is estimated upwards of \$0.7million.
- The building personnel expressed need for cooling in office and other areas served by AH-4. SWA recommends connecting cooling to this unit from the main campus chilled water loop. A new Heat recovery unit is also recommended as the present AH-4 is 100% outside air unit. The total budget for this work is approximately \$350,000.

Summary table

ECM#	Description
1	Upgrade existing lighting; upgrade all T12 magnetic fixtures to T8 electronic fixtures. Also upgrade any remaining fluorescent exit signs with new 5W LED models; see appendix A
2	Upgrade interior lighting controls; see appendix A
3	Weather-strip exterior doors; weather-stripping will decrease the amount of conditioned air that is lost between the exterior door and frame
4	Replace electric DHW heaters; replacing electric heating units with condensing gas-fired water heaters will save energy consumption and reduce costs of expensive electric energy
5	Replace pneumatic controls; pneumatic controls lose accuracy overtime and newer DDC digital controls remain calibrated resulting in energy savings as well as increased comfort
6	Connect pool to campus HW loop; the current HW loop capacity for the campus can support the heat load of the swimming pool during the months that the HW loop is operating
7	Install demand controlled ventilation (DCV) technology; carbon dioxide sensors should be installed in the return duct for the gymnasium and fitness center area air handling units. This sensor will allow the fan providing ventilation to be turned on only when there is a demand for ventilation. This allows the fan to turn off and reduce excessive use when not necessary.

ECM#1: Upgrade existing lighting

Description:

On the day of the site visit, SWA completed a lighting inventory of the Physical Education Building on the RVCC campus. Existing lighting is currently being retrofitted in portions of the building but much of the building still uses T12 fixtures with magnetic ballasts and some fluorescent exit signs. SWA recommends replacing all T12 magnetic fixtures with T8 electronic fixtures as well as fluorescent exit signs with LED exit signs. See Appendix A, Sheet 2 for complete lighting retrofit details.

Currently, the Physical Education building uses 400W metal halide fixtures in the gymnasium for lighting. There are 32 metal halide fixtures installed currently that require an excessive amount of power to produce poor quality light. A fixture containing a single 400W metal halide light bulb consumes 454W of power continuously compared to a 4-lamp T5 fixture that consumes 228W of power continuously and provides a better quality light.

Installation cost:

Estimated installed cost: \$35,834
 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		
35,863	-	4.1	\$ 5,810	6.2	20	\$ 84,858	6.8%	64,213

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		
35,863	-	4.1	\$ 5,810	4.2	20	\$ 84,858	12.6%	64,213

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 \$2,580.

*NJ Clean Energy – LED Exit signs (\$10/\$20 per fixture)
Maximum incentive amount is \$20.*

*NJ Clean Energy – Prescriptive Lighting Incentive, Incentive based on installing T-5 and T-8 High Bay Fixtures (\$16-\$284 per fixture).
Maximum incentive amount of \$9,088*

Options for funding ECM:

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

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

ECM#2: Upgrade interior lighting controls

Description:

Currently, the Physical Education 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, gymnasium, 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 can 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: \$11,880
 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		
19,476	-	-	\$ 3,155	3.8	12	\$ 31,034	13.4%	34,871

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		
19,476	-	-	\$ 3,155	3.4	12	\$ 31,034	15.6%	34,871

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 \$1080.*

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: 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 Physical Education building was intact but worn out in some areas and no longer performing as expected.

Installation cost:

Estimated installed cost: \$264

Source of cost estimate: RSMeans

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		
-	47	0.0	\$ 76	3.5	10	\$ 643	14.4%	518

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

Rebates/financial incentives:

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

Options for funding ECM:

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

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

ECM#4: *Replace electric DHW heaters*

Description:

Currently, the Physical Education Building uses two electric Domestic Hot Water heaters to meet current hot water demand. These heaters have a capacity of 36 kW and 120 gallons of storage capacity. Electricity is the most expensive way to heat water and it is also inefficient. SWA recommends replacing these electric units with a single gas-fired condensing unit that is capable of meeting the same demands. Newer condensing type water heaters can reach up to 95% efficiency and will cost much less to operate.

Installation cost:

Estimated installed cost: \$12,650
 Source of cost estimate: Similar project

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		
18,440	-862	2.1	\$ 1,462	8.7	25	\$ 24,896	3.9%	23,515

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		
18,440	-862	2.1	\$ 1,462	5.0	25	\$ 25,896	9.5%	23,515

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 – Natural Gas Water Heating, Gas-fired water heaters >50 gallons (\$1.00-\$2.00 per MBH)
 Maximum incentive amount is \$468 based on current size of system.*

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: Replace pneumatic controls

Description:

Currently, the Physical Education Building uses older pneumatic controls to control the HVAC system throughout the building. Pneumatic controls lose accuracy over time and are much less efficient than newer digital DDC control systems. SWA recommends replacing existing pneumatic controls with a programmable digital DDC control system.

Installation cost:

Estimated installed cost: \$104,000

Source of cost estimate: Vendor

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		
11,506	3,998	1.8	\$ 12,420	8.4	25	\$ 211,532	4.1%	64,671

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		
11,506	3,998	1.8	\$ 12,420	8.4	25	\$ 211,532	4.1%	64,671

Assumptions: SWA calculated the savings for this measure using measurements taken the day of the field visit and using the billing analysis. SWA assumes that replacing pneumatic controls with digital DDC controls is the equivalent of changing the thermostatic set points by 2°F. By assuming a set point change of 2°F, installing DDC controls will save approximately 5% of heating and cooling costs. Additionally, there will be pneumatic compressor savings and operation & maintenance savings, which is estimated based on 1 hour per week savings of an O&M personnel

Rebates/financial incentives:

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

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#6: *Connect pool to campus HW loop*

Description:

The Physical Education Building contains a 25m competitive short course swimming pool on the second floor. This pool is currently heated inefficiently by a large atmospheric boiler. Based on capacity of the campus-wide CHP system that feeds the chilled water/hot water loops, SWA recommends shifting the pool heating load to campus hot water loop, and leaving the existing boiler in place as a back up for summer heating only. Savings shown have a negative ROI because this measure includes savings during the heating season only.

Installation cost:

Estimated installed cost: \$35,000
 Source of cost estimate: Provided by vendor to RVCC

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		
-	1,368	0.0	\$ 12,575	2.8	25	\$ 214,171	20.5%	15,079

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		
-	1,368	0.0	\$ 12,575	2.8	25	\$ 214,171	20.5%	15,079

Assumptions: SWA calculated the savings for this measure using measurements taken the day of the field visit and using the billing analysis. The heating load of the pool was calculated using the Shah method. SWA calculated existing usage using estimating an efficiency of 75% and calculated savings by assuming that the efficiency would increase to 85%. Savings were calculated assuming that the pool would be heated by the campus loop for 7 months out of the year. There could be additional savings in kWh from pumps, if the central plant pumps could develop enough pressure to obviate the local pool pumps. Additional cost savings resulted from maintenance savings of approximately \$6,000 per year, and from the 50cents/therm rate differential of gas costs between main gas meter and boiler gas meters applicable for non-summer months only.

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: Install demand controlled ventilation

Description:

The Physical Education Building is currently undergoing renovation to install a fitness center. Currently, the ventilation systems available to both the gymnasium and proposed fitness center have no controls for ventilation. SWA recommends that the Physical Education building install CO₂ sensors to limit the amount of energy that is used when the gym is not being used. SWA recommends installing two CO₂ sensors in the return ducts of the ventilation system. The ventilation system should ventilate according to ASHRAE minimum standards and when a set level of CO₂ is sensed in the return ducts of the specified spaces, and then the fan power would increase in order to meet ventilation based on occupancy.

