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**Local Government Energy Program
Energy Audit Report**

For

***City of New Brunswick
New Brunswick Water Utility- Control Building
1 Comstock St
New Brunswick, NJ 08901***

Project Number: LGEA63



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INTRODUCTION

On April 30th, Steven Winter Associates, Inc. (SWA) and PMK Group, a business unit of Birdsall Services Group (BSG-PMK), performed an energy audit and assessment of the New Brunswick Water Utility Control Building in The City of New Brunswick, NJ. Current conditions and energy-related information were collected in order to analyze and facilitate the implementation of energy conservation measures for the building.

The New Brunswick Water Utility Control Building is a partial two story building totaling 10,000 square feet. The Water Utility Control Building was constructed in 1916 with an addition completed in 1935. The New Brunswick Water Utility Control Building contains; water control equipment, offices, a high lift pump area and other offices.

The New Brunswick Water Utility Control Building is occupied by approximately 2 employees at any given time.

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

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

Launched in 2008, the LGEA Program provides subsidized energy audits for municipal and local government-owned facilities, including offices, courtrooms, town halls, police and fire stations, sanitation buildings, transportation structures, schools and community centers. The Program will subsidize 75% of the cost of the audit. If the net cost of the installed measures recommended by the audit, after applying eligible NJ SmartStart Buildings incentives, exceeds the remaining cost of the audit, then that additional 25% will also be paid by the program. The Board of Public Utilities (BPU's) Office of Clean Energy has assigned TRC Energy Services to administer the Program.

EXECUTIVE SUMMARY

This document contains the energy audit report for the New Brunswick Water Utility Control Building in The City of New Brunswick, NJ 08901.

Based on the field visit performed by Steven Winter Associates (SWA) and PMK staff on April 30th, 2010 and the results of a comprehensive energy analysis, this report describes the site's current conditions and recommendations for improvements. Suggestions for measures related to energy conservation and improved comfort are provided in the scope of work. Energy and resource savings are estimated for each measure that results in a reduction of heating, cooling, and electric usage.

Current Conditions

In the most recent full year of data collected, February, 2009 through January, 2010, the New Brunswick Water Utility Control Building consumed a total of 74,276 kWh of electricity for a total cost of \$9,861. In the most recent full year of natural gas data collected, March, 2009 through February, 2010, 10,110 therms of gas were consumed for a total cost of \$12,334. With electricity and natural gas combined, the building consumed 1267 MMBtus of energy at a total cost of \$22,195.

SWA/BSG-PMK has entered energy information about the New Brunswick Water Utility Control Building in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. The building was classified as a Other building preventing it from receiving a performance rating. Buildings achieving an Energy Star rating of 75 are eligible to apply for the Energy Star award and receive the Energy Star plaque to convey superior performance. These ratings also greatly help when applying for Leadership in Energy and Environmental Design (LEED) building certification through the United States Green Building Council (USGBC).

The Site Energy Use Intensity is 127 kBtu/ft²yr compared to the national average of a similar building consuming 104 kBtu/ft²yr. Implementing the recommendations included in this report will reduce the building energy consumption by approximately 71 kBtu/ft²yr.

Based on the assessment of the New Brunswick Water Utility Control Building, SWA/BSG-PMK has separated the recommendations into three categories (See Section 4 for more details). These are summarized as follows:

Category I Recommendations: Capital Improvements:

At this time there are no capital improvements recommended by SWA/BSG-PMK.

Category II: Operations & Maintenance:

- Repair roof drains, gutters, downspouts and flashing
- Repair damaged interior walls
- Monitor moisture build up with in wall cavities
- Replace damaged ceiling tiles
- Clean roof gutters
- Seal openings around window air conditioning units to prevent infiltration.

Category III: Energy Conservation Measures:

At this time, SWA/BSG-PMK highly recommends a total of **4** Energy Conservation Measures (ECMs) for the New Brunswick Water Utility Control Building that are summarized in the following table. The total investment cost for these ECMs, with incentives, is **\$1,314,655** (based on a projected eligibility for New Jersey's Office of Clean Energy current incentive and rebate programs). SWA/BSG-PMK estimates a first year savings of **\$113,372** with an aggregated simple payback of approximately **11 years**. SWA/BSG-PMK estimates that implementing the highly recommended ECMs will reduce the carbon footprint of the facility by **256,000 lbs of CO₂**.

The recommended ECMs and the list below are cost-effective energy efficiency measures and building upgrades that will reduce operating expenses for the City of New Brunswick. Based on the requirements of the LGEA program, the City of New Brunswick must commit to implementing some of these measures, and must submit paperwork to the Local Government Energy Audit program within one year of this report's approval to demonstrate that they have spent, net of other NJCEP incentives, at least 25% of the cost of the audit (per building). The minimum amount to be spent, net of other NJCEP incentives, is \$1,752.50.

SWA recommends that the City of New Brunswick enroll in the following incentive programs through the NJ Office of Clean Energy in order to reduce the installation costs of most measures:

- Direct Install
- SmartStart

The building would not qualify for the Pay-for-Performance program since the energy audit did not show that source energy consumption could not be reduced by 15+%.

Please refer to Appendix C for further details.

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

ROI Return on Investment (%)

Assumptions:

Discount rate: 3.2% per DOE FEMP guidelines Electricity rate \$0.13 \$/kWh
 Energy price escalation rate: 0% per DOE FEMP guidelines Gas rate \$1.22 \$/therm

Avg. Annual Demand: 0.00417 Area of Building (SF): 10,000

Table 1 - Highly Recommended 5-10 Year Payback ECMs																			
ECM #	ECM description	Source	Est. Installed Cost, \$	Est. Incentives, \$	Net Est. ECM Cost with Incentives, \$	kWh, 1st Yr Savings	kW, Demand Reduction/Mo	Therms, 1st Yr Savings	kBtu/sq ft, 1st Yr Savings	Est. Operating Cost, 1st Yr Savings, \$	Total 1st Yr Savings \$	Life of Measure, Yrs	Est. Lifetime Energy Cost Savings, \$	Simple Payback, Yrs	Lifetime Return on Investment, %	Annual Return on Investment, %	Internal Rate of Return, %	Net Present Value, \$	CO2 Reduced, lbs/yr
1	Lighting Upgrades	Empirical Data	\$4,000	\$945	\$3,055	4,662	1.62	0	1.59	\$0	\$606	15	\$7,132	5.04	133%	9%	18%	\$4,181	6,387
2	High-Efficiency Modulating Furnace	Similar Projects	\$10,000	\$400	\$9,600	0	0.00	1,071	10.71	\$0.00	\$1,307	18	\$17,675	7.35	84%	5%	12%	\$8,375	12,534
TOTAL			\$14,000	\$1,345	\$12,655	4,662	1.62	1,071	12.30	\$0.00	\$1,913	-	\$24,807	6.62	-	-	-	\$12,556	18,921

Table 2 - Recommended Extended-Payback ECMs																			
ECM #	ECM description	Source	Est. Installed Cost, \$	Est. Incentives, \$	Net Est. ECM Cost with Incentives, \$	kWh, 1st Yr Savings	kW, Demand Reduction/Mo	Therms, 1st Yr Savings	kBtu/sq ft, 1st Yr Savings	Est. Operating Cost, 1st Yr Savings, \$	Total 1st Yr Savings \$	Life of Measure, Yrs	Est. Lifetime Energy Cost Savings, \$	Simple Payback, Yrs	Lifetime Return on Investment, %	Annual Return on Investment, %	Internal Rate of Return, %	Net Present Value, \$	CO2 Reduced, lbs/yr
3	Replace Refrigerators	Vendor Website	\$2,000	\$0	\$2,000	1,010	0.35	0	0.34	\$0	\$131	19	\$1,848	15.23	-8%	0%	2%	-\$119	1,384
4	144.8-kW Roof-Mounted PV System	Similar Projects	\$1,448,000	\$148,000	\$1,300,000	172,040	59.76	0	58.70	\$0	\$111,328	30	\$2,126,730	11.68	64%	2%	8%	\$882,078	235,695
TOTAL			\$1,450,000	\$148,000	\$1,302,000	173,050	60.11	0	59.05	\$0.00	\$111,459	-	\$2,128,578	11.68	-	-	-	\$881,959	237,079

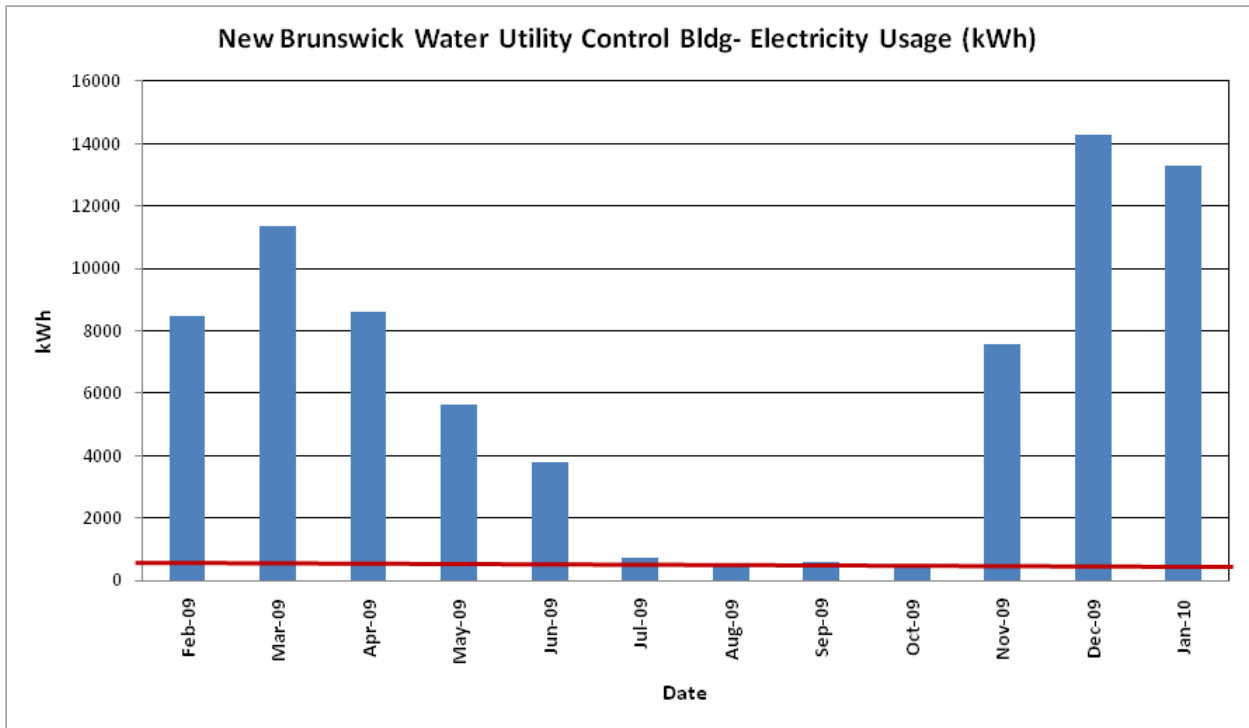
1. HISTORIC ENERGY CONSUMPTION

1.1. Energy Usage and Cost Analysis

SWA/BSG-PMK analyzed utility bills that were received from the utility company supplying the New Brunswick Water Utility Control Building with electric and natural gas from February, 2009 through January, 2010.

