TOWNSHIP OF NORTH BRUNSWICK
MUNICIPAL BUILDING
ENERGY ASSESSMENT

for

NEW JERSEY
BUREAU OF PUBLIC UTILITIES

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1.0 INTRODUCTION & BACKGROUND

This report summarizes the energy audit for the North Brunswick Township Municipal Building. The three story, approximately 86,460 square foot building houses the North Brunswick Township Police Department, Township Court, and Municipal Offices.

New Jersey's Clean Energy Program, funded by the New Jersey Board of Public Utilities, supports energy efficiency and sustainability for Municipal and Local Government Energy Audits. Through the support of a utility trust fund, New Jersey is able to assist state and local authorities in reducing energy consumption while increasing comfort.

2.0 EXECUTIVE SUMMARY

This report details the results of the energy audit for the North Brunswick Township Municipal Building in North Brunswick, New Jersey. The approximately 86,460 square foot, three story facility accommodates the police department, court, and municipal offices. The following areas were evaluated for energy conservation measures:

- Boiler replacement
- Occupancy sensors
- Demand control ventilation
- Hot water reset
- Variable speed drives
- Motor efficiency upgrades
- Door seal replacement
- Energy recovery ventilation

Various potential Energy Conservation Measures (ECMs) were identified for the above categories. Measures which are recommended for implementation have a payback of 10 years or less. This threshold is considered a viable return on investment. Potential annual savings of $64,700 for the recommended ECMs may be realized with a payback of 4.1 years.

The ECMs identified in this report will allow for the building to reduce its energy usage and if pursued has the opportunity to qualify for the New Jersey SmartStart Buildings Program. A summary of the costs, savings, and paybacks for the recommended ECMs follows:

ECM-1 Boiler Replacement

Budgetary Cost	Annual Utility Savings					Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total	ROI			
$	kW	kWh	Therms	$		$	Years	Years
63,600	-	-	5,880	8,100	1.55	1,800	7.9	7.6

* Incentive shown is per the New Jersey Smart Start Program, 2009 Gas Heating Application. Incentive is based on the purchase of two 900 MBH hot water boilers.

ECM-2 Hot Water Temperature Reset

Budgetary Cost	Annual Utility Savings					Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total	ROI			
$	kW	kWh	Therms	$		$	Years	Years
8,200	-	0	630	900	0.65	N/A	9.1	N/A

* There is no incentive available through the New Jersey Smart Start Program for this ECM.

ECM-3 Install Premium Efficiency Motors

Budgetary Cost	Annual Utility Savings					Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total	ROI			
$	kW	kWh	Therms	$		$	Years	Years
12,100	5.0	14,300	0	2,400	1.98	900	5.0	4.7

* Incentive shown is per New Jersey Smart Start Program, 2009 Premium Motors Application for 10 HP, 15 HP, and 30 HP motors.

ECM-4 Install Variable Speed Drives on Hot Water Pumps and Air Handling Unit Fans

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
45,500	0	171,200	0	26,000	7.6	8,900	1.8	1.4

* Incentive shown is per the New Jersey Smart Start Program, 2009 Prescriptive Variable Frequency Drives Application for 10 HP, 15 HP, and 30 HP motors.

ECM-5 Install Demand Control Ventilation

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
37,500	-	10,850	6,340	10,400	3.2	N/A	3.6	N/A

* There is no incentive available through the New Jersey Smart Start Program for this ECM.

ECM-7 Install Door Seals

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
4,600	-	1,020	680	1,100	1.4	N/A	4.2	N/A

* There is no incentive available through the New Jersey Smart Start Program for this ECM.

ECM-8 Install Occupancy Sensors for Interior Lighting

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
8,600	-	25,000	0	3,000	5.6	1,400	2.9	2.4

* Incentive shown is per the New Jersey Smart Start Program, 2009 Lighting Controls Application. Incentive is based on $35 for ceiling-mounted occupancy sensors and $20 for wall-mounted, occupancy sensors.

ECM-9 Install Occupancy Sensors for VAV Control

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
97,400	-	60,100	2,620	12,800	1.0	N/A	7.6	N/A

3.0 EXISTING CONDITIONS

3.1 Building General

3.1.1 Structure

The North Brunswick Public Municipal Building is an 86,460 square foot facility constructed in 1991. The building, consisting of a basement, first floor, second floor and third floor, houses the administrative offices, township court, and police department.

The building exterior is composed of face brick and concrete with some metal fascia built on a concrete foundation. The walls are constructed of CMU with 1" cement plaster on the interior of the exterior walls. The interior partitions are metal studs with ½" gypsum board.

The windows and doors are double pane glass with metal frames. Public access to the administrative office areas and courtroom are provided by two main entrance doors located at the main lobby, and one side entrance door located on the west side of the building. There is also a single public access door leading to the public safety lobby. There are also separate doors, for staff use only, which provides access to the staff office areas and the shipping/receiving room.

The roof is a combination of flat white modified vinyl membrane and pitched metal roofing. The flat white vinyl membrane roof was installed in 2007 and the pitched metal roofing sections are original to the building's construction.

3.1.2 Operating Hours

The police department operates continuously year round. The administrative office area is open Monday through Friday from 8:30 AM – 4:00 PM. The administrate building is closed for 13 holiday-days per year.

The court room is used for Township Court, Planning Board meetings, and Zoning Board meetings. The Township Court hours are typically Wednesday from 9:00 AM to 3:30 PM and Wednesday 4:00 PM to 8:00 PM. Court is also held for one additional 2 hour session per week. The time of the additional session varies however it usually occurs during administrative office hours. Planning Board meetings are held on the second Tuesday of each month from 7:30 PM to 9:00 PM and Zoning Board meetings are held on the last Wednesday of the month from 7:00 PM to 9:00 PM.

3.2 Utility Usage

The building uses electricity, natural gas, and municipal water, and is connected into the municipal sewage system.

Electricity and natural gas are purchased from, and delivered by, the Public Service Electric and Gas Company (PSE&G). The Town of North Brunswick owns and operates the township's domestic water supply and sewer disposal systems, and does not charge for the building's water usage. For 2008, the building had electricity usage of 1,452,000 kWh, at a cost of $220,700, and natural gas usage of 41,300 therms at a cost of $57,200. The building's annual utility bill was $277,900.

The largest portion of the energy bill is for electricity, and the average blended rate is $0.152 per kWh. Electricity is used for air conditioning, lighting, computers, and office equipment. The building had a

maximum demand of 414 kW and a minimum of 240 kW during 2008. The monthly average over the observed 12 month period was 311 kW.

Pricing information obtained from the Energy Information Administration (EIA) indicated that the average blended rate for commercial customers in New Jersey over the same period was $0.147 per kWh. The average price is lower by 3.2% and equates to potential savings of approximately $7,000 per year. Lower electricity supply pricing may be available by switching to an alternate supplier. A list of electric suppliers licensed by the NJ Board of Public Utilities to sell electricity to customers served by PSE&G is provided in Appendix A.

Natural gas was used in 2008 for building heating, air reheat used for humidity control during summer cooling, and for domestic hot water production. The average blended rate for natural gas is $1.38 per therm. Pricing information obtained from the EIA indicated that the average blended rate for commercial customers in New Jersey over the same period was $1.43 per therm. The facility's price for natural gas was lower than average; however, a list of gas suppliers licensed by the NJ Board of Public Utilities to sell gas to customers served by PSE&G is provided in Appendix A, which may be utilized to determine if lower costs than currently being charged are available.

Utility data is also provided in Appendix A.

3.3 HVAC Systems

3.3.1 Central System

The HVAC system is comprised of water chillers, hot water heating boilers, air handing units with chilled water coils, and variable air volume (VAV) distribution boxes with hot water heating coils. The heating hot water is produced by two natural gas-fired boilers and circulated through a piping system to each heating coil. The chilled water used for cooling is produced by two air cooled chillers and circulated through a piping system to each chilled water coil. The central system has four air handling units (AHUs) and 140 individual zones, each with a dedicated VAV box and space temperature sensor. The central system is controlled by a direct digital control (DDC) system with a central user interface.

3.3.2 Hot Water Heating Systems

Hot water is produced by six natural gas-fired Hydrotherm boilers. The boilers are original to the building construction and each has a heating output capacity of 300 MBH with an efficiency rating of 80%. Heating hot water from the boilers is circulated to the hot water heating coils located in the VAV boxes by a hot water circulating pump.

3.3.3 Chilled Water Systems

Chilled water is produced by two McQuay air cooled water chillers with a cooling capacity of 75 tons and 125 tons, and are located outside on a concrete pad. Chilled water from the chillers is circulated to the chilled water coils located in the air handling units by use of chilled water circulating pumps.

3.3.4 Individual Split Systems

The building has three individual split air conditioning systems used for cooling only. Each system includes an air handling unit with a direct expansion cooling coil and separate compressor/condenser unit located outside. The individual split systems provide cooling for the police department server room,

police dispatch room, and police administration office's uninterruptible power supply room. The split systems have individual thermostats and are not connected to the DDC.

3.3.5 Controls

The DDC system incorporates electronic actuators and temperature sensors to control the building's heating, air conditioning, and ventilating systems. The DDC system has a central computer user interface and is used to schedule the HVAC equipment to turn off or provide temperature setback during unoccupied building hours. Individual zone space temperature setpoints are set with the central user interface. The temperature of supply air from the VAV boxes and individual spaces are controlled by the DDC system.

3.4 Lighting/Electrical Systems

Interior lighting is a combination of T-12 and T-8 fluorescent light fixtures. The T-12s are original to the building construction; however, all remaining T-12s are in the process of being retrofitted to T-8s.

The building's exterior parking lot lighting consists of high pressure sodium fixtures. The exterior parking lot lighting is controlled by photocells.

The building has one 350 kW diesel fired generator, located in one of the basement's mechanical room, for emergency backup.

3.5 Plumbing Systems

The plumbing system consists of domestic water piping, sanitary piping, and vent piping. Domestic hot water is generated by a solar hot water system. The solar hot water system was installed in 2009 and consists of 4 solar collector panels located on the roof and a 150 gallon storage tank located in a basement mechanical room. The hot water heating system also includes a 120 gallon natural gas tank heater used for backup. Plumbing fixtures include urinals, toilets, sinks, showers, and hose bibbs.

4.0 ENERGY CONSERVATION MEASURES

4.1 ECM-1 Boiler Replacement

Hot water used for building heat is produced by six Hydrotherm gas-fired boilers each with a heating output capacity of 272 MBH. The boilers, which operate year round, are located in the basement's mechanical room and have a standard thermal efficiency rating of 80%. The boilers produce hot water for building heating, and air reheat used for space relative humidity control during summer cooling. This ECM evaluates the replacement of the existing boilers with high efficiency condensing boilers.

Condensing boilers work on the principle of recovering as much waste heat as possible, which is normally ejected into the atmosphere from the flue of a conventional (non-condensing) boiler. This design maximizes the heat transfer from the burner and recovers useful heat which would normally be lost with the flue gases. When in condensing mode, (condensing boilers do not condense continually) the flue gases give up their latent heat which is then recovered by the heat exchanger within the boiler. As a result, the temperature of the gases exiting the flue of a condensing boiler is typically 120-140°F; the temperature in a current non-condensing boiler stack is higher. When used in conjunction with a hot water reset system, condensing boilers have the ability to operate at thermal efficiencies up to 94%, depending on the unit.

The building's current utility usage was analyzed to estimate the existing annual natural gas consumption by the hot water heating boilers. It was determined that the boilers used approximately 39,500 therms of natural gas throughout the heating season. The existing boiler's firing efficiency rating (80%) was then applied to determine the building's baseline boiler load, or hot water heating demand. The building heating demand was next applied to the proposed boiler thermal efficiency rating of 94%. It was found that the new boiler would have an annual consumption of approximately 33,620 therms, resulting in a savings of 5,880 therms of natural gas per year.

The existing boilers and exhaust flue would have to be removed, including immediate hot water supply and return piping. The new gas-fired, condensing, hot water boilers would be integrated with the existing DDC system for hot water temperature reset. For the new condensing boilers, a new boiler exhaust flue system must also be installed.

Boilers have an expected life of 20 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 117,600 therms and $162,000.

The implementation cost and savings related to this ECM are presented in Appendix B and summarized below:

ECM-1 Boiler Replacement

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
63,600	-	-	5,880	8,100	1.55	1,800	7.9	7.6

* Incentive shown is per the New Jersey Smart Start Program, 2009 Gas Heating Application. Incentive is based on the purchase of two 900 MBH hot water boilers.

This measure is recommended. The town has indicated that engineering and construction drawings for boiler replacement has been obtained and are under review.

4.2 ECM-2 Hot Water Temperature Reset

Heating hot water (HHW) is produced in the boilers and presently heated to a setpoint temperature of 180°F. This temperature remains constant throughout the year. Varying the heating hot water supply temperature as building heating load decreases in relation to outside air temperature will save energy.

The HHW is circulated through piping to the heating coils located on the building's VAV boxes. The hot water pipe is insulated; however, some heat energy is lost between the hot water in the pipe and the surrounding air. HHW temperatures as low as 140°F are sufficient during periods of higher outside air temperatures and lower building heating loads. Lowering the temperature will reduce the amount of hot water piping energy loss and save natural gas heating costs.

To calculate the savings, the size and lengths of the HHW pipe was obtained from the building drawings, and the amount of heat energy lost at a 180°F HHW temperature setpoint during occupied hours was determined. Weather bin data was then used to determine the varying HHW temperature setpoint and corresponding lower energy loss. Discussions with the building staff indicated that the hot water temperature of 180°F is necessary to maintain the heating demand when outside temperatures are below 20°F and savings were not included during these temperatures. The annual savings are 630 therms.

Implementation of this ECM will require a changeout of the temperature controller on the boiler and program modifications to the existing DDC system.

HVAC controls have a life expectancy of 15 years according to ASHRAE and total energy savings over the life of the project are estimated at 9,450 therms and $13,500.

The implementation cost and savings related to this ECM are presented in Appendix C and summarized below:

ECM-2 Hot Water Temperature Reset

Budgetary Cost	Annual Utility Savings					Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total	ROI			
$	kW	kWh	Therms	$		$	Years	Years
8,200	-	0	630	900	0.65	N/A	9.1	N/A

* There is no incentive available through the New Jersey Smart Start Program for this ECM.

This measure is recommended.

4.3 ECM-3 Install Premium Efficiency Motors

Some of the existing electric motors on the HVAC system fans and pumps are not efficient. This ECM evaluates replacing the existing standard efficiency motors with premium efficiency motors. Savings were determined by comparing the energy usage of the existing fan and pump motors to the energy usage with premium efficiency motors.

ECM-4 evaluates installation of variable speed drives, which will require replacement of the existing motors with inverter duty rated motors. This ECM evaluates replacing the motors with premium efficiency inverter motors, which will provide annual electrical savings of 14,200 kWh and $2,400. This measure would require installing new motors, reconnecting the output shaft and electrical wiring, and balancing the systems.

Premium efficient motors have an expected lifetime of 15 years, according to ASHRAE, and the estimated annual energy savings are 14,200 kWh for a total energy savings of 214,000 kWh over the life of the project or $36,000.

The implementation cost and savings related to this ECM are presented in Appendix D and summarized below:

ECM-3 Install Premium Efficiency Motors

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
12,100	5.0	14,300	0	2,400	1.98	900	5.0	4.7

* Incentive shown is per New Jersey Smart Start Program, 2009 Premium Motors Application for 10 HP, 15 HP, and 30 HP motors.

This measure is recommended.

4.4 ECM-4 Install Variable Speed Drives on Hot Water Pumps and Air Handling Unit Fans

The existing heating hot water distribution pumps and AHU fans operate at constant speed whenever the equipment is in operation, regardless of load. This is wasteful as the heating and cooling loads may not require the pump and fans to operate at full flow. It is recommended that the pumps and fans be placed on variable speed drives (VSD) and the speed of each motor controlled to match the load.

To calculate the savings from this measure, a model was developed that estimated the percentage of heating hot water and air handling unit air flow based on varying outside air temperatures. The HVAC water and air flow rates will change to correspond to the outside temperature. Weather bin data and occupied building hours were used in the model and annual energy savings of 171,200 kWh and $26,000 were determined.