Installation cost:

Estimated installed cost: \$7,000
 Source of cost estimate: Similar project

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		
15,770	1,947	1.8	\$ 5,598	1.3	10	\$ 47,272	57.5%	49,698

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		
15,770	1,947	1.8	\$ 5,598	1.3	10	\$ 47,272	57.5%	49,698

Assumptions: SWA calculated the savings for this measure using measurements taken the day of the field visit and using the billing analysis. SWA assumes that each ventilation fan would have a reduced runtime for a period of 3 hours during each day of operation. SWA assumes that the fans alternate between ASHRAE minimum guidelines for fitness center ventilation and ASHRAE minimum guidelines for maximum occupancy for fitness center ventilation.

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

Description:

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

5.5. Geothermal

Description:

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

5.6. Wind

Description:

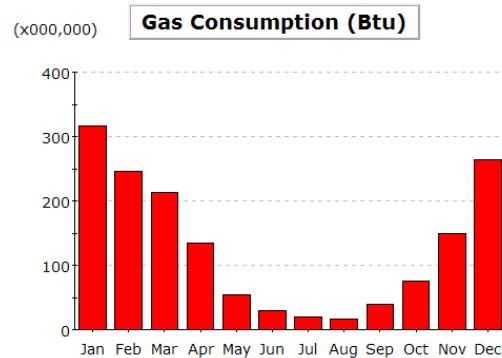
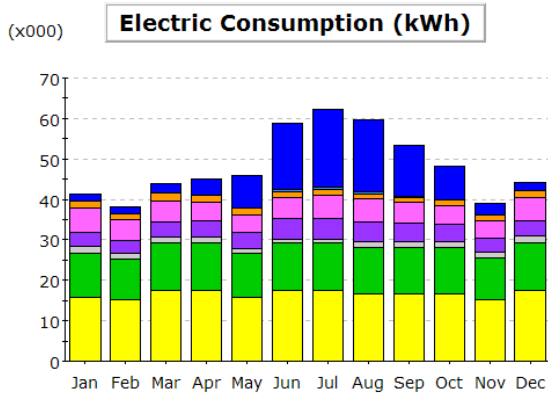
Wind power production is not appropriate for this location, because required land is not available for the wind turbine. Also available wind energy resource is very low.

6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

6.1. Load profiles

In 2007, a power survey was conducted at the Physical Education 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 Physical Education Building was not surveyed during this testing.

Below are charts taken from the Physical Education Building eQUEST model that simulates the natural gas and electricity annual load profiles for the building. Since the building is not separately metered for gas or electricity, an accurate load profile could not be determined based on utility bills.



- | | | | |
|--|--|--|--|
| Area Lighting | Exterior Usage | Water Heating | Refrigeration |
| Task Lighting | Pumps & Aux. | Ht Pump Supp. | Heat Rejection |
| Misc. Equipment | Ventilation Fans | Space Heating | Space Cooling |

6.2. Tariff analysis

Currently, natural gas and electricity is provided to the Physical Education Building through 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 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