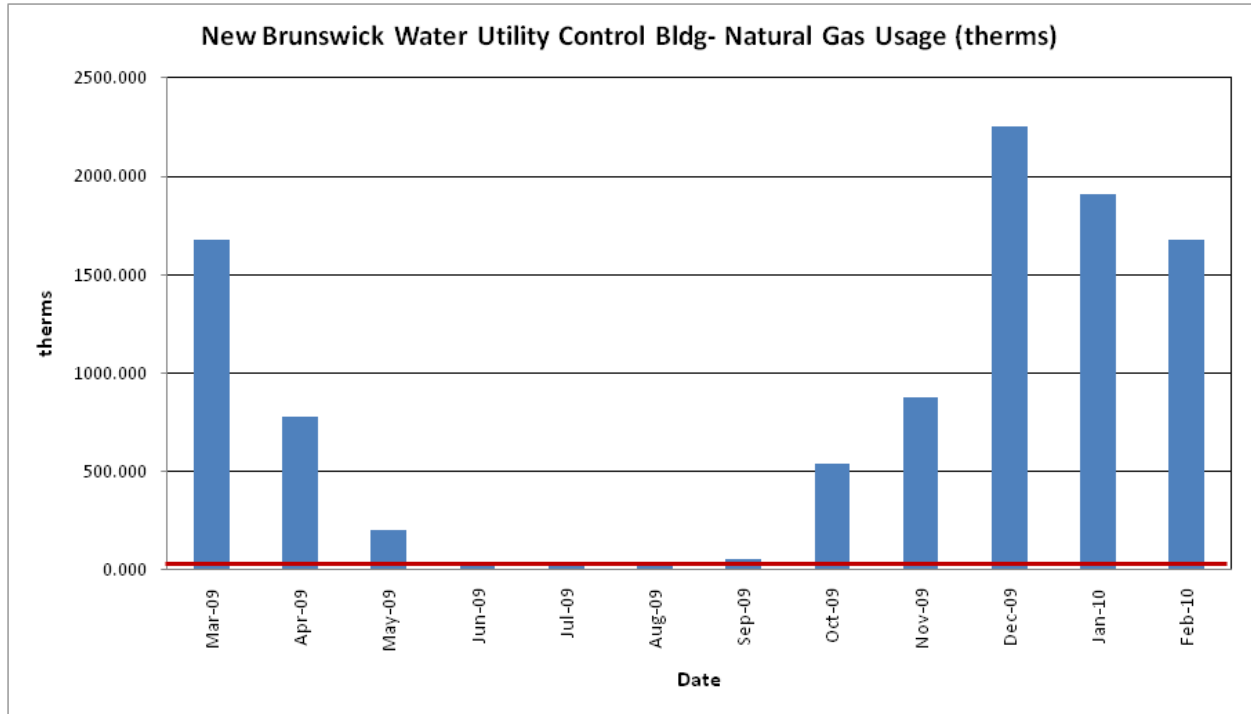
Electricity – The New Brunswick Water Utility Control Building is currently served by one electric meter. The facility currently receives electricity from Public Service Electric & Gas at **an average rate of \$0.13/kWh** based on 12 months of utility bills from February, 2009 through January, 2010. The facility consumed **approximately 74,276 kWh or \$9,861 worth of electricity** in the previous year with an average monthly demand of 26.0 kW.

The following charts show electricity usage for the New Brunswick Water Utility Control Building based on utility bills for the billing analysis period. The red line indicates the estimated base-load in kWh.



Natural Gas – The New Brunswick Water Utility Control Building is currently served by one meter for natural gas. The facility currently receives natural gas from Public Service Electric & Gas at **an average aggregated rate of \$1.22/therm** based on 12 months of utility bills for March, 2009 through February, 2010. The facility consumed **approximately 10,110 therms or \$12,334 worth of natural gas** in the previous year.

The following charts show the natural gas usage for the New Brunswick Water Utility Control Building based on utility bills for the analysis period of March, 2009 through February, 2010



The natural gas usage mimics seasonal needs for heating the buildings showing that natural gas is primarily used for heating. The red line indicates the base-load level for the heating, domestic hot water, and/or cooking needs. The natural gas usage above the red line shows the amount of natural gas used for heating.

1.2. Utility Rate

The New Brunswick Water Utility Control Building currently receives electricity from Public Service Electric & Gas at a general service market rate for electricity use (kWh) with (kW) demand charge. The facility currently pays an average rate of approximately \$0.13/kWh based on the most recent 12 months of utility bills.

The New Brunswick Water Utility Control Building currently receives natural gas supply from Public Service Electric & Gas at a general service market rate for natural gas in therms. There is one gas meter that provides natural gas service to the facility. The average aggregated rate (supply and transport) for the meter is approximately \$1.22/therm based on the most recent 12 months of utility bills.

1.3. Energy Benchmarking

SWA/BSG-PMK has entered energy information about the New Brunswick Water Utility Control Building in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. The username is *cityofnewbrunswick* and the password is *newbrunswick*. The building was classified as a Other space preventing it from earning a performance rating which can be used to achieve an Energy Star building certification.

The Site Energy Use Intensity is 127 kBtu/sq.ft./yr compared to the national average of buildings classified as Other space consuming 104 kBtu/sq.ft./yr. Implementing this report's recommended Energy Conservation Measures (ECMs) will reduce use by approximately 71 kBtu/sq.ft./yr.

SWA/BSG-PMK has created the Portfolio Manager site information for New Brunswick Water Utility Control Building. This information can be accessed at: <https://www.energystar.gov/istar/pmpam/>, with the following:

Username: *cityofnewbrunswick*

Password: *newbrunswick*



STATEMENT OF ENERGY PERFORMANCE

New Brunswick Water Utility- Control Bldg

Building ID: 2377594
 For 12-month Period Ending: April 30, 2010¹
 Date SEP becomes ineligible: N/A

Date SEP Generated: July 07, 2010

Facility
 New Brunswick Water Utility- Control Bldg
 1 Comstock St
 New Brunswick, NJ 08901

Facility Owner
 City of New Brunswick
 76 Bayard St
 New Brunswick, NJ 08901

Primary Contact for this Facility
 Chris Butler
 76 Bayard St
 New Brunswick, NJ 08901

Year Built: 1945
Gross Floor Area (ft²): 10,000

Energy Performance Rating² (1-100) N/A

Site Energy Use Summary³

Electricity - Grid Purchase(kBtu)	256,842
Natural Gas (kBtu) ⁴	1,010,988
Total Energy (kBtu)	1,267,830

Energy Intensity⁵

Site (kBtu/ft ² /yr)	127
Source (kBtu/ft ² /yr)	192

Emissions (based on site energy use)

Greenhouse Gas Emissions (MTCO ₂ e/year)	93
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Electric Distribution Utility

Public Service Elec & Gas Co

National Average Comparison

National Average Site EUI	104
National Average Source EUI	213
% Difference from National Average Source EUI	-10%
Building Type	Other

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, Licensed Professional 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.

2. FACILITY AND SYSTEMS DESCRIPTION

This section gives an overview of the current state of the facility and systems. Please refer to the Proposed Further Recommendations section for recommendations for improvement.

Based on visits from SWA on Friday, May 07, 2010, the following data was collected and analyzed.

2.1. Building Characteristics

The partial two-story, (slab on grade), 10,000 square feet Water Utility Control building was constructed in 1916 with a wing addition completed in 1935. It houses water control equipment and offices, a high lift pump area and other offices.



Front and Left Side Façade



Partial Rear Façade (typ.)



Partial Front Façade



Partial Front Façade

2.2. Building occupancy profiles

Its occupancy is approximately 2 employees at any given time 24/7.

2.3. Building Envelope

Due to unfavorable weather conditions (min. 18 deg. F delta-T in/outside and no/low wind), no exterior envelope infrared (IR) images were taken during the field audit.

General Note: All findings and recommendations on the exterior envelope (base, walls, roofs, doors and windows) are based on the energy auditors' experience and expertise, on construction document reviews (if available) and on detailed visual analysis, as far as accessibility and weather conditions allowed at the time of the field audit.

2.3.1. Exterior Walls

The exterior wall envelope is mostly constructed of brick veneer and some limestone type accents, over structural brick with 0 inches of assumed insulation. The interior is mostly exposed painted brick and some painted gypsum wall board finish.

Note: Wall insulation levels could not be verified in the field and are based on reports from building management.

Exterior and interior wall surfaces were inspected during the field audit. They were found to be in overall poor, age-appropriate condition with numerous signs of uncontrolled moisture, air-leakage and other energy-compromising issues detected on all facades.

The following specific exterior wall problem spots and areas were identified:



Uncontrolled roof water run-off due to defective gutters, downspouts and flashing.



Water damage on interior finishes and major cracks are apparent throughout.



Efflorescence on brick and masonry walls indicate moisture presence within the wall cavity.



Substantial structural damage visible on interior structural members caused by water inside the envelope assembly



2.3.2. Roof

The building's roof is predominantly a low-pitch gable type over a wood structure, with a asphalt shingle finish. It was replaced about 7 years ago. Zero inches of detectable roof insulation. Other parts of the building are also covered by a flat and parapet type over steel decking with a built-up asphalt finish and reflective coating. Zero inches of detectable and assumed roof insulation were recorded. This roof was replaced 12 years ago.

Note: Roof insulation levels could not be verified in the field, and are based on reports from building management.

Roofs, related flashing, gutters and downspouts were inspected during the field audit. They were reported to be in overall poor condition, with numerous signs of uncontrolled moisture, air-leakage and other energy-compromising issues.

The following specific roof problem spots were identified:



Ineffective/clogged gutters



Water damaged ceiling tiles and wood paneling visible in the interior



2.3.3. Base

The building's base is composed of a slab-on-grade floor with a perimeter foundation and no detectable slab edge/perimeter insulation.

Slab/perimeter insulation levels could not be verified in the field or on construction plans, and are based upon similar wall types and time of construction.

The building's base and its perimeter were inspected for signs of uncontrolled moisture or water presence and other energy-compromising issues. Overall the base was reported to be in acceptable condition with no signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

2.3.4. Windows

The building contains basically one type of window.

- Double-hung type windows with a non-insulated aluminum frame, clear double glazing and no interior or exterior shading devices. The windows are located throughout the building and were replaced 16 years ago.

Windows, shading devices, sills, related flashing and caulking were inspected as far as accessibility allowed for signs of moisture, air-leakage and other energy compromising issues. Overall, the windows were found to be in barely acceptable, age and use appropriate condition with some signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

The following specific window problem spot was identified:



Air-leakage at sleeved window/wall air-conditioning

2.3.5. Exterior Doors

The building contains only one type of exterior door.

- Aluminum and glass type exterior doors. They are located throughout the building and were replaced fairly recently.

