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Local Government Energy Program
Energy Audit Report

For

City of New Brunswick
Dept. of Public Works - Rear Building

400 Jersey Ave
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 Dept. of Public Works - Rear 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 Dept. of Public Works - Rear Building is a two story building totaling 10,000 square feet. The lower level of the Dept. of Public Works - Rear Building contains; truck bays, storage, and working areas The upper level houses the administrative offices.

The Dept. of Public Works - Rear Building is occupied consistently by approximately 8 employees for 48 hours a week.

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 Dept. of Public Works - Rear 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 Dept. of Public Works - Rear Building consumed a total of 82,320 kWh of electricity for a total cost of $14,185. In the most recent full year of natural gas data collected, February, 2009 through January, 2010, 12,513 therms of gas were consumed for a total cost of $14,193. With electricity and natural gas combined, the building consumed 1269 MMBtus of energy at a total cost of $28,378.

SWA/BSG-PMK has entered energy information about the Dept. of Public Works - Rear Building in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. The building was classified as a Service (Vehicle Repair) and Office 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 150 kBtu/ft^{2}yr compared to the national average of a similar building consuming 77 kBtu/ft^{2}yr. Implementing the recommendations included in this report will reduce the building energy consumption by approximately 63 kBtu/ft^{2}yr. There may be energy procurement opportunities for City of New Brunswick to reduce annual utility costs, which are $1,837/year higher, when compared to the average estimated NJ commercial utility rates.

Based on the assessment of the Dept. of Public Works - Rear 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:

The roofing material has reached the end of its useful life and is becoming brittle and wearing through; replacement of the roof should be considered in the coming years

Category II: Operations & Maintenance:

- Recommend replacing the Accustat with an adjustable seven day thermostat.
- Maintain Aprilaire humidifier according to manufacturer suggested intervals. Original locations of installed unit makes maintenance difficult consider relocation of unit.
- Remove insect nests from overhangs and cracks
- Caulk unsealed exterior wall penetrations.

Category III: Energy Conservation Measures:

At this time, SWA/BSG-PMK highly recommends a total of **5** Energy Conservation Measures (ECMs) for the Dept. of Public Works - Rear Building that are summarized in the following table. The total investment cost for these ECMs, with incentives, is **$65,446** (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 **$7,988** with an aggregated simple payback of approximately **8 years**. SWA/BSG-PMK estimates that implementing the highly recommended ECMs will reduce the carbon footprint of the facility by **80,941 lbs of CO_2**.

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 $1,176.25.

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:

- Pay-for-Performance
- Direct Install
- SmartStart

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	$0.17 $/kWh
Energy price escalation rate:	0% per DOE FEMP guidelines	Gas rate	$1.11 $/therm
Avg. Annual Demand:	0.00555	Area of Building (SF)	10,000

Table 1 - Recommended 5-10 Year Payback ECMs

#REF!	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	$2,996	$645	$2,351	3,170	1.47	0	1.08	$0	$539	15	$6,342	4.36	170%	11%	22%	$4,083	4,344
	Occupancy Sensors		$1,200	$120	$1,080	930	0.43	0	0.32	$0	$158	10	$1,335	6.83	24%	2%	8%	$268	1,274
2	Heating Override Control	Similar Projects	$15,000	$0	$15,000	0	0.00	2,124	21.24	$0	$2,358	10	$19,907	6.36	33%	3%	13%	$13,145	24,851
3	High-Efficiency Gas-Fired Unit Heaters	Vendor Website	$24,375	$0	$24,375	0	0.00	2,648	26.48	$0	$2,940	13	$30,867	8.29	27%	2%	7%	$6,888	30,985
4	Waste Oil Furnace	Vendor Website	$10,000	$0	$10,000	0	0.00	984.44	9.84	$0	$1,093	18	$14,778	9.15	48%	3%	8%	$5,029	11,518
	TOTAL		$53,571	$765	$52,806	4,100	1.90	5,757	58.97	$0.00	$7,087	-	$73,228	7.45	-	-	-	$29,413	72,971

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
5	Upgrade Rooftop Packaged DX Unit	Similar Projects	$13,000	$360	$12,640	3,616	1.67	257.77	3.81	$0	$901	15	$10,601	14.03	-16%	-1%	1%	-$1,885	7,970
	TOTAL		$13,000	$360	$12,640	3,616	1.67	258	3.81	$0.00	$901	-	$10,601	14.03	-	-	-	-$1,885	7,970

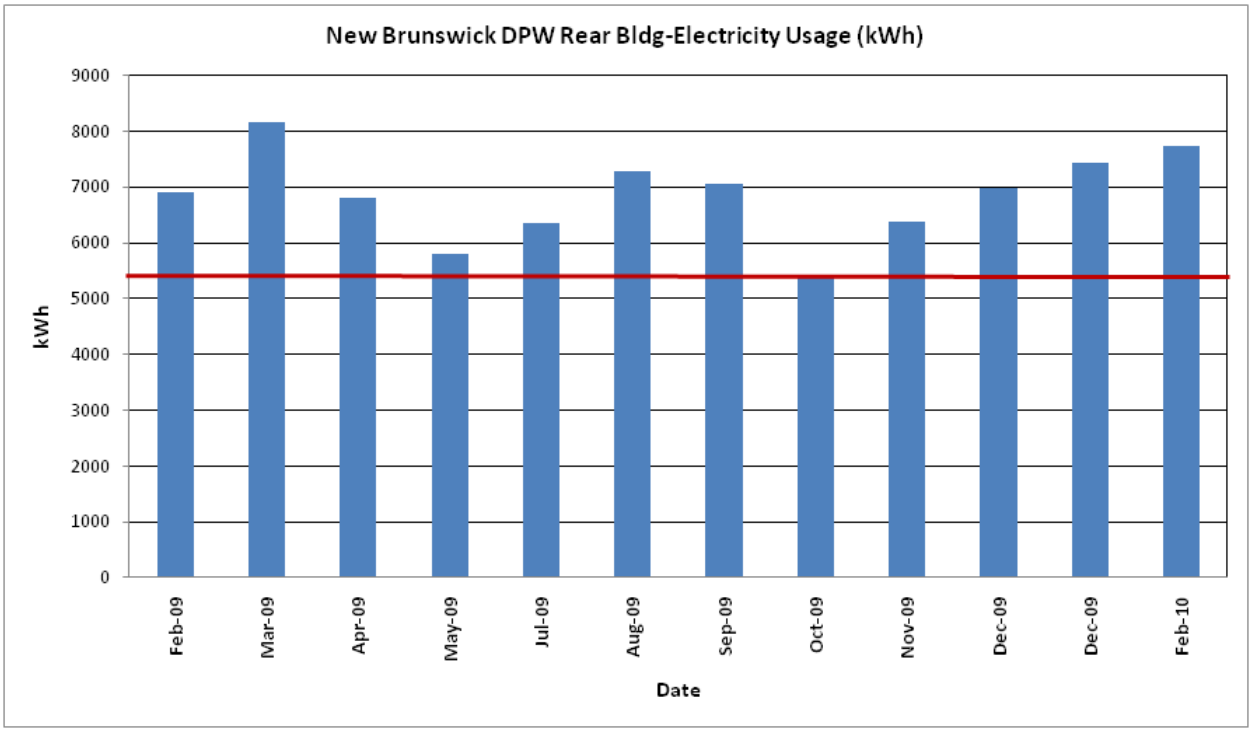
1. HISTORIC ENERGY CONSUMPTION

1.1. Energy Usage and Cost Analysis

SWA/BSG-PMK analyzed utility bills that were received from the utility company supplying the Dept. of Public Works Rear building with electric and natural gas from February, 2009 through January, 2010.