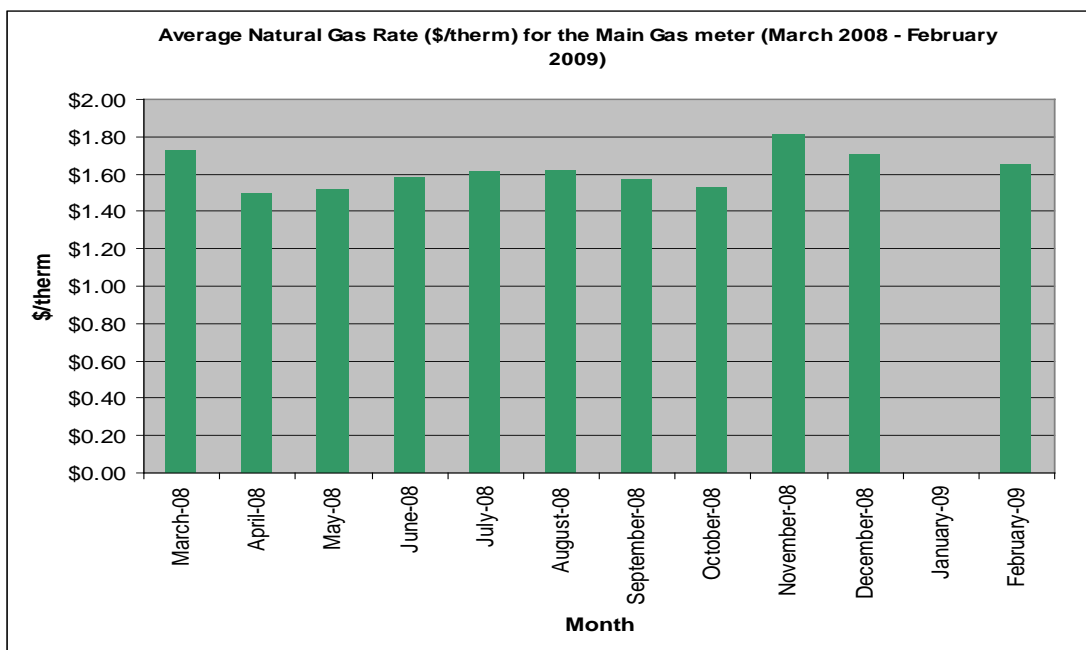
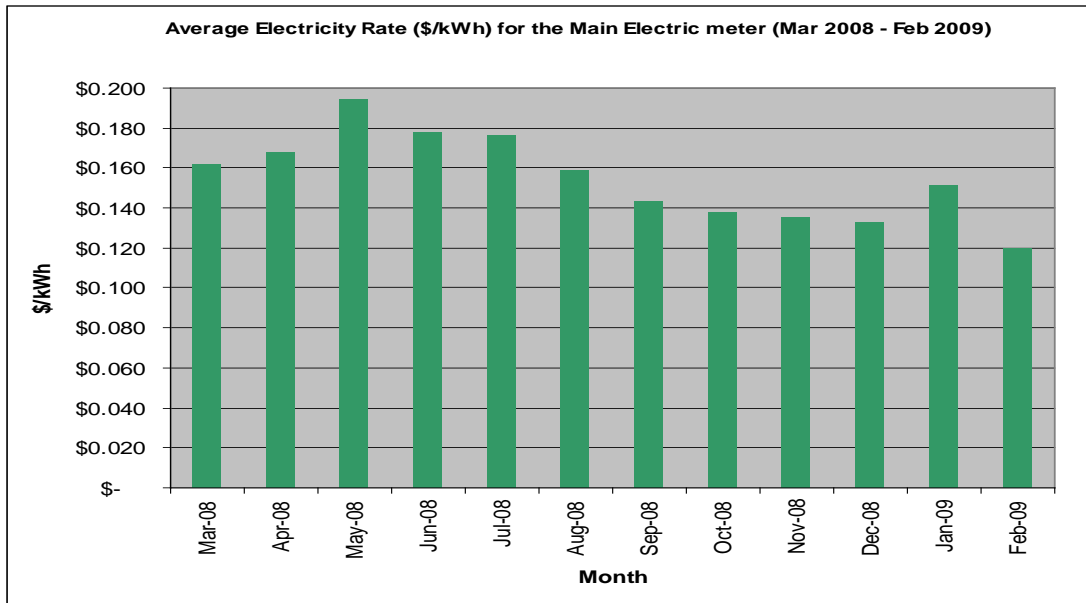
The Physical Education Building receives natural gas from the main campus meter which already uses an Energy Services Company (ESCO) that acts as a third party energy supplier. Additionally, it receives part of its electricity generated by CHP, and hence consumes some gas indirectly. Further, it is connected 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 Physical Education building annual utility costs are \$6,981.95 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 (W)
1	Phys. Ed	First Floor	SCPA Locker Room	10-43	4' linear T8	magnetic	29	2	Fluorescent	34	12	23664	Switch	No	1972
2	Phys. Ed	First Floor	SCPA Locker Room	10-43	4' linear T8	magnetic	9	1	Fluorescent	34	12	3672	Switch	No	306
3	Phys. Ed	First Floor	SCPA Locker Room	10-43	4' linear T8	magnetic	2	4	Fluorescent	34	12	3264	Switch	No	272
4	Phys. Ed	First Floor	SCPA Locker Room	10-43	LED Exit Signs	-	2	1	LED	5	24	240	None	No	10
5	Phys. Ed	First Floor	Lobby area	37	4' linear T12	magnetic	4	1	Fluorescent	40	15	2400	Switch	No	160
6	Phys. Ed	First Floor	Lobby area	37	Fluorescent Exit	-	1	1	Fluorescent	20	24	480	None	No	20
7	Phys. Ed	First Floor	Storage 1 (near campus entrance)	79	4' linear T8	magnetic	2	2	Fluorescent	34	4	544	Switch	No	136
8	Phys. Ed	First Floor	Storage 2 - Larger Center Storage	37	4' linear T12	magnetic	2	2	Fluorescent	40	4	640	Switch	No	160
9	Phys. Ed	First Floor	Storage 3 (on athletic field side)	59	4' linear T8	magnetic	2	2	Fluorescent	34	4	544	Switch	No	136
10	Phys. Ed	First Floor	Hallway near storage rooms	12	4' linear T12	magnetic	15	1	Fluorescent	40	15	9000	Switch	No	600
11	Phys. Ed	First Floor	Hallway near storage rooms	12	4' linear T8	electronic	2	2	Fluorescent	32	15	1920	Switch	No	128
12	Phys. Ed	First Floor	Janitor's Closet near Women's swim	15	4' linear T8	electronic	1	2	Fluorescent	32	4	256	Switch	No	64
13	Phys. Ed	First Floor	Main Corridor	13	4' linear T12	magnetic	23	1	Fluorescent	40	15	13800	Switch	No	920
14	Phys. Ed	First Floor	Main Corridor	13	Fluorescent Exit	-	1	1	Fluorescent	20	24	480	None	No	20
15	Phys. Ed	First Floor	Main Corridor	13	LED Exit Signs	-	1	1	LED	5	24	120	None	No	5
16	Phys. Ed	First Floor	Mechanical Room - Right Storage	42	4' linear T8	magnetic	3	2	Fluorescent	34	4	816	Switch	No	204
17	Phys. Ed	First Floor	Mechanical Room - Left Storage	42	4' linear T8	magnetic	3	2	Fluorescent	34	4	816	Switch	No	204
18	Phys. Ed	First Floor	Mechanical Room	71	4' linear T12	magnetic	10	2	Fluorescent	40	15	12000	Switch	No	800
19	Phys. Ed	First Floor	Mechanical Room - Tunnel	7	4' linear T12	magnetic	3	2	Fluorescent	40	15	3600	Switch	No	240
20	Phys. Ed	First Floor	Mechanical Room - Tunnel	7	32W CFL	-	3	1	CFL	32	15	1440	Switch	No	96
21	Phys. Ed	First Floor	Mechanical Room - East Side	41	4' linear T12	magnetic	1	2	Fluorescent	40	15	1200	Switch	No	80
22	Phys. Ed	First Floor	Mechanical Room - East Side	41	8' linear T12	magnetic	5	2	Fluorescent	72	15	10800	Switch	No	720
23	Phys. Ed	First Floor	Facilities Department - Lobby	44	2' linear T5	electronic	2	1	Fluorescent	24	15	720	Switch	No	48
24	Phys. Ed	First Floor	Facilities Department - Receptionist	45	LED Exit Signs	-	3	1	LED	5	24	360	None	No	15
25	Phys. Ed	First Floor	Facilities Department - Receptionist	45	40W Halogen	-	5	1	Halogen	40	15	3000	Switch	No	200
26	Phys. Ed	First Floor	Facilities Department - First office on right	42	4' linear T5	electronic	1	1	Fluorescent	14	12	168	Switch	No	14
27	Phys. Ed	First Floor	Facilities Department - Second office on right	43	4' linear T5	electronic	1	1	Fluorescent	14	12	168	Switch	No	14
28	Phys. Ed	First Floor	Facilities Department - Room behind Receptionist	40	2' U-shaped T8	electronic	1	2	Fluorescent	32	12	768	Switch	No	64
29	Phys. Ed	First Floor	Facilities Department - Storage on Left	38	2' U-shaped T8	electronic	2	2	Fluorescent	32	12	1536	Switch	No	128
30	Phys. Ed	First Floor	Facilities Department - Bathroom	28	2' U-shaped T8	electronic	2	2	Fluorescent	32	12	1536	Switch	No	128
31	Phys. Ed	First Floor	Facilities Department - Open Area	40	4' linear T5	electronic	3	1	Fluorescent	14	12	504	Switch	No	42
32	Phys. Ed	First Floor	Facilities Department - Director's Office	34	4' linear T5	electronic	4	1	Fluorescent	14	12	672	Switch	No	56
33	Phys. Ed	First Floor	Men's Swim Locker	39	LED Exit Signs	-	1	1	LED	5	24	120	None	No	5
34	Phys. Ed	First Floor	Men's Swim Locker	39	4' linear T12	magnetic	1	1	Fluorescent	40	15	600	Switch	No	40
35	Phys. Ed	First Floor	Men's Swim Locker	39	4' linear T8	electronic	14	2	Fluorescent	32	15	13440	Switch	No	896
36	Phys. Ed	First Floor	Men's Swim Locker - Shower Room	14	50W Halogen	-	8	1	Halogen	50	4	1600	Switch	No	400
37	Phys. Ed	First Floor	Women's Swim Locker	39	LED Exit Signs	-	1	1	LED	5	24	120	None	No	5
38	Phys. Ed	First Floor	Women's Swim Locker	39	4' linear T12	magnetic	1	1	Fluorescent	40	15	600	Switch	No	40
39	Phys. Ed	First Floor	Women's Swim Locker	39	4' linear T8	electronic	14	2	Fluorescent	32	15	13440	Switch	No	896
40	Phys. Ed	First Floor	Women's Swim Locker - Shower Room	14	50W Halogen	-	8	1	Halogen	50	4	1600	Switch	No	400
41	Phys. Ed	Second Floor	Pool Area	30	MV Lights	-	14	1	MV		6	0	Switch	No	0
42	Phys. Ed	Second Floor	Pool - Spectator Area	30	32W CFL	-	4	1	CFL	32	6	768	Switch	No	128
43	Phys. Ed	Second Floor	North Stairwell	11	Fluorescent Exit	-	2	1	Fluorescent	20	24	960	None	No	40
44	Phys. Ed	Second Floor	North Stairwell	11	4' linear T12	magnetic	11	1	Fluorescent	40	15	6600	Switch	No	440
45	Phys. Ed	Second Floor	General Pool Area	40	4' linear T8	electronic	4	4	Fluorescent	32	15	7680	Switch	No	512
46	Phys. Ed	Second Floor	General Pool Area	40	100W "acorn" MV	-	10	1	MV	100	4	4000	Switch	No	1000