Installing VSDs for the hot water pumps will require piping pressure sensors to provide feedback to the drive. As equipment in the heating system meets the load, control valves begin to close, reducing system flow and increasing pressure. The piping changes in the boiler room will be minor and should only require that a pressure sensor be installed. The system currently utilizes two pumps in lead-standby mode. This also allows facility personnel to rotate the pumps to provide equal run time. The cost estimate for this ECM includes a VSD for each pump. Each pump motor was rebuilt in 2009, however motors operating by VSD control need to be inverter duty, premium efficiency motors and therefore the motors will need to be replaced as recommended in ECM-3.

The supply air fans on the AHUs also operate at constant speed whenever a unit is operating, regardless of load. The units supply conditioned air to VAV boxes in individual zones. The space temperature in each zone or office is regulated by adjusting the amount of air leaving the VAV box. As flow rate of air changes, the speed of the AHU fan remains constant, which wastes energy. It is recommended that the fans be placed on a VSDs and fan speed controlled to match the load.

Installing VSDs on the fans will require inverter duty, premium efficiency motors (ECM-3) and air pressure sensors to provide feedback to the drive. The fan on AHU #1 operates with a VSD. This ECM evaluated the energy savings and cost associated with installing VSDs on the remaining three AHU fans.

HVAC controls have an expected life of 15 years, according ASHRAE, and total energy savings over the life of the project are estimated at 2,568,300 kWh and $390,000.

The implementation cost and savings related to this ECM are presented in Appendix E and summarized as follows:

ECM-4 Install Variable Speed Drives on Hot Water Pumps and Air Handling Unit Fans

Budgetary Cost	Annual Utility Savings					Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total	ROI			
$	kW	kWh	Therms	$		$	Years	Years
45,500	0	171,200	0	26,000	7.6	8,900	1.8	1.4

* Incentive shown is per the New Jersey Smart Start Program, 2009 Prescriptive Variable Frequency Drives Application for 10 HP, 15 HP, and 30 HP motors.

This measure is recommended.

4.5 ECM-5 Install Demand Control Ventilation

The ventilation for the building is provided by four AHUs with a total combined supply air capacity of 60,700 CFM, including 9,900 CFM of outdoor air. Each AHU draws fresh air in through an outdoor air intake hood, and blends it with return air prior to being conditioned and discharged into the building. Since there is no control for the minimum amount of fresh air intake, the same amount of outdoor air is being treated regardless of the ventilation demand as determined by the occupancy rate.

An energy savings option would be utilization of demand control ventilation (DCV), which measures carbon dioxide (CO_2) in the return air stream to an air handler and adjusts the outside air ventilation to maintain a CO_2 setpoint. An increase in CO_2 is representative of an increase in the number of occupants in a space. Outside air dampers will modulate and allow only the required amount of outside ventilation needed to match building occupancy. By controlling the ventilation based on occupancy, savings of natural gas and electricity can be achieved.

To determine savings, the energy required for constant outside air ventilation was compared to variable ventilation based on room occupancy. Estimates for the occupancy rate were made based on discussions with building personnel. The outside air CFM rates are based on equipment information and code requirements for outside air ventilation. Hourly bin data for heating and cooling along with current room temperature setpoints were used to determine the savings.

Implementing DCV would require installation of a CO_2 sensor, upgrades to the outside air damper actuators, control system programming, and electrical wiring modifications. Annual energy savings of $10,400 will be realized since less energy will be required to heat and cool the outside air.

HVAC controls have an expected life of 15 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 162,800 kWh, 95,100 therms and $156,000.

The implementation cost and savings related to this ECM are presented in Appendix F and summarized as follows:

ECM-5 Install Demand Control Ventilation

Budgetary Cost	Annual Utility Savings					Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total	ROI			
$	kW	kWh	Therms	$		$	Years	Years
37,500	-	10,850	6,340	10,400	3.2	N/A	3.6	N/A

* There is no incentive available through the New Jersey Smart Start Program for this ECM.

This measure is recommended.

4.6 ECM-6 Energy Recovery Ventilation

Energy recovery ventilation (ERV) is the process of transferring the heating/cooling value contained in normally exhausted building air and using it to heat or cool the incoming outdoor ventilation air. The benefit of using energy recovery is the ability to maintain indoor air quality while reducing the HVAC equipment energy requirements. Air handling units introduce fresh outside air and exhaust stale building air. This ECM evaluates the installation of a fixed plate energy recovery air heat exchanger for each air handling unit.

Savings were determined by use of a model to calculate the energy needed to condition the minimum outside ventilation air for each AHU. The outside air CFM rates are based on equipment information and code requirements for outside air ventilation. The amount of energy varies with the outside air temperature, and weather bin data was used for the calculations. The model was then used to calculate the savings by utilizing the energy in the stale exhaust air to condition the incoming fresh outside air.

This ECM would require installing four ERVs; two in the basement mechanical room, and one each in the first and third floors' mechanical rooms, and connecting them to the air handling units. Modifications to existing ductwork, damper actuators, electrical wiring, and DDC system programming would also be necessary.

The ERVs will require additional fan energy to move the air across their heat exchangers and the energy model shows this amount to be an increase of 3,060 kWh per year. Annual natural gas savings will be 8,240 therms and the net overall savings will be $10,900 per year.

Energy recovery ventilators have a live expectancy of 20 years according to ASHRAE, and total energy savings over the life of the project are estimated at (61,200 kWh), 164,800 therms, and $218,000.

The implementation cost and savings related to this ECM are presented in Appendix G and summarized below:

ECM-6 Energy Recovery Ventilation

Budgetary Cost	Annual Utility Savings					Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total	ROI			
$	kW	kWh	Therms	$		$	Years	Years
190,800		(3,060)	8,240	10,900	0.1	N/A	17.5	N/A

* There is no incentive available through the New Jersey Smart Start Program for this ECM

This measure is not recommended.

4.7 ECM-7 Door Seals

The doors are original to the building's construction and the gaps around the perimeters are a source of air infiltration. Installing door seals and weatherstripping will reduce infiltration and save energy.

This measure determined the perimeter length and gap spacing of the outside doors. Infiltration reductions and the associated energy savings were then calculated by using weather bin heating and cooling hour data.

Weatherstripping has an expected life of 10 years, according to the manufacturer, and total energy savings over the life of the project are estimated at 10,200 kWh, 6,800 therms and $11,000.

The implementation cost and savings related to this ECM are presented in Appendix H and summarized below:

ECM-7 Install Door Seals

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
4,600	-	1,020	680	1,100	1.4	N/A	4.2	N/A

* There is no incentive available through the New Jersey Smart Start Program for this ECM.

This measure is recommended.

4.8 ECM-8 Install Occupancy Sensors for Interior Lighting

Lighting fixtures throughout the building are manually switched on and off, and are operational from opening to closing of the building. The operating time of many of the building's interior lighting fixtures can be reduced by installing occupancy sensors in the administrative offices, conference rooms, lounge/breakrooms, storage rooms, and the men's and women's restrooms. Occupancy sensors were not considered in the mechanical rooms, hallways, and stairways due to safety concerns. Sensors were also not considered for the public safety section and police department as lighting for this area is mandated to be on 24/7.

The energy consumption of the lighting fixtures was determined to be 73,200 kWh per year. To calculate the annual energy consumption utilizing occupancy sensors the same fixture power requirement was used with the reduced annual hours of operation. This ECM considers installation of approximately 65 occupancy sensors. The difference between the existing and proposed annual energy consumption was the energy savings. Calculations are provided in Appendix E.

Lighting controls have an expected life of 15 years, according to the manufacturer, and total energy savings over the life of the project are estimated at 374,600 kWh, and $45,000.

The implementation cost and savings related to this ECM are presented in Appendix I and summarized as follows:

ECM-8 Install Occupancy Sensors for Interior Lighting

Budgetary Cost	Annual Utility Savings					Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total	ROI			
$	kW	kWh	Therms	$		$	Years	Years
8,600	-	25,000	0	3,000	5.6	1,400	2.9	2.4

* Incentive shown is per the New Jersey Smart Start Program, 2009 Lighting Controls Application. Incentive is based on $35 for ceiling-mounted occupancy sensors and $20 for wall-mounted, occupancy sensors.

This measure is recommended and recent discussions indicate that the town is moving forward with this ECM.

4.9 ECM-9 Occupancy Sensors for VAV Control

This ECM assumes the implementation of ECM-8. The lighting occupancy sensors would also be utilized to shut off the air flow from the VAV boxes in unoccupied areas. This ECM also proposes installation of the sensors in the police department, which was not considered in ECM-8 for safety reasons, to control the VAV boxes. Individual space temperature setpoints throughout the building are controlled by utilizing VAV boxes to adjust the amount of conditioned air flowing to satisfy the heating or cooling load of offices or zones. Each VAV box currently has a minimum damper setting which allows a portion of conditioned air to flow to a space regardless of occupancy and heating and cooling load. Shutting off the flow of conditioned air when the area is unoccupied will save heating, cooling, and AHU fan energy.

As previously mentioned the municipal building's DDC HVAC control system is presently used to schedule the HVAC equipment to turn off or provide temperature setback during unoccupied building hours. With the exception of the police department (24/7) and the court room, the unoccupied hours are Monday – Friday, 4:00 PM to 8:30 AM and on weekends and holidays. The proposed occupancy sensors for VAV control would provide additional energy savings during occupied building hours. This would occur when employees leave a room or office to go to a meeting. lunch, breaks or are on vacation. To compute the annual savings for this ECM, a model was used to determine the current energy consumption of each AHU when the VAV boxes are open at their current minimum damper settings. The model was then used to determine the amount of energy saved by adjusting the VAV box air flow to zero when the office or zone is identified as unoccupied by use of the occupancy sensors. The result was an annual savings of 60,100 kWh, 2,620 therms and $12,800.
Programming changes to the existing central HVAC control system for approximately 140 VAV boxes will be necessary as well as electrical wiring and VAV box damper actuator modifications.

HVAC controls have an expected life of 15 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 901,800 kWh and 39,300 therms and $192,000.

The implementation cost and savings related to this ECM are presented in Appendix J and summarized as follows:

ECM-9 Install Occupancy Sensors for VAV Control

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
97,400	-	60,100	2,620	12,800	1.0	N/A	7.6	N/A

* There is no incentive available through the New Jersey Smart Start Program for this ECM.

This measure is recommended.

4.10 Potential Incentives

The North Brunswick Municipal Building energy conservation project may be eligible for incentives by the New Jersey Office of Clean Energy. The largest incentives available will be for the New Jersey Pay for Performance (P4P) Program. The P4P program is designed for qualified energy conservation projects in facilities that consume a minimum average electric demand of 200 kW per month (total of 12 months peak demand/12). Facilities that meet this criterion must also achieve a minimum performance target of 15% by using an approved simulation modeling tool before and after construction. Implementing the measures identified in this report will allow the building to achieve this reduction. To utilize this program, a P4P Partner would need to be engaged. The 200 kW/month average minimum has been dropped so any structure can apply. This new incentive structure will be in effect until December 31, 2009.

Incentives for this program include the following:

- Incentive #1: The P4P Program pays $0.05 per square foot to a maximum of $25,000 or 25% of facility annual energy cost for the P4P Partner to develop an Energy Reduction Plan (ERP). This incentive is paid after approval of the ERP and signed Installation Agreement. Applicant must agree to commit to implementation of the ERP within 6 months or the incentive must be returned to the state.

- Incentive #2: Paid after installation of recommended measures; base incentives deliver $0.11/kWh and $1.10/therm not to exceed 30% of total project cost.

- Incentive #3: Paid after acceptance of Post-Construction Benchmarking Report showing energy savings over one year utilizing the approved simulation modeling tool and EPA Portfolio Manager. Incentive #3 base incentives deliver $0.07/kWh and $0.70/therm not to exceed 20% of total project cost.

Combining Incentives #2 and #3 will deliver a total of $0.18/ kWh and $1.80/therm not to exceed 50% of total project cost. Incentives for #2 and #3 are increased by $0.005/kWh and $0.05/therm for each percentage increase above the minimum performance target calculated with the approved simulation modeling tool, not to exceed 50% of total project cost.

Incentives are also available for prescriptive measures for various types of equipment under the New Jersey SmartStart Buildings incentive program. Prescriptive measures are paid after installation and no energy savings verification will be required. There are incentives available under this program for boiler replacement (ECM-1), premium efficiency motors (ECM-3), variable speed drives (ECM-4) and the installation of occupancy sensors for lighting controls (ECM-8) and VAV boxes (ECM-9) suggested in this study. These incentives were calculated utilizing the New Jersey SmartStart Building Equipment

incentive program. This program provides incentives dependent upon the existing equipment type and proposed equipment retrofit measure. If the North Brunswick Municipal Building qualifies and enters into the New Jersey Pay for Performance Program, then the savings from the ECMs, which qualify for New Jersey SmartStart incentive program, will be included in total building energy usage and savings. Applicants cannot apply for both programs for the same project.

When calculating the total incentive for the New Jersey Pay For Performance program, all energy conservation measures are applicable as the amount received is based on building wide energy improvements. Since the overall energy reduction for the building is estimated at 28.4%, it does meet the 15% minimum. Therefore the building is eligible to receive monies based on Incentives #2 and #3 as discussed above.

The P4P incentive calculations are presented in Appendix K.

5.0 ALTERNATIVE ENERGY SCREENING EVALUATION

5.1 Geothermal

Geothermal heat pumps (GHP) transfer heat between the constant temperature of the earth and the building to maintain the building's interior space conditions. Below the surface of the earth throughout New Jersey the temperature remains in the low 50°F range throughout the year. This stable temperature provides a source for heat in the winter and a means to reject excess heat in the summer. With GHP systems, water is circulated between the building and the piping buried in the ground. The ground heat exchanger in a GHP system is made up of a closed or open loop pipe system. Most common is the closed loop in which high density polyethylene pipe is buried horizontally at 4-6 feet deep or vertically at 100 to 400 feet deep. These pipes are filled with an environmentally friendly antifreeze/water solution that acts as a heat exchanger. In the summer, the water picks up heat from the building and moves it to the ground. In the winter the system reverses and fluid picks up heat from the ground and moves it to the building. Heat pumps make collection and transfer of this heat to and from the building possible.

The building has a mixture of HVAC systems including water chillers, hot water heating boilers, air handling units with chilled water coils, and VAV boxes with hot water coils. To take advantage of a GHP system, the building would have to install a low temperature closed loop water source heat pump system to realize the benefit of the consistent temperature of the ground. A water to water heat pump system could be utilized and used in conjunction with the existing equipment however system modifications and the installation of fluid heat exchangers would be necessary.

This measure is not recommended due to the high cost to retrofit the existing systems.

5.2 Solar

5.2.1 Photovoltaic Rooftop Solar Power Generation

The Municipal building was evaluated for the potential to install rooftop photovoltaic (PV) solar panels for power generation. Present technology incorporates the use of solar cell arrays that produce direct current (DC) electricity. This DC current is converted to alternating current (AC) with the use of an electrical device known as an inverter.

The PVWATTS solar power generation model was utilized to calculate PV power generation. The New Jersey Clean Power Estimator provided by the New Jersey Clean Energy Program is presently being updated; therefore, the site recommended use of the PVWAT solar grid analyzer version 1. The closest city available in the model is Newark, New Jersey and a fixed tilt array type was utilized to calculate energy production. The PVWAT solar power generation model is provided in Appendix L.

The State of New Jersey incentives for non-residential PV applications is $1.00/watt up to 50 kW of installed PV array. Federal tax credits are also available for renewable energy projects up to 30% of installation cost. Municipalities do not pay federal taxes; therefore, would not be able to utilize the federal tax credit incentive.

Installation of (PV) arrays in the state New Jersey will allow the owner to participate in the New Jersey solar renewable energy certificates program (SREC). This is a program that has been set up to allow entities with large amounts of environmentally unfriendly emissions to purchase credits from zero emission (PV) solar-producers. An alternative compliance penalty (ACP) is paid for by the high emission producers and is set each year on a declining scale of 3% per year. One SREC credit is equivalent to

1000 kilowatt hours of PV electrical production; these credits can be traded for period of 15 years from the date of installation. The cost of the ACP penalty for 2009 is $689; this is the amount that must be paid per SERC by the high emission producers. The expected dollar amount that will be paid to the PV producer for 2009 is expected to be $600/SREC credit. Payments that will be received from the PV producer will change from year to year dependent upon supply and demand. Renewable Energy Consultants is a third party SREC broker that has been approved by the New Jersey Clean Energy Program. As stated above there is no definitive way to calculate an exact price that will be received by the PV producer per SREC over the next 15 years. Renewable Energy Consultants estimated an average of $487/ SERC per year and this number was utilized in the cash flow for this report.