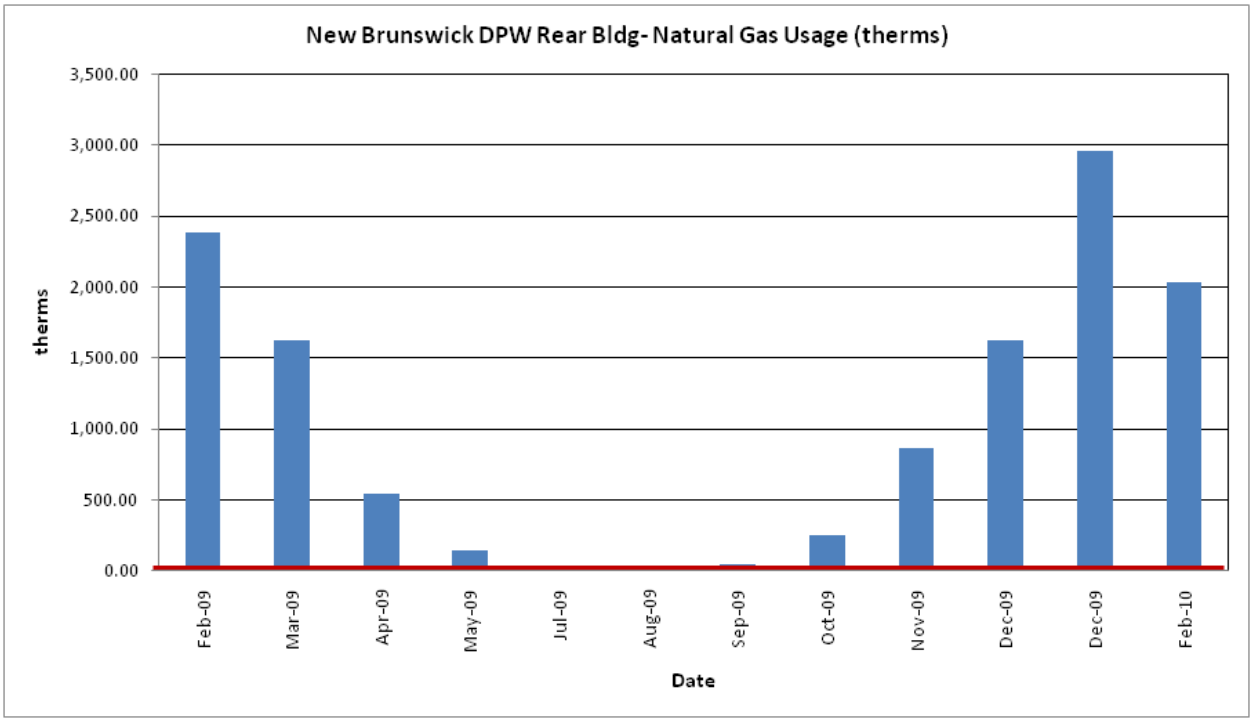
Electricity – The Dept. of Public Works Rear building is currently served by one electric meter. The facility currently receives electricity from Public Service Electric & Gas at **an average rate of $0.17/kWh** based on 12 months of utility bills from February, 2009 through January, 2010. The facility consumed **approximately 82,320 kWh or $14,185 worth of electricity** in the previous year with an average monthly demand of 37.1 kW.

The following charts show electricity usage for the Dept. of Public Works Rear building based on utility bills for the billing analysis period. The red line indicates the estimated base-load in kWh.



Natural Gas – The Dept. of Public Works Rear 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 $1.13/therm** based on 12 months of utility bills for February, 2009 through January, 2010. The facility consumed **approximately 12,513 therms or $14,193 worth of natural gas** in the previous year.

The following charts show the natural gas usage for the Dept. of Public Works Rear building based on utility bills for the analysis period of February, 2009 through January, 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 Dept. of Public Works Rear 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 $0.17/kWh based on the most recent 12 months of utility bills.

The Dept. of Public Works Rear 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 $1.13/therm based on the most recent 12 months of utility bills.

1.3. Energy Benchmarking

SWA/BSG-PMK has entered energy information about the Dept. of Public Works Rear 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 Service (Vehicle Repair/Service) preventing it from earning a performance rating which can be used to achieve an Energy Star building certification.

The Site Energy Use Intensity is 150 kBtu/sq.ft/yr compared to the national average of buildings classified as Service (Vehicle Repair/Service) consuming 77 kBtu/sq.ft./yr. Implementing this report's recommended Energy Conservations Measures (ECMs) will reduce use by approximately 63 kBtu/sq.ft./yr.

SWA/BSG-PMK has created the Portfolio Manager site information for Dept. of Public Works - Rear Building. This information can be accessed at: https://www.energystar.gov/istar/pmpam/, with the following:

Username: *cityofnewbrunswick*
Password: *newbrunswick*

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
New Brunswick-DPW-Rear

Building ID: 2350110
For 12-month Period Ending: March 31, 2010[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: June 14, 2010

Facility
New Brunswick-DPW-Rear
400 Jersey Ave
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: 1992
Gross Floor Area (ft²): 10,000

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

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	279,004
Natural Gas (kBtu)[4]	1,225,076
Total Energy (kBtu)	1,504,080

Energy Intensity[5]

Site (kBtu/ft²/yr)	150
Source (kBtu/ft²/yr)	221

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	108

Electric Distribution Utility
Public Service Elec & Gas Co

National Average Comparison

National Average Site EUI	77
National Average Source EUI	150
% Difference from National Average Source EUI	48%
Building Type	Service (Vehicle Repair/Service, Postal Service)

Stamp of Certifying Professional

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

Certifying Professional
N/A

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

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

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

EPA Form 5900-16

2. FACILITY AND SYSTEMS DESCRIPTION

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 two-story, (slab on grade), 10,000 square feet DPW (rear) building was constructed in 1992 with no additions or major alterations. It houses truck bays, offices and working areas.


Front Façade


Partial Right Side Façade (typ.)


Partial Rear Façade (typ.)


Partial Left Side Façade (typ.)

2.2. Building occupancy profiles

Its occupancy is approximately 8 employees at any given time from 7 am until 4 pm, Monday through Friday.

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 split-face concrete block and some vertical metal panel accents, over concrete block with 0 inches of detectable insulation. The interior is mostly painted CMU (Concrete Masonry Unit) in the truck bay area and finished gypsum drywall in the office area on the second floor.

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 good condition with only a few signs of uncontrolled moisture, air-leakage or other energy-compromising issues.

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

Insect nesting in exterior wall cracks and cavities

Un-caulked/un-sealed exterior wall penetrations

2.3.2. Roof

The building's roof is predominantly a flat and parapet type over steel decking with a built-up asphalt finish. It is original. Two inches of foam board roof insulation were recorded.

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

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 detected on all roof areas. Interior finishes are either exposed steel decking over steel trusses in the truck bay area and suspended acoustic tiles in the office area.

The following specific roof problem spot was identified:


The roofing material has reached the end of its useful lifespan. Brittle tar and exposed fiber mat underlayment was detected.

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 and are based on available construction plans.

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 good 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;

- Slider type windows with a non-insulated aluminum frame, tinted double glazing and no interior or exterior shading devices. The windows are located throughout the building and are original.

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 good condition with no signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

2.3.5. Exterior Doors

The building contains two different types of exterior doors;

- Metal type exterior doors. They are located throughout the building and are original.
- Overhead type exterior doors. They are located on either side of the building and are original. .

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 good 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 reasonably air-tight, considering the building's use and occupancy, 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

There are multiple heating systems at this facility. Two gas fired roof top Reznor power vented packaged duct furnaces heat the main garage, materials warehouse, and stairwells. The 175 MBH unit # 2, heats the Main Garage, and the 65 MBH unit # 1 heats the stairwells and materials warehouse areas, both are 80% efficient. The main garage is also heated by two 300 MBH Reznor gas-fired unit heaters, rated at 80% efficiency. The Grounds Department garage is heated by two 250 MBH Reznor gas-fired unit heaters, which are 79% efficient. A 300 MBH Reznor gas-fired unit heater provides heating for the west vehicle garage. The offices are heated by a

Figure 1: Reznor outdoor furnace

Figure 2: Trane packaged DX rooftop unit

90 MBH of gas fired Trane packaged rooftop DX unit. The offices system is equipped with one Aprilaire duct mounted humidifier.

Category II Operations and Maintenance: Maintain Aprilaire humidifier according to manufacturer suggested intervals. Original location of installed unit makes Maintenance difficult consider relocation of unit.

Category III Recommendation – ECM #2: Install (6) roll up door sensors (one for each garage door) that will automatically shut off the heating systems in the garage when one of the garage doors is open.