All exterior doors, thresholds, related flashing, caulking and weather-stripping were inspected for signs of moisture, air-leakage and other energy-compromising issues. Overall, the doors were found to be in acceptable condition with no signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

2.3.6. Building Air Tightness

Overall the field auditors found the building to be not adequately air-tight with numerous areas of suggested improvements, as described in more detail earlier in this chapter.

The air tightness of buildings helps maximize all other implemented energy measures and investments, and minimizes potentially costly long-term maintenance, repair and replacement expenses.

2.4. HVAC systems

2.4.1. Heating

Heating is primarily provided by gas fired unit heaters, and forced hot air in the office and operator room. The gravity filter room is heated by two Sunray low-intensity infrared radiant heaters, each with a heating capacity of 125 MBH. The locker/break room is heated by a 75 MBH, 80% efficient Modine gas-fired unit heater. There are seven (7) 75 MBH, 83% efficient Reznor gas-fired unit heaters; four



Sunray low-intensity infrared radiant heater

(4) units are located in the pump room, two (2) units are in the electrical one, and one (1) is in the generator room. Four (4) 5.6 kW TPI Corp. electric unit heaters are located in the basement.

Category III Recommendation – ECM #2: Replace the furnace that heats the office and operator room with a high-efficiency modulating unit.

2.4.2. Cooling

There are two air-conditioning units in the facility. The shower/locker room area is cooled by a 12,600 BTUH, 10.8 EER Samsung through-the-wall air-conditioner, installed in 2007. The locker/break room area is cooled by a 2 ton, 9.4 EER GE window air-conditioner, installed in 2004. Both were found to be in good working condition and do not warrant replacement.

2.4.3. Ventilation

Ventilation is provided by eight (8) exhaust fans and two (2) outside air intake hoods, all of which are Loren Cook units and are located on the roof. The intake hoods service the generator room. The electrical room is vented by two (2) exhaust fans, rated at 9,589 CFM and 1,500 CFM. Two (2) 750 CFM exhaust fans provide ventilation for general exhaust. Four (4) 13,250 CFM exhaust fans vent the pump room. All were found to be in good working order. These fans are fractional horse power and not viable ECM's

2.4.4. Domestic Hot Water

Domestic hot water is provided by a 65 gallon, 4.5 kW Bradford White electric water heater, installed in 2003.



Bradford White water heater

2.5. Electrical systems

2.5.1. Lighting

A complete inventory of all interior, exterior, and exit sign light fixtures were examined and documented in Appendix A of this report including an estimated total lighting power consumption. The facility consists primarily of T12 Fluorescent fixtures with magnetic ballasts.

Category III Recommendation - ECM 1: Recommend upgrading all T-12 lighting fixtures with magnetic ballasts to T-8 fixtures with electronic ballasts. This and various other lighting upgrades are outlined in Appendix A.

2.5.2. Appliances and Process

Appliances

Appliances, such as refrigerators, that are over 10 years of age should be replaced with newer efficient models with the Energy Star label. For example, Energy Star refrigerators use as little as 315 kWh / yr. When compared to the average electrical consumption of older equipment, Energy Star equipment results in a large savings. Building management should select Energy Star label appliances and equipment when replacing: refrigerators, printers, computers, and copy machines, etc.

More information can be found in the “Products” section of the Energy Star website at: <http://www.energystar.gov>.

In this facility, there are (2) refrigerators, (2) microwaves, a toaster, (2) toaster ovens, (6) computers, (1) TVs, a 4-burner gas stove/oven, and (2) coffee makers. In this facility, some of the appliances found and noted in the attached equipment list were older than the 10 year threshold and should be considered for the Energy Star program.

Category III Recommendation – ECM #3: Replace the (2) refrigerators with more efficient units.

Process:

There are four (4) Flowserve pumps with Emerson motors in the pump room. Pump #1 and Pump #2 are rated at 450 HP and are 95% efficient, and Pump #3 and Pump #4 are rated at 4,175 GPM and 250 HP, and are 94.5% efficient. Two Worthington pumps, neither of which are in use, are located in the basement. Two Byron Jackson vertical pumps with Westinghouse motors are also located in the basement; these pumps are rated at 30 HP and are 89.5% efficient. All pumps are in good condition.



Flowserve pump

2.5.3. Elevators

There are no elevators at this facility.

3. Building Systems Equipment List

New Brunswick Water Utility - Control Building							
Building System	Description	Locations	Model #	Fuel	Space Served	Year Installed	Estimtaed. Remaining Useful Life %
Heating	Low-intensity infrared radiant heater, 125 MBH	Gravity Filter Room	Sunray, M# CR-1250D-4 N, S# BBB-204142	Natural gas	Gravity Filter Room	Approx. 2005	67%
Heating	Low-intensity infrared radiant heater, 125 MBH	Gravity Filter Room	Sunray, M# CR-1250D-4 N, S# BBB-204143	Natural gas	Gravity Filter Room	Approx. 2005	67%
Heating	(4) gas-fired unit heaters, 75 MBH, 83% efficient	Pump room	Reznor, M# UDAS75, S# BGG79Y2N78440X	Natural gas	Pump room	2007	77%
Heating	Gas-fired unit heater, 75 MBH, 80% efficient	Locker/break room	Modine, M# FG 75AAD111, S# 38011012184-4209	Natural gas	Locker/break room	Approx. 2009	90%
Heating	Gas-fired unit heater, 75 MBH, 83% efficient	Generator room	Reznor, M# UDAS75	Natural gas	Generator room	2007	77%
Heating	(2) gas-fired unit heaters, 75 MBH, 83% efficient	Electrical room	Reznor, M# UDAS75	Natural gas	Electrical room	2007	77%
Heating	(2) electric unit heaters, 5.6 kW	Basement	TPI Corp., M# HF686T2M, S# LN56089-001	Electricity	Basement	2003	53%
Heating	(2) electric unit heaters, 5.6 kW	Basement	TPI Corp., M# HF686TC	Electricity	Basement	2003	53%
Heating/ Cooling	Furnace w/ cooling coil (suitable for R-22)	Entrance	Janitrol, M# A49-00, S# 9612074495	Natural gas, electricity	Office, Operator Room	Approx. 1990	0%
Cooling	Through-the-wall air-conditioner, 12,600 BTUH, 10.8 EER	Shower/locker room	Samsung, M# AW1291M, S# PAEW 300007	Electricity	Locker room	Approx. 2007	70%
Cooling	Window air-conditioner, 24,000 BTUH, 9.4 EER	Locker/break room	GE, M# ASM24DES1, S# DG 350111	Electricity	Locker/break room	2004	40%

Domestic Hot Water	Electric water heater, 65 gallons, 4.5 kW	Basement	Bradford White, M# MI65R6DS13, S# ZG3418052	Electricity	Entire building	2003	53%
Pumping	Pump #1	Pump room	Flowserve, S# 0710MS004418-1	Electricity	Process	2009	95%
	Pump motor, 450 HP, 890 RPM, 95% efficient		Emerson, M# 6226-JC3, S# L08 20067906-100R-01				
Pumping	Pump #2	Pump room	Flowserve, S# 0710MS004419-1	Electricity	Process	2009	95%
	Pump motor, 450 HP, 890 RPM, 95% efficient		Emerson, M# L08 20062920-100R-01				
Pumping	Pump #4: 4,175 GPM, 250 HP, 1,180 RPM, 160' head	Pump room	Flowserve, M# 300LNN600, S# 0710MS004421-1	Electricity	Process	2009	95%
	Pump motor, 250 HP, 1,180 RPM, 94.5% efficient		Emerson, M# 6313-J, S# L09 20067923-100R-01				
Pumping	Pump #3: 4,175 GPM, 250 HP, 1,180 RPM, 160' head	Pump room	Flowserve, M# 300LNN600, S# 0710MS004420-1	Electricity	Process	2009	95%
	Pump motor, 250 HP, 1,180 RPM, 94.5% efficient		Emerson, M# 6313-J, S# L09 20067926-100R-01				
Pumping	Pump, not in use	Basement	Worthington	Electricity	Process	Unknown	0%
Pumping	Pump, 6,550 GPM, 450 HP, 1,160 RPM, not in use	Basement	Worthington, S# A350172	Electricity	Process	Unknown	0%
Pumping	Vertical pump	Basement	Byron Jackson, S# 841H4443	Electricity	Basement	Approx. 2000	50%
	Pump motor, 30 HP, 1,765 RPM, 89.5% efficient		Westinghouse, M# T80P, S# 8408				
Pumping	Vertical pump	Basement	Byron Jackson, S# 841H4444	Electricity	Basement	Approx. 2000	50%
	Pump motor, 30 HP, 1,765 RPM, 89.5% efficient		Westinghouse, M# T80P, S# 8409				

Ventilation	EF-10A: Exhaust fan, 9,589 CFM, 837 RPM; 3HP, 1,125 RPM motor	Roof	Loren Cook, M# 300 ACL 300CIOL, S# 0769S032076- 0070000701	Electricity	Electrical room	2008	90%
Ventilation	EF-10: Exhaust fan, 1,500 CFM, 1,574 RPM; 0.25 HP, 1,725 RPM motor	Roof	Loren Cook, M# 135 ACE 135C3B, S# 07SS959523- 01/0001801	Electricity	Electrical room	2007	85%
Ventilation	EF-6: Exhaust fan, 13,250 CFM, 864 RPM; 1.5 HP, 1,725 RPM motor	Roof	Loren Cook, M# 360 HXEM 36HXEM8B, S# 076S959523- 00/0002102	Electricity	Pump room	2007	85%
Ventilation	EF-5: Exhaust fan, 13,250 CFM, 684 RPM; 1.5 HP, 1,725 RPM motor	Roof	Loren Cook, M# 360 HEXM 36HXEM8B, S# 076S959523- 00/0002101	Electricity	Pump room	2007	85%
Ventilation	EF-12: Exhaust fan, 750 CFM, 2,013 RPM; 0.25 HP, 1,725 RPM motor	Roof	Loren Cook, M# 100 ACE 100C3B, S# 076S959523 01/0002902	Electricity	General exhaust	2007	85%
Ventilation	EF-11: Exhaust fan, 750 CFM, 2,013 RPM; 0.25 HP, 1,725 RPM motor	Roof	Loren Cook, M# 100 ACE 100C3B, S# 076S959523- 01/0002901	Electricity	General exhaust	2007	85%
Ventilation	EF-7: Exhaust fan, 13,250 CFM, 864 RPM; 1.5 HP, 1,725 RPM motor	Roof	Loren Cook, M# 360 HXEM 36HXEM8B, S# 076S959523- 00/0002103	Electricity	Pump room	2007	85%
Ventilation	EF-8: Exhaust fan, 13,250 CFM, 864 RPM; 1.5 HP, 1,725 RPM motor	Roof	Loren Cook, M# 360 HXEM 36HXEM8B, S# 076S959523- 00/0002104	Electricity	Pump room	2007	85%

Ventilation	OAI-1: Outside air intake hood	Roof	Loren Cook, M# SPECIAL GI 72X180GI ALUM, S# 076S959523- 01/0008801	Electricity	Generator room	2007	85%
Ventilation	OAI-2: Outside air intake hood	Roof	Loren Cook, M# SPECIAL GI 72X180GI ALUM, S# 076S959523- 01/0008802	Electricity	Generator room	2007	85%
Appliance	Microwave	Office	Haier, M# MWM0701TB, S# 1234567017 20090324	Electricity	Office	2009	93%
Appliance	Refrigerator	Operator Room	Hotpoint, M# CTX14CYTBLWH, S# HL891439	Electricity	Operator Room	1994	16%
Appliance	Microwave	Operator Room	Sharp, M# R-3A85, S# 75275	Electricity	Operator Room	1994	0%
Appliance	Stove/oven, (4) burners	Operator Room	Avanti, no nameplate	Natural gas	Operator Room	Approx. 2000	50%
Appliance	Microwave	Locker/break room	Sharp, M# R- 305HW, S# 185827	Electricity	Locker/break room	2003	30%
Appliance	Refrigerator	Locker/break room	Sanyo, M# SR1150, S# 41200510	Electricity	Locker/break room	Approx. 2000	47%

Note: *The remaining useful life of a system (in %) is the relationship between the system manufactured and / or installed date and the standard life expectancy of similar equipment based on ASHRAE (2003), ASHRAE Handbook: HVAC Applications, Chapter 36.