The municipal building had a maximum kW demand of 414 kW and a minimum kW of 240 kW during 2008. The monthly average over the observed 12 month period was 311 kW. The facility's existing load will justify the use of the maximum incentive cap of 50 kW of installed PV solar array; therefore, a 50 kW system size was selected for the calculations. The system costs for PV installations were derived from the most recent NYSERDA (New York State Energy Research and Development Agency) estimates of total cost of system installation. It should be noted that the cost of installation is currently $10 per watt or $10,000 per kW of installed system. This has increased in the past few years due to the rise in national demand for PV power generator systems. Other cost considerations will also need to be considered. PV panels have an approximate 20 year life span; however, the inverter device that converts DC electricity to AC has a life span of 10 to 12 years and will need to be replaced multiple times during the useful life of the PV system.

Photovoltaic (PV) Rooftop Solar Power Generation – 50 kW System

Budgetary Cost	Annual Utility Savings				Total Savings	New Jersey Renewable Energy Incentive*	New Jersey Renewable SREC**	Payback (without incentive)	Payback (with incentives)
	Electricity		Natural Gas	Total					
$	kW	kWh	Therms	$	$	$	$	Years	Years
500,000	0	59,200	0	9,000	9,000	50,000	28,800	>25	11.9

*Incentive based on New Jersey Renewable Energy Program for non-residential applications of $1.00 per Watt of installed capacity
** Estimated Solar Renewable Energy Certificate Program (SREC) for 15 years at $487/1000 kWh

This measure is not recommended at this time due to the long payback period; however, it could be a potentially viable renewable measure for the town to consider in the future if electricity rates continue to increase and if PV installation costs decline below $10 per watt.

5.2.2 Solar Thermal Domestic Hot Water Plant

This was not evaluated since the building installed a system in 2009.

5.3 Wind

Small wind turbines use a horizontal axis propeller, or rotor, to capture the kinetic energy of the wind and convert it into rotary motion to drive a generator which usually is designed specifically for the wind turbine. The rotor consists of two or three blades, usually made from wood or fiberglass. These materials give the turbine the needed strength and flexibility, and have the added advantage of not interfering with television signals. The structural backbone of the wind turbine is the mainframe, and includes the slip-rings that connect the wind turbine, which rotates as it points into changing wind directions, and the fixed tower wiring. The tail aligns the rotor into the wind.

To avoid turbulence and capture greater wind energy, turbines are mounted on towers. Turbines should be mounted at least 30 feet above any structure or natural feature within 300 feet of the installation. Smaller turbines can utilize shorter towers. For example, a 250-watt turbine may be mounted on a 30-50 foot tower, while a 10 kW turbine will usually need a tower of 80-120 feet. Tower designs include tubular or latticed, guyed or self-supporting. Wind turbine manufacturers also provide towers.

The New Jersey Clean Energy Program for small wind installations has designated numerous pre-approved wind turbines for installation in the State of New Jersey. Incentives for wind turbine installations are based on kilowatt hours saved in the first year. Systems sized under 16,000 kWh per year of production will receive a $3.20 per kWh incentive. Systems producing over 16,000 kWh will receive $51,200 for the first 16,000 kWh of production with an additional $0.50 per kWh up to a maximum cap of 750,000 kWh per year. Federal tax credits are also available for renewable energy projects up to 30% of installation cost for systems less than 100 kW. However, as noted previously, municipalities do not pay federal taxes and is, therefore, not eligible for the tax credit incentive.

The most important part of any small wind generation project is the mean annual wind speed at the height of which the turbine will be installed. In the North Brunswick area, the map indicates a mean annual wind speed of 10 miles per hour. For the municipal building, there are site restrictions. Parking lots, trees and local residential housing would greatly affect a tower location.

An aerial satellite image of the site and wind speed map is included in Appendix L.

This measure is not recommended due to the low mean annual wind speed.

5.4 Combined Heat and Power Generation (CHP)

Combined heat and power, cogeneration, is self-production of electricity on-site with beneficial recovery of the heat byproduct from the electrical generator. Common CHP equipment includes reciprocating engine-driven, micro turbines, steam turbines, and fuel cells. Typical CHP customers include industrial, commercial, institutional, educational institutions, and multifamily residential facilities. CHP systems that are commercially viable at the present time are sized approximately 50 kW and above, with numerous options in blocks grouped around 300 kW, 800 kW, 1,200 kW and larger. Typically, CHP systems are used to produce a portion of the electricity needed by a facility some or all of the time, with the balance of electric needs satisfied by purchase from the grid.

Any proposed CHP project will need to consider many factors, such as existing system load, use of thermal energy produced, system size, natural gas fuel availability, and proposed plant location.

The municipal building does have need for electrical generation and the ability to use most of the thermal byproduct during the winter. However thermal usage during the summer months is low, and thermal energy produced by the CHP plant will be wasted.

The most viable option for a CHP plant would be a reciprocating engine natural gas-fired unit. However, since the municipal building is located in a residential area, noise would be an issue.

This measure is not recommended due to limited use of summertime heat and noise issues.

5.5 Biomass Power Generation

Biomass power generation is a process in which waste organic materials are used to produce electricity or thermal energy. These materials would otherwise be sent to the landfill or expelled to the atmosphere. To participate in NJCEP's Customer On-Site Renewable Energy program, participants must install an on-site sustainable biomass or fuel cell energy generation system. Incentives for bio-power installations are available to support up to 1MW-dc of rated capacity.

*Class I organic residues are eligible for funding through the NJCEP CORE program. Class I wastes include the following renewable supply of organic material:

- Wood wastes not adulterated with chemicals, glues or adhesives
- Agricultural residues (corn stover, rice hulls or nut shells, manures, poultry litter, horse manure, etc) and/or methane gases from landfills
- Food wastes
- Municipal tree trimming and grass clipping wastes
- Paper and cardboard wastes
- Non adulterated construction wood wastes, pallets

The NJDEP evaluates biomass resources not identified in the RPS.

Examples of eligible facilities for a CORE incentive include:

- Digestion of sewage sludge
- Landfill gas facilities
- Combustion of wood wastes to steam turbine
- Gasification of wood wastes to reciprocating engine
- Gasification or pyrolysis of bio-solid wastes to generation equipment

* from NJOCE Website

This measure is not recommended because the building does not have a waste stream that can be utilized for the production of electricity or thermal energy.

5.5 Demand Response Curtailment

Presently, electricity is delivered by PSE&G, which receives the electricity from regional power grid RFC. PSE&G is the regional transmission organization (RTO) that coordinates the movement of wholesale electricity in all or parts of 13 states and the District of Columbia including the State of New Jersey.

Utility Curtailment is an agreement with the PSE&G regional transmission organization and an approved Curtailment Service Provider (CSP) to shed electrical load by either turning major equipment off or energizing all or part of a facility utilizing an emergency generator; therefore, reducing the electrical demand on the utility grid. This program is to benefit the utility company during high demand periods and PSE&G offers incentives to the CSP to participate in this program. Enrolling in the program will require program participants to drop electrical load or turn on emergency generators during high electrical demand conditions or during emergencies. Part of the program also will require that program participants reduce their required load or run emergency generators with notice to test the system.

Presently the North Brunswick Municipal Building utilizes one Cummins 350 kW back up generator and has an average monthly kW demand during the observed period of 311 kW. PSE&G utilizes curtailment providers to bundle and organize demand reduction load. A PSE&G pre-approved CSP will require a minimum of 100 kW of load reduction to participate in any curtailment program. The municipal building will need to de-energize their facility during the periods of high grid demand. By use of the generator, the building would have the ability to reduce their electrical load by the required 100 kW minimum and enter the demand response program. However, discussions with maintenance staff indicated the amount of load connected to the generator may be well below the 100 kW minimum. The known connected loads are emergency lighting, the elevator, and the computers and radio dispatch equipment located in the police department. It is doubtful that these will exceed the 100kW requirement; however, an engineering study would need to be conducted to evaluate actual connected load, and determine if the present emergency generator will meet emission requirements to be allowed to participate in the demand response program.

The facility may not be able satisfy the Curtailment Service Provider required 100kW minimum; therefore, this ECM is not recommended.

6.0 EPA PORTFOLIO MANAGER

The United States Energy Protection Agency (EPA) is a federal agency in charge of regulating environment waste and policy in the United States. The mission of the EPA is to protect human health and the environment. The EPA has released an interactive energy management tool known as the EPA Portfolio Manger that allows building owners to track and assess energy consumption across their facility. This program is designed to allow property owners and managers to share, compare and improve upon their facility's energy consumption. Inputting such parameters at electricity, heating fuel, building characteristics and location into the website based program generates a naturalized energy rating score out of 100. The Portfolio Manager was not able to provide the naturalized energy rating score for the facility because municipal buildings are not yet listed under the categories needed to provide the score and generate a full report. Once an account is registered, monthly utility data can be entered to track the savings progress and retrieve an updated energy rating score on a monthly basis.

The building has a Site Energy Usage Index (EUI) of 105 kBtu/ft^2/yr. This EUI is higher than average as compared to the EUI of similar facilities, and a lower index is preferable. Several factors are attributable to this usage index, including wasted energy from high outside air ventilation, lack of variable speed drives, lack of premium efficient motors, and lack of lighting controls. If the all of the measures recommended in this report are fully implemented it is projected that the site EUI would be reduced to 75 kBtu/ft^2/yr.

Information regarding the Energy Star Portfolio Manager is located in Appendix M. The user name and password for the Municipal Building's EPA Portfolio Manager Account was provided to Harry Rossmann, Supervisor of Building Services for the North Brunswick Municipal Building.

7.0 CONCLUSIONS & RECOMMENDATIONS

The energy audit conducted by CHA at the Mansfield Township Municipal Building in Port Murray, New Jersey identified potential ECMs for variable speed drives, motor upgrade, door seals, boiler replacement, occupancy sensors, demand control ventilation, and hot water reset. Potential annual savings of $64,700 may be realized for the recommended ECMs, with a summary of the costs, savings, and paybacks as follows:

ECM-1 Boiler Replacement

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
63,600	-	-	5,880	8,100	1.55	1,800	7.9	7.6

* Incentive shown is per the New Jersey Smart Start Program, 2009 Gas Heating Application. Incentive is based on the purchase of two 900 MBH hot water boilers.

ECM-2 Hot Water Temperature Reset

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
8,200	-	0	630	900	0.65	N/A	9.1	N/A

* There is no incentive available through the New Jersey Smart Start Program for this ECM.

ECM-3 Install Premium Efficiency Motors

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
12,100	5.0	14,300	0	2,400	1.98	900	5.0	4.7

* Incentive shown is per New Jersey Smart Start Program, 2009 Premium Motors Application for 10 HP, 15 HP, and 30 HP motors.

ECM-4 Install Variable Speed Drives on Hot Water Pumps and Air Handling Unit Fans

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
45,500	0	171,200	0	26,000	7.6	8,900	1.8	1.4

* Incentive shown is per the New Jersey Smart Start Program, 2009 Prescriptive Variable Frequency Drives Application for 10 HP, 15 HP, and 30 HP motors.

ECM-5 Install Demand Control Ventilation

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
37,500	-	10,850	6,340	10,400	3.2	N/A	3.6	N/A

* There is no incentive available through the New Jersey Smart Start Program for this ECM.

ECM-7 Install Door Seals

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
4,600	-	1,020	680	1,100	1.4	N/A	4.2	N/A

* There is no incentive available through the New Jersey Smart Start Program for this ECM.

ECM-8 Install Occupancy Sensors for Interior Lighting

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
8,600	-	25,000	0	3,000	5.6	1,400	2.9	2.4

* Incentive shown is per the New Jersey Smart Start Program, 2009 Lighting Controls Application. Incentive is based on $35 for ceiling-mounted occupancy sensors and $20 for wall-mounted, occupancy sensors.

ECM-9 Install Occupancy Sensors for VAV Control

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
97,400	-	60,100	2,620	12,800	1.0	N/A	7.6	N/A

APPENDIX A

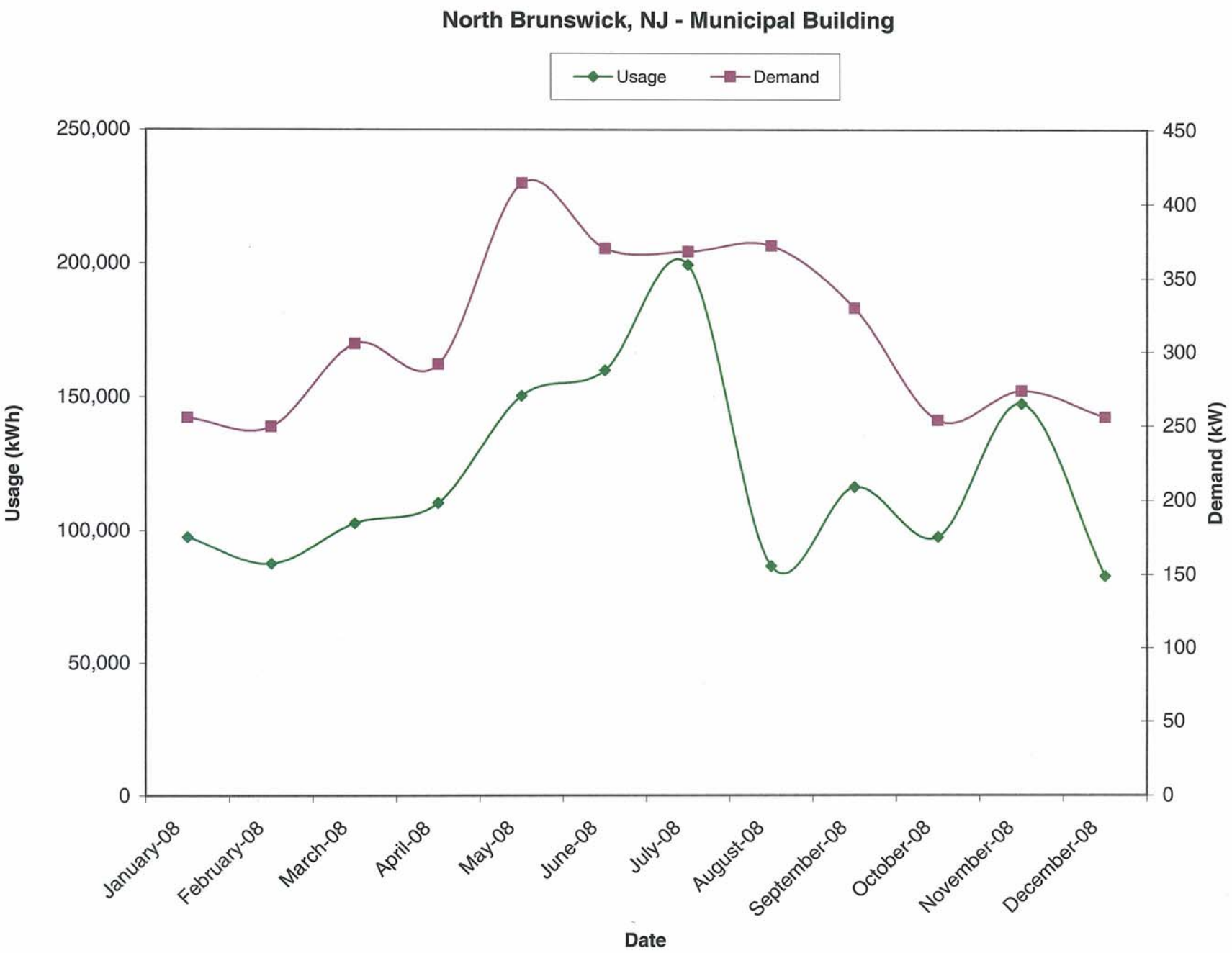
Utility Usage Analysis

New Jersey BPU Energy Audit Program
CHA #20418
Building: North Brunswick Township Municipal Building

Account Number: 62 696 228 59 Meter Number: 778010450 Rate: LPLS
Public Service Electric & Gas Company (PSE&G)