Category III Recommendation – ECM #3: Replace all gas-fired unit heaters, which have reached the end of their useful life, with high-efficiency units.

Category III Recommendation – ECM #4: Install a waste oil furnace, which will heat the garage with fuel that would otherwise be disposed of.

Category III Recommendation – ECM #5: Replace the packaged rooftop DX unit, which heats and cools the offices, with a high-efficiency unit.

2.4.2. Cooling

The offices are cooled by a 5-ton Trane packaged DX rooftop unit, which was installed in 1998 and has a Seasonal Energy Efficiency Ratio (SEER) of 10. The unit is controlled by an Accustat that provides a non adjustable temperature setting for heating and cooling, is mounted in center 2nd floor office. Several occupants mentioned indicated that the space is not comfortable during either season. The east garage is cooled by an Emerson 10,000 BTUH through-the-wall air-conditioner, which has an Energy Efficiency Ratio (EER) of 9.

Category II Operations and Maintenance - Recommend replacing the Accustat with an adjustable seven day thermostat.

Category III Recommendation – ECM #5: Replace the packaged rooftop DX unit, which heats and cools the offices, with a high-efficiency unit.

2.4.3. Ventilation

There are six (6) roof mounted Penn Ventilator Exhaust fans that provide ventilation throughout the building. There are two (2) roof ventilators that provide outside air to the Grounds and Vehicle storage areas. All unit heaters are direct vented combustion and exhaust air. The Carbon Monoxide from vehicle exhaust is capture through an under slab piped exhaust system by (1) rooftop exhaust fan. Natural ventilation is provided from open roll up doors at all garages as well as open doors and windows. All systems were observed to be operating and in good condition.

2.4.4. Domestic Hot Water

Domestic hot water is provided by a Bradford White 75 gallon, 76 MBH natural gas water heater that was in stall in 2007 and is in good operating condition.

2.5. Electrical systems

2.5.1. Lighting

A complete inventory of all interior and exterior 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, 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 (4) refrigerators, (2) microwaves, a toaster, a four-burner stove/refrigerator/sink, (6) computers, a fax/copy machine, and a water cooler. There is also an automatic tank drain with a 5 HP motor in the shop/storage room. 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.

2.5.3. Elevators

There are no elevators at this facility.

3. Building Systems Equipment List

New Brunswick Dept. of Public Works - Building #1 (Central Garage)							
Building System	Description	Locations	Model #	Fuel	Space Served	Year Installed	Estimtaed. Remaining Useful Life %
Heating	HV-2 Outdoor, power vented, gas-fired packaged duct furnace; 175 MBH, 80% efficient	Roof	Reznor Design Three, M# RPB175-2E, S# APJ66H5N63094	Natural gas	1st Floor Storage	1990	0%
Heating	HV-1 Outdoor, power vented, gas-fired packaged duct furnace; 65 MBH, 80% efficient	Roof	Reznor, M# RDF1-65, S# APJ61J2N63088/ CA/MV9	Natural gas	Garage	1990	0%
Heating	Gas-fired unit htr # 3 300 MBH, 80% efficient	Garage (west)	Reznor, M# SCB300-5-2, S# APJ62H6N63091	Natural gas	Garage (East)	1990	0%
Heating	Gas-fired unit htr # 1 250 MBH, 79% efficient	Garage (east)	Reznor (nameplate not accessible)	Natural gas	Grounds Dept. garage	1990	0%
Heating	Gas-fired unit htr # 2 250 MBH, 79% efficient	Roof	Reznor, M# SCB250-5-2, S# APJ62H5N63090	Natural gas	Grounds Dept. garage	1990	0%
Heating	Gas-fired unit htr # 4 300 MBH, 80% efficient	Main garage	Reznor (nameplate not accessible)	Natural gas	Main garage	1990	0%
Heating	Gas-fired unit htr # 5 - 300 MBH, 80% efficient	Main garage	Reznor (nameplate not accessible)	Natural gas	Main garage	1990	0%
Heating/ Cooling	Packaged DX rooftop unit; 5 tons cooling, 10 SEER; 90/71 MBH heating, 79% efficient	Roof	Trane M# YCD060 A3L0AB, S# E431436180	Electric/ natural gas	2nd floor offices & 1sr floor Lounge and Lockers	1990	0%
Cooling	Through-the-wall air-conditioner,	Garage (east)	Emerson, M# 10FG13G, S# CH783461 0616	Electric	Garage (east)	Approx. 1990	0%

	10,000 BTUH, 9 EER						
Ventilation	Exhaust fan #4	Roof	Penn Ventilator, M# IB24	Electric	Garage, front	Approx. 1990	20%
Ventilation	Exhaust fan #6	Roof	Penn Ventilator, M# BB45	Electric	1st/2nd floor restrooms, 1st floor locker room	Approx. 1990	20%
Ventilation	Exhaust fan #5	Roof	Penn Ventilator, M# IB24	Electric	Garage, rear	Approx. 1990	20%
Ventilation	Exhaust fan #7	Roof	Penn Ventilator	Electric	Road Dept. garage	Approx. 1990	20%
Ventilation	Exhaust fan #8	Roof	Not accessible	Electric	Ground Dept. garage	Approx. 1990	20%
Ventilation	Exhaust fan #9	Roof	Not accessible	Electric	Vehicle Exhaust	Approx. 1990	20%
Ventilation	Exhaust fan #10	Roof	Penn Ventilator	Electric	Ground Dept. garage, rear	Approx. 1990	20%
Ventilation	Exhaust fan #11	Roof	Penn Ventilator	Electric	DPW storage	Approx. 1990	20%
Ventilation	Exhaust fan #12	Roof	Penn Ventilator	Electric	DPW garage	Approx. 1990	20%
Ventilation	(6) flues for unit heaters	Roof	No nameplate	None	Unit heaters	Approx. 1990	50%
Air-Compression	Air-compressor	Shop/storage	Champion, M# VR5-8, S# R15 64666	Electric	Process	Approx. 2005	70%
	Air-compressor motor, 5 HP, 1,750 RPM, 82.5% efficient		Marathon Electric, M# UVC 184TBDR7026DH L, Frame # 184T, Type # BDR				
Domestic Hot Water	Water heater, 75 gallons, 76 MBH	Closet near restrooms	Bradford White, M# MI75S6BN, S# DB8799828	Natural gas	Sinks, shower	2007	77%
Appliances	Refrigerator	Garage (east)	Not accessible	Electric	Garage (east)	Unknown	Unknown
Appliances	Refrigerator	Office of the Secretary to the Director	GE, M# GMR04AAMBWW, S# SG301832	Electric	Office of the Secretary to the Director	2008	89%
Appliances	Microwave	Garage (east)	Sharp, M# R-209EK, S# 134493	Electric	Garage (east)	2001	0%

Appliances	Refrigerator	Garage (east)	Welbilt, M# W1100, S# 001618	Electric	Garage (east)	1993	11%
Appliances	Refrigerator	Break rooom	Kenmore (nameplate removed)	Electric	Break rooom	Approx. 1990	20%
Appliances	Microwave	Break rooom	GE, M# JVM1540DN1BB, S# SR 904907 B	Electric	Break rooom	2008	90%
Appliances	4-burner stove/sink/ refrigerator	Break rooom	King Refrigerator, M# KR63ECP0, S# 64452D63N2M0	Electric	Break rooom	Approx. 1985	10%

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:

The roofing material has reached the end of its useful life and is becoming brittle and wearing through; replacement of the roof should be considered in the coming years

Category II: Operations & Maintenance:

Recommend replacing the Accustat with an adjustable seven day thermostat.

Maintain Aprilaire humidifier according to manufacturer suggested intervals. Original locations of installed unit makes maintenance difficult consider relocation of unit.

Remove insect nests from overhangs and cracks

Caulk unsealed exterior wall penetrations.