4. ENERGY CONSERVATION MEASURES

Based on the assessment of this building, SWA and BSG-PMK have separated the investment opportunities into three categories of recommendations:

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

Category I Recommendations: Capital Improvements:

At this time there are no capital improvements recommended by SWA/BSG-PMK.

Category II: Operations & Maintenance:

- Repair roof drains, gutters, downspouts and flashing
- Repair damaged interior walls
- Monitor moisture build up with in wall cavities
- Replace damaged ceiling tiles
- Clean roof gutters
- Seal openings around window air conditioning units to prevent infiltration.

Category III Recommendations: Energy Conservation Measures:

Summary Table

ECM #	Description
1	Lighting Upgrades
2	High-Efficiency Modulating Furnace
3	Replace Refrigerators
4	144.8-kW Roof-Mounted PV System

ECM #1: Lighting Upgrades

Description:

Lighting at the Control Building primarily consists of standard-efficiency fixtures with T12 lamps and magnetic ballasts. There are several Metal Halide fixtures and a number of the fixtures have been upgraded to T8 lamps and electronic ballasts. SWA/BSG-PMK recommends retrofitting the T12 fixtures with T8 lamps and electronic ballasts. Lighting replacements typically yield a short payback and should because of the low cost to upgrade combined favorable energy savings.

Recommended lighting upgrades are detailed in Appendix A.

Installation cost:

Lighting	
Cost	\$4,000.00
Rebate	\$945.00
Net Cost	\$3,055.00
Savings (kWh)	4,662
Savings (\$)	\$606.10
Payback	5.0

Source of cost estimate: Empirical Data

Economics (without incentives):

ECM #	ECM description	Source	Est. Installed Cost, \$	Est. Incentives, \$	Net Est. ECM Cost with Incentives, \$	kWh, 1st Yr Savings	kW, Demand Reduction/Mo	Therms, 1st Yr Savings	kBtu/sq ft, 1st Yr Savings	Est. Operating Cost, 1st Yr Savings, \$	Total 1st Yr Savings \$	Life of Measure, Yrs	Est. Lifetime Energy Cost Savings, \$	Simple Payback, Yrs	Lifetime Return on Investment, %	Annual Return on Investment, %	Internal Rate of Return, %	Net Present Value, \$	CO2 Reduced, lbs/yr
1	Lighting Upgrades	Empirical Data	\$4,000	\$945	\$3,055	4,662	1.62	0	1.59	\$0	\$606	15	\$7,132	5.04	133%	9%	18%	\$4,181	6,387

Assumptions:

The electric cost used in this ECM was \$0.13/kWh, which was the facilities' average rate for the 12-month period from February, 2009 through January, 2010. The replacements for each lighting fixture, the costs to replace or retrofit each one, and the rebates and wattages for each fixture are located in Appendix A.

Rebates/financial incentives:

The New Jersey SmartStart offers rebates for upgrading lighting fixtures and installing lighting controls. The total rebate this ECM qualifies for is \$945.

ECM #2: High-Efficiency Modulating Furnace

Description:

The office and operator room are heated by a gas-fired duct furnace. The furnace has reached the end of its 18-year useful life, and should be replaced. High-efficiency modulating furnaces are now available; Luxaire, for example, manufactures a model that is up to 98% efficient. The current unit was 80% efficient at the time of their purchase, but due to its age and condition, its efficiency was estimated to decrease by 10 percentage points, to 70%. The unit's nameplate did not indicate the heating capacity of the unit, but the size of the unit indicates that it is likely no larger than 120 MBH.

Installation cost:

Estimated installed cost: \$10,000

Source of cost estimate: Similar Projects

Economics:

ECM #	ECM description	Source	Est. Installed Cost, \$	Est. Incentives, \$	Net Est. ECM Cost with Incentives, \$	kWh, 1st Yr Savings	kW, Demand Reduction/Mo	Therms, 1st Yr Savings	kBtu/sq ft, 1st Yr Savings	Est. Operating Cost, 1st Yr Savings, \$	Total 1st Yr Savings \$	Life of Measure, Yrs	Est. Lifetime Energy Cost Savings, \$	Simple Payback, Yrs	Lifetime Return on Investment, %	Annual Return on Investment, %	Internal Rate of Return, %	Net Present Value, \$	CO ₂ Reduced, lbs/yr
2	High-Efficiency Modulating Furnace	Similar Projects	\$10,000	\$400	\$9,600	0	0.00	1,071	10.71	\$0.00	\$1,307	18	\$17,675	7.35	84%	5%	12%	\$8,375	12,534

Assumptions:

The cost per therm of natural gas that was used, taken from twelve months of the Control building's energy bills, was \$1.22. Per ASHRAE, the outdoor drybulb temperature is above 10°F 99.6% percent of a year, and the number of heating degree days for a typical year in this region is 5,065. The desired indoor temperature was estimated to be 68°F. The savings were calculated using the following equations:

$$\frac{\text{Capacity} \times \text{Degree-Days} \times 24}{\text{Efficiency}_{\text{current}} \times (\text{Temp}_{\text{indoor}} - \text{Temp}_{99.6\%})} \times \frac{1 \text{ therm}}{100,000.4 \text{ BTU}} \times \frac{(\text{Weekly Operating Hours})}{24 \times 7} = \text{Current Gas Input (therms)}$$

$$\text{Gas Output (therms)} = \text{Current Gas Input} \times \text{Efficiency}_{\text{current}}$$

$$\text{Proposed Gas Input (therms)} = \frac{\text{Gas Output}}{\text{Efficiency}_{\text{proposed}}}$$

$$\text{Savings (therms)} = \text{Current Gas Input} - \text{Proposed Gas Input}$$

Rebates/financial incentives:

This ECM is calculated based on a projected eligibility for New Jersey's Smart Start Rebate, which pays up to \$400 for each gas-fired furnace, for a total of \$400 for this measure.

ECM #3: Replace Refrigerators

Description:

Refrigerators are needed to be in constant operation in order to keep food from spoiling. Older refrigerators, particularly ones built in 1990 or earlier, have poor insulation and require more electricity in order to produce enough cooling to keep food at a preferred temperature. The two refrigerators in the Control Building, are a; 1985, 10.6 ft.³ Sanyo top freezer unit, and a 14.4 ft.³ Hotpoint top freezer unit, built in 1994. Each should be replaced with Energy Star models. The Sanyo unit consumes 975 kWh of electricity per year, while the Hotpoint unit consumes 761 kWh of electricity per year; by comparison, a 15.5 ft.³ GE top freezer unit consumes 363 kWh of electricity per year

Installation cost: \$1,000 for each unit, \$2,000 total

Source of cost estimate: Vendor website

Economics:

ECM #	ECM description	Source	Est. Installed Cost, \$	Est. Incentives, \$	Net Est. ECM Cost with Incentives, \$	kWh, 1st Yr Savings	kW, Demand Reduction/Mo	Therms, 1st Yr Savings	kBtu/sq ft, 1st Yr Savings	Est. Operating Cost, 1st Yr Savings, \$	Total 1st Yr Savings \$	Life of Measure, Yrs	Est. Lifetime Energy Cost Savings, \$	Simple Payback, Yrs	Lifetime Return on Investment, %	Annual Return on Investment, %	Internal Rate of Return, %	Net Present Value, \$	CO ₂ Reduced, lbs/yr
3	Replace Refrigerators	Vendor Website	\$2,000	\$0	\$2,000	1,010	0.35	0	0.34	\$0	\$131	19	\$1,848	15.23	-8%	0%	2%	-\$119	1,384

Assumptions:

The electric cost used in this ECM was \$0.13/kWh, which was the Control Building’s average rate for the 12-month period ranging from February, 2009 through February, 2010. Current and proposed annual electric consumptions for each refrigerator were found on the website for the United States Environmental Protection Agency (EPA), which has a database of refrigerators and their annual electric consumptions.

Rebates/financial incentives:

No rebates or incentives were be found for this ECM.

ECM #4: 144.8-kW Roof-Mounted PV System

Description:

Currently, the control building does not use any renewable energy systems. Renewable energy systems, such as photovoltaic panels, can be mounted on the roof of the facility and can offset a significant portion of the purchased electricity for the building. Power stations generally have two separate electrical charges: usage and demand. Usage is the amount of electricity in kilowatt-hours that a building uses from month to month. Demand is the amount of electrical power that a building uses at any given instance in a month period. During the summer periods, when electric demand at a power station is high due to the amount of air conditioners, lights, equipment, etc. being used within the region, demand charges go up to offset the utility’s cost to provide enough electricity at that given time. Photovoltaic systems not only offset the amount of electricity use by a building, but also reduce the building’s electrical demand, resulting in a higher cost savings as well. SWA/BSG-PMK presents below the economics of installing a 144.8-kW PV system to offset electrical demand for the building and reduce the annual net electric consumption for the building. A system of 724 commercial multi-crystalline 230 watt panels would generate 172,040 kWh of electricity per year.

Installation cost:

Estimated installed cost: \$1,448,000; SREC revenue included in “Total 1st Year Savings”
 Source of cost estimate: Similar projects

Economics:

ECM #	ECM description	Source	Est. Installed Cost, \$	Est. Incentives, \$	Net Est. ECM Cost with Incentives, \$	kWh, 1st Yr Savings	kW, Demand Reduction/Mo	Therms, 1st Yr Savings	kBtu/sq ft, 1st Yr Savings	Est. Operating Cost, 1st Yr Savings, \$	Total 1st Yr Savings \$	Life of Measure, Yrs	Est. Lifetime Energy Cost Savings, \$	Simple Payback, Yrs	Lifetime Return on Investment, %	Annual Return on Investment, %	Internal Rate of Return, %	Net Present Value, \$	CO2 Reduced, lbs/yr
4	144.8-kW Roof-Mounted PV System	Similar Projects	\$1,448,000	\$148,000	\$1,300,000	172,040	59.76	0.00	58.70	\$0	\$111,328	30	\$2,126,730	11.68	64%	2%	8%	\$882,078	235,695

Assumptions:

Cost of installation was estimated, using data from similar projects, at approximately \$7,000 per kW. Annual energy savings were calculated via “PV Watts”, an online tool on the website of the National Renewable Energy Laboratory.