47	Phys. Ed	Second Floor	General Pool Area	40	LED Exit Signs	-	4	1	LED	5	24	480	None	No	20
48	Phys. Ed	Second Floor	General Pool Area - Back Storage	40	32W CFL	-	1	1	CFL	32	4	128	Sw itch	No	32
49	Phys. Ed	Second Floor	Left Storage in front of Pool Area	17	4' linear T8	electronic	1	2	Fluorescent	32	4	256	Sw itch	No	64
50	Phys. Ed	Second Floor	Right Storage in front of Pool Area	17	4' linear T8	electronic	1	2	Fluorescent	32	4	256	Sw itch	No	64
51	Phys. Ed	Second Floor	Lobby area	33	4' linear T8	electronic	2	1	Fluorescent	32	15	960	Sw itch	No	64
52	Phys. Ed	Second Floor	Lobby area	33	4' linear T12	magnetic	1	1	Fluorescent	40	15	600	Sw itch	No	40
53	Phys. Ed	Second Floor	West Stairw ell	17	4' linear T12	magnetic	6	1	Fluorescent	40	15	3600	Sw itch	No	240
54	Phys. Ed	Second Floor	West Stairw ell	17	Fluorescent Exit	-	1	1	Fluorescent	20	24	480	None	No	20
55	Phys. Ed	Second Floor	West Stairw ell	17	LED Exit Signs	-	1	1	LED	5	24	120	None	No	5
56	Phys. Ed	Second Floor	South Entrance (Display lights)	21	2' linear T5	electronic	6	1	Fluorescent	24	15	2160	Sw itch	No	144
57	Phys. Ed	Second Floor	Men's Locker	43	4' linear T8	electronic	9	2	Fluorescent	32	15	8640	Occ. Sensor	No	576
58	Phys. Ed	Second Floor	Men's Locker (Smaller Room)	5	2' linear T12	magnetic	1	1	Fluorescent	20	15	300	Sw itch	No	20
59	Phys. Ed	Second Floor	Women's Locker	43	4' linear T8	electronic	9	2	Fluorescent	32	15	8640	Occ. Sensor	No	576
60	Phys. Ed	Second Floor	Women's Locker (Smaller Room)	5	2' linear T12	magnetic	1	1	Fluorescent	20	15	300	Sw itch	No	20
61	Phys. Ed	Second Floor	Janitor's Closet (West)	105	4' linear T8	electronic	1	2	Fluorescent	32	4	256	Sw itch	No	64
62	Phys. Ed	Second Floor	Fitness Lab	62	4' linear T8	electronic	10	2	Fluorescent	32	12	7680	Sw itch	No	640
63	Phys. Ed	Second Floor	S.C.P.A Offices	80	4' linear T8	electronic	18	4	Fluorescent	32	12	27648	Sw itch	No	2304
64	Phys. Ed	Second Floor	S.C.P.A Offices	80	4' linear t8	electronic	24	2	Fluorescent	32	12	18432	Sw itch	No	1536
65	Phys. Ed	Second Floor	Room 235	78	4' linear T12	magnetic	12	4	Fluorescent	40	12	23040	Sw itch	No	1920
66	Phys. Ed	Second Floor	Men's Room	42	4' linear T8	electronic	2	1	Fluorescent	32	15	960	Sw itch	No	64
67	Phys. Ed	Second Floor	Men's Room	42	2' linear T8	electronic	4	2	Fluorescent	17	15	2040	Sw itch	No	136
68	Phys. Ed	Second Floor	Women's Room	42	4' linear T8	electronic	2	1	Fluorescent	32	15	960	Sw itch	No	64
69	Phys. Ed	Second Floor	Women's Room	42	2' linear T8	electronic	2	1	Fluorescent	17	15	510	Sw itch	No	34
70	Phys. Ed	Second Floor	Lobby area	56	LED Exit Signs	-	3	1	LED	5	24	360	None	No	15
71	Phys. Ed	Second Floor	Lobby - South Entrance area	56	4' linear T12	magnetic	5	1	Fluorescent	40	15	3000	Sw itch	No	200
72	Phys. Ed	Second Floor	Lobby - South Entrance area	56	75W Flood	-	1	1	Flood	75	15	1125	Sw itch	No	75
73	Phys. Ed	Second Floor	Lobby - South Entrance area	56	Fluorescent Exit	-	2	1	Fluorescent	20	24	960	Sw itch	No	40
74	Phys. Ed	Second Floor	Lobby - South Entrance area	56	LED Exit Signs	-	1	1	LED	5	24	120	Sw itch	No	5
75	Phys. Ed	Second Floor	West Hallw ay	32	4' linear T8	electronic	12	1	Fluorescent	32	15	5760	Sw itch	No	384
76	Phys. Ed	Second Floor	West Hallw ay	32	LED Exit Signs	-	1	1	LED	5	24	120	Sw itch	No	5
77	Phys. Ed	Second Floor	East Hallw ay	32	4' linear T8	electronic	12	1	Fluorescent	32	15	5760	Sw itch	No	384
78	Phys. Ed	Second Floor	East Hallw ay	32	LED Exit Signs	-	1	1	LED	5	24	120	Sw itch	No	5
79	Phys. Ed	Second Floor	Gymnasium	25	400W MH	-	32	1	400MH	454	15	217920	Sw itch	No	14528
80	Phys. Ed	Second Floor	Gymnasium	25	LED Exit Signs	-	7	1	LED	5	24	840	None	No	35
81	Phys. Ed	Third Floor	Mechanical Room	16	4' linear T12	magnetic	24	2	Fluorescent	40	15	28800	Sw itch	No	1920