Category III Recommendations: Energy Conservation Measures:

Summary Table

ECM #	Description
1	Lighting Upgrades & Occupancy Sensors
2	Heating Override Control
3	High-Efficiency Gas-Fired Unit Heaters
4	Waste Oil Furnace
5	Upgrade Rooftop Packaged DX Unit

ECM #1: Lighting Upgrades & Occupancy Sensors

Description:

Lighting at the DPW (Rear) primarily consists of standard-efficiency fixtures with T12 lamps and magnetic ballasts. SWA/BSG-PMK recommends retrofitting the T12 fixtures with T8 lamps and electronic ballasts and replacing the incandescent fixtures with compact fluorescent lamps. Lighting replacements typically yield a short payback.

Recommended lighting upgrades are detailed in Appendix A.

Installation cost:

	Lighting (Only)	Sensors (Only)	Complete Lighting Upgrade
Cost	$2,996.00	$1,200.00	$4,196.00
Rebate	$645.00	$120.00	$765.00
Net Cost	$2,351.00	$1,080.00	$3,431.00
Savings (kWh)	3,170	930	3,814
Savings ($)	$538.97	$158.06	$648.41
Payback	4.4	6.8	5.3

Source of cost estimate: Empirical Data

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
1	Lighting Upgrades	Empirical Data	$2,996	$645	$2,351	3,170	1.47	0	1.08	$0	$539	15	$6,342	4.36	170%	11%	22%	$4,083	4,344
	Occupancy Sensors		$1,200	$120	$1,080	930	0.43	0	0.32	$0	$158	10	$1,335	6.83	24%	2%	8%	$268	1,274

Assumptions:

The electric cost used in this ECM was $0.17/kWh, which was the facilities' average rate for the 12-month period from Feb, 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 $765.

ECM #2: Heating Override Control

Description:

The garage is heated by six (6) gas-fired unit heaters and two (2) outdoor duct furnaces, which have a cumulative heating capacity of 1,550 MBH. These units operate at all times when the areas are occupied, including when the garage doors are open. The operation of the units while the doors are open allows infiltration, and is inefficient as warm air escapes as the units need to remain in operation while attempting to maintain the desired temperature. It is recommended that six (6) end switches or photo eyes be installed that will automatically shut off the units when one of the six garage doors are in the fully-open position.

Installation cost:

Estimated installed cost: $2,500 for each end switch or photo eye (six total), $15,000 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
2	Heating Override Control	Similar Projects	$15,000	$0	$15,000	0	0.00	2,124	21.24	$0.00	$2,358	10	$19,907	6.36	33%	3%	13%	$13,145	24,851

Assumptions:

The cost per therm of natural gas that was used, taken from twelve months of the building's energy bills, was $1.11. Per the American Society of Heating, Refrigeration & Air-Conditioning Engineers (ASHRAE), the outdoor dry bulb temperature is above 10°F 99.6% percent of a year, and the number of heating degree-days for one year is 5,034. The desired indoor temperature was estimated to be 65°F. Due to the fact that the garages are not occupied at all hours of the day, it was assumed that the units only operate approximately 55 out of a possible 168 hours every week, and therefore only $\frac{55}{168}$ of the heating degree days were used for the calculations of the current energy consumptions; for the proposed energy consumptions, it was assumed that the end switch or photo eye would reduce the weekly operating hours by 15%. The existing heating units are 80% efficient, but due to their age and condition, their efficiency was assumed to decrease by 10%, to 70%. The savings were calculated using the following equation:

$$\frac{\text{Capacity}\times\text{Degree-Days}\times 24}{\text{Efficiency}_{\text{current}}\times\left(\text{Temp.}_{\text{indoor}}-\text{Temp.}_{99.6\%}\right)}\times\frac{1\text{ therm}}{100{,}000.4\text{ BTU}}\times\frac{(\text{Weekly Operating Hours})}{24\times 7}\times 15\%=\text{Current Gas Input (therms)}$$

Rebates/financial incentives:

No rebates or incentives for unit heaters were found.

ECM #3: High-Efficiency Gas-Fired Unit Heaters

Description:

Heating is provided to the garages by five (6) gas-fired unit heaters, installed in 1990. Three (3) units have a heating capacity of 300 MBH, the two (2) have heating capacities of 250 MBH, and all are rated at approximately 80% efficiency. The units have reached the end their 13-year useful life, and should be replaced. High-efficiency unit heaters are available, which are 92% efficient. The current units were 80% efficient at the time of their purchase, but due to their age and condition, their efficiency was estimated to decrease by 10%, to 70%.

Installation cost:

Estimated installed cost: $4,875 each for the unit heaters, $24,375 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	High-Efficiency Gas-Fired Unit Heaters	Vendor Website	$24,375	$0	$24,375	0	0.00	2,648	26.48	$0	$2,940	13	$30,867	8.29	27%	2%	7%	$6,888	30,985

Assumptions:

The cost per therm of natural gas that was used, taken from twelve months of the building's energy bills, was $1.11. Per the American Society of Heating, Refrigeration & Air-Conditioning Engineers (ASHRAE), the outdoor dry bulb temperature is above 10°F 99.6% percent of a year, and the number of heating degree-days for one year is 5,034. The desired indoor temperature was estimated to be 65°F. Due to the fact that the garages are not occupied at all hours of the day, it was assumed that the units only operate approximately 55 out of a possible 168 hours every week, and therefore only $\frac{55}{168}$ of the heating degree days were used for the calculations of the current energy consumptions. The savings were calculated using the following equations:

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

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

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

Savings (therms)=Current Gas Input-Proposed Gas Input

Rebates/financial incentives:

No rebates or incentives for unit heaters were found.

ECM #4: Waste Oil Furnace

Description:

The main garage is partially heated by two (2) Reznor outdoor furnaces, with heating capacities of 175 MBH and 65 MBH and each rated at 80% efficiency. Although the units are still functional, they have reached the end of their useful life. Newer outdoor furnaces, however, also are 80% efficient, and replacing the units would not save much energy or produce an acceptable payback. One option to save money and energy, and to also extend the lives of the furnaces by using them less often, is to install a 250 MBH waste oil furnace. In the past year, processes in the two DPW buildings have resulted in 615 gallons of excess oil, which has been disposed of. Rather than disposing of this oil, it could instead be used as a source of heat that the DPW would not have to pay for. The existing furnaces would stay in place and be used in cases of oil shortages.

Installation cost:

Estimated installed cost: $10,000
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, $	CO2 Reduced, lbs/yr
4	Waste Oil Furnace	Vendor Website	$10,000	$0	$10,000	0	0.00	984.44	9.84	$0	$1,093	$18	$14,778	9.15	48%	3%	8%	$5,029	11,518

Assumptions:

The cost per therm of natural gas that was used, taken from twelve months of the building's energy bills, was $1.11. Waste oil carries no cost. Waste oil furnaces are approximately 83% efficient, and the efficiency of the existing furnaces, due to their age and condition, were assumed to decrease by 10%, to 70%. The heating value for waste oil is 135 MBTU/gallon. The savings is equal to the number of therms of gas not used as a result of installing the waste oil furnace. The savings were calculated using the following series of equations:

BTUs of heat generated by the oil:

$$BTU_{oil}=615\text{ gal}\times 135{,}000\frac{\text{BTU}}{\text{gal}}\times 83\%=68{,}910{,}750\text{ BTU}$$

Therms of gas saved:

$$\frac{68{,}910{,}750\text{ BTU}}{70\%}\times\frac{1\text{ therm}}{100{,}000.4\text{ BTU}}=984.4\text{ therms}$$

Rebates/financial incentives:

No rebates or incentives for waste oil furnaces were found.

ECM #5: Upgrade Rooftop Packaged DX Unit

Description:

The 2nd-floor offices are cooled and partially heated by a 5-ton, 90-MBH rooftop packaged DX unit, with gas heating and electric cooling. The unit, installed in 1990, is nearing the end of its useful life and should be replaced. Higher-efficiency rooftop units are now available, which have Seasonal Energy Efficiency Ratios (SEERs) of up to 15.5. The current unit had a SEER of 10 and a heating efficiency of 80% at the time of its purchase, but due to its age and condition, its SEER and efficiency were estimated to decrease by 10%, to 9 and 70%, respectively. The heating efficiency of the proposed unit is 80%.