Rebates/financial incentives:

This ECM is eligible for New Jersey’s Solar Renewable Energy Certificates (SREC). SRECs are marketable certificates issued to the owner of a PV system for each 1,000 kWh (1MWh) of electricity generated. SRECs are sold or traded separately from the power generated; the income from the sale of the SREC can be used to offset the cost of the system by applying the revenue to a loan payment or debt service. The value of the SREC is market driven, and is controlled by the amount of the Solar Alternative Compliance Payment (SACP) which is set by the NJBPU. The SREC market is derived from New Jersey’s Renewable Portfolio Standard (RPS), which requires that all licensed energy suppliers in the state invest in energy generated from renewable sources, with specific requirements for solar power. If a supplier does not invest by purchasing SRECs, the supplier must pay the SACP for a percentage of the total annual power produced. Since SRECs typically trade just below the SACP, there is an incentive for the supplier to buy SRECs. The SREC Program provides a

market for SRECs to be created and verified on the owner's behalf. The New Jersey Clean Energy program facilitates the sale of SRECs to New Jersey electric suppliers. PV system owners in New Jersey with a grid-connected PV system are eligible to participate in New Jersey's SREC Program.

The NJBPU has stated its intention to continue to operate a program of rebates and SRECs. On September 12, 2007, the NJBPU approved an SREC only pilot incentive program. The program set the SACP at an initial value of \$711, decreasing annually for an eight (8) year period. SRECs would be generated for fifteen (15) years (referred to as the Qualification Life), and have a two (2) year trading life. The NJBPU believes that to achieve an internal rate of return of twelve (12) percent, the target SREC price would be \$611, reducing by three (3) percent per year for the same eight (8) year period that the SACP is set.

5. ENERGY CONSERVATION MEASURE FUNDING ALTERNATIVES

BSG-PMK/SWA has reviewed several funding options for the purposes of subsidizing the costs for installing the energy conservation measures noted within this report.

Although funding options are constantly changing and updating this project may benefit from enrolling in a number of alternative programs such as the; The NJ SmartStart program with Technical Assistance, alternate funding by applying for financing and competitive grants through the United States Department of Energy as well as local utility incentive programs in an effort to offset a portion of the cost of ECM implementation.

The Smart Start program offers reimbursement incentives for various equipment purchases, and lighting incentives. The benefits and requirements of this program can be found at:

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

The Pay-for-Performance program offers incentives for working with an approved contractor to create a scope of work that will reduce source energy consumption by 15+%. Incentives are achieved during various phases of reporting and implementation. The benefits and requirements of this program can be found at:

<http://www.njcleanenergy.com/commercial-industrial/programs/pay-performance>

Financial assistance is also available through the United States Department of Energy in the form of; Grants, Cooperative Research and development agreements, small business innovation research, and Loan Guarantee Programs. Further information for these programs is available at:

http://www1.eere.energy.gov/financing/types_assistance.html

Local Utility incentives such as a Direct Install Program, offer incentives that can provide up to 80% subsidy of the cost to install particular ECM's. As each utility company has different guidelines and incentives it is important to contact your local utility authority for eligibility in these programs.

Additional funding may also be found through the following funding methods:

- Energy Savings Improvement Program (ESIP) – Public Law 2009, Chapter 4 authorizes government entities to make energy related improvements to their facilities and pay for the costs using the value of energy savings that result from the improvements.
- Municipal Bonds – Municipal bonds are a bond issued by a city or other local government, or their agencies. Municipal bonds may be general obligations of the issuer or secured by specified revenues. Interest income received by holders of municipal bonds is often exempt from the federal income tax and from the income tax of the state in which they are issued, although municipal bonds issued for certain purposes may not be tax exempt.
- Power Purchase Agreement – Public Law 2008, Chapter 3 authorizes contractor of up to fifteen (15) years for contracts commonly known as “power purchase agreements.”

These are programs where the contracting unit (Owner) procures a contract for, in most cases, a third party to install, maintain, and own a renewable energy system.

BSG-PMK/SWA recommends the Owner review the use of the above-listed funding options in addition to utilizing their standard method of financing for facilities upgrades in order to fund the proposed energy conservation measures.

6. RENEWABLE AND DISTRIBUTED ENERGY MEASURES

6.1. Existing systems

There are currently no existing renewable energy systems.

6.2. Solar Photovoltaic

As a result of our study, the roof of the New Brunswick Water Utility Control Building has been identified as not conducive for the application of a Photovoltaic (PV) system, but there is open space adjacent to the New Brunswick Water Utility Control Building that has been identified as conducive for the application of Photovoltaic (PV) system.

Based on the goal of generating as much electric load as possible utilizing renewable energy while meeting the limitations of usable space available, a PV system with a design capacity of 144.8 kW was selected. The total annual generating capacity of the system is 172,040 kWh as estimated using PV WATTS calculator provided by the Department of Energy (DOE), National Renewable Energy Laboratory (NREL).



AC Energy
&
Cost Savings



(Type comments here to appear on printout; maximum 1 row of 80 characters.)

Station Identification	
City:	Newark
State:	New_Jersey
Latitude:	40.70° N
Longitude:	74.17° W
Elevation:	9 m
PV System Specifications	
DC Rating:	144.8 kW
DC to AC Derate Factor:	0.770
AC Rating:	111.5 kW
Array Type:	Fixed Tilt
Array Tilt:	35.0°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	15.0 ¢/kWh

Results			
Month	Solar Radiation (kWh/m ² /day)	AC Energy (kWh)	Energy Value (\$)
1	3.24	11514	1727.10
2	3.95	12613	1891.95
3	4.56	15653	2347.95
4	4.92	15628	2344.20
5	5.46	17483	2622.45
6	5.52	16646	2496.90
7	5.45	16757	2513.55
8	5.36	16308	2446.20
9	5.07	15495	2324.25
10	4.37	14289	2143.35
11	3.05	10054	1508.10
12	2.75	9599	1439.85
Year	4.48	172040	25806.00

This proposed PV system would include 724 flat, crystalline PV modules installed on the roof. The system is based on commonly used 200 Watt PV modules, and one (1) inverter for conversion to AC power.

It is noted this system would supplement the utility power supply since PV electricity production is based on weather. The estimated cost of construction would be approximately \$1,448,000 for this system. The approximate annual savings would be \$111,326, which would make the approximate payback 13 years

PV System – New Brunswick Water Utility Control Bldg

	Savings	Cost
Estimated Cost Of Construction		\$1,448,000
REIP Incentive		-\$148,000
Township Investment		\$1,300,000
First Year Electric Energy Savings	\$25,806	
Estimated Annual SREC Revenue	\$86,020	
Annual Maintenance		\$500
First Year Savings	\$11,326	
Simple Payback Analysis	Approximately 13 Years	

If the Client is interested in moving forward, a structural analysis of the roofs must be performed to confirm they will support the addition of PV modules.

6.3. Solar Thermal Collectors

Solar thermal collectors are not recommended for this location based on the shading and amount of roof area available with unobstructed southern exposure.

6.4. Combined Heat and Power

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

6.5. Geothermal

Geothermal is not applicable to this project. A geothermal system would require the existing heating distribution system to be removed and replaced with a heat pump system. Large underground vertical or horizontal loop systems would need to be installed beneath the existing concrete pad and asphalt. These modifications to the existing heat distribution system would be extremely disruptive to the use of the building and the surrounding neighborhood in addition to the high cost of such an installation and retrofit.

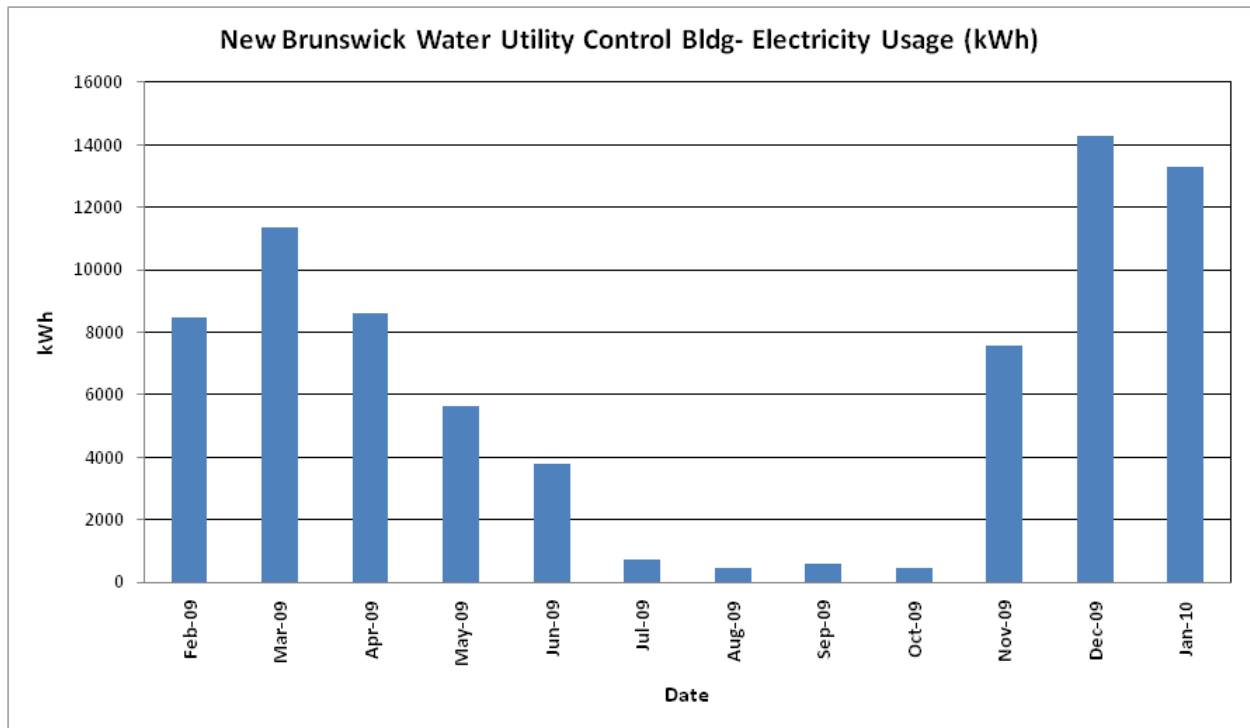
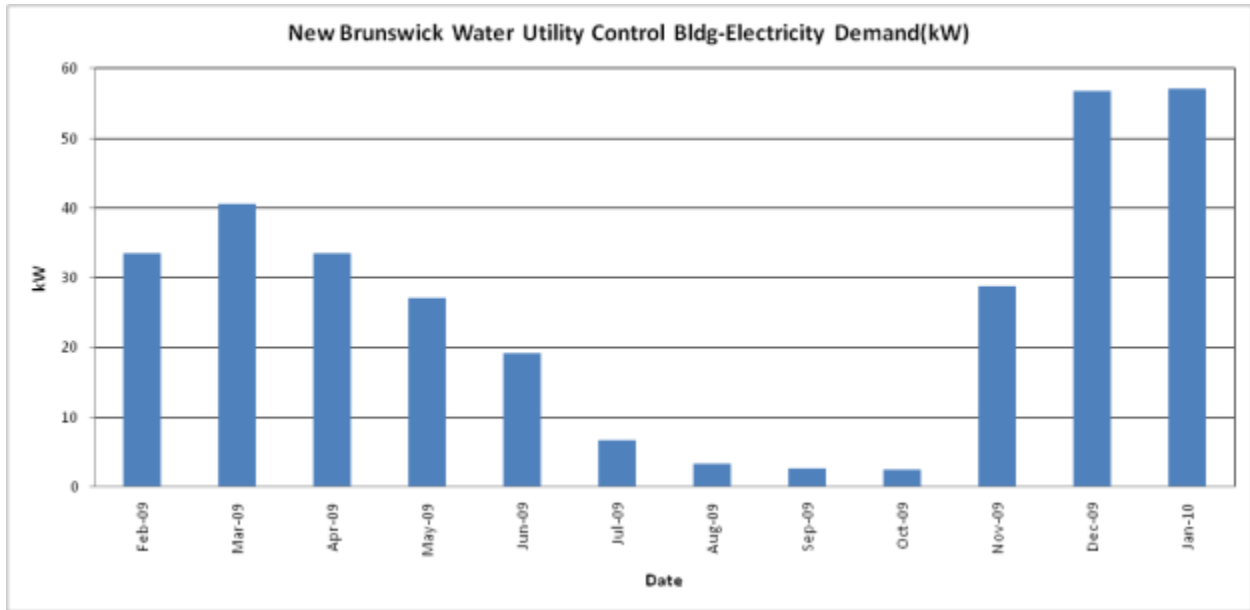
6.6. Wind