Electricity						
Period	kWh	kW	Cost	Demand Unit Cost	Supply Unit Cost	Blended Rate
			($)	($/kW)	($/kWh)	($/kWh)
Jan-08	95,800	240	12,002.27	6.66	0.1047	0.1253
Feb-08	97,600	256	12,418.50	6.37	0.1067	0.1272
Mar-08	87,600	250	11,269.98	6.44	0.1060	0.1287
Apr-08	102,800	306	12,969.27	5.85	0.1051	0.1262
May-08	110,400	292	13,801.15	5.98	0.1058	0.1250
Jun-08	150,400	414	25,436.98	15.38	0.1243	0.1691
Jul-08	160,000	370	28,073.07	16.86	0.1341	0.1755
Aug-08	199,600	368	36,112.02	21.96	0.1380	0.1809
Sep-08	86,600	372	15,639.15	10.66	0.1321	0.1806
Oct-08	116,200	330	17,244.17	9.94	0.1170	0.1484
Nov-08	97,600	254	14,122.66	11.97	0.1097	0.1447
Dec-08	147,400	274	21,632.21	18.54	0.1082	0.1468
Total	1,452,000	414	220,721.43		0.1182	0.1520
Monthly Ave.	121,000	311	18,393	11.92		

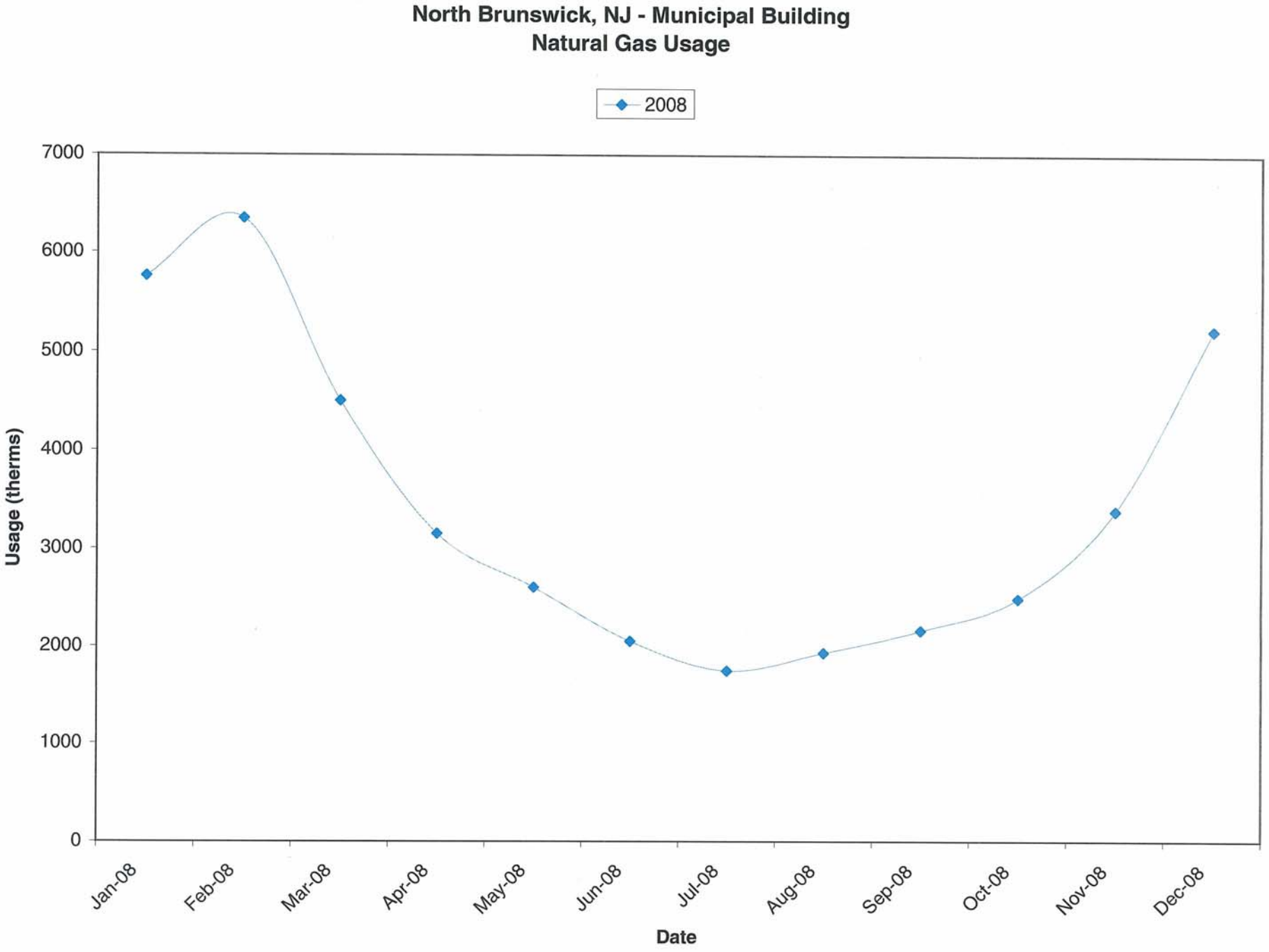
Electricity													
Service Charge	Annual Demand kW	Summer Demand kW	0n-peak kWh	Off-peak kWh	Societal Benefits kWh	Securitization Transition kWh	Delivery Total	Generation kW	Transmission kW	Supply on-peak kWh	Supply off-peak kWh	Supply Total	Total
$372.11	$774.10	$0.00	$173.15	$139.82	$573.55	$953.75	$2,986.48	$289.12	$535.58	$5,288.02	$2,903.07	$9,015.79	$12,002.27
$372.11	$825.70	$0.00	$163.99	$154.86	$584.33	$974.83	$3,075.82	$288.94	$514.94	$5,170.70	$3,368.10	$9,342.68	$12,418.50
$372.11	$806.35	$0.00	$158.12	$128.06	$524.46	$874.95	$2,864.05	$288.94	$515.26	$4,891.92	$2,709.81	$8,405.93	$11,269.98
$372.11	$986.97	$0.00	$196.02	$139.82	$615.46	$1,026.77	$3,337.15	$288.94	$515.26	$5,950.49	$2,877.43	$9,632.12	$12,969.27
$372.11	$941.82	$0.00	$208.44	$152.24	$660.96	$1,102.67	$3,438.24	$288.94	$515.26	$6,384.24	$3,174.47	$10,362.91	$13,801.15
$372.11	$1,335.32	$3,176.83	$273.78	$217.58	$900.44	$1,502.19	$7,778.25	$1,340.02	$515.00	$10,772.06	$5,031.65	$17,658.73	$25,436.98
$372.11	$1,193.40	$2,839.20	$305.79	$216.93	$957.92	$1,598.08	$7,483.43	$1,690.37	$514.91	$13,085.92	$5,298.44	$20,589.64	$28,073.07
$483.74	$1,543.03	$3,671.00	$366.56	$285.54	$1,195.00	$1,993.60	$9,538.47	$2,197.48	$669.39	$16,274.42	$7,432.26	$26,573.55	$36,112.02
$235.67	$759.90	$1,807.87	$156.81	$126.11	$518.48	$864.97	$4,469.81	$1,070.56	$326.11	$6,700.65	$3,072.02	$11,169.34	$15,639.15
$372.11	$1,064.38	$0.00	$216.93	$162.71	$686.96	$1,160.60	$3,663.69	$1,685.08	$532.11	$7,677.24	$3,686.05	$13,580.48	$17,244.17
$372.11	$819.25	$0.00	$175.77	$143.10	$643.05	$974.82	$3,128.10	$1,683.40	$537.58	$5,699.33	$3,074.25	$10,994.56	$14,122.66
$607.78	$1,443.47	$0.00	$323.79	$277.29	$1,059.24	$1,481.94	$5,193.51	$2,748.15	$888.11	$8,205.69	$4,596.75	$16,438.70	$21,632.21
$4,676.18	$12,493.69	$11,494.90	$2,719.15	$2,144.06	$8,919.85	$14,509.17	$56,957.00	$13,859.94	$6,579.51	$96,100.68	$47,224.30	$163,764.43	


North Brunswick, NJ - Municipal Building
Usage
Demand
250,000
200,000
150,000
100,000
50,000
0
450
400
350
300
250
200
150
100
50
0
Usage (kWh)
Demand (kW)
January-08
February-08
March-08
April-08
May-08
June-08
July-08
August-08
September-08
October-08
November-08
December-08
Date

New Jersey BPU Energy Audit Program
CHA #20418
Building: North Brunswick Township Municipal Building

Account Number: 62 696 228 59 Meter Number: 2279364 Rate: LVG
Public Service Electric & Gas Company (PSE&G) Delivery & Supply

Natural Gas										
	Delivery							Supply		
Period	Service Charge	Therms	Distribution	Demand	Balancing Charge	Societal Benefits	Total Demand	Total Supply	Total Cost	Blended Cost $/therm
Jan-08	$91.89	5,760	$276.49	$1,135.25	$366.28	$223.43	$2,093.34	$5,683.77	$7,777.11	
Feb-08	$91.89	6,348	$302.36	$796.46	$422.65	$246.23	$1,859.59	$6,731.75	$8,591.34	
Mar-08	$91.89	4,505	$221.21	$696.11	$263.32	$174.75	$1,447.28	$5,285.79	$6,733.07	
Apr-08	$91.89	3,152	$161.62	$0.00	$0.00	$122.26	$375.77	$3,916.55	$4,292.32	
May-08	$91.89	2,602	$137.38	$0.00	$0.00	$100.91	$330.18	$3,640.30	$3,970.48	
Jun-08	$91.89	2,049	$113.05	$0.00	$0.00	$79.48	$284.42	$3,055.80	$3,340.22	
Jul-08	$91.89	1,746	$99.70	$0.00	$0.00	$67.73	$259.32	$2,825.15	$3,084.47	
Aug-08	$91.89	1,927	$107.68	$0.00	$0.00	$74.75	$274.32	$2,495.19	$2,769.51	
Sep-08	$91.89	2,158	$117.82	$0.00	$0.00	$83.69	$293.40	$2,464.73	$2,758.13	
Oct-08	$91.89	2,483	$132.14	$0.00	$0.00	$96.19	$320.22	$2,586.58	$2,906.80	
Nov-08	$91.89	3,379	$171.60	$696.11	$145.94	$147.59	$1,253.13	$3,204.26	$4,457.39	
Dec-08	$91.89	5,218	$252.58	$696.11	$310.08	$240.17	$1,590.83	$4,961.81	$6,552.64	
		41,327					$10,381.80	$46,851.68	$57,233.48	$1.38


North Brunswick, NJ - Municipal Building
Natural Gas Usage
2008
7000
6000
5000
4000
3000
2000
1000
0
Usage (therms)
Jan-08
Feb-08
Mar-08
Apr-08
May-08
Jun-08
Jul-08
Aug-08
Sep-08
Oct-08
Nov-08
Dec-08
Date

ELECTRIC MARKETERS LIST

The following is a listing of marketers/suppliers/brokers that have been licensed by the NJ Board of Public Utilities to sell electricity to residential, small commercial and industrial customers served by the Public Service Electric and Gas Company distribution system. **This listing is provided for informational purposes only and PSE&G makes no representations or warranties as to the competencies of the entities listed herein or to the completeness of this listing.**

American Powernet Management
867 Berkshire Blvd, Suite 101
Wyomissing, PA 19610
www.americanpowernet.com

BOC Energy Services
575 Mountain Avenue
Murray Hill, NJ 07974
www.boc-gases.com

Commerce Energy Inc.
535 Route 38, Suite 138
Cherry Hill, NJ 08002
(888) 817-8572 or
(858) 910-8099
www.commerceenergy.com

ConEdison Solutions
701 Westchester Avenue
Suite 201 West
White Plains, NY 10604
(800) 316-8011
www.ConEdSolutions.com

Constellation NewEnergy, Inc.
1199 Route 22 East
Mountainside, NJ 07092
908 228-5100
www.newenergy.com

Credit Suisse (USA), Inc.
700 College Road East
Princeton, NJ 08450
www.creditsuisse.com

Direct Energy Services, LLC
One Gateway Center, Suite 2600
Newark, NJ 07102
(973) 799-8568
www.directenergy.com

FirstEnergy Solutions
395 Ghent Road Suite 407
Akron, OH 44333
(800) 977-0500
www.fes.com

Gerdau Ameristeel Energy Co.
North Crossman Road
Sayreville, NJ 08872

Gexa Energy LLC New Jersey
20 Greenway Plaza, Suite 600
Houston, TX 77046
(866) 304-GEXA
Beth.miller@gexaenergy.com

Glacial Energy of New Jersey
2602 McKinney Avenue, Suite 220
Dallas, TX 75204
www.glacialenergy.com

Hess Corporation
1 Hess Plaza
Woodbridge, NJ 07095
www.hess.com

Integrys Energy Services, Inc
99 Wood Avenue, Suite 802
Iselin, NJ 08830
www.integrysenergy.com

Liberty Power Delaware, LLC
1901 W Cypress Road, Suite 600
Fort Lauderdale, FL 33309
(866) Power-99
(866) 769-3799
www.libertypowercorp.com

Liberty Power Holdings, LLC
1901 W Cypress Creek Road, Suite 600
Fort Lauderdale, FL 33309
(866) Power-99
(866) 769-3799
www.libertypowercorp.com

Pepco Energy Services, Inc.
d/b/a Power Choice
23 S. Kinderkamack Rd Ste D
Montvale, NJ 07645
(800) 363-7499
www.pepco-services.com

PPL EnergyPlus, LLC
Energy Marketing Center
Two North Ninth Street
Allentown, PA 18101
1-866-505-8825
http://www.pplenergyplus.com/

Sempra Energy Solutions
The Mac-Cali Building
581 Main Street, 8th Floor
Woodbridge, NJ 07095
(877) 273-6772
www.SempraSolutions.com

South Jersey Energy Company
1 South Jersey Plaza, Route 54
Folsom, NJ 08037
(800) 756-3749
www.sjindustries.com

Strategic Energy, LLC
6 East Main Street, Suite 6E
Ramsey, NJ 07446
(888) 925-9115
www.sel.com

Suez Energy Resources NA
333 Thornall Street FL6
Edison, NJ 08818
866.999.8374(toll free)
www.suezenergyresources.com

UGI Energy Services, Inc.
d/b/a POWERMARK
1 Meridian Blvd. Suite 2C01
Wyomissing, PA 19610
(800) 427-8545
www.ugienergyservices.com

Jan 14, 2009

GAS MARKETERS LIST

The following is a listing of marketers/suppliers/brokers that have been licensed by the NJ Board of Public Utilities to sell natural gas to residential, small commercial and industrial customers served by the Public Service Electric and Gas Company distribution system. **This listing is provided for informational purposes only and PSE&G makes no representations or warranties as to the competencies of the entities listed herein or to the completeness of this listing.**

Gateway Energy Services
44 Whispering Pines Lane
Lakewood, NJ 08701
(800) 805-8586
www.gesc.com

Metro Energy Group, LLC
14 Washington Place
Hackensack, NJ 07601
www.metroenergy.com

RPL Holdings, Inc
601 Carlson Pkwy
Minnetonka, MN 55305

Great Eastern Energy
3044 Coney Island Ave. PH
Brooklyn, NY 11235
888-651-4121
www.greateasterngas.com

Metromedia Energy, Inc.
6 Industrial Way
Eatontown, NJ 07724
(800) 828-9427
www.metromediaenergy.com

South Jersey Energy Company
One South Jersey Plaza, Rte 54
Folsom, NJ 08037
(800) 756-3749
www.sjindustries.com/sje.htm

Hess Corporation
1 Hess Plaza
Woodbridge, NJ 07095
(800) 437-7872
www.hess.com

Mitchell- Supreme Fuel
(NATGASCO)
532 Freeman Street
Orange, NJ 07050
(800) 840-4GAS
www.mitchellsupreme.com

Sprague Energy Corp.
Two International Drive, Ste 200
Portsmouth, NH 03801
800-225-1560
www.spragueenergy.com

Hudson Energy Services, LLC
545 Route 17 South
Ridgewood, NJ 07450
(201) 251-2400
www.hudsonenergyservices.com

MxEnergy Inc.
P.O. Box 177
Annapolis Junction, MD 20701
800-375-1277
www.mxenergy.com

Stuyvesant Energy LLC
642 Southern Boulevard
Bronx, NY 10455
(718) 665-5700
www.stuyfuel.com

Intelligent Energy
7001 SW 24th Avenue
Gainesville, FL 32607
Sales: 1 877 I've Got Gas
(1 877 483-4684)
Customer Service:
1 800 927-9794
www.intelligentenergy.org