Installation cost:

Estimated installed cost: $13,000
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
5	Upgrade Rooftop Packaged DX Unit	Similar Projects	$13,000	$360	$12,640	3,616	1.67	257.77	3.81	$0	$901	15	$10,601	14.03	-16%	-1%	1%	-$1,885	7,970

Assumptions:

The cost per therm of natural gas that was used, taken from twelve months of the DPW Central Garage's energy bills, was $1.11. Per the American Society of Heating, Refrigeration & Air-Conditioning Engineers (ASHRAE), the outdoor dry bulb temperature is above 10°F 99.6% percent of a year, and the number of heating degree-days for one year is 5,034. The desired indoor temperature was estimated to be 68°F. . The savings were calculated using the following equations:

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

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

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

Savings (therms)=Current Gas Input-Proposed Gas Input

The cooling savings can now be calculated. Using 12 months of the facility's electricity bills, it was determined that the cost of electricity is currently $0.17/kWh. SEER values, as stated above, are 9 for the existing unit and 15.5 for the proposed one. Per ASHRAE, the outdoor dry bulb temperature is above 93°F 0.4% percent of a year, and there are 1,024 annual cooling degree days at this geographical area. The desired indoor temperature during the cooling season was assumed to be 74°F.

The following equation, the degree-day equation for cooling systems, was used to calculate the electric consumptions of the current and proposed air-conditioners:

$$\frac{\text{Capacity} \times \text{Degree-Days} \times 24 \ \frac{\text{hours}}{\text{day}}}{1{,}000 \times \text{SEER} \times \left(\text{Temp.}_{0.4\%} - \text{Temp.}_{\text{indoor}}\right)} = \text{Electric Consumption (in kWh)}$$

Rebates/financial incentives:

This ECM is calculated based on a projected eligibility for New Jersey's SmartStart Rebate, which pays up to $72 per ton for central DX units, or $360 for this measure.

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 par 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

Photovoltaic (PV) technology was considered for installation on the roofs of the Dept. of Public Works Rear building. Based on the shading and the amount of roof area available with unobstructed southern exposure it was determined that PV installations are not cost effective or feasible for this location.

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.

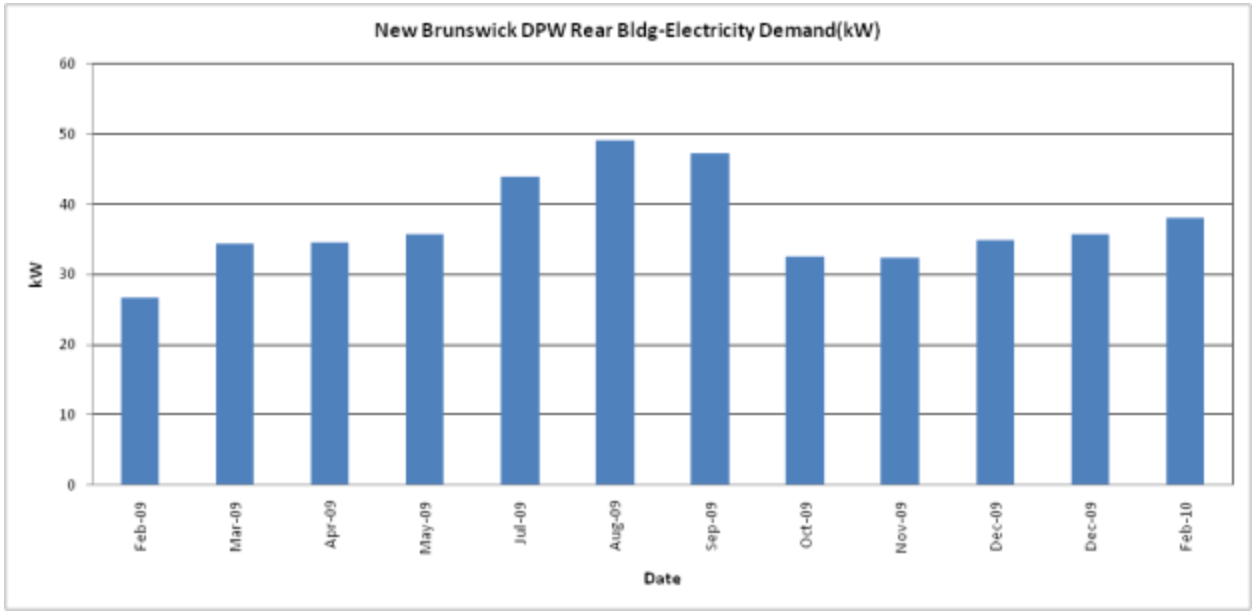
6.6. Wind

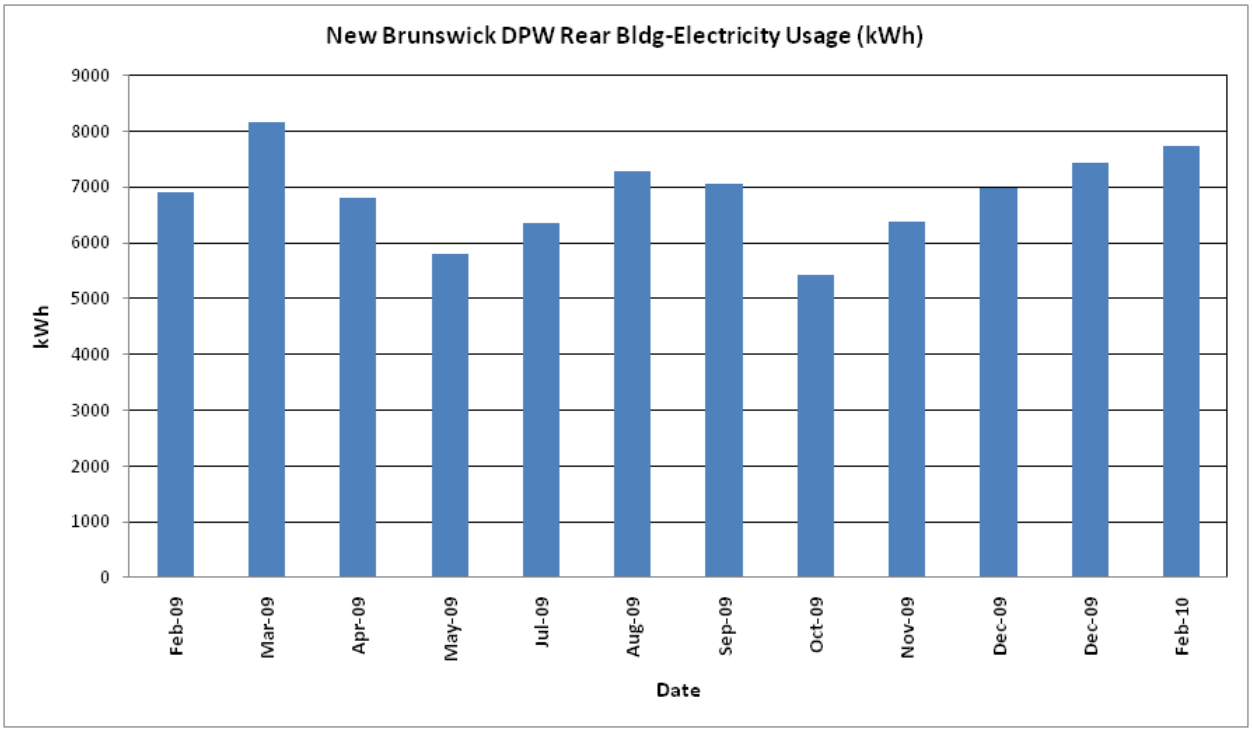
Wind power production is not appropriate for this location because required land is not available for the wind turbine. Also, the available wind energy resource is very low.

7. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

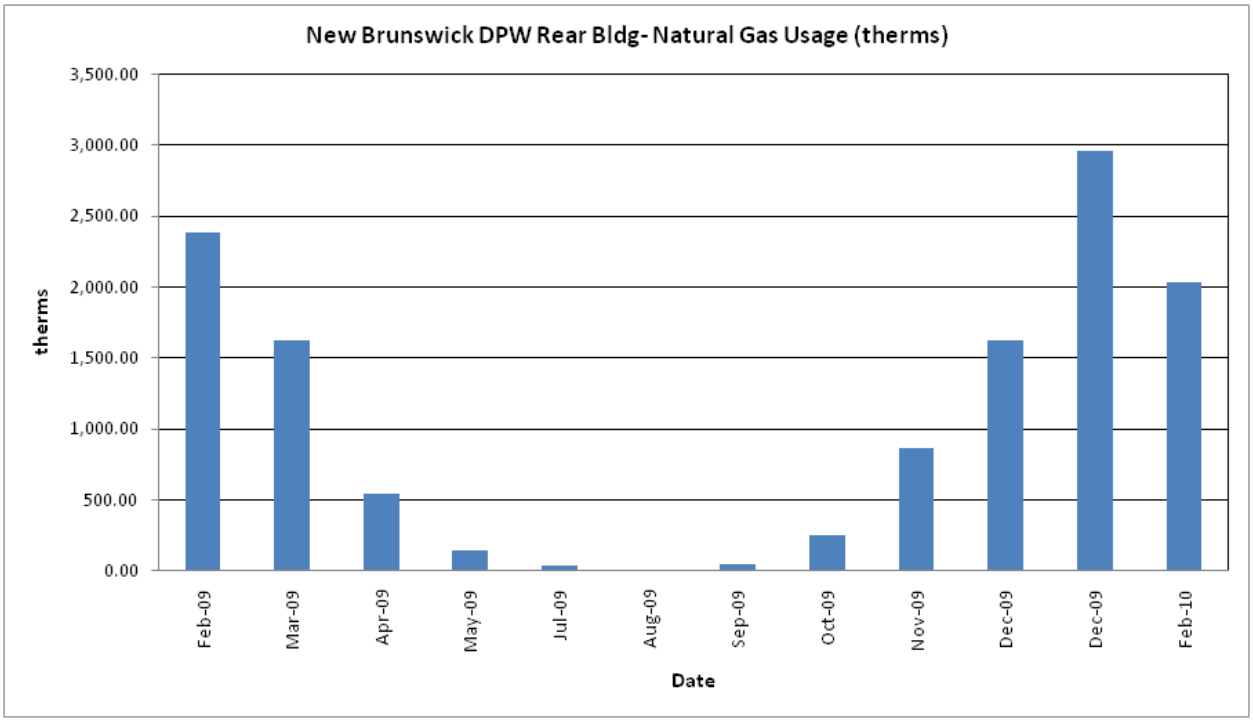
7.1. Energy Purchasing

The average electrical peak demand for the previous year was 37.1 kW and the maximum peak demand was 49.1 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.



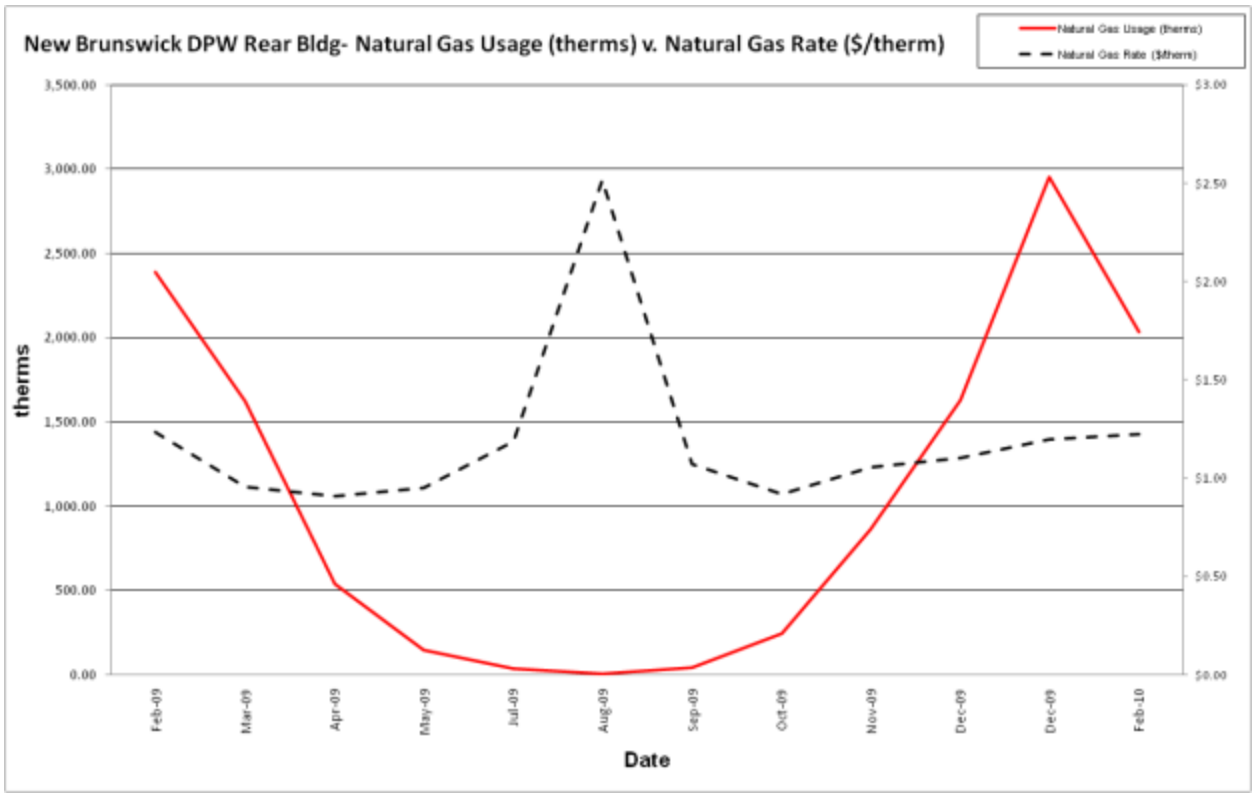
The natural gas usage shows that the most natural gas is consumed in the winter months, meaning the majority of natural gas use in this building is for heating.

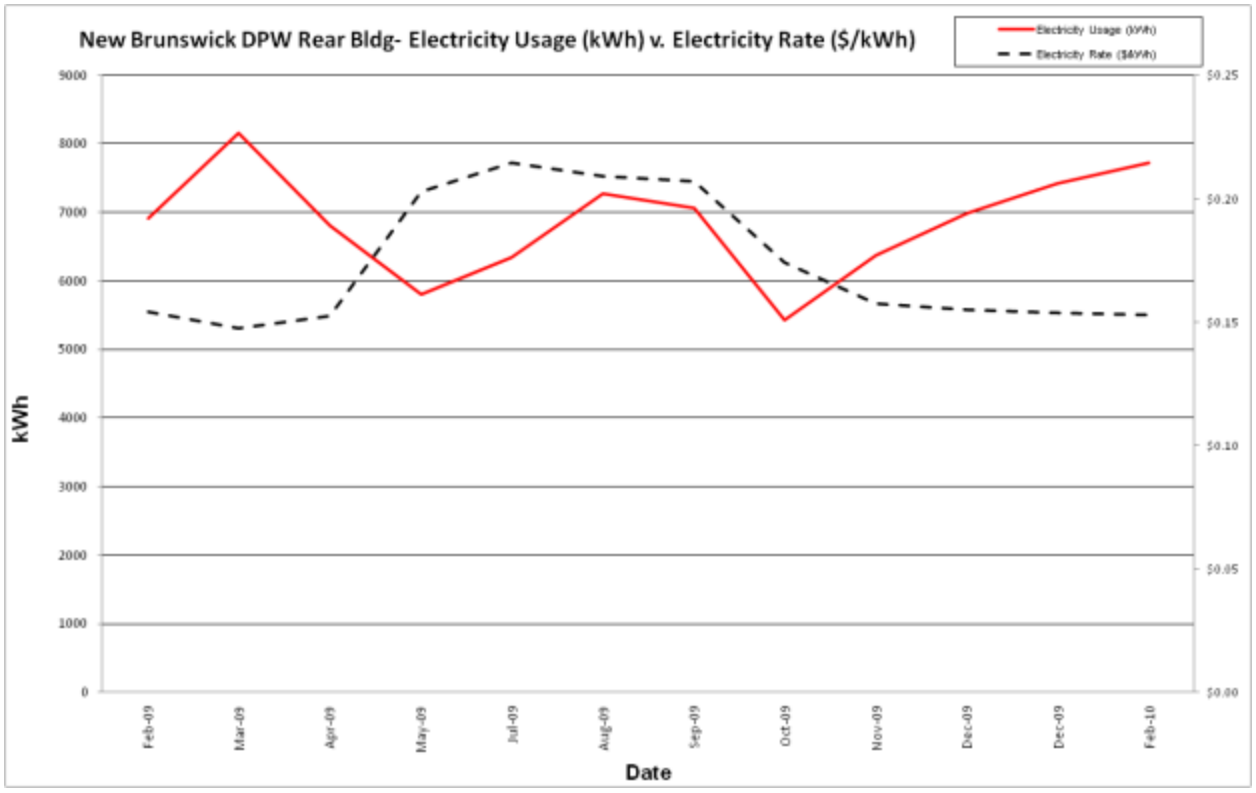
7.2. Tariff analysis

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 Dept. of Public Works Rear 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 Dept. of Public Works Rear building is direct-metered (via one meter) and currently purchases electricity from Public Service Electric & Gas at a general service rate. The general service rate for electric charges are market-rate based on use and the Dept. of Public Works Rear 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.