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

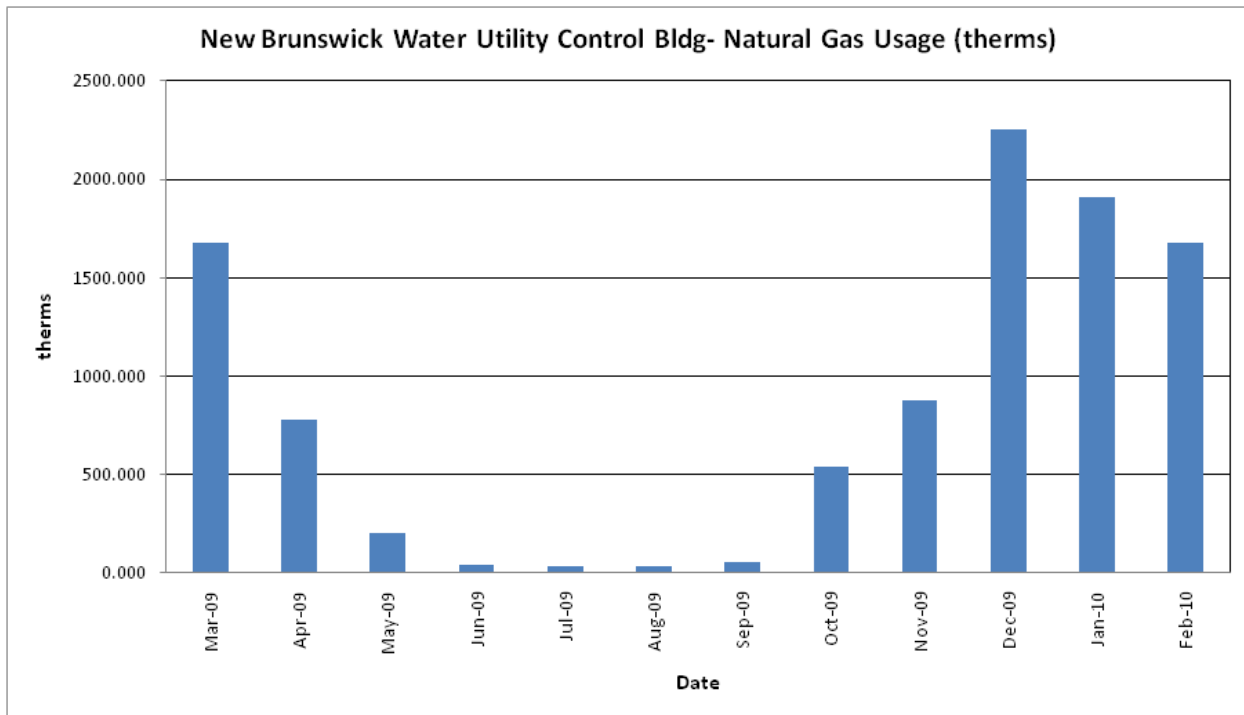
7. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

7.1. Energy Purchasing

The average electrical peak demand for the previous year was 26 kW and the maximum peak demand was 57.12 kW. The electric and gas load profiles for this project are presented in the following charts. The first chart shows electric demand (in kW) for the previous 12 months and the other two charts show electric and gas usage (in kWh), respectively.



The electrical demand peaks (except for a few fluctuations) reflect the electrical consumption peaks.



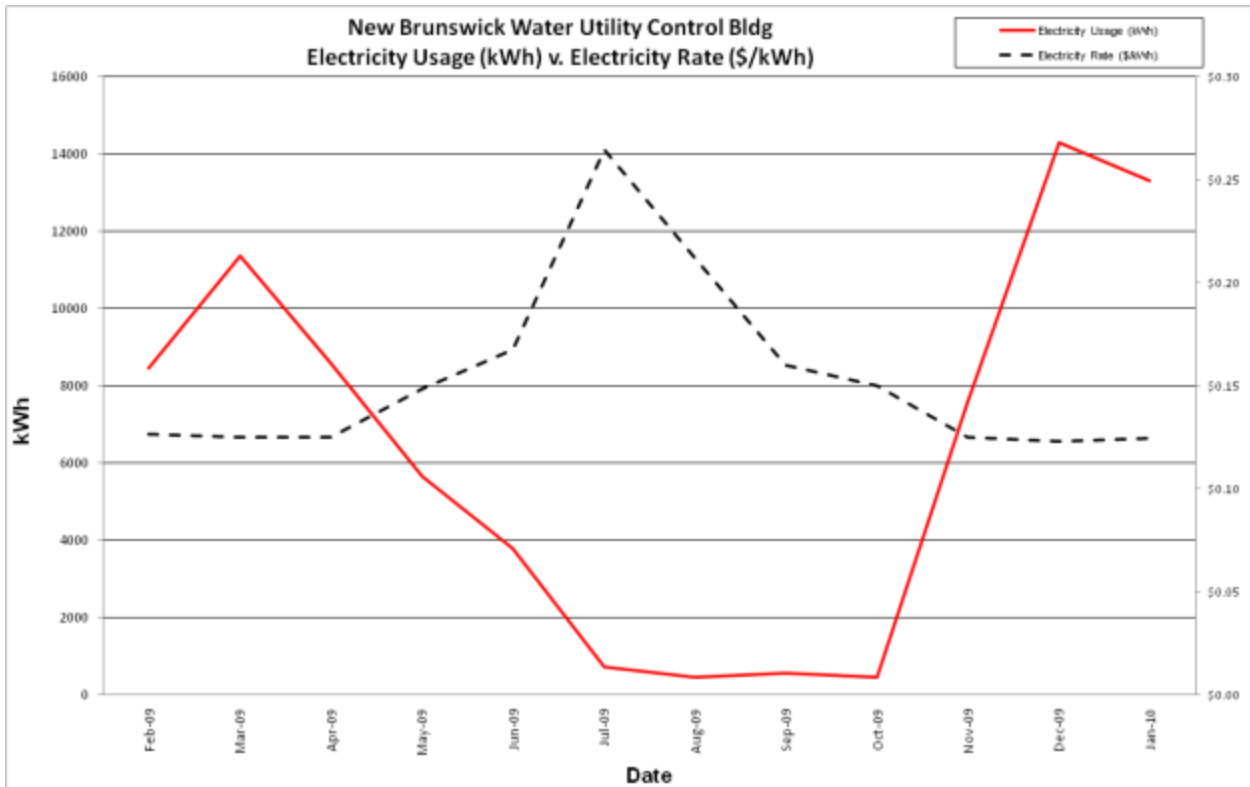
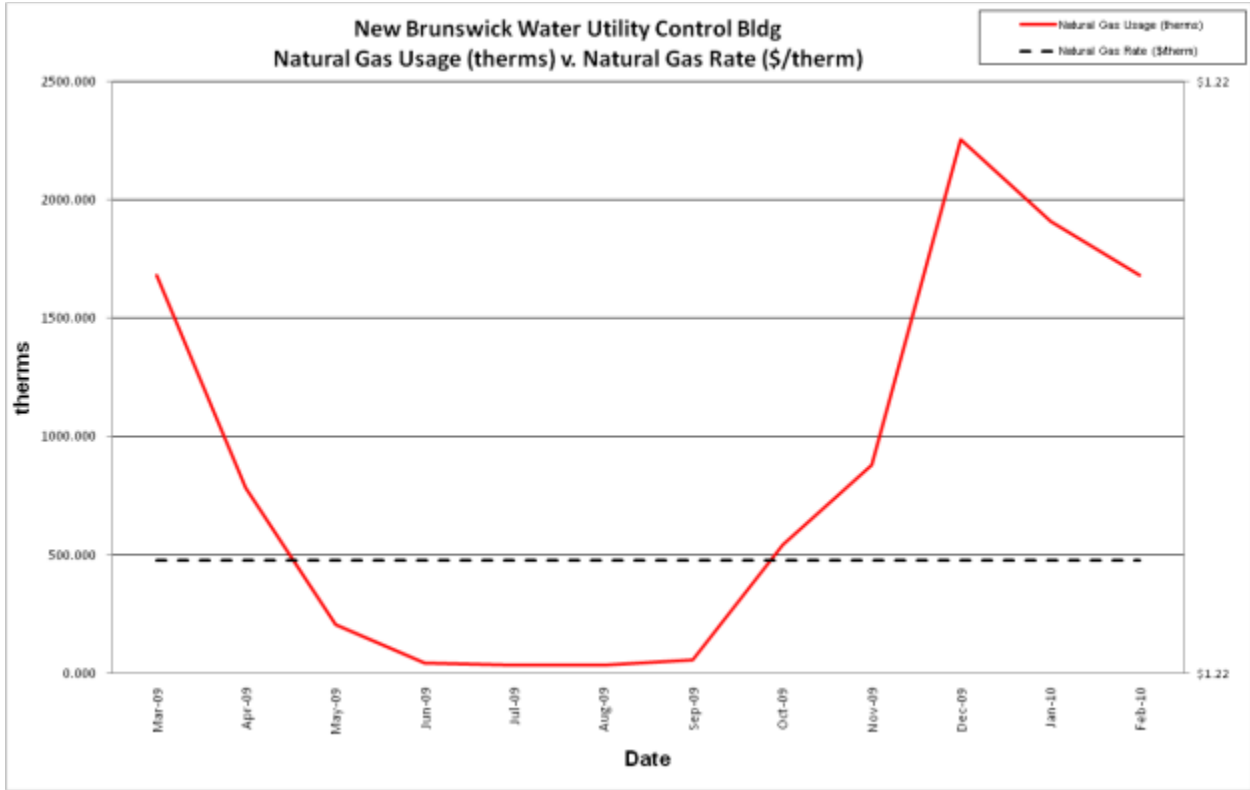
The natural gas usage shows that the most natural gas is consumed in the winter months, meaning the majority of natural gas use in this building is for heating.