Pepco Energy Services, Inc.
23 S Kinderkamack Rd, Suite D
Montvale, NJ 07645
(800) 363-7499
www.pepco-services.com

Tiger Natural Gas, Inc.
1422 E. 71st Street, Suite J.
Tulsa, OK 74136
1-888-875-6122
www.tigernaturalgas.com

Systrum Energy
877-SYSTRUM
(877-797-8786)
www.systrumenergy.com

Plymouth Rock Energy, LLC
165 Remsen Street
Brooklyn, NJ 11201
866-539-6450
www.plymouthrockenergy.com

UGI Energy Services, Inc.
d/b/a GASMARK
704 E. Main Street, Suite I
Moorestown, NJ 08057
856-273-9995
www.ugienergyservices.com

Macquarie Cook Energy, LLC
10100 Santa Monica Blvd, 18th
Fl
Los Angeles, CA 90067

PPL EnergyPlus, LLC
Energy Marketing Center
Two North Ninth Street
Allentown, PA 18101
1-866-505-8825
www.pplenergyplus.com/natural+gas/

Woodruff Energy
73 Water Street
P.O. Box 777
Bridgeton, NJ 08302
(856) 455-1111
www.woodruffenergy.com

APPENDIX B

ECM-1 Boiler Replacement

North Brunswick
CHA #20418
Building: Municipal Building

ECM-1 Boiler Replacement

Existing Fuel	Nat.Gas
Proposed Fuel	Nat.Gas

Item	Value	Units	Formula/Comments
Baseline Fuel Cost	$ 1.38	$/Therm	
Proposed Fuel Cost	$ 1.38	$/Therm	
Boiler Input	1,800	MBH	6 of 8 boilers used for heating, remaining 2 not in use.
Other Heating Equipment Input	0	MBH	
Boiler Input % of Total	100.0%		
Baseline Fuel Use	39,500	Therms	Based on historical utility data
Baseline Fuel Use of Boiler	39,500	Therms	
Existing Boiler Plant Efficiency	80%		Estimated or Measured
Baseline Boiler Load	3,160,000	Mbtu/yr	Baseline Fuel Use x Existing Efficiency x 100 Mbtu/Therms
Baseline Fuel Cost	$ 54,510		
Proposed Boiler Plant Efficiency	94%		New Condensing Boiler Efficiency
Proposed Fuel Use	33,617	Therms	Baseline Boiler Load / Proposed Efficiency / 100 Mbtu/Therms
Proposed Fuel Cost	$ 46,391		
Annual Savings	5,883	Therms	
Annual Savings	**$ 8,119**	**/yr**	

North Brunswick
CHA #20418
Building: Municipal Building

ECM-1 Boiler Replacement

Multipliers	
Material:	0.98
Labor:	1.21
Equipment:	1.09

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
						$ -	$ -	$ -	$ -	
Boiler Removal	1	ea		$ 600		$ -	$ 726	$ -	$ 726	
Condensate Neutralization Kit	1	ea	$ 300	$ 250		$ 294	$ 303	$ -	$ 597	
Flue Modifications	30	lf	$ 20	$ 40		$ 588	$ 1,452	$ -	$ 2,040	
Piping Modifications	2	ea	$ 650	$ 700		$ 1,274	$ 1,694	$ -	$ 2,968	
Electric Modifications	2	ea	$ 600	$ 700		$ 1,176	$ 1,694	$ -	$ 2,870	
Gas-Fired Condensing HW Boiler w/ freight *	2	ea	$ 18,000	$ 1,500		$ 35,280	$ 3,630	$ -	$ 38,910	Includes Startup
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

* Boiler price based on vendor quote

$ 48,111	Subtotal
$7,217	15% Contingency
$8,299	15% Contractor O&P
$0	0% Engineering
$63,626	**Total**

New Jersey Smart Start Incentive	QTY	UNIT	$ / UNIT	TOTAL SAVINGS	Cost W/O INCENTIV	Cost W/ INCENTIV
					$ -	$ -
NG Boilers > 1500 - ≤4000 MBH	1,800	MBH	$1	$1,800	$ 38,910	$ 37,110
					$ -	$ -
				$1,800	$38,910	$37,110

Total ECM Cost w/ Incentives	**$61,826**

HIGH EFFICIENCY COMMERCIAL CONDENSING BOILERS

Sample

KNIGHT XL
COMMERCIAL BOILER

SMART SYSTEM™

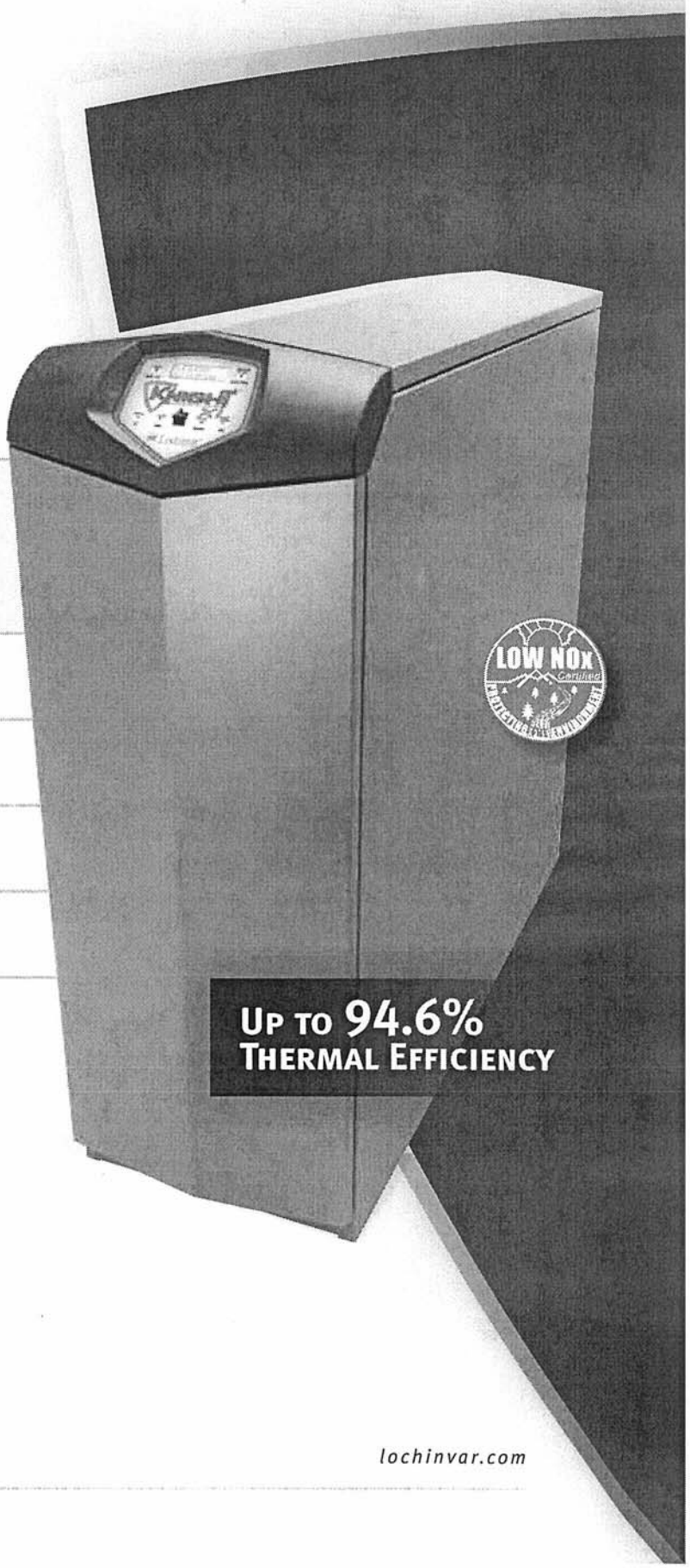
OPERATING CONTROL FEATURING
A BUILT-IN CASCADING SEQUENCER

5 MODELS: 399,000 – 800,000 BTU/HR

FIRING RATE MODULATION TO 5:1

LESS THAN 20 ppm NOx

DIRECT-VENT FLEXIBILITY TO 100 FEET



UP TO 94.6%
THERMAL EFFICIENCY

Lochinvar®
High Efficiency Water Heaters, Boilers and Pool Heaters

lochinvar.com

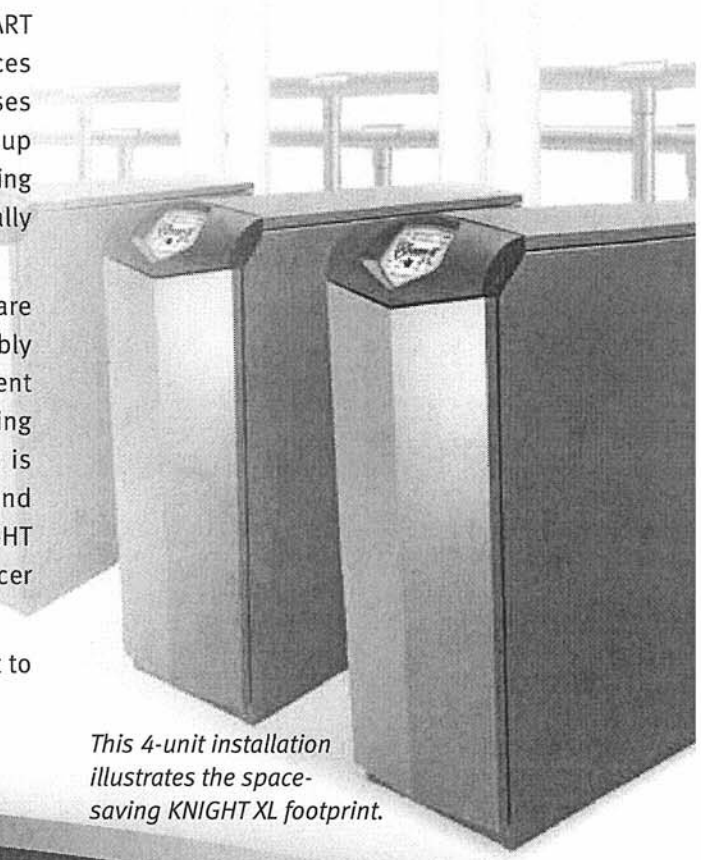
KNIGHT® XL
COMMERCIAL BOILER

THE SMARTEST CHOICE FOR CONDENSING BOILER PERFORMANCE

The KNIGHT® XL, engineered with Lochinvar's exclusive SMART SYSTEM™ control and an array of other innovative features, places it far ahead of any commercial heating boiler in its class. It promises and delivers ultimate ease of installation and maintenance. With up to 94.6% thermal efficiency, low-NOx emissions and a fully modulating burner, it is the best "green choice" for today's environmentally focused market.

Five modulating/condensing stainless steel KNIGHT XL boilers are available, with 399,000–800,000 Btu/hr inputs, with remarkably small space-saving footprints. All are equipped for direct-vent installation with air intake and exhaust runs up to 100 feet using PVC, CPVC or AL29-4C venting materials. This range of choices is ideal for light-duty applications such as small hotels, schools and office buildings. For higher-demand applications, up to eight KNIGHT XL units can be installed utilizing the built-in cascading sequencer to deliver up to 6.4 million Btu/hr heating capacity.

THE KNIGHT XL BOILER reflects Lochinvar's constant commitment to providing all the options you need to serve every application.



This 4-unit installation illustrates the space-saving KNIGHT XL footprint.

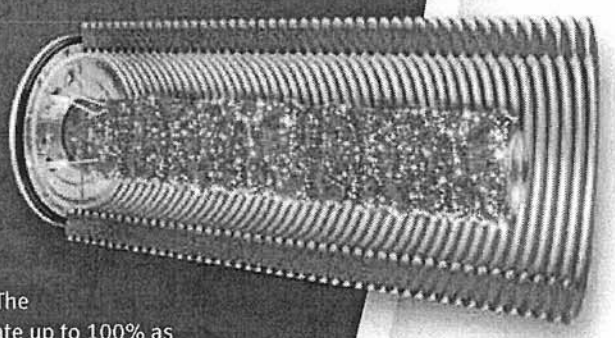
THE KNIGHT XL COMBUSTION SYSTEM

ADVANCED NEGATIVE REGULATION TECHNOLOGY

KNIGHT XL safely and reliably operates with supply gas pressure as low as 4 inches water column, as Negative Regulation (Neg/Reg) technology automatically adjusts fan speed that ensures the correct volume and mix of fuel and air throughout the firing range.

TWO-IN-ONE STAINLESS STEEL HEAT EXCHANGER

A combined primary and secondary heat exchanger captures flue gas heat and allows entering water temperatures as low as 50°F. The stainless steel, pH-tolerant design features a weld-sealed assembly with no O-rings or gaskets, and does not require special glycol. ASME Section IV approved and stamped.



FULLY MODULATING BURNER

The SMART SYSTEM allows fully modulating combustion with 5:1 turndown. The burner can fire as low as 20% of maximum input, and modulates the firing rate up to 100% as demand increases.

The burner is a single stainless steel assembly covered with woven steel mesh, and fires in a 360° pattern along the entire length of the primary heat exchanger. This allows the compact KNIGHT XL to exceed the capacity of units with larger multiple burners.

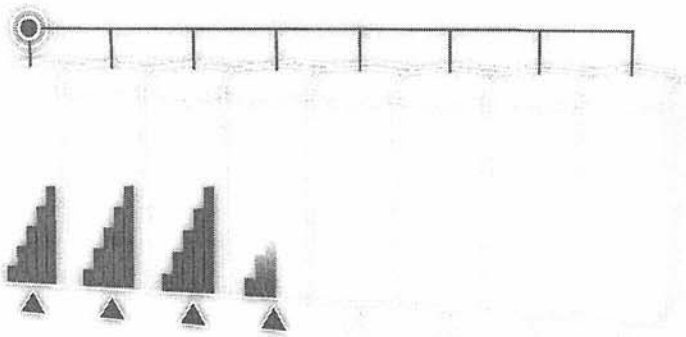
SMART SYSTEM™

Including a Built-in Cascading Sequencer!

SMART SYSTEM provides unequalled control and monitoring functions that are easy to understand and use.

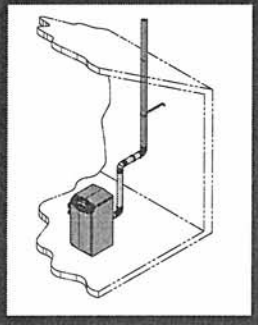
- 2-Line, 16-Character LCD Display
- Password Security
- Building Management System Control
- PC Connection
- Outdoor Reset
- Night Setback
- System Pump Control and Boiler Pump Control
- Pump Relay with Freeze Protection
- Hot Water Generator Compatibility
- Inlet/Outlet and System Temperature Sensors
- Low Water Flow Indicator
- Product Service Indicator
- Field Connection Versatility

Sequence up to an 8-boiler system using simple 2-wire daisy-chain connection, eliminating cost and uncertainty of separate "third party" sequencer. On demand, one boiler functions as the lead unit, and modulates to capacity. Increasing load then "cascades" to additional "lag" boilers in sequence as needed. Lead-lag rotation shifts lead boiler role every 24 hours, distributing equal lead-lag runtimes to each unit.

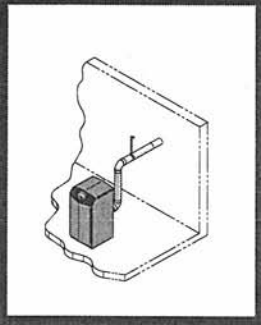


Direct-Venting up to 100 Feet - KNIGHT XL offers 7 venting options and tremendous flexibility for placement of units within the building, because it permits direct-vent air intake and exhaust runs up to 100 equivalent feet using either PVC, CPVC or AL29-4C stainless steel vent pipe. Intake and exhaust runs can terminate horizontally through a sidewall or vertically through the roof.