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 (W)
1	Phys. Ed	First Floor	SCPA Locker Room	10-43	4' linear T8	electronic	29	2	Fluorescent	32	12	22272	Switch	No	1856
2	Phys. Ed	First Floor	SCPA Locker Room	10-43	4' linear T8	electronic	9	1	Fluorescent	32	12	3456	Switch	No	288
3	Phys. Ed	First Floor	SCPA Locker Room	10-43	4' linear T8	electronic	2	4	Fluorescent	32	12	3072	Switch	No	256
4	Phys. Ed	First Floor	SCPA Locker Room	10-43	LED Exit Signs	-	2	1	LED	5	24	240	None	No	10
5	Phys. Ed	First Floor	Lobby area	37	4' linear T8	electronic	4	1	Fluorescent	32	15	1920	Switch	No	128
6	Phys. Ed	First Floor	Lobby area	37	LED Exit Signs	-	1	1	Fluorescent	5	24	120	None	No	5
7	Phys. Ed	First Floor	Storage 1 (near campus entrance)	79	4' linear T8	electronic	2	2	Fluorescent	32	4	512	Switch	No	128
8	Phys. Ed	First Floor	Storage 2 - Larger Center Storage	37	4' linear T8	electronic	2	2	Fluorescent	32	4	512	Switch	No	128
9	Phys. Ed	First Floor	Storage 3 (on athletic field side)	59	4' linear T8	electronic	2	2	Fluorescent	32	4	512	Switch	No	128
10	Phys. Ed	First Floor	Hallway near storage rooms	12	4' linear T8	electronic	15	1	Fluorescent	32	15	7200	Switch	No	480
11	Phys. Ed	First Floor	Hallway near storage rooms	12	4' linear T8	electronic	2	2	Fluorescent	32	15	1920	Switch	No	128
12	Phys. Ed	First Floor	Janitor's Closet near Women's swim	15	4' linear T8	electronic	1	2	Fluorescent	32	4	256	Switch	No	64
13	Phys. Ed	First Floor	Main Corridor	13	4' linear T8	electronic	23	1	Fluorescent	32	15	11040	Switch	No	736
14	Phys. Ed	First Floor	Main Corridor	13	LED Exit Signs	-	1	1	Fluorescent	5	24	120	None	No	5
15	Phys. Ed	First Floor	Main Corridor	13	LED Exit Signs	-	1	1	LED	5	24	120	None	No	5
16	Phys. Ed	First Floor	Mechanical Room - Right Storage	42	4' linear T8	electronic	3	2	Fluorescent	32	4	768	Switch	No	192
17	Phys. Ed	First Floor	Mechanical Room - Left Storage	42	4' linear T8	electronic	3	2	Fluorescent	32	4	768	Switch	No	192
18	Phys. Ed	First Floor	Mechanical Room	71	4' linear T8	electronic	10	2	Fluorescent	32	15	9600	Switch	No	640
19	Phys. Ed	First Floor	Mechanical Room - Tunnel	7	4' linear T8	electronic	3	2	Fluorescent	32	15	2880	Switch	No	192
20	Phys. Ed	First Floor	Mechanical Room - Tunnel	7	32W CFL	-	3	1	CFL	32	15	1440	Switch	No	96
21	Phys. Ed	First Floor	Mechanical Room - East Side	41	4' linear T8	electronic	1	2	Fluorescent	32	15	960	Switch	No	64
22	Phys. Ed	First Floor	Mechanical Room - East Side	41	8' linear T8	magnetic	5	2	Fluorescent	56	15	8400	Switch	No	560
23	Phys. Ed	First Floor	Facilities Department - Lobby	44	2' linear T5	electronic	2	1	Fluorescent	24	15	720	Switch	No	48
24	Phys. Ed	First Floor	Facilities Department - Receptionist	45	LED Exit Signs	-	3	1	LED	5	24	360	None	No	15
25	Phys. Ed	First Floor	Facilities Department - Receptionist	45	40W Halogen	-	5	1	Halogen	40	15	3000	Switch	No	200
26	Phys. Ed	First Floor	Facilities Department - First office on right	42	4' linear T5	electronic	1	1	Fluorescent	14	12	168	Switch	No	14
27	Phys. Ed	First Floor	Facilities Department - Second office on right	43	4' linear T5	electronic	1	1	Fluorescent	14	12	168	Switch	No	14
28	Phys. Ed	First Floor	Facilities Department - Room behind Receptionist	40	2' U-shaped T8	electronic	1	2	Fluorescent	32	12	768	Switch	No	64
29	Phys. Ed	First Floor	Facilities Department - Storage on Left	38	2' U-shaped T8	electronic	2	2	Fluorescent	32	12	1536	Switch	No	128
30	Phys. Ed	First Floor	Facilities Department - Bathroom	28	2' U-shaped T8	electronic	2	2	Fluorescent	32	12	1536	Switch	No	128
31	Phys. Ed	First Floor	Facilities Department - Open Area	40	4' linear T5	electronic	3	1	Fluorescent	14	12	504	Switch	No	42
32	Phys. Ed	First Floor	Facilities Department - Director's Office	34	4' linear T5	electronic	4	1	Fluorescent	14	12	672	Switch	No	56
33	Phys. Ed	First Floor	Men's Swim Locker	39	LED Exit Signs	-	1	1	LED	5	24	120	None	No	5
34	Phys. Ed	First Floor	Men's Swim Locker	39	4' linear T8	electronic	1	1	Fluorescent	32	15	480	Switch	No	32
35	Phys. Ed	First Floor	Men's Swim Locker	39	4' linear T8	electronic	14	2	Fluorescent	32	15	13440	Switch	No	896
36	Phys. Ed	First Floor	Men's Swim Locker - Shower Room	14	50W Halogen	-	8	1	Halogen	50	4	1600	Switch	No	400
37	Phys. Ed	First Floor	Women's Swim Locker	39	LED Exit Signs	-	1	1	LED	5	24	120	None	No	5
38	Phys. Ed	First Floor	Women's Swim Locker	39	4' linear T8	electronic	1	1	Fluorescent	32	15	480	Switch	No	32
39	Phys. Ed	First Floor	Women's Swim Locker	39	4' linear T8	electronic	14	2	Fluorescent	32	15	13440	Switch	No	896
40	Phys. Ed	First Floor	Women's Swim Locker - Shower Room	14	50W Halogen	-	8	1	Halogen	50	4	1600	Switch	No	400
41	Phys. Ed	Second Floor	Pool Area	30	MV Lights	-	14	1	MV	6	0	0	Switch	No	0
42	Phys. Ed	Second Floor	Pool - Spectator Area	30	32W CFL	-	4	1	CFL	32	6	768	Switch	No	128
43	Phys. Ed	Second Floor	North Stairwell	11	LED Exit Signs	-	2	1	Fluorescent	5	24	240	None	No	10
44	Phys. Ed	Second Floor	North Stairwell	11	4' linear T8	electronic	11	1	Fluorescent	32	15	5280	Switch	No	352
45	Phys. Ed	Second Floor	General Pool Area	40	4' linear T8	electronic	4	4	Fluorescent	32	15	7680	Switch	No	512
46	Phys. Ed	Second Floor	General Pool Area	40	100W "acorn" MV	-	10	1	MV	100	4	4000	Switch	No	1000
47	Phys. Ed	Second Floor	General Pool Area	40	LED Exit Signs	-	4	1	LED	5	24	480	None	No	20
48	Phys. Ed	Second Floor	General Pool Area - Back Storage	40	32W CFL	-	1	1	CFL	32	4	128	Switch	No	32
49	Phys. Ed	Second Floor	Left Storage in front of Pool Area	17	4' linear T8	electronic	1	2	Fluorescent	32	4	256	Switch	No	64
50	Phys. Ed	Second Floor	Right Storage in front of Pool Area	17	4' linear T8	electronic	1	2	Fluorescent	32	4	256	Switch	No	64