7.2. Tariff analysis

Currently, natural gas is provided via one gas meter with Public Service Electric & Gas serving as transmission and supply provider. The general service rate for natural gas charges a market-rate price based on use and the New Brunswick Water Utility Control Building billing data does not breakdown demand costs for all periods. Typically, the natural gas prices increase during the cooling months when natural gas is less of a demand.

The New Brunswick Water Utility Control Building is direct-metered (via one meter) and currently purchases electricity transmission from Public Service Electric & Gas and electricity supply from Direct Energy at a general service rate. The general service rate for electric charges are market-rate based on use and the New Brunswick Water Utility Control Building billing does show a breakdown of demand costs. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year. Typically, the electricity prices increase during the cooling months when electricity is used by the HVAC condensing units and air handlers.

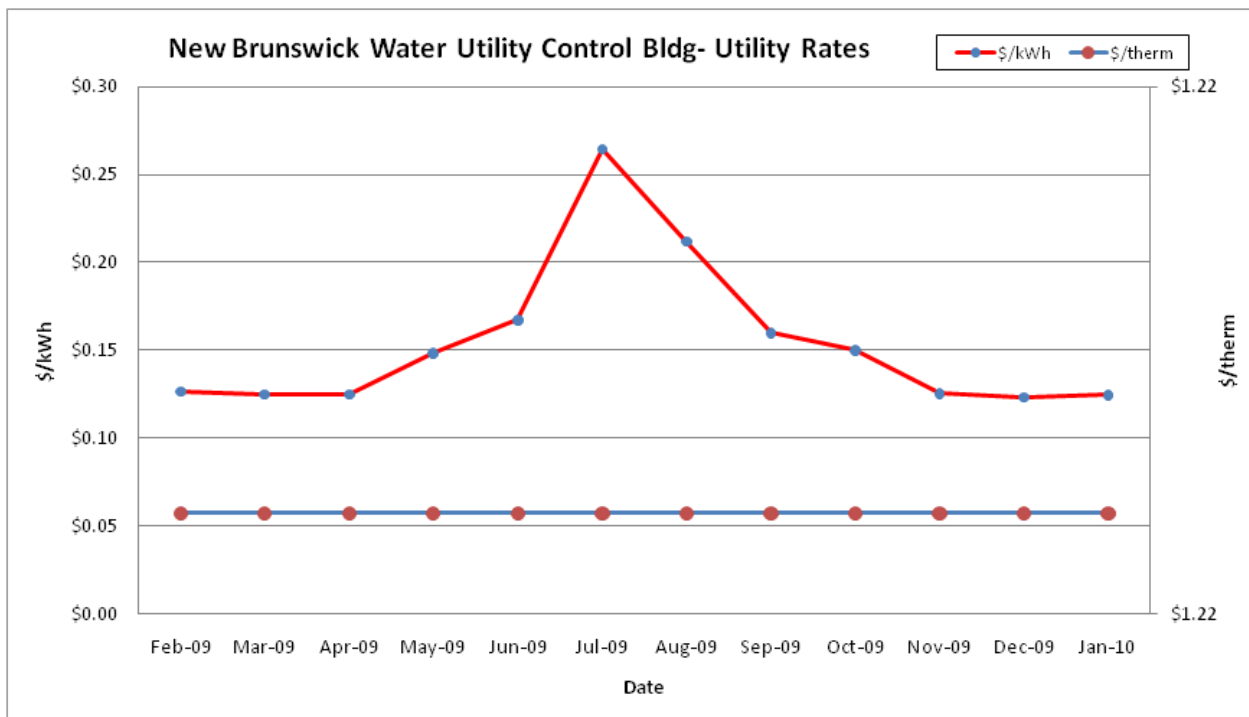
The following charts compare the utility consumption and utility rates for the natural gas and electricity over the previous 12 month period.



7.3. Energy Procurement strategies

Billing analysis shows large price fluctuations of over the course of the year for the New Brunswick Water Utility Control Building natural gas account. Changing third party suppliers could reduce the cost associated with energy procurement. Customers that have a large variation in monthly billing rates can often reduce the costs associated with energy procurement by selecting a third party energy supplier. Contact the NJ Energy Choice Program for further information on Energy Services Companies (ESCOs) that can act as third party energy suppliers. Appendix B contains a complete list of third party energy suppliers.

New Brunswick Water Utility already purchases electricity from a PSE&G at a rate lower than the state average. Natural gas is purchased for less than the state average from PSE&G.



8. METHOD OF ANALYSIS

8.1. Assumptions and methods

Energy modeling method: Spreadsheet-based calculation methods

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

RS Means 2009 (Building Construction Cost Data)

RS Means 2009 (Mechanical Cost Data)

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

8.2. 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.

LIGHTING ANALYSIS

New Brunswick
Water Utility Control Building
1 Comstock Street



Upgrade Code	Upgrade Description	Existing		Proposed		Lighting		
		Fixture	Watts	Fixture	Watts	Total # of Upgrades	Cost per Upgrade (\$)	SmartStart Rebate per Upgrade
1	Retrofit the 8' fixture by replacing the (1) T12 Lamps and Magnetic Ballast(s) with (1) T8 Lamps and an Electronic Ballast	1L8' EE/STD	83	1L8' T8/ELEC	67	15	\$50.00	\$15.00
2	4' wrap around fixture w/ (4) T8 Lamps and Electronic Ballast/No Upgrade	4L4' T8/ELEC	110	No Upgrade	110	1	\$0.00	\$0.00
3	Retrofit the 4' fixture by replacing the (2) T12 Lamps and Magnetic Ballast(s) with (2) T8 Lamps and an Electronic Ballast	2L4' EE/STD	80	2L4' T8/ELEC	61	17	\$50.00	\$15.00
4	Retrofit the 4' recessed fixture by replacing the (4) T12 Lamps and Magnetic Ballast(s) with (4) T8 Lamps and an Electronic Ballast	4L4' EE/STD	160	4L4' T8/ELEC	110	27	\$80.00	\$15.00
5	4' recessed fixture with (3) T8 Lamps and an Electronic Ballast	3L4' T8/ELEC	89	No Upgrade	89	20	\$0.00	\$0.00
6	250W Metal Halide Fixture / No Upgrade	250W MH/BALLAST	286	No Upgrade	286	18	\$0.00	\$0.00
7	Pole-mounted fixture with 250W high-pressure sodium / No upgrade	250W HPS/BALLAST	295	No Upgrade	295	7	\$0.00	\$0.00
8	Replace 15W incandescent exit signs w/ 2W LED exit signs	15W EXIT	15	LED	2	6	\$40.00	\$10.00
9						0	\$0.00	\$0.00
10						0	\$0.00	\$0.00
11						0	\$0.00	\$0.00
12						0	\$0.00	\$0.00

Summary

	Lighting (Only)	Sensors (Only)	Complete Lighting Upgrade
Cost	\$4,000.00	\$0.00	\$4,000.00
Rebate	\$945.00	\$0.00	\$945.00
Net Cost	\$3,055.00	\$0.00	\$3,055.00
Savings (kWh)	4,662	0	4,662
Savings (\$)	\$606.10	\$0.00	\$606.10
Payback	5.0		5.0

Variables:

\$0.13	Avg. Electric Rate (\$/kWh)
	Avg. Demand Rate (\$/kW)
2080	Operating Hours/Year
8	Operating Hours/Work Day

Assumptions:

25%	Occupancy Sensor Savings (Avg)
40%	Occupancy Sensor Savings(>Avg)

Notes:

Seq. #	Upgrade Code	Room/Area	Hrs/Work Day	Hrs/Year	Existing				Proposed				kW Reduction	Lighting				Occupancy Sensors (ONLY)				Lighting & Occupancy Sensors			
					Fixture	Qty.	Watts	Foot Candles	Fixture	Qty.	Watts	Energy Savings, kWh		Cost (\$)	Savings (\$)	Payback (yrs)	Energy Savings, kWh	Cost (\$)	Savings (\$)	Payback (yrs)	SmartStart Rebate	Energy Savings, kWh	Post-Rebate Cost (\$)	Savings (\$)	Payback (yrs)
Totals:					16118		14127	1.991	4662	\$4,000.00	\$606.10	6.6	0	\$0.00	\$0.00	\$945.00	\$0.00	4662	\$3,055.00	\$606.10	5.0				
1	4	Operators room	8	2080	4L4' EE/STD	9	1440		4L4' T8/ELEC	9	990	0.45	936	\$720.00	\$121.68	5.9	0	\$0.00	\$0.00	\$135.00	\$0.00	936	\$585.00	\$121.68	4.8
2	1	Lobby foyer	8	2080	1L8' EE/STD	2	166		1L8' T8/ELEC	2	134	0.032	67	\$100.00	\$8.65	11.6	0	\$0.00	\$0.00	\$30.00	\$0.00	67	\$70.00	\$8.65	8.1
3	2	Lobby foyer	8	2080	4L4' T8/ELEC	1	110		No Upgrade	1	110	0	0	\$0.00	\$0.00		0	\$0.00	\$0.00	\$0.00	\$0.00	0	\$0.00	\$0.00	
4	3	Lobby foyer	8	2080	2L4' EE/STD	1	80		2L4' T8/ELEC	1	61	0.019	40	\$50.00	\$5.14	9.7	0	\$0.00	\$0.00	\$15.00	\$0.00	40	\$35.00	\$5.14	6.8
5	1	Gravity filter room	8	2080	1L8' EE/STD	6	498		1L8' T8/ELEC	6	402	0.096	200	\$300.00	\$25.96	11.6	0	\$0.00	\$0.00	\$90.00	\$0.00	200	\$210.00	\$25.96	8.1
6	4	Restroom	8	2080	4L4' EE/STD	1	160		4L4' T8/ELEC	1	110	0.05	104	\$80.00	\$13.52	5.9	0	\$0.00	\$0.00	\$15.00	\$0.00	104	\$65.00	\$13.52	4.8
7	4	Office	8	2080	4L4' EE/STD	6	960		4L4' T8/ELEC	6	660	0.3	624	\$480.00	\$81.12	5.9	0	\$0.00	\$0.00	\$90.00	\$0.00	624	\$390.00	\$81.12	4.8
8	5	Pump room	8	2080	3L4' T8/ELEC	12	1068		No Upgrade	12	1068	0	0	\$0.00	\$0.00		0	\$0.00	\$0.00	\$0.00	\$0.00	0	\$0.00	\$0.00	
9	6	Pump room	8	2080	250W MH/BALLAST	12	3432		No Upgrade	12	3432	0	0	\$0.00	\$0.00		0	\$0.00	\$0.00	\$0.00	\$0.00	0	\$0.00	\$0.00	
10	3	Stairwell	8	2080	2L4' EE/STD	1	80		2L4' T8/ELEC	1	61	0.019	40	\$50.00	\$5.14	9.7	0	\$0.00	\$0.00	\$15.00	\$0.00	40	\$35.00	\$5.14	6.8
11	4	Locker room	8	2080	4L4' T8/ELEC	2	320		4L4' T8/ELEC	2	220	0.1	208	\$160.00	\$27.04	5.9	0	\$0.00	\$0.00	\$30.00	\$0.00	208	\$130.00	\$27.04	4.8
12	4	Shower room	8	2080	4L4' EE/STD	2	320		4L4' T8/ELEC	2	220	0.1	208	\$160.00	\$27.04	5.9	0	\$0.00	\$0.00	\$30.00	\$0.00	208	\$130.00	\$27.04	4.8
13	3	Basement	8	2080	2L4' EE/STD	15	1200		2L4' T8/ELEC	15	915	0.285	593	\$750.00	\$77.06	9.7	0	\$0.00	\$0.00	\$225.00	\$0.00	593	\$525.00	\$77.06	6.8
14	1	Basement	8	2080	1L8' EE/STD	7	581		1L8' T8/ELEC	7	469	0.112	233	\$350.00	\$30.28	11.6	0	\$0.00	\$0.00	\$105.00	\$0.00	233	\$245.00	\$30.28	8.1
15	5	Electrical control room	8	2080	3L4' T8/ELEC	8	712		No Upgrade	8	712	0	0	\$0.00	\$0.00		0	\$0.00	\$0.00	\$0.00	\$0.00	0	\$0.00	\$0.00	
16	6	Generator room	8	2080	250W MH/BALLAST	6	1716		No Upgrade	6	1716	0	0	\$0.00	\$0.00		0	\$0.00	\$0.00	\$0.00	\$0.00	0	\$0.00	\$0.00	
17	4	Office	8	2080	4L4' EE/STD	7	1120		4L4' T8/ELEC	7	770	0.35	728	\$560.00	\$94.64	5.9	0	\$0.00	\$0.00	\$105.00	\$0.00	728	\$455.00	\$94.64	4.8
18	7	Exterior	8	2080	250W HPS/BALLAST	7	2065		No Upgrade	7	2065	0	0	\$0.00	\$0.00		0	\$0.00	\$0.00	\$0.00	\$0.00	0	\$0.00	\$0.00	
19	8	Exit signs	24	8760	15W EXIT	6	90		LED	6	12	0.078	683	\$240.00	\$88.83	2.7	0	\$0.00	\$0.00	\$60.00	\$0.00	683	\$180.00	\$88.83	2.0