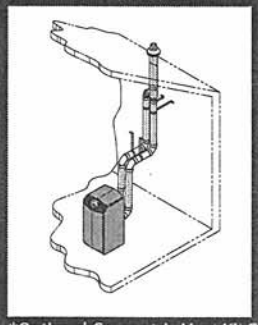
Room Air Vertical



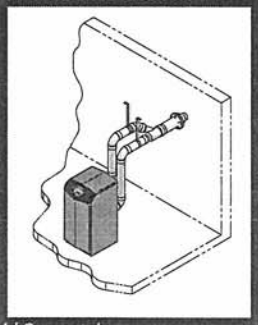
Room Air Sidewall



Direct Vent Vertical*

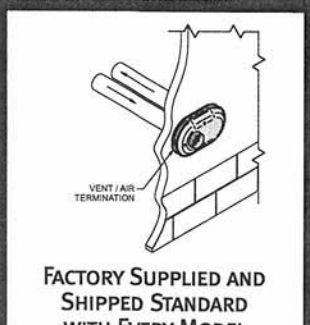


Direct Vent Sidewall*



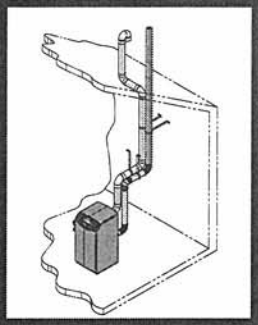
*Optional Concentric Vent Kit Sold Separately

Sidewall Vent Termination

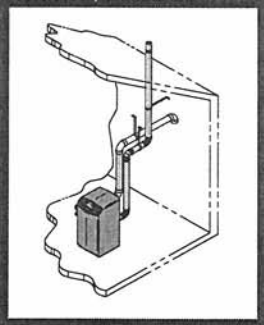


Factory Supplied and Shipped Standard with Every Model

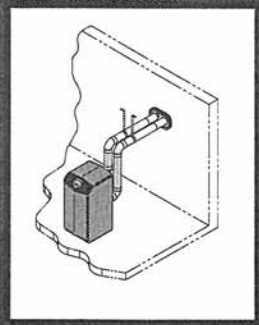
Direct Vent Vertical



Vertical w/Sidewall Air

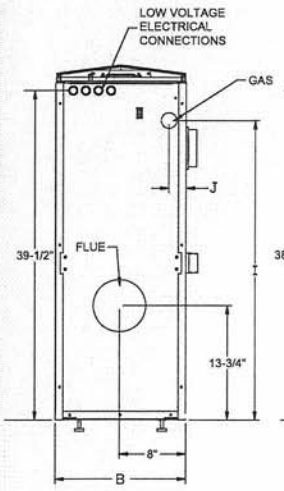


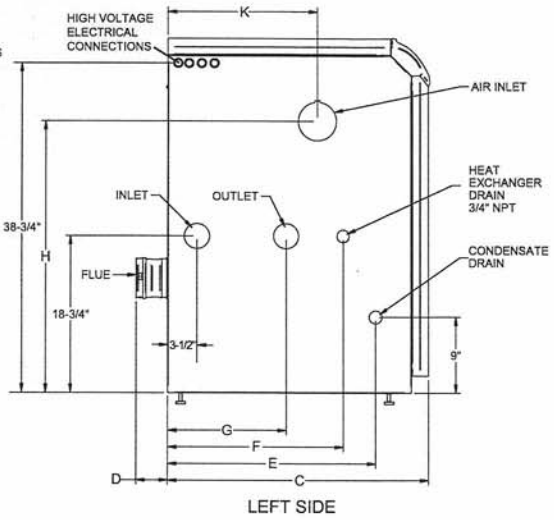
Direct Vent Sidewall

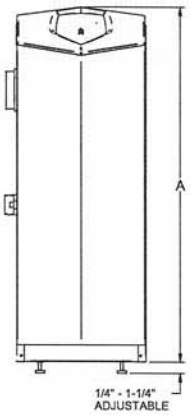


Sidewall Vent Termination

KNIGHT® XL BOILER DIMENSIONS AND SPECIFICATIONS







Model Number Guide

KB	N	700	M13
Model	Natural Gas	Btu/hr Input	Firing Controls

Knight XL Boiler,
Natural Gas,
700,000 Btu/hr input,
M13 firing controls

KNIGHT XL HEATING BOILER

Model Number	Input Min MBH	Input Max MBH	Thermal Efficiency	Output MBH	Net I=B=R MBH
KBN399	80	399	93.3%	372	324
KBN500	100	500	93.3%	467	406
KBN600	120	600	94.6%	567	493
KBN700	140	700	94.3%	660	574
KBN800	160	800	94.0%	752	654

DIMENSIONS AND SPECIFICATIONS

A	B	C	D	E	F	G	H	I	J	K	Gas Conn.	Water Conn.	Air Inlet	Vent Size	Shipping Wt. (lbs.)
42-1/2"	15-1/2"	27-3/4"	3-3/4"	20-3/4"	21"	14"	34"	34"	2"	18-3/4"	1"	1-1/2"	4"	4"	280
42-1/2"	15-1/2"	31-1/4"	3-3/4"	25-1/2"	21"	14"	32-1/2"	36"	2"	18"	1"	1-1/2"	4"	4"	310
42-1/2"	15-1/2"	36-1/4"	3-3/4"	25"	21"	14"	36"	32-3/4"	5-1/2"	19-1/2"	1"	2"	4"	4"	340
42-1/2"	15-1/2"	40-1/4"	3-3/4"	29"	23"	17"	36"	32-3/4"	3-1/4"	23-1/2"	1"	2"	4"	6"	370
42-1/2"	15-1/2"	45-1/4"	3-3/4"	33-1/4"	23"	17"	36"	32-3/4"	3-1/4"	27-3/4"	1"	2"	4"	6"	405

Notes: Change 'N' to 'L' for L.P. Gas Model. No deration on L.P. models. Performance data based on manufacturer test results. 120 VAC /15 AMP circuit required.
All dimensions shown in inches.

STANDARD FEATURES

- **Up to 94.6% Thermal Efficiency**
- **Modulating Burner with 5:1 Turndown**
  - Direct-Spark Ignition
  - Low NOx Operation
  - Sealed Combustion
  - Low Gas Pressure Operation
- **Vertical & Horizontal Direct-Vent**
  - Category IV venting up to 100 feet
  - PVC, CPVC or AL29-4C Venting up to 100 Feet
  - Factory Supplied Sidewall Vent Termination
- **ASME Stainless Steel Heat Exchanger**
  - ASME Certified, "H" Stamped
  - Gasketless Heat Exchanger
  - 160 psi Working Pressure
  - Highly efficient, condensing design
- On/Off Switch
- Adjustable High Limit w/ Manual Reset
- Flow Switch
- Inlet & Outlet Temperature Sensors
- Flue Temperature Sensor
- Low Air Pressure Switch
- 50 psi ASME Relief Valve
- Temperature & Pressure Gauge
- Adjustable Leveling Legs
- Condensate Trap
- Zero Clearances to Combustible Material
- 10 Year Limited Warranty (See Warranty for Details)

SMART SYSTEM FEATURES

- **SMART SYSTEM Digital Operating Control**
  - 2 line, 16 Character Display
  - Dual Level Password Security
  - Domestic Hot Water Prioritization
  - Built in Cascading Sequencer for up to 8 Boilers
  - Building Management System Integration with 0-10 VDC Input
  - Outdoor Reset Control with Outdoor Air Sensor
  - Low Water Flow Safety Control & Indication
  - Inlet & Outlet Temperature Readout
  - Freeze Protection
  - Service Reminder
  - Time Clock
- **Data Logging**
  - Hours Running, Space Heating
  - Hours Running, Domestic Hot Water
  - Ignition Attempts
  - Last 10 Lockouts
- **Programmable System Efficiency Optimizers**
  - Night Setback
  - Anti-Cycling
  - Outdoor Air Reset Curve
  - Ramp Delay
  - Boost Temperature & Time
- **Three Pump Control**
  - System Pump
  - Boiler Pump
  - Domestic Hot Water Pump
- **High Voltage Terminal Strip**
  - 120 VAC / 50-60 Hertz / 1 Phase Power Supply
  - Three sets of Pump Contacts with Pump Relays
- **Low Voltage Terminal Strip**
  - 24 VAC Auxiliary Device Relay
  - Auxiliary Proving Switch Contacts
  - Flow Switch Contacts
  - Alarm on Any Failure Contacts
  - Runtime Contacts
  - DHW Thermostat Contacts
  - Room Thermostat Contacts
  - System Sensor Contacts
  - DHW Tank Sensor Contacts
  - Outdoor Air Sensor Contacts
  - Cascade Contacts
  - 0-10 VDC BMS External Control Contact

OPTIONAL EQUIPMENT

- Alarm Bell on Any Failure
- Condensate Neutralization Kit
- High & Low Gas Pressure Switches w/ Manual Reset (KB500-KB800)
- Low Water Cutoff w/Manual Reset & Test
- SMART SYSTEM PC Software
- Stainless Steel Vent Kits (KB700-KB800)
- Multi-Stack Frame

FIRING CODES

- M9 Standard Construction
- M7 California Code
- M13 CSD1 / FM / GE Gap (KB500-KB800)

Patent # 7,506,617

Lochinvar®
High Efficiency Water Heaters, Boilers and Pool Heaters

300 Maddox Simpson Parkway, Lebanon, TN 37090 | 615-889-8900 | fax: 615-547-1000 | www.Lochinvar.com

APPENDIX C

ECM-2 Boiler Hot Water Temperature Reset

North Brunswick
CHA #20418
Building: Municipal Building

ECM-2 Boiler Hot Water Temperature Reset

Description
Existing heating hot water (HHW) supply set point is 180°F.
Proposed:
Vary heating hot water supply temperature as building heating load decreases in relation to outside air temperature.

					Proposed Usage			Utility Usage	
Amb. Bin Temp °F	Avg. DB Bin Temp °F	Bin Hours	Heating Bin HOURS	Existing Heat Loss In Piping MBH	Avg. HHW Temp @ OA Temp °F	Proposed Heat Loss In Piping MBH	Proposed Boiler Efficiency	Existing Utility Use Therms/Yr	Proposed Utility Use Therms/Yr
100-104	102.5	0	0	0	0	0	0%	0	0
95-99	97.5	3	0	0	0	0	0%	0	0
90-94	92.5	34	0	0	0	0	0%	0	0
85-89	87.5	131	0	0	0	0	0%	0	0
80-84	82.5	500	0	0	0	0	0%	0	0
75-79	77.5	620	0	0	0	0	0%	0	0
70-74	72.5	664	0	0	0	0	0%	0	0
65-69	67.5	854	0	0	0	0	0%	0	0
60-64	62.5	927	0	0	0	0	0%	0	0
55-59	57.5	600	0	0	0	0	0%	0	0
50-54	52.5	610	610	25,474	140	18,300	80%	318	229
45-49	47.5	611	611	25,515	140	18,330	80%	319	229
40-44	42.5	656	656	27,395	140	19,680	80%	342	246
35-39	37.5	1,023	1,023	42,720	140	30,690	80%	534	384
30-34	32.5	734	734	30,652	140	22,020	80%	383	275
25-29	27.5	334	334	13,948	142	10,020	80%	174	125
20-24	22.5	252	252	10,524	150	7,560	80%	132	95
15-19	17.5	125	125	5,220	157	3,750	80%	0	0
10-14	12.5	47	47	1,963	165	1,410	80%	0	0
5-9	7.5	22	22	919	172	660	80%	0	0
0-4	2.5	13	13	543	180	390	80%	0	0
-5- -1	-2.5	0	0	0	180	0	80%	0	0
-10- -6	-7.5	0	0	0	180	0	80%	0	0
Totals		**8,760**	**4,427**	**184,872**		**132,810**		**2,203**	**1,573**

Annual Energy Savings		**630**	**Therms/yr**
Annual Cost Savings		**$ 850**	**/yr**

Fuel cost	$ 1.38	$/Therm
Existing Boiler Efficiency	80%	
Avg. Proposed Boiler Efficiency	80%	

Building HHW Piping System		
Heating On Temperature	55	°F
Total Length of Pipe	2400	LF
Existing HHW Set point High	180	°F
Existing HHW Set point Low	180	°F
Avg HHW Temp	180	°F
Avg Pipe Size	1 1/2	Inches
Avg Insul Thickness	1	Inches
Existing Heat Loss	17.4	Btu/Hr/LF
Percent in Uncond. Space	100%	
Existing System Heat Loss	41,760	Btu/Hr
Avg Prop HHW Supply Temp	142	°F
Proposed Heat Loss	12.5	Btu/Hr/LF
Proposed System Heat Loss	30,000	Btu/Hr

	Size (in)	Length (ft)	
	0.75	800	
	1	800	
	2	400	
	4	400	
Average	1 1/2	**2400**	**Total**

Comments:

A-B	Newark, NJ weather bins
C	Based on building balance points and bin data.
E	Existing heat loss in piping system based on current average HHW temperature.
F	Estimated Average HHW temperature with HW reset based on OA temperature.
G	Proposed heat loss in piping system based on estimated average HW temperature.
H	Utility usage to overcome heat loss in HHW piping system based on boiler efficiency.

North Brunswick
CHA #20418
Building: Municipal Building

ECM-2 Boiler Hot Water Temperature Reset

Multipliers	
Material:	0.98
Labor:	1.21
Equipment:	1.09

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
						$ -	$ -	$ -	$ -	
Hydrotherm temperature reset control kit	1	ea	$ 2,800	$ 1,000		$ 2,744	$ 1,210	$ -	$ 3,954	
Electric Modifications	2	ea	$ 400	$ 600		$ 784	$ 1,452	$ -	$ 2,236	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

$ 6,190	Subtotal
$929	15% Contingency
$1,068	15% Contractor O&P
$0	0% Engineering
$8,186	**Total**

APPENDIX D

ECM-3 Premium Efficiency Motors

North Brunswick
CHA #20418
Building: Municipal Building

ECM-3 Install Premium Efficiency Motors

Demand Cost $/kW-month	Energy Cost $/kWh	
$ 11.92	$ 0.119	Supply

Multipliers		
Material	Labor	Equipment
0.98	1.21	1.09

Savings Analysis

Cost Estimates

#	Motor ID	Location	Existing HP	Load Factor	Existing Efficiency[a]	Existing kW	New HP[b]	New Load Factor	New Efficiency[a]	New kW	Demand Savings kW	Demand Savings $	Occ Hours	kWh Savings	$ kWh Savings	Total $ Savings	Estimated Cost	Payback Years	Unit Costs Materials	Unit Costs Labor	Unit Costs Equipment	Subtotal Costs Materials	Subtotal Costs Labor	Subtotal Costs Equipment	Total Cost	Remarks
1	Pump-3	125 Ton Chiller	15	0.9	0.875	11.5	15	0.9	0.927	10.9	0.646	$ 92	708	457	$ 54	$ 147	$ 1,463	10.0	$ 999	$ 400	$ -	$ 979	$ 484	$ -	$ 1,463	Lag pump, 50% of Hours when OA > 70°F
2	Pump-4	125 Ton Chiller	15	0.9	0.875	11.5	15	0.9	0.927	10.9	0.646	$ 92	708	457	$ 54	$ 147	$ 1,463	10.0	$ 999	$ 400	$ -	$ 979	$ 484	$ -	$ 1,463	Lag pump, 50% of Hours when OA > 70°F
3	Pump-5	HHW	15	0.9	0.895	11.2	15	0.9	0.927	10.9	0.388	$ 56	4,380	1,701	$ 202	$ 258	$ 1,463	5.7	$ 999	$ 400	$ -	$ 979	$ 484	$ -	$ 1,463	Lead pump, 50% of Hours
4	Pump-6	HHW	15	0.9	0.895	11.2	15	0.9	0.927	10.9	0.388	$ 56	4,380	1,701	$ 202	$ 258	$ 1,463	5.7	$ 999	$ 400	$ -	$ 979	$ 484	$ -	$ 1,463	Lag pump, 50% of Hours
5	Fan-2	AHU-2	15	0.9	0.895	11.2	15	0.9	0.927	10.9	0.388	$ 56	2,210	858	$ 102	$ 158	$ 1,463	9.3	$ 999	$ 400	$ -	$ 979	$ 484	$ -	$ 1,463	Fan is off during unoccupied hours
6	Fan-3	AHU-3 Supply	30	0.9	0.883	22.8	30	0.9	0.938	21.5	1.345	$ 192	2,210	2,973	$ 353	$ 546	$ 2,306	4.2	$ 1,736	$ 500	$ -	$ 1,701	$ 605	$ -	$ 2,306	Fan is off during unoccupied hours
7	Fan-4	AHU-3 Return	15	0.9	0.87	11.6	15	0.9	0.927	10.9	0.712	$ 102	2,210	1,573	$ 187	$ 289	$ 1,463	5.1	$ 999	$ 400	$ -	$ 979	$ 484	$ -	$ 1,463	Fan is off during unoccupied hours
8	Fan-5	AHU-4	10	0.9	0.856	7.8	10	0.9	0.916	7.3	0.512	$ 73	8,760	4,483	$ 533	$ 606	$ 1,061	1.7	$ 749	$ 270	$ -	$ 734	$ 327	$ -	$ 1,061	Fan serves police department 24/365
		Total	**130**			**99.0**	**130**			**93.9**	**5.02**	**$ 719**		**14,204**	**$ 1,689**	**$ 2,408**	**$ 12,143**	**5.0**								