51	Phys. Ed	Second Floor	Lobby area	33	4' linear T8	electronic	2	1	Fluorescent	32	15	960	Switch	No	64
52	Phys. Ed	Second Floor	Lobby area	33	4' linear T8	electronic	1	1	Fluorescent	32	15	480	Switch	No	32
53	Phys. Ed	Second Floor	West Stairwell	17	4' linear T8	electronic	6	1	Fluorescent	32	15	2880	Switch	No	192
54	Phys. Ed	Second Floor	West Stairwell	17	LED Exit Signs	-	1	1	Fluorescent	5	24	120	None	No	5
55	Phys. Ed	Second Floor	West Stairwell	17	LED Exit Signs	-	1	1	LED	5	24	120	None	No	5
56	Phys. Ed	Second Floor	South Entrance (Display lights)	21	2' linear T5	electronic	6	1	Fluorescent	24	15	2160	Switch	No	144
57	Phys. Ed	Second Floor	Men's Locker	43	4' linear T8	electronic	9	2	Fluorescent	32	15	8640	Occ. Sensor	No	576
58	Phys. Ed	Second Floor	Men's Locker (Smaller Room)	5	2' linear T8	electronic	1	1	Fluorescent	15	15	225	Switch	No	15
59	Phys. Ed	Second Floor	Women's Locker	43	4' linear T8	electronic	9	2	Fluorescent	32	15	8640	Occ. Sensor	No	576
60	Phys. Ed	Second Floor	Women's Locker (Smaller Room)	5	2' linear T8	electronic	1	1	Fluorescent	15	15	225	Switch	No	15
61	Phys. Ed	Second Floor	Janitor's Closet (West)	105	4' linear T8	electronic	1	2	Fluorescent	32	4	256	Switch	No	64
62	Phys. Ed	Second Floor	Fitness Lab	62	4' linear T8	electronic	10	2	Fluorescent	32	12	7680	Switch	No	640
63	Phys. Ed	Second Floor	S.C.P.A Offices	80	4' linear T8	electronic	18	4	Fluorescent	32	12	27648	Switch	No	2304
64	Phys. Ed	Second Floor	S.C.P.A Offices	80	4' linear T8	electronic	24	2	Fluorescent	32	12	18432	Switch	No	1536
65	Phys. Ed	Second Floor	Room 235	78	4' linear T8	electronic	12	4	Fluorescent	32	12	18432	Switch	No	1536
66	Phys. Ed	Second Floor	Men's Room	42	4' linear T8	electronic	2	1	Fluorescent	32	15	960	Switch	No	64
67	Phys. Ed	Second Floor	Men's Room	42	2' linear T8	electronic	4	2	Fluorescent	17	15	2040	Switch	No	136
68	Phys. Ed	Second Floor	Women's Room	42	4' linear T8	electronic	2	1	Fluorescent	32	15	960	Switch	No	64
69	Phys. Ed	Second Floor	Women's Room	42	2' linear T8	electronic	2	1	Fluorescent	17	15	510	Switch	No	34
70	Phys. Ed	Second Floor	Lobby area	56	LED Exit Signs	-	3	1	LED	5	24	360	None	No	15
71	Phys. Ed	Second Floor	Lobby - South Entrance area	56	4' linear T8	electronic	5	1	Fluorescent	32	15	2400	Switch	No	160
72	Phys. Ed	Second Floor	Lobby - South Entrance area	56	75W Flood	-	1	1	Flood	75	15	1125	Switch	No	75
73	Phys. Ed	Second Floor	Lobby - South Entrance area	56	LED Exit Signs	-	2	1	Fluorescent	5	24	240	Switch	No	10
74	Phys. Ed	Second Floor	Lobby - South Entrance area	56	LED Exit Signs	-	1	1	LED	5	24	120	Switch	No	5
75	Phys. Ed	Second Floor	West Hallway	32	4' linear T8	electronic	12	1	Fluorescent	32	15	5760	Switch	No	384
76	Phys. Ed	Second Floor	West Hallway	32	LED Exit Signs	-	1	1	LED	5	24	120	Switch	No	5
77	Phys. Ed	Second Floor	East Hallway	32	4' linear T8	electronic	12	1	Fluorescent	32	15	5760	Switch	No	384
78	Phys. Ed	Second Floor	East Hallway	32	LED Exit Signs	-	1	1	LED	5	24	120	Switch	No	5
79	Phys. Ed	Second Floor	Gymnasium	25	4-lamp T5	-	32	1	Fluorescent	228	15	109440	Switch	No	7296
80	Phys. Ed	Second Floor	Gymnasium	25	LED Exit Signs	-	7	1	LED	5	24	840	None	No	35
81	Phys. Ed	Third Floor	Mechanical Room	16	4' linear T8	electronic	24	2	Fluorescent	32	15	23040	Switch	No	1536

Totals		Existing Lighting Total Power (Watts)	39007	Watts
Existing Usage (kWh/year)	137,283	Existing Lighting Power Density (W/sqft)	0.75	W/sqft
Proposed Usage (kWh/year)	101,420			
Existing Est. Cost (\$/year)	\$ 21,278.80	Proposed Lighting Total Power (Watts)	29750	Watts
Proposed Est. Cost (\$/year)	\$ 16,632.82	Proposed Lighting Power Density (W/sqft)	0.57	W/sqft
Total kWh Savings	35,863			
Total \$ Savings	\$ 5,558.76			