Appendix B: Third Party Energy Suppliers (ESCOs)

PSE&G SERVICE TERRITORY

Last Updated: 05/19/10

***CUSTOMER CLASS - R – RESIDENTIAL C – COMMERCIAL I –INDUSTRIAL**

*****GREEN POWER MARKETER**

Supplier	Telephone & Web Site	*Customer Class
American Powernet Management, LP 437 North Grove St. Berlin, NJ 08009	(877) 977-2636 www.americanpowernet.com	C ACTIVE
Commerce Energy, Inc. 4400 Route 9 South, Suite 100 Freehold, NJ 07728	(800) 556-8457 www.commerceenergy.com	C ACTIVE
ConEdison Solutions Cherry Tree Corporate Center 535 State Highway 38 Cherry Hill, NJ 08002	(888) 665-0955 www.conedsolutions.com	C ACTIVE
Constellation NewEnergy, Inc. 900A Lake Street, Suite 2 Ramsey, NJ 07446	(888) 635-0827 www.newenergy.com	C/I ACTIVE
Credit Suisse, (USA) Inc. 700 College Road East Princeton, NJ 08450	(212) 538-3124 www.creditsuisse.com	C ACTIVE
Direct Energy Services, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com	C/I ACTIVE
FirstEnergy Solutions 300 Madison Avenue Morristown, NJ 07962	(800) 977-0500 www.fes.com	C/I ACTIVE
Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, N.J. 08701	(800) 805-8586 www.gesc.com	R/C/I ACTIVE
Green Mountain Energy Company*** 3000 Atrium Way	(800) 810-7300	R/C/I

Mount Laurel, NJ 08054	www.greenmountain.com	ACTIVE
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com	C/I ACTIVE
Integrus Energy Services, Inc. 99 Wood Ave, South, Suite 802 Iselin, NJ 08830	(877) 763-9977 www.integrusenergy.com	C/I ACTIVE
Liberty Power Delaware, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(866) 769-3799 www.libertypowercorp.com	C/I ACTIVE
Liberty Power Holdings, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(866) 769-3799 www.libertypowercorp.com	C/I ACTIVE
Linde Energy Services 575 Mountain Avenue Murray Hill, NJ 07974	(800) 247-2644 www.linde.com	C/I ACTIVE
Palmco Power NJ, LLC One Greentree Centre 10000 Lincoln Drive East, Suite 201 Marlton, NJ 08053	(877) 726-5862 www.PalmcoEnergy.com	C/I ACTIVE
Pepco Energy Services, Inc. 112 Main St. Lebanon, NJ 08833	(800) ENERGY-9 (363-7499) www.pepco-services.com	C/I ACTIVE
Sempra Energy Solutions The Mac-Cali Building 581 Main Street, 8th Floor Woodbridge, NJ 07095	(877) 273-6772 www.semprasolutions.com	C/I ACTIVE
South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037	(800) 756-3749 www.southjerseyenergy.com	C/I ACTIVE

Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 07928	(800) 225-1560 www.spragueenergy.com	C/I ACTIVE
Sterling Planet, Inc.*** 58 Otto Avenue Beverly, NJ 08010	(877) 457-2306 www.sterlingplanet.com	R/C/I ACTIVE
Strategic Energy, LLC 55 Madison Avenue, Suite 400 Morristown, NJ 07960	(888) 925-9115 www.sel.com	C/I ACTIVE
Suez Energy Resources NA, Inc. 333 Thornall Street, 6th Floor Edison, NJ 08837	(888) 644-1014 www.suezenergyresources.com	C/I ACTIVE
UGI Energy Services, Inc. 224 Strawbridge Drive Suite 107 Moorestown, NJ 08057	(856) 273-9995 www.ugienergyservices.com	C/I ACTIVE
Verde Energy USA, Inc. 50 East Palisades Avenue Englewood, NJ 07631	(800) 388-3862 www.lowcostpower.com	R/C/I ACTIVE
Viridian Energy 2001 Route 46, Waterview Plaza Suite 310 Parsippany, NJ 07054	(866) 663-2508 www.viridian.com	R/C/I ACTIVE

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Appendix C: Incentive Programs

New Jersey Clean Energy Pay for Performance

The NJ Clean Energy Pay for Performance (P4P) Program relies on a network of Partners who provide technical services to clients. LGEA participating clients who are not receiving Direct Energy Efficiency and Conservation Block Grants are eligible for P4P. SWA is an eligible Partner and can develop an Energy Reduction Plan for each project with a whole-building traditional energy audit, a financial plan for funding the energy measures and an installation construction schedule.

The Energy Reduction Plan must define a comprehensive package of measures capable of reducing a building's energy consumption by 15+%. P4P incentives are awarded upon the satisfactory completion of three program milestones: submittal of an Energy Reduction Plan prepared by an approved Program Partner, installation of the recommended measures and completion of a Post-Construction Benchmarking Report. The incentives for electricity and natural gas savings will be paid based on actual savings, provided that the minimum 15% performance threshold savings has been achieved.

For further information, please see: <http://www.njcleanenergy.com/commercial-industrial/programs/pay-performance/existing-buildings> .

Direct Install 2010 Program*

Direct Install is a division of the New Jersey Clean Energy Programs' Smart Start Buildings. It is a turn-key program for small to mid-sized facilities to aid in upgrading equipment to more efficient types. It is designed to cut overall energy costs by upgrading lighting, HVAC and other equipment with energy efficient alternatives. The program pays **up to 60%** of the retrofit costs, including equipment cost and installation costs.

Eligibility:

- Existing small and mid-sized commercial and industrial facilities with peak electrical demand **below 200 kW** within 12 months of applying
- Must be located in New Jersey
- Must be served by one of the state's public, regulated or natural gas companies
 - Electric: Atlantic City Electric, Jersey Central Power & Light, Orange Rockland Electric, PSE&G
 - Natural Gas: Elizabethtown Gas, New Jersey Natural Gas, PSE&G, South Jersey Gas

For the most up to date information on contractors in New Jersey who participate in this program, go to: <http://www.njcleanenergy.com/commercial-industrial/programs/direct-install>

Smart Start

New Jersey's SmartStart Building Program is administered by New Jersey's Office of Clean Energy. The program also offers design support for larger projects and technical assistance for smaller projects. If your project specifications do not fit into anything defined by the program, there are even incentives available for custom projects.

There are a number of improvement options for commercial, industrial, institutional, government, and agricultural projects throughout New Jersey. Alternatives are designed to enhance quality while building in energy efficiency to save money. Project categories included in this program are New Construction and Additions, Renovations, Remodeling and

Equipment Replacement.

For the most up to date information on how to participate in this program, go to:
<http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings>.

Renewable Energy Incentive Program*

The Renewable Energy Incentive Program (REIP) provides incentives that reduce the upfront cost of installing renewable energy systems, including solar, wind, and sustainable biomass. Incentives vary depending upon technology, system size, and building type. Current incentive levels, participation information, and application forms can be found at the website listed below.

Solar Renewable Energy Credits (SRECs) represent all the clean energy benefits of electricity generated from a solar energy system. SRECs can be sold or traded separately from the power, providing owners a source of revenue to help offset the cost of installation. All solar project owners in New Jersey with electric distribution grid-connected systems are eligible to generate SRECs. Each time a system generates 1,000 kWh of electricity an SREC is earned and placed in the customer's account on the web-based SREC tracking system.

For the most up to date information on how to participate in this program, go to:
<http://www.njcleanenergy.com/renewable-energy/home/home>.

Utility Sponsored Programs

Check with your local utility companies for further opportunities that may be available.

Energy Efficiency and Conservation Block Grant Rebate Program

The Energy Efficiency and Conservation Block Grant (EECBG) Rebate Program provides supplemental funding up to \$20,000 for eligible New Jersey local government entities to lower the cost of installing energy conservation measures. Funding for the EECBG Rebate Program is provided through the American Recovery and Reinvestment Act (ARRA).

For the most up to date information on how to participate in this program, go to:
<http://njcleanenergy.com/EECBG>

Other Federal and State Sponsored Programs

Other federal and state sponsored funding opportunities may be available, including BLOCK and R&D grant funding. For more information, please check <http://www.dsireusa.org/>.

*Subject to availability. Incentive program timelines might not be sufficient to meet the 25% in 12 months spending requirement outlined in the LGEA program.