Notes

a Existing and new efficiencies should be entered if known. If not known, use provided curve fit based on "DOE Survey Installed Average" and NEMA Premium values, respectively.

b Same as existing HP unless resized to better match load

APPENDIX E

ECM-4 Variable Speed Drives

North Brunswick
CHA #20418
Building: Municipal Building

Balance Pt Temp	65
VFD Eff. (CC)	98.5%
Elect. Cost / kWh	$0.152

ECM-4 Install Variable Speed Drives

Summary:

Install variable speed drives on boiler hot water pump and air handling unit fans
The boiler utilizes two hot water circulating pumps (P-5 and P-6). One pump is online and the other is standby
The online pump operates at full speed regardless of load
The standby pump shares 1/2 of annual run hours. 2 VFD's would be installed, one on P-5 and one on P-6

The supply air fans on AHU-2, AHU-3 and AHU-4 are operating at constant speed regardless of load
The supply air fan on AHU-1 is presently operating with a VFD

ID	Qty	HP	Total HP	Existing Motor Motor Eff.	New Motor Motor Eff.	Exist. Motor kW Note 1	New Motor kW Note 2
Boiler Pump P-5 and P-6	1	15.0	15.0	92.7%	92.7%	9.66	9.66
					Total:	9.66	9.66

OAT - DB Avg Temp F (A)	Annual Hours in Bin (B)	Occupied Bin Hours (C)	Operating Hours Bin (D)	Pump Load % (E) =0.5+0.5* (A-TP)/(97-TP))	Existing Pump kWh (F) =D*AA	Proposed Pump kW (G) =BB*E^2.5/CC	Proposed Pump kWh (H) =D*G	Proposed Savings kWh (I) =F-H
97.5	3	2	3	100%	29	9.8	29	0
92.5	34	17	34	93%	328	8.2	278	51
87.5	131	66	131	85%	1,265	6.6	859	406
82.5	500	252	500	77%	4,828	5.2	2,579	2,250
77.5	620	313	620	70%	5,987	4.0	2,450	3,537
72.5	664	335	664	62%	6,412	2.9	1,948	4,464
67.5	854	431	854	54%	8,247	2.1	1,786	6,461
62.5	927	468	927	50%	8,952	1.7	1,607	7,345
57.5	600	303	600	52%	5,794	1.9	1,147	4,647
52.5	610	308	610	55%	5,891	2.2	1,342	4,549
47.5	611	308	611	60%	5,900	2.7	1,670	4,230
42.5	656	331	656	65%	6,335	3.3	2,191	4,144
37.5	1,023	516	1,023	70%	9,879	4.0	4,112	5,767
32.5	734	370	734	75%	7,088	4.8	3,506	3,583
27.5	334	169	334	80%	3,225	5.6	1,874	1,351
22.5	252	127	252	85%	2,434	6.5	1,646	788
17.5	125	63	125	90%	1,207	7.5	942	265
12.5	47	24	47	95%	454	8.6	405	49
7.5	22	11	22	97%	212	9.1	200	13
2.5	13	7	13	99%	126	9.6	124	1
-2.5	0	0	0	0%	0	0.0	0	0
-7.5	0	0	0	0%	0	0.0	0	0
		4,420	8,760		84,595		30,696	53,899

Reduced % =	100	%
Reduced Energy Savings =	53,899	kWh
Reduced Financial Savings =	$8,193	

ID	Qty	HP	Total HP	Existing Motor Motor Eff.	New Motor Motor Eff.	Exist. Motor kW Note 1	New Motor kW Note 2
AHU-2 Supply Fan	1	15.0	15.0	92.7%	92.7%	9.66	9.66
					Total:	9.66	9.66

OAT - DB Avg Temp F	Annual Hours in Bin	Occupied Bin Hours	Operating Hours Bin	Fan Load %	Existing Fan kWh	Proposed Fan kW	Proposed Fan kWh	Proposed Savings kWh
(A)	(B)	(C)	(D)	(E) =0.5+0.5* (A-TP)/(97-TP))	(F) =D*AA	(G) =BB*E^2.5/CC	(H) =D*G	(I) =F-H
97.5	3	2	2	100%	15	9.8	15	0
92.5	34	17	17	93%	166	8.2	140	26
87.5	131	66	66	85%	638	6.6	434	205
82.5	500	252	252	77%	2,436	5.2	1,301	1,135
77.5	620	313	313	70%	3,021	4.0	1,236	1,785
72.5	664	335	335	62%	3,235	2.9	983	2,252
67.5	854	431	431	54%	4,161	2.1	901	3,260
62.5	927	468	468	50%	4,517	1.7	811	3,706
57.5	600	303	303	52%	2,924	1.9	579	2,345
52.5	610	308	308	55%	2,972	2.2	677	2,295
47.5	611	308	308	60%	2,977	2.7	843	2,134
42.5	656	331	331	65%	3,196	3.3	1,105	2,091
37.5	1,023	516	516	70%	4,985	4.0	2,075	2,910
32.5	734	370	370	75%	3,576	4.8	1,769	1,808
27.5	334	169	169	80%	1,627	5.6	946	682
22.5	252	127	127	85%	1,228	6.5	830	398
17.5	125	63	63	90%	609	7.5	475	134
12.5	47	24	24	95%	229	8.6	205	24
7.5	22	11	11	97%	107	9.1	101	6
2.5	13	7	7	99%	63	9.6	63	1
-2.5	0	0	0	0%	0	0.0	0	0
-7.5	0	0	0	0%	0	0.0	0	0
		4,420	4,420		42,683		15,488	27,195

Reduced % =	100	%
Reduced Energy Savings =	27,195	kWh
Reduced Financial Savings =	$4,134	

ID	Qty	HP	Total HP	Existing Motor Motor Eff.	New Motor Motor Eff.	Exist. Motor kW Note 1	New Motor kW Note 2
AHU-3 Supply Fan	1	30.0	30.0	88.3%	93.8%	20.28	19.08
					Total:	20.28	19.08

OAT - DB Avg Temp F	Annual Hours in Bin	Occupied Bin Hours	Operating Hours Bin	Fan Load %	Existing Fan kWh	Proposed Fan kW	Proposed Fan kWh	Proposed Savings kWh
(A)	(B)	(C)	(D)	(E) =0.5+0.5* (A-TP)/(97-TP))	(F) =D*AA	(G) =BB*E^2.5/CC	(H) =D*G	(I) =F-H
97.5	3	2	2	100%	31	19.4	29	1
92.5	34	17	17	93%	348	16.1	277	71
87.5	131	66	66	85%	1,340	13.0	857	483
82.5	500	252	252	77%	5,115	10.2	2,571	2,544
77.5	620	313	313	70%	6,343	7.8	2,443	3,900
72.5	664	335	335	62%	6,793	5.8	1,942	4,851
67.5	854	431	431	54%	8,737	4.1	1,781	6,956
62.5	927	468	468	50%	9,484	3.4	1,602	7,882
57.5	600	303	303	52%	6,138	3.8	1,143	4,995
52.5	610	308	308	55%	6,241	4.3	1,338	4,903
47.5	611	308	308	60%	6,251	5.4	1,665	4,586
42.5	656	331	331	65%	6,711	6.6	2,184	4,527
37.5	1,023	516	516	70%	10,466	7.9	4,099	6,367
32.5	734	370	370	75%	7,509	9.4	3,495	4,015
27.5	334	169	169	80%	3,417	11.1	1,869	1,548
22.5	252	127	127	85%	2,578	12.9	1,641	938
17.5	125	63	63	90%	1,279	14.9	939	340
12.5	47	24	24	95%	481	17.0	404	77
7.5	22	11	11	97%	225	18.0	199	26
2.5	13	7	7	99%	133	18.9	124	9
-2.5	0	0	0	0%	0	0.0	0	0
-7.5	0	0	0	0%	0	0.0	0	0
		4,420	4,420		89,621		30,601	59,020

Reduced % =	100	%
Reduced Energy Savings =	59,020	kWh
Reduced Financial Savings =	$8,971	

ID	Qty	HP	Total HP	Existing Motor Motor Eff.	New Motor Motor Eff.	Exist. Motor kW Note 1	New Motor kW Note 2
AHU-4 Supply Fan	1	10.0	10.0	85.6%	91.6%	6.97	6.52
					Total:	6.97	6.52

OAT - DB Avg Temp F	Annual Hours in Bin	Occupied Bin Hours	Operating Hours Bin	Fan Load %	Existing Fan kWh	Proposed Fan kW	Proposed Fan kWh	Proposed Savings kWh
(A)	(B)	(C)	(D)	(E) =0.5+0.5* (A-TP)/(97-TP))	(F) =D*AA	(G) =BB*E^2.5/CC	(H) =D*G	(I) =F-H
97.5	3	2	3	100%	21	6.6	20	1
92.5	34	17	34	93%	237	5.5	187	50
87.5	131	66	131	85%	913	4.4	580	333
82.5	500	252	500	77%	3,486	3.5	1,740	1,746
77.5	620	313	620	70%	4,323	2.7	1,654	2,669
72.5	664	335	664	62%	4,629	2.0	1,315	3,315
67.5	854	431	854	54%	5,954	1.4	1,205	4,749
62.5	927	468	927	50%	6,463	1.2	1,084	5,379
57.5	600	303	600	52%	4,183	1.3	774	3,409
52.5	610	308	610	55%	4,253	1.5	905	3,348
47.5	611	308	611	60%	4,260	1.8	1,127	3,133
42.5	656	331	656	65%	4,574	2.3	1,478	3,095
37.5	1,023	516	1,023	70%	7,132	2.7	2,775	4,358
32.5	734	370	734	75%	5,117	3.2	2,366	2,752
27.5	334	169	334	80%	2,329	3.8	1,265	1,064
22.5	252	127	252	85%	1,757	4.4	1,111	646
17.5	125	63	125	90%	871	5.1	636	236
12.5	47	24	47	95%	328	5.8	274	54
7.5	22	11	22	97%	153	6.1	135	19
2.5	13	7	13	99%	91	6.5	84	7
-2.5	0	0	0	0%	0	0.0	0	0
-7.5	0	0	0	0%	0	0.0	0	0
		4,420	8,760		61,074		20,714	40,360

Reduced % =	100	%
Reduced Energy Savings =	40,360	kWh
Reduced Financial Savings =	$6,135	

Total Reduced Energy Savings =	180,475	kWh
Total Reduced Financial Savings =	$27,432	

North Brunswick
CHA #20418
Building: Municipal Building

ECM-4 Install Variable Speed Drives

Multipliers	
Material:	0.98
Labor:	1.21
Equipment:	1.09

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
						$ -	$ -	$ -	$ -	
10 Hp VSD	1	EA	$ 2,021	$ 509		$ 1,981	$ 616	$ -	$ 2,597	10 HP Motor
15 Hp VSD	3	EA	$ 2,336	$ 772		$ 6,869	$ 2,801	$ -	$ 9,670	15 HP Motor
30 Hp VSD	1	EA	$ 4,909	$ 772		$ 4,811	$ 934	$ -	$ 5,745	30 HP Motor
Electrical - misc.	4	EA	$ 500	$ 250		$ 1,960	$ 1,210	$ -	$ 3,170	
Pressure Differential Sensors	4	LS	$ 1,150	$ 500		$ 4,508	$ 2,420	$ -	$ 6,928	Includes tapping
DDC Programming	4	EA		$ 1,000		$ -	$ 4,840	$ -	$ 4,840	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

$ 32,950	Subtotal
$ 6,590	20% Contingency
$ 5,931	15% Contractor O&P
$ -	0% Engineering
$ 45,471	**Total**

APPENDIX F

ECM-5 Demand Control Ventilation

North Brunswick
CHA #20418
Building: Municipal Building

ECM-5 Install Demand Control Ventilation

Description:
Outside air can be significantly reduced for most of the time that the building is occupied.
Savings will result from the avoided heating and cooling of excessive outside air.

Method:

The outdoor air introduced into the spaces is currently constant based on design occupancy conditions.
This ECM proposes the installation of CO2 sensors in the space to allow for reduced outdoor air flows when conditions allow.
An average reduction of 50% is assumed possible with the implementation of DCV
The DCV system will automatically adjust the outdoor air damper position through the EMS to reduce outdoor air flows based on indoor CO2 levels.

AHU-1

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
			Existing					Proposed Demand Ventilation					Savings	
Avg. DB Bin Temp °F	OA Enthalpy Btu/lb	Occupied Bin HOURS	OA CFM	Cooling Load MBH	Heating Load MBH	Cooling kWh	Heating therms	Derated O.A. CFM	Cooling Load MBH	Heating Load MBH	Cooling kWh	Heating therms	Cooling kWh	Heating therms
102.5	49.1	0	4,000	409	0	0	-	2,000	204	0	0	-	0	-
97.5	42.5	2	4,000	290	0	36	-	2,000	145	0	18	-	18	-
92.5	39.5	17	4,000	236	0	332	-	2,000	118	0	166	-	166	-
87.5	36.6	66	4,000	184	0	995	-	2,000	92	0	497	-	497	-
82.5	34	252	4,000	137	0	2,829	-	2,000	68	0	1,414	-	1414	-
77.5	31.6	313	4,000	94	0	2,400	-	2,000	47	0	1,200	-	1200	-
72.5	29.2	335	4,000	50	0	1,384	-	2,000	25	0	692	-	692	-
67.5	27	431	4,000	0	19	0	105	2,000	0	10	0	52	0	52
62.5	24.5	468	4,000	0	41	0	240	2,000	0	21	0	120	0	120
57.5	21.4	303	4,000	0	63	0	237	2,000	0	31	0	119	0	119
52.5	18.7	308	4,000	0	84	0	324	2,000	0	42	0	162	0	162
47.5	16.2	308	4,000	0	106	0	408	2,000	0	53	0	204	0	204
42.5	14.4	331	4,000	0	127	0	527	2,000	0	64	0	264	0	264
37.5	12.6	516	4,000	0	149	0	962	2,000	0	75	0	481	0	481
32.5	10.7	370	4,000	0	171	0	790	2,000	0	85	0	395	0	395
27.5	8.6	169	4,000	0	192	0	405	2,000	0	96	0	202	0	202
22.5	6.8	127	4,000	0	214	0	340	2,000	0	107	0	170	0	170
17.5	5.5	63	4,000	0	235	0	186	2,000	0	118	0	93	0	93
12.5	4.1	24	4,000	0	257	0	76	2,000	0	129	0	38	0	38
7.5	2.6	11	4,000	0	279	0	39	2,000	0	139	0	19	0	19
2.5	1	7	4,000	0	300	0	25	2,000	0	150	0	12	0	12
-2.5	0	0	4,000	0	322	0	-	2,000	0	161	0	-	0	-
-7.5	-1.5	0	4,000	0	343	0	-	2,000	0	172	0	-	0	-
Total		**4,420**		**1398.6**		**7,975**	**4,662**		**699.3**		**3,988**	**2,331**	**3,988**	**2,331**

	Total CFM	O.A. CFM	O.A. %
Org. scheduled CFM	13,500	4,000	30%
Derated CFM	13,500	2,000	15%
SA Enthalpy	26.4	BTU/lbma	**AA**
SA Set point, Winter	72.0	°F	**BB**
SA Set point, Summer	72.0	°F	
Balance Point	60.0	°F	**BP**
EER	12.2	btu/Wh	
Gas Heat Content	100,000	BTU/therm	
Boiler Efficiency	80%		
Electricity	$ 0.152	$/kWh blended	
Natural Gas	$ 1.38	$/Therm	

100% Energy Cost Savings

Thermal Savings	2,331	therms	$ 3,217	
Electrical Savings	3,988	kWh	$ 606	
			$ 3,823	Total