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

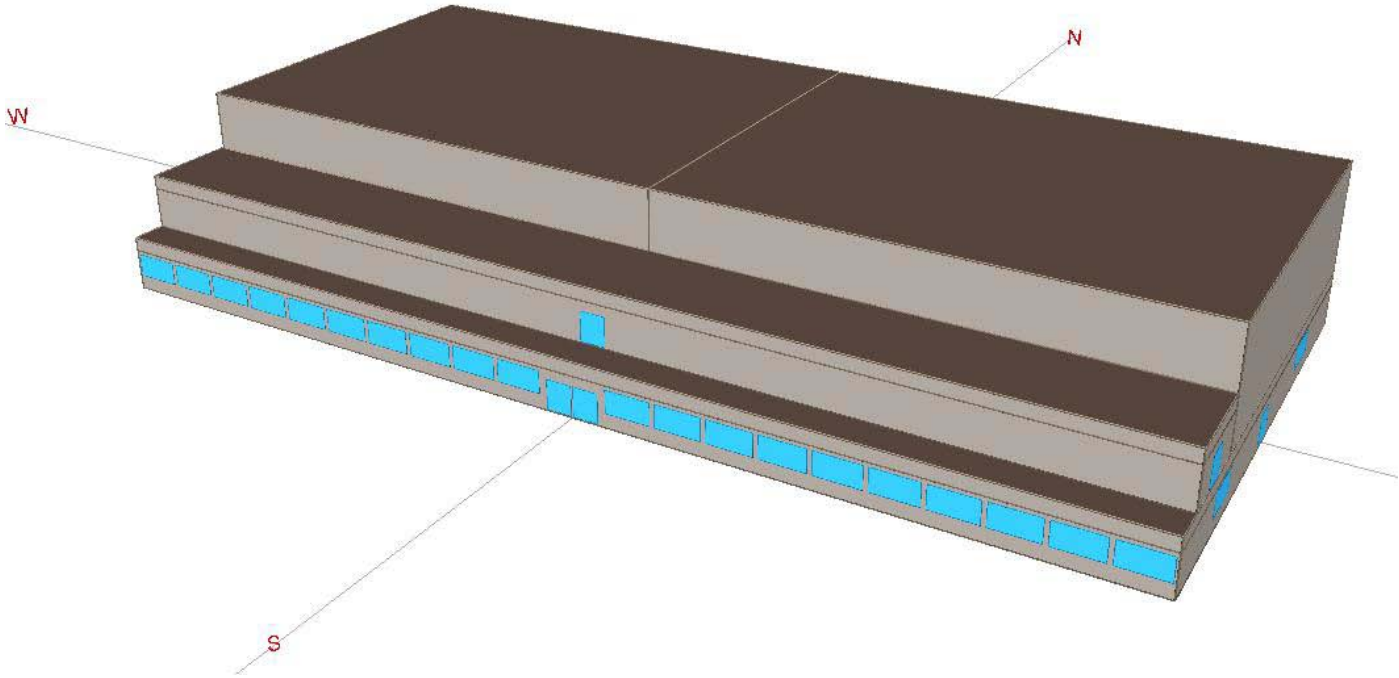
Proposed Lighting Controls																
#	Building	Level/Floor	Location in Building	Measured Lighting Level in Footcandles	Fixture Type	Ballast Type	No. of Fixtures	No. of Lamps	Type of Lamp	Watts/Lamp	Hrs/Day	Energy Use (Watt hours/day)	Controls	Number of New Controls	Daylighting possible?	Total Power (W)
1	Phys. Ed	First Floor	SCPA Locker Room	10-43	4' linear T8	electronic	29	2	Fluorescent	32	10	18560	Occ. Sensor	1	No	1856
2	Phys. Ed	First Floor	SCPA Locker Room	10-43	4' linear T8	electronic	9	1	Fluorescent	32	10	2880	Occ. Sensor	1	No	288
3	Phys. Ed	First Floor	SCPA Locker Room	10-43	4' linear T8	electronic	2	4	Fluorescent	32	10	2560	Occ. Sensor	1	No	256
4	Phys. Ed	First Floor	SCPA Locker Room	10-43	LED Exit Signs	-	2	1	LED	5	24	240	None		No	10
5	Phys. Ed	First Floor	Lobby area	37	4' linear T8	electronic	4	1	Fluorescent	32	12	1536	Occ. Sensor	1	No	128
6	Phys. Ed	First Floor	Lobby area	37	LED Exit Signs	-	1	1	Fluorescent	5	24	120	None		No	5
7	Phys. Ed	First Floor	Storage 1 (near campus entrance)	79	4' linear T8	electronic	2	2	Fluorescent	32	2	256	Occ. Sensor	1	No	128
8	Phys. Ed	First Floor	Storage 2 - Larger Center Storage	37	4' linear T8	electronic	2	2	Fluorescent	32	2	256	Occ. Sensor	1	No	128
9	Phys. Ed	First Floor	Storage 3 (on atheletic field side)	59	4' linear T8	electronic	2	2	Fluorescent	32	2	256	Occ. Sensor	1	No	128
10	Phys. Ed	First Floor	Hallway near storage rooms	12	4' linear T8	electronic	15	1	Fluorescent	32	12	5760	Occ. Sensor	1	No	480
11	Phys. Ed	First Floor	Hallway near storage rooms	12	4' linear T8	electronic	2	2	Fluorescent	32	12	1536	Occ. Sensor	1	No	128
12	Phys. Ed	First Floor	Janitor's Closet near Women's swim	15	4' linear T8	electronic	1	2	Fluorescent	32	4	256	Switch		No	64
13	Phys. Ed	First Floor	Main Corridor	13	4' linear T8	electronic	23	1	Fluorescent	32	12	8832	Occ. Sensor	1	No	736
14	Phys. Ed	First Floor	Main Corridor	13	LED Exit Signs	-	1	1	Fluorescent	5	24	120	None		No	5
15	Phys. Ed	First Floor	Main Corridor	13	LED Exit Signs	-	1	1	LED	5	24	120	None		No	5
16	Phys. Ed	First Floor	Mechanical Room - Right Storage	42	4' linear T8	electronic	3	2	Fluorescent	32	2	384	Occ. Sensor	1	No	192
17	Phys. Ed	First Floor	Mechanical Room - Left Storage	42	4' linear T8	electronic	3	2	Fluorescent	32	2	384	Occ. Sensor	1	No	192
18	Phys. Ed	First Floor	Mechanical Room	71	4' linear T8	electronic	10	2	Fluorescent	32	12	7680	Occ. Sensor	1	No	640
19	Phys. Ed	First Floor	Mechanical Room - Tunnel	7	4' linear T8	electronic	3	2	Fluorescent	32	12	2304	Occ. Sensor	1	No	192
20	Phys. Ed	First Floor	Mechanical Room - Tunnel	7	32W CFL	-	3	1	CFL	32	15	1440	Switch		No	96
21	Phys. Ed	First Floor	Mechanical Room - East Side	41	4' linear T8	electronic	1	2	Fluorescent	32	12	768	Occ. Sensor	1	No	64
22	Phys. Ed	First Floor	Mechanical Room - East Side	41	8' linear T8	magnetic	5	2	Fluorescent	56	12	6720	Occ. Sensor	1	No	560
23	Phys. Ed	First Floor	Facilities Department - Lobby	44	2' linear T5	electronic	2	1	Fluorescent	24	12	576	Occ. Sensor	1	No	48
24	Phys. Ed	First Floor	Facilities Department - Receptionist	45	LED Exit Signs	-	3	1	LED	5	24	360	None		No	15
25	Phys. Ed	First Floor	Facilities Department - Receptionist	45	40W Halogen	-	5	1	Halogen	40	15	3000	Switch		No	200
26	Phys. Ed	First Floor	Facilities Department - First office on right	42	4' linear T5	electronic	1	1	Fluorescent	14	12	168	Switch		No	14
27	Phys. Ed	First Floor	Facilities Department - Second office on right	43	4' linear T5	electronic	1	1	Fluorescent	14	12	168	Switch		No	14
28	Phys. Ed	First Floor	Facilities Department - Room behind Receptionist	40	2' U-shaped T8	electronic	1	2	Fluorescent	32	12	768	Switch		No	64
29	Phys. Ed	First Floor	Facilities Department - Storage on Left	38	2' U-shaped T8	electronic	2	2	Fluorescent	32	10	1280	Occ. Sensor	1	No	128
30	Phys. Ed	First Floor	Facilities Department - Bathroom	28	2' U-shaped T8	electronic	2	2	Fluorescent	32	10	1280	Occ. Sensor	1	No	128
31	Phys. Ed	First Floor	Facilities Department - Open Area	40	4' linear T5	electronic	3	1	Fluorescent	14	10	420	Occ. Sensor	1	No	42
32	Phys. Ed	First Floor	Facilities Department - Director's Office	34	4' linear T5	electronic	4	1	Fluorescent	14	10	560	Occ. Sensor	1	No	56
33	Phys. Ed	First Floor	Men's Swim Locker	39	LED Exit Signs	-	1	1	LED	5	24	120	None		No	5
34	Phys. Ed	First Floor	Men's Swim Locker	39	4' linear T8	electronic	1	1	Fluorescent	32	12	384	Occ. Sensor	1	No	32
35	Phys. Ed	First Floor	Men's Swim Locker	39	4' linear T8	electronic	14	2	Fluorescent	32	12	10752	Occ. Sensor	1	No	896
36	Phys. Ed	First Floor	Men's Swim Locker - Shower Room	14	50W Halogen	-	8	1	Halogen	50	4	1600	Switch		No	400
37	Phys. Ed	First Floor	Women's Swim Locker	39	LED Exit Signs	-	1	1	LED	5	24	120	None		No	5
38	Phys. Ed	First Floor	Women's Swim Locker	39	4' linear T8	electronic	1	1	Fluorescent	32	12	384	Occ. Sensor	1	No	32
39	Phys. Ed	First Floor	Women's Swim Locker	39	4' linear T8	electronic	14	2	Fluorescent	32	12	10752	Occ. Sensor	1	No	896
40	Phys. Ed	First Floor	Women's Swim Locker - Shower Room	14	50W Halogen	-	8	1	Halogen	50	2	800	Occ. Sensor	1	No	400
41	Phys. Ed	Second Floor	Pool Area	30	MV Lights	-	14	1	MV		6	0	Switch		No	0
42	Phys. Ed	Second Floor	Pool - Spectator Area	30	32W CFL	-	4	1	CFL	32	4	512	Occ. Sensor	1	No	128
43	Phys. Ed	Second Floor	North Stairwell	11	LED Exit Signs	-	2	1	Fluorescent	5	24	240	None		No	10
44	Phys. Ed	Second Floor	North Stairwell	11	4' linear T8	electronic	11	1	Fluorescent	32	12	4224	Occ. Sensor	1	No	352
45	Phys. Ed	Second Floor	General Pool Area	40	4' linear T8	electronic	4	4	Fluorescent	32	12	6144	Occ. Sensor	1	No	512
46	Phys. Ed	Second Floor	General Pool Area	40	100W "acorn" MV	-	10	1	MV	100	2	2000	Occ. Sensor	1	No	1000