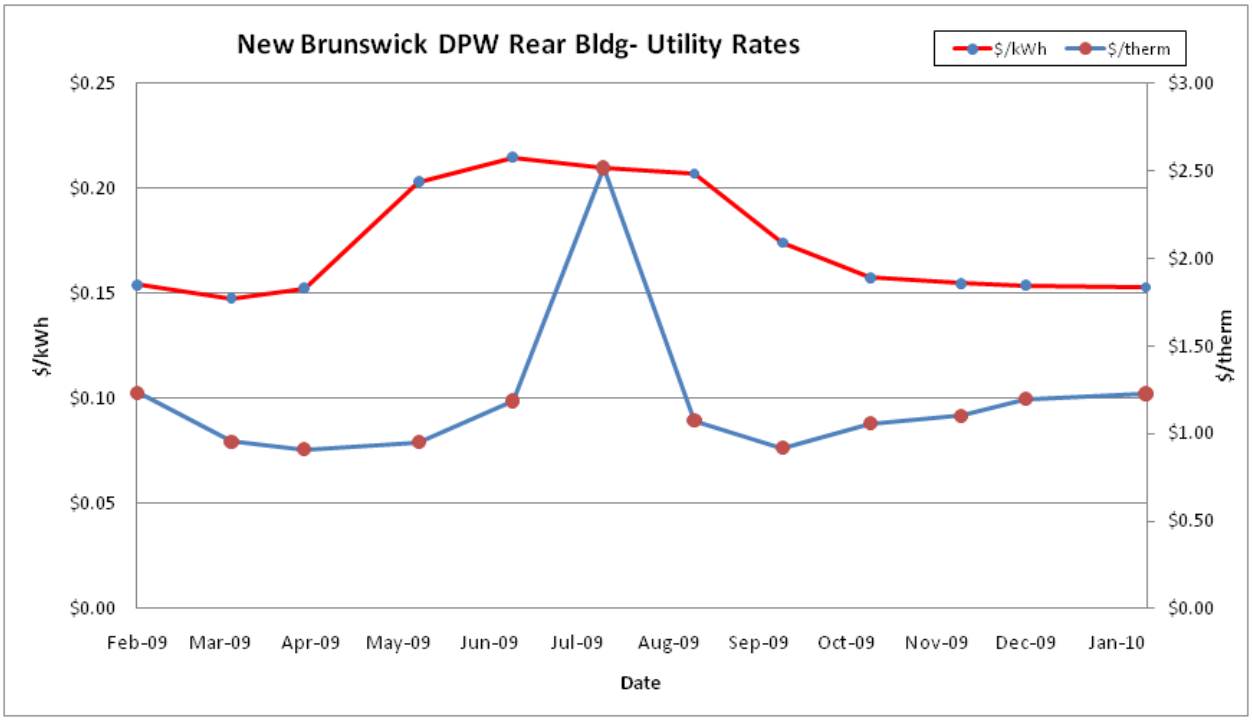

New Brunswick DPW Rear Bldg- Natural Gas Usage (therms) v. Natural Gas Rate ($/therm)
Natural Gas Usage (therms)
Natural Gas Rate ($/therm)
therms
3,500.00
3,000.00
2,500.00
2,000.00
1,500.00
1,000.00
500.00
0.00
$3.00
$2.50
$2.00
$1.50
$1.00
$0.50
$0.00
Feb-09
Mar-09
Apr-09
May-09
Jul-09
Aug-09
Sep-09
Oct-09
Nov-09
Dec-09
Dec-09
Feb-10
Date


New Brunswick DPW Rear Bldg- Electricity Usage (kWh) v. Electricity Rate ($/kWh)
Electricity Usage (kWh)
Electricity Rate ($/kWh)
kWh
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
$0.25
$0.20
$0.15
$0.10
$0.05
$0.00
Feb-09
Mar-09
Apr-09
May-09
Jul-09
Aug-09
Sep-09
Oct-09
Nov-09
Dec-09
Dec-09
Feb-10
Date

7.3. Energy Procurement strategies

Billing analysis shows large price fluctuations of over the course of the year for the Dept. of Public Works - Rear 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.

SWA/BSG-PMK also recommends that New Brunswick contact third party energy suppliers in order to negotiate a lower electricity rate. Comparing the current electric rate to average utility rates of similar type buildings in New Jersey, which are approximately $0.15/kWh, it may be possible to save up to $ 0.02/kWh, which would have equated to approximately $1,837 for the past 12 months. New Brunswick already purchases natural gas for lower rate than the average rate of $1.45/therm.



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
DPW (Rear)
400 Jersey Avenue

BIRDSALL SERVICES GROUP
ENGINEERS & CONSULTANTS

Upgrade Code	Upgrade Description	Existing Fixture	Existing Watts	Proposed Fixture	Proposed Watts	Lighting: Total # of Upgrades	Lighting: Cost per Upgrade ($)	Lighting: SmartStart Rebate per Upgrade
1	70W High Pressure Sodium Wall pack	70W HPS/BALLAST	92	No Upgrade	92	1	$0.00	$0.00
2	150W High Pressure Sodium Wall pack	150W HPS/BALLAST	190	No Upgrade	190	2	$0.00	$0.00
3	Retrofit the 4' wraparound fixture by replaceing the (2) T12 Lamps and Magnetic Ballast(s) with (2) T8 Lamps and an Electronic Ballast	2L4' EE/STD	80	2L4' T8/ELEC	61	9	$50.00	$15.00
4	Retrofit the 4' recessed fixture by replaceing the (4) T12 Lamps and Magnetic Ballast(s) with (4) T8 Lamps and an Electronic Ballast	4L4' EE/STD	160	4L4' T8/ELEC	110	19	$80.00	$15.00
5	Retrofit the 4' recessed fixture by replaceing the (2) T12 Lamps and Magnetic Ballast(s) with (2) T8 Lamps and an Electronic Ballast	2L4' EE/STD	80	2L4' T8/ELEC	61	8	$50.00	$15.00
6	2 Prong 26W CFL HighHat Recessed / No Upgrade	26W CF/HW	28	No Upgrade	28	2	$0.00	$0.00
7	250 MH: GE Multivapor-250/Phillips MH-250 / No Upgrade	250W MH/BALLAST	286	No Upgrade	286	13	$0.00	$0.00
8	Retrofit the 4' fixture by replaceing the (2) T12 Lamps and Magnetic Ballast(s) with (2) T8 Lamps and an Electronic Ballast	2L4' STD/STD	94	2L4' T8/ELEC	61	0	$50.00	$15.00
9	Replace the 60W Incandescent Lamps wih 13W Compact Fluorescents	60W Incandescent	60	13W CF/SI	15	1	$6.00	$0.00
10	Retrofit the 4' wraparound fixture by replaceing the (4) T12 Lamps and Magnetic Ballast(s) with (4) T8 Lamps and an Electronic Ballast	4L4' EE/STD	160	4L4' T8/ELEC	110	4	$80.00	$15.00
11	Retrofit the 8' fixture by replaceing the (4) T12 Lamps and Magnetic Ballast(s) with (4) T8 Lamps and an Electronic Ballast	4L8' EE/STD	276	4L8' T8/ELEC	233	3	$100.00	$15.00
12						0	$0.00	$0.00

Summary

	Lighting (Only)	Sensors (Only)	Complete Lighting Upgrade
Cost	$2,996.00	$1,200.00	$4,196.00
Rebate	$645.00	$120.00	$765.00
Net Cost	$2,351.00	$1,080.00	**$3,431.00**
Savings (kWh)	3,170	930	**3,814**
Savings ($)	$538.97	$158.06	**$648.41**
Payback	4.4	6.8	**5.3**

Variables:

$0.17	Avg. Electric Rate ($/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: Fixture	Existing: Qty.	Existing: Watts	Existing: Foot Candles	Proposed: Fixture	Proposed: Qty.	Proposed: Watts	kW Reduction	Lighting: Energy Savings, kWh	Lighting: Cost ($)	Lighting: Savings ($)	Lighting: Payback (yrs)	Controls: Type	Controls: Qty.	Occupancy Sensors (ONLY): Energy Savings, kWh	Occupancy Sensors (ONLY): Cost ($)	Occupancy Sensors (ONLY): Savings ($)	Occupancy Sensors (ONLY): Payback (yrs)	SmartStart Rebate: Lighting	SmartStart Rebate: Sensors	Lighting & Occupancy Sensors: Energy Savings, kWh	Lighting & Occupancy Sensors: Post-Rebate Cost ($)	Lighting & Occupancy Sensors: Savings ($)	Lighting & Occupancy Sensors: Payback (yrs)
		Totals:					10174				8527	1.647	3170	$2,996.00	$538.97	5.6			930	$1,200.00	$158.06	7.6	$645.00	$120.00	3814	$3,431.00	$648.41	5.3
1	1	Exterior Lights	7	1820	70W HPS/BALLA	1	92		No Upgrade	1	92	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
2	2		7	1820	150W HPS/BALL	2	380		No Upgrade	2	380	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
3	3	Stairwell	10	2600	2L4' EE/STD	4	320		2L4' T8/ELEC	4	244	0.076	198	$200.00	$33.59	6.0			0	$0.00	$0.00		$60.00	$0.00	198	$140.00	$33.59	4.2
4	4	Office/Copy Room	8	2080	4L4' EE/STD	3	480		4L4' T8/ELEC	3	330	0.15	312	$240.00	$53.04	4.5			0	$0.00	$0.00		$45.00	$0.00	312	$195.00	$53.04	3.7
5	5	Hallway	10	2600	2L4' EE/STD	7	560		2L4' T8/ELEC	7	427	0.133	346	$350.00	$58.79	6.0			0	$0.00	$0.00		$105.00	$0.00	346	$245.00	$58.79	4.2
6	4	Office 1	8	2080	4L4' EE/STD	2	320		4L4' T8/ELEC	2	220	0.1	208	$160.00	$35.36	4.5	OSW	1	166	$200.00	$28.29	7.1	$30.00	$20.00	322	$310.00	$54.81	5.7
7	4	Office 2	8	2080	4L4' EE/STD	2	320		4L4' T8/ELEC	2	220	0.1	208	$160.00	$35.36	4.5	OSW	1	166	$200.00	$28.29	7.1	$30.00	$20.00	322	$310.00	$54.81	5.7
8	4	Office 3	8	2080	4L4' EE/STD	2	320		4L4' T8/ELEC	2	220	0.1	208	$160.00	$35.36	4.5	OSW	1	166	$200.00	$28.29	7.1	$30.00	$20.00	322	$310.00	$54.81	5.7
9	4	Office 4	8	2080	4L4' EE/STD	3	480		4L4' T8/ELEC	3	330	0.15	312	$240.00	$53.04	4.5	OSW	1	250	$200.00	$42.43	4.7	$45.00	$20.00	484	$375.00	$82.21	4.6
10	3	BR	1	260	2L4' EE/STD	1	80		2L4' T8/ELEC	1	61	0.019	5	$50.00	$0.84	59.5			0	$0.00	$0.00		$15.00	$0.00	5	$35.00	$0.84	41.7
11	6	Office 5	8	2080	26W CF/HW	1	28		No Upgrade	1	28	0	0	$0.00	$0.00		OSW	1	15	$200.00	$2.48	80.8	$0.00	$20.00	15	$180.00	$2.48	72.7
12	7	Office/Storage	8	2080	250W MH/BALLA	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	
13	4	Break Room	8	2080	4L4' EE/STD	4	640		4L4' T8/ELEC	4	440	0.2	416	$320.00	$70.72	4.5			0	$0.00	$0.00		$60.00	$0.00	416	$260.00	$70.72	3.7
14	4	Locker Room/Bathroom	8	2080	4L4' EE/STD	3	480		4L4' T8/ELEC	3	330	0.15	312	$240.00	$53.04	4.5			0	$0.00	$0.00		$45.00	$0.00	312	$195.00	$53.04	3.7
15	5		8	2080	2L4' EE/STD	1	80		2L4' T8/ELEC	1	61	0.019	40	$50.00	$6.72	7.4			0	$0.00	$0.00		$15.00	$0.00	40	$35.00	$6.72	5.2
16	6		8	2080	26W CF/HW	1	28		No Upgrade	1	28	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
17	9	Janitor Closet/DHW	1	260	60W Incandescen	1	60		13W CF/SI	1	15	0.045	12	$6.00	$1.99	3.0			0	$0.00	$0.00		$0.00	$0.00	12	$6.00	$1.99	3.0
18	3	Stairwell	8	2080	2L4' EE/STD	4	320		2L4' T8/ELEC	4	244	0.076	158	$200.00	$26.87	7.4			0	$0.00	$0.00		$60.00	$0.00	158	$140.00	$26.87	5.2
19	7	Street Department	8	2080	250W MH/BALLA	4	1144		No Upgrade	4	1144	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
20	10	Office	8	2080	4L4' EE/STD	2	320		4L4' T8/ELEC	2	220	0.1	208	$160.00	$35.36	4.5	OSW	1	166	$200.00	$28.29	7.1	$30.00	$20.00	322	$310.00	$54.81	5.7
21	11	Storage Area	1	260	4L8' EE/STD	2	552		4L8' T8/ELEC	2	466	0.086	22	$200.00	$3.80	52.6			0	$0.00	$0.00		$30.00	$0.00	22	$170.00	$3.80	44.7

					Existing				Proposed			kW Reduction	Lighting				Controls		Occupancy Sensors (ONLY)				SmartStart Rebate		Lighting & Occupancy Sensors			
Seq. #	Upgrade Code	Room/Area	Hrs/ Work Day	Hrs/ Year	Fixture	Qty.	Watts	Foot Candles	Fixture	Qty.	Watts		Energy Savings, kWh	Cost ($)	Savings ($)	Payback (yrs)	Type	Qty.	Energy Savings, kWh	Cost ($)	Savings ($)	Payback (yrs)	Lighting	Sensors	Energy Savings, kWh	Post-Rebate Cost ($)	Savings ($)	Payback (yrs)
22	11	Locker Room	8	2080	4L8' EE/STD	1	276		4L8' T8/ELEC	1	233	0.043	89	$100.00	$15.20	6.6			0	$0.00	$0.00		$15.00	$0.00	89	$85.00	$15.20	5.6
23	7	Asphalt Equipment Garage	5	1300	250W MH/BALLAS	3	858		No Upgrade	3	858	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
24	10	Storage Closet	1	260	4L4' EE/STD	1	160		4L4' T8/ELEC	1	110	0.05	13	$80.00	$2.21	36.2			0	$0.00	$0.00		$15.00	$0.00	13	$65.00	$2.21	29.4
25	10	Engineering	8	2080	4L4' EE/STD	1	160		4L4' T8/ELEC	1	110	0.05	104	$80.00	$17.68	4.5			0	$0.00	$0.00		$15.00	$0.00	104	$65.00	$17.68	3.7

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**
Integrys Energy Services, Inc. 99 Wood Ave, South, Suite 802 Iselin, NJ 08830	(877) 763-9977 www.integrysenergy.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.south jerseyenergy.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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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.