47	Phys. Ed	Second Floor	General Pool Area	40	LED Exit Signs	-	4	1	LED	5	24	480	None	No	20	
48	Phys. Ed	Second Floor	General Pool Area - Back Storage	40	32W CFL	-	1	1	CFL	32	4	128	Sw itch	No	32	
49	Phys. Ed	Second Floor	Left Storage in front of Pool Area	17	4' linear T8	electronic	1	2	Fluorescent	32	2	128	Occ. Sensor	1	No	64
50	Phys. Ed	Second Floor	Right Storage in front of Pool Area	17	4' linear T8	electronic	1	2	Fluorescent	32	2	128	Occ. Sensor	1	No	64
51	Phys. Ed	Second Floor	Lobby area	33	4' linear T8	electronic	2	1	Fluorescent	32	12	768	Occ. Sensor	1	No	64
52	Phys. Ed	Second Floor	Lobby area	33	4' linear T8	electronic	1	1	Fluorescent	32	12	384	Occ. Sensor	1	No	32
53	Phys. Ed	Second Floor	West Stairwell	17	4' linear T8	electronic	6	1	Fluorescent	32	12	2304	Occ. Sensor	1	No	192
54	Phys. Ed	Second Floor	West Stairwell	17	LED Exit Signs	-	1	1	LED	5	24	120	None	No	5	5
55	Phys. Ed	Second Floor	West Stairwell	17	LED Exit Signs	-	1	1	LED	5	24	120	None	No	5	5
56	Phys. Ed	Second Floor	South Entrance (Display lights)	21	2' linear T5	electronic	6	1	Fluorescent	24	12	1728	Occ. Sensor	1	No	144
57	Phys. Ed	Second Floor	Men's Locker	43	4' linear T8	electronic	9	2	Fluorescent	32	12	6912	Occ. Sensor	1	No	576
58	Phys. Ed	Second Floor	Men's Locker (Smaller Room)	5	2' linear T8	electronic	1	1	Fluorescent	15	12	180	Occ. Sensor	1	No	15
59	Phys. Ed	Second Floor	Women's Locker	43	4' linear T8	electronic	9	2	Fluorescent	32	12	6912	Occ. Sensor	1	No	576
60	Phys. Ed	Second Floor	Women's Locker (Smaller Room)	5	2' linear T8	electronic	1	1	Fluorescent	15	12	180	Occ. Sensor	1	No	15
61	Phys. Ed	Second Floor	Janitor's Closet (West)	105	4' linear T8	electronic	1	2	Fluorescent	32	2	128	Occ. Sensor	1	No	64
62	Phys. Ed	Second Floor	Fitness Lab	62	4' linear T8	electronic	10	2	Fluorescent	32	10	6400	Occ. Sensor	1	No	640
63	Phys. Ed	Second Floor	S.C.P.A Offices	80	4' linear T8	electronic	18	4	Fluorescent	32	10	23040	Occ. Sensor	1	No	2304
64	Phys. Ed	Second Floor	S.C.P.A Offices	80	4' linear T8	electronic	24	2	Fluorescent	32	10	15360	Occ. Sensor	1	No	1536
65	Phys. Ed	Second Floor	Room 235	78	4' linear T8	electronic	12	4	Fluorescent	32	10	15360	Occ. Sensor	1	No	1536
66	Phys. Ed	Second Floor	Men's Room	42	4' linear T8	electronic	2	1	Fluorescent	32	12	768	Occ. Sensor	1	No	64
67	Phys. Ed	Second Floor	Men's Room	42	2' linear T8	electronic	4	2	Fluorescent	17	12	1632	Occ. Sensor	1	No	136
68	Phys. Ed	Second Floor	Women's Room	42	4' linear T8	electronic	2	1	Fluorescent	32	12	768	Occ. Sensor	1	No	64
69	Phys. Ed	Second Floor	Women's Room	42	2' linear T8	electronic	2	1	Fluorescent	17	12	408	Occ. Sensor	1	No	34
70	Phys. Ed	Second Floor	Lobby area	56	LED Exit Signs	-	3	1	LED	5	24	360	None	No	15	15
71	Phys. Ed	Second Floor	Lobby - South Entrance area	56	4' linear T8	electronic	5	1	Fluorescent	32	12	1920	Occ. Sensor	1	No	160
72	Phys. Ed	Second Floor	Lobby - South Entrance area	56	75W Flood	-	1	1	Flood	75	15	1125	Sw itch	No	75	75
73	Phys. Ed	Second Floor	Lobby - South Entrance area	56	LED Exit Signs	-	2	1	Fluorescent	5	24	240	Sw itch	No	10	10
74	Phys. Ed	Second Floor	Lobby - South Entrance area	56	LED Exit Signs	-	1	1	LED	5	24	120	Sw itch	No	5	5
75	Phys. Ed	Second Floor	West Hallway	32	4' linear T8	electronic	12	1	Fluorescent	32	12	4608	Occ. Sensor	1	No	384
76	Phys. Ed	Second Floor	West Hallway	32	LED Exit Signs	-	1	1	LED	5	24	120	Sw itch	No	5	5
77	Phys. Ed	Second Floor	East Hallway	32	4' linear T8	electronic	12	1	Fluorescent	32	12	4608	Occ. Sensor	1	No	384
78	Phys. Ed	Second Floor	East Hallway	32	LED Exit Signs	-	1	1	LED	5	24	120	Sw itch	No	5	5
79	Phys. Ed	Second Floor	Gymnasium	25	4-lamp T5	-	32	1	Fluorescent	228	12	87552	Occ. Sensor	1	No	7296
80	Phys. Ed	Second Floor	Gymnasium	25	LED Exit Signs	-	7	1	LED	5	24	840	None	No	35	35
81	Phys. Ed	Third Floor	Mechanical Room	16	4' linear T8	electronic	24	2	Fluorescent	32	12	18432	Occ. Sensor	1	No	1536

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Totals	
Proposed Usage with existing controls (kWh/year)	101,420
Proposed Usage with new controls (kWh/year)	81,944
Total kWh savings	19,476
Total annual \$ Savings	\$ 3,018.75

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>	

PSE&G NATURAL GAS SERVICE TERRITORY

Last Updated: 06/15/09

<p>Cooperative Industries 412-420 Washington Avenue Belleville, NJ 07109 800-6BUYGAS (6-289427) www.cooperativenet.com</p>	<p>Direct Energy Services, LLP 120 Wood Avenue, Suite 611 Iselin, NJ 08830 866-547-2722 www.directenergy.com</p>	<p>Dominion Retail, Inc. 395 Highway 170 - Suite 125 Lakewood, NJ 08701 866-275-4240 http://retail.dom.com</p>
<p>Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701 800-805-8586 www.gesc.com</p>	<p>UGI Energy Services, Inc. d/b/a GASMAR 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>