AHU-2

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
			Existing					Proposed Demand Ventilation					Savings	
Avg. DB Bin Temp °F	OA Enthalpy Btu/lb	Occupied Bin HOURS	OA CFM	Cooling Load MBH	Heating Load MBH	Cooling kWh	Heating therms	Derated O.A. CFM	Cooling Load MBH	Heating Load MBH	Cooling kWh	Heating therms	Cooling kWh	Heating therms
102.5	49.1	0	2,400	245	0	0	-	1,200	123	0	0	-	0	-
97.5	42.5	2	2,400	174	0	22	-	1,200	87	0	11	-	11	-
92.5	39.5	17	2,400	141	0	199	-	1,200	71	0	99	-	99	-
87.5	36.6	66	2,400	110	0	597	-	1,200	55	0	298	-	298	-
82.5	34	252	2,400	82	0	1,697	-	1,200	41	0	849	-	849	-
77.5	31.6	313	2,400	56	0	1,440	-	1,200	28	0	720	-	720	-
72.5	29.2	335	2,400	30	0	830	-	1,200	15	0	415	-	415	-
67.5	27	431	2,400	0	12	0	63	1,200	0	6	0	31	0	31
62.5	24.5	468	2,400	0	25	0	144	1,200	0	12	0	72	0	72
57.5	21.4	303	2,400	0	38	0	142	1,200	0	19	0	71	0	71
52.5	18.7	308	2,400	0	51	0	194	1,200	0	25	0	97	0	97
47.5	16.2	308	2,400	0	64	0	245	1,200	0	32	0	122	0	122
42.5	14.4	331	2,400	0	76	0	316	1,200	0	38	0	158	0	158
37.5	12.6	516	2,400	0	89	0	577	1,200	0	45	0	288	0	288
32.5	10.7	370	2,400	0	102	0	474	1,200	0	51	0	237	0	237
27.5	8.6	169	2,400	0	115	0	243	1,200	0	58	0	121	0	121
22.5	6.8	127	2,400	0	128	0	204	1,200	0	64	0	102	0	102
17.5	5.5	63	2,400	0	141	0	111	1,200	0	71	0	56	0	56
12.5	4.1	24	2,400	0	154	0	46	1,200	0	77	0	23	0	23
7.5	2.6	11	2,400	0	167	0	23	1,200	0	84	0	12	0	12
2.5	1	7	2,400	0	180	0	15	1,200	0	90	0	7	0	7
-2.5	0	0	2,400	0	193	0	-	1,200	0	97	0	-	0	-
-7.5	-1.5	0	2,400	0	206	0	-	1,200	0	103	0	-	0	-
Total		**4,420**		**839.2**		**4,785**	**2,797**		**419.6**		**2,393**	**1,399**	**2,393**	**1,399**

	Total CFM	O.A. CFM	O.A. %
Org. scheduled CFM	14,000	2,400	17%
Derated CFM	14,000	1,200	9%
SA Enthalpy	26.4	BTU/lbma	AA
SA Set point, Winter	72.0	°F	BB
SA Set point, Summer	72.0	°F	
Balance Point	60.0	°F	BP
EER	12.2	btu/Wh	
Gas Heat Content	100,000	BTU/therm	
Boiler Efficiency	80%		
Electricity	$ 0.152	$/kWh blended	
Natural Gas	$ 1.38	$/Therm	

100% Energy Cost Savings

Thermal Savings	1,399	therms	$ 1,930	
Electrical Savings	2,393	kWh	$ 364	
			$ 2,294	Total

AHU-3

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
			Existing					Proposed Demand Ventilation					Savings	
Avg. DB Bin Temp °F	OA Enthalpy Btu/lb	Occupied Bin HOURS	OA CFM	Cooling Load MBH	Heating Load MBH	Cooling kWh	Heating therms	Derated O.A. CFM	Cooling Load MBH	Heating Load MBH	Cooling kWh	Heating therms	Cooling kWh	Heating therms
102.5	49.1	0	2,500	255	0	0	-	1,250	128	0	0	-	0	-
97.5	42.5	2	2,500	181	0	22	-	1,250	91	0	11	-	11	-
92.5	39.5	17	2,500	147	0	207	-	1,250	74	0	104	-	104	-
87.5	36.6	66	2,500	115	0	622	-	1,250	57	0	311	-	311	-
82.5	34	252	2,500	86	0	1,768	-	1,250	43	0	884	-	884	-
77.5	31.6	313	2,500	59	0	1,500	-	1,250	29	0	750	-	750	-
72.5	29.2	335	2,500	32	0	865	-	1,250	16	0	433	-	433	-
67.5	27	431	2,500	0	12	0	65	1,250	0	6	0	33	0	33
62.5	24.5	468	2,500	0	26	0	150	1,250	0	13	0	75	0	75
57.5	21.4	303	2,500	0	39	0	148	1,250	0	20	0	74	0	74
52.5	18.7	308	2,500	0	53	0	203	1,250	0	26	0	101	0	101
47.5	16.2	308	2,500	0	66	0	255	1,250	0	33	0	127	0	127
42.5	14.4	331	2,500	0	80	0	330	1,250	0	40	0	165	0	165
37.5	12.6	516	2,500	0	93	0	601	1,250	0	47	0	301	0	301
32.5	10.7	370	2,500	0	107	0	494	1,250	0	53	0	247	0	247
27.5	8.6	169	2,500	0	120	0	253	1,250	0	60	0	127	0	127
22.5	6.8	127	2,500	0	134	0	212	1,250	0	67	0	106	0	106
17.5	5.5	63	2,500	0	147	0	116	1,250	0	74	0	58	0	58
12.5	4.1	24	2,500	0	161	0	48	1,250	0	80	0	24	0	24
7.5	2.6	11	2,500	0	174	0	24	1,250	0	87	0	12	0	12
2.5	1	7	2,500	0	188	0	15	1,250	0	94	0	8	0	8
-2.5	0	0	2,500	0	201	0	-	1,250	0	101	0	-	0	-
-7.5	-1.5	0	2,500	0	215	0	-	1,250	0	107	0	-	0	-
Total		**4,420**		**874.1**		**4,985**	**2,914**		**437.1**		**2,492**	**1,457**	**2,492**	**1,457**

	Total CFM	O.A. CFM	O.A. %
Org. scheduled CFM	25,000	2,500	10%
Derated CFM	25,000	1,250	5%
SA Enthalpy	26.4	BTU/lbma	AA
SA Set point, Winter	72.0	°F	BB
SA Set point, Summer	72.0	°F	
Balance Point	60.0	°F	BP
EER	12.2	btu/Wh	
Gas Heat Content	100,000	BTU/therm	
Boiler Efficiency	80%		
Electricity	$ 0.152	$/kWh blended	
Natural Gas	$ 1.38	$/Therm	

100% Energy Cost Savings

Thermal Savings	1,457	therms	$ 2,011	
Electrical Savings	2,492	kWh	$ 379	
			$ 2,390	Total

AHU-4

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
			Existing					Proposed Demand Ventilation					Savings	
Avg. DB Bin Temp °F	OA Enthalpy Btu/lb	Occupied Bin HOURS	OA CFM	Cooling Load MBH	Heating Load MBH	Cooling kWh	Heating therms	Derated O.A. CFM	Cooling Load MBH	Heating Load MBH	Cooling kWh	Heating therms	Cooling kWh	Heating therms
102.5	49.1	0	1,000	102	0	0	-	500	51	0	0	-	0	-
97.5	42.5	3	1,000	72	0	18	-	500	36	0	9	-	9	-
92.5	39.5	34	1,000	59	0	164	-	500	29	0	82	-	82	-
87.5	36.6	131	1,000	46	0	493	-	500	23	0	246	-	246	-
82.5	34	500	1,000	34	0	1,402	-	500	17	0	701	-	701	-
77.5	31.6	620	1,000	23	0	1,189	-	500	12	0	595	-	595	-
72.5	29.2	664	1,000	13	0	686	-	500	6	0	343	-	343	-
67.5	27	854	1,000	0	5	0	52	500	0	2	0	26	0	26
62.5	24.5	927	1,000	0	10	0	119	500	0	5	0	59	0	59
57.5	21.4	600	1,000	0	16	0	117	500	0	8	0	59	0	59
52.5	18.7	610	1,000	0	21	0	161	500	0	11	0	80	0	80
47.5	16.2	611	1,000	0	26	0	202	500	0	13	0	101	0	101
42.5	14.4	656	1,000	0	32	0	261	500	0	16	0	131	0	131
37.5	12.6	1,023	1,000	0	37	0	476	500	0	19	0	238	0	238
32.5	10.7	734	1,000	0	43	0	391	500	0	21	0	196	0	196
27.5	8.6	334	1,000	0	48	0	201	500	0	24	0	100	0	100
22.5	6.8	252	1,000	0	53	0	168	500	0	27	0	84	0	84
17.5	5.5	125	1,000	0	59	0	92	500	0	29	0	46	0	46
12.5	4.1	47	1,000	0	64	0	38	500	0	32	0	19	0	19
7.5	2.6	22	1,000	0	70	0	19	500	0	35	0	10	0	10
2.5	1	13	1,000	0	75	0	12	500	0	38	0	6	0	6
-2.5	0	0	1,000	0	80	0	-	500	0	40	0	-	0	-
-7.5	-1.5	0	1,000	0	86	0	-	500	0	43	0	-	0	-
Total		**8,760**		**349.7**		**3,952**	**2,310**		**174.8**		**1,976**	**1,155**	**1,976**	**1,155**

	Total CFM	O.A. CFM	O.A. %
Org. scheduled CFM	8,200	1,000	12%
Derated CFM	8,200	500	6%
SA Enthalpy	26.4	BTU/lbma	**AA**
SA Set point, Winter	72.0	°F	**BB**
SA Set point, Summer	72.0	°F	
Balance Point	60.0	°F	**BP**
EER	12.2	btu/Wh	
Gas Heat Content	100,000	BTU/therm	
Boiler Efficiency	80%		
Electricity	$ 0.152	$/kWh blended	
Natural Gas	$ 1.38	$/Therm	

100% Energy Cost Savings

Thermal Savings	1,155	therms	$ 1,594	
Electrical Savings	1,976	kWh	$ 300	
			$ 1,894	Total

Savings Summary

Thermal Savings	6,342	therms	$ 8,752	
Electrical Savings	10,848	kWh	$ 1,649	
			$ 10,401	Total

Comments:

A-B Newark Bin
C Proposed AHU occupied hours of operation based on a schedules. Bin Hours for different OCC may be found in bin data spread sheet
D Design outside air requirements are based on blueprint drawings or field observations
E Existing Cooling Load. Calculated based on outdoor air enthalpy.
F Existing Heating Load. == 1.08 * [col D] * {[BB] - [col A]) / 1000
G Existing Cooling kWh = -[col E] / 12 Mbtu/Ton-Hr * EER * [col C].
H Existing Heating Usage Therms Gas = [col F] / 100 Mbtu/Therm / Furnace Efficiency * [col C].
I Proposed Derated OA CFM: [col D] * (1 - 0.5)
J Proposed Cooling Load = -4.5 * [col I] * {[col B] - [AA]} / 1000
K Proposed Heating Load = 1.08 * [col I] * {[BB] - [col A]) / 1000
L Proposed Cooling kWh = -[col J] / 12 Mbtu/Ton-Hr * EER * [col C].
M Proposed Heating Usage Therms Gas = [col K] / 100 Mbtu/Therm / Furnace Efficiency * [col C].
N Cooling kWh Savings: [col G] - [col L]
O Heating Usage Savings = [col H] - [col M]

North Brunswick
CHA #20418
Building: Municipal Building

ECM-5 Install Demand Control Ventilation

Multipliers	
Material:	0.98
Labor:	1.21
Equipment:	1.09

	QTY	UNIT	UNIT COSTS MAT.	UNIT COSTS LABOR	UNIT COSTS EQUIP.	SUBTOTAL COSTS MAT.	SUBTOTAL COSTS LABOR	SUBTOTAL COSTS EQUIP.	TOTAL COST	REMARKS
Demand Control Ventilation										
CO2 sensor	4	ea	$ 400	$ 100	$ -	$ 1,568	$ 484	$ -	$ 2,052	
Replace damper actuators	4	ea	$ 400	$ 150	$ -	$ 1,568	$ 726	$ -	$ 2,294	
Control system programming	4	ea	$ 500	$ 2,500	$ -	$ 1,960	$ 12,100	$ -	$ 14,060	
electrical/wiring	4	ea	$ 1,000	$ 1,000	$ -	$ 3,920	$ 4,840	$ -	$ 8,760	
						$ -	$ -	$ -	$ -	

$27,166	Subtotal
$ 5,433	20% Contingency
$ 4,890	15% Contractor O&P
$ -	Engineering
$ 37,489	**Total**

APPENDIX G

ECM-6 Energy Recovery Ventilation

North Brunswick
CHA #20418
Building: Municipal Building

ECM-6 Energy Recovery Ventilation

Description:
Ventilation is accomplished by exhausting air from the building to the outside and introducing fresh makeup outside air into the HVAC air handling units.
Transferring energy from the conditioned stale exhaust air into the unconditioned outside makeup air will save energy

Method:
Introduction of outside air and rejection of stale exhaust air occurs at the air handling units located in the building mechanical rooms.
The stale exhaust air is conditioned air and the incoming outside air needs to be heated or cooled.
This ECM evaluates the installation of an energy recovery ventilator which will capture the energy in the exhaust air and transfer it to the incoming unconditioned outside air.

AHU-1

A	B	C	D	E	F	G	H
			Energy Recovered				
Avg. DB Bin Temp °F	OA Enthalpy Btu/lb	Occupied Bin HOURS	OA CFM (Load Recovered)	Cooling MBH	Heating MBH	Cooling kWh	Heating therms
102.5	49.1	0	2,600	266	0	0	-
97.5	42.5	2	2,600	188	0	23	-
92.5	39.5	17	2,600	153	0	216	-
87.5	36.6	66	2,600	119	0	647	-
82.5	34	252	2,600	89	0	1,839	-
77.5	31.6	313	2,600	61	0	1,560	-
72.5	29.2	335	2,600	33	0	900	-
67.5	27	431	2,600	0	13	0	68
62.5	24.5	468	2,600	0	27	0	156
57.5	21.4	303	2,600	0	41	0	154
52.5	18.7	308	2,600	0	55	0	211
47.5	16.2	308	2,600	0	69	0	265
42.5	14.4	331	2,600	0	83	0	343
37.5	12.6	516	2,600	0	97	0	625
32.5	10.7	370	2,600	0	111	0	513
27.5	8.6	169	2,600	0	125	0	263
22.5	6.8	127	2,600	0	139	0	221
17.5	5.5	63	2,600	0	153	0	121
12.5	4.1	24	2,600	0	167	0	50
7.5	2.6	11	2,600	0	181	0	25
2.5	1	7	2,600	0	195	0	16
-2.5	0	0	2,600	0		0	-
-7.5	-1.5	0	2,600	0		0	-
Total		**4,420**		**909.1**		**5,184**	**3,031**

	Total CFM	O.A. CFM	O.A. %	
Org. scheduled CFM	13,500	4,000	30%	
Heat Recovery Effectiveness	65%	2,600	←	OA CFM conditioned by ERV
SA Enthalpy	26.4	BTU/lbma	**AA**	
SA Set point, Winter	72.0	°F	**BB**	
SA Set point, Summer	72.0	°F		
Balance Point	60.0	°F	**BP**	
EER	12.2	btu/Wh		(Includes ancillary equipment)
Gas Heat Content	100,000	BTU/therm		
Boiler Efficiency	80%			
Electricity	$ 0.152	$/kWh blended		
Natural Gas	$ 1.38	$/Therm		
ERV Fan Motor Hp	5	ERV Fan kW	2.98	

Ventilation Energy Recovered		ERV Fan Energy	Total Energy Savings		
Therms	3,031		3,031	$ 4,182	
kWh	5,184	13,184	-8,000	$ (1,216)	
				$ 2,966	Total

AHU-2

A	B	C	D	E	F	G	H
			Energy Recovered				
Avg. DB Bin Temp *F	OA Enthalpy Btu/lb	Occupied Bin HOURS	OA CFM (Load Recovered)	Cooling Load MBH	Heating Load MBH	Cooling kWh	Heating therms
102.5	49.1	0	1,560	159	0	0	-
97.5	42.5	2	1,560	113	0	14	-
92.5	39.5	17	1,560	92	0	129	-
87.5	36.6	66	1,560	72	0	388	-
82.5	34	252	1,560	53	0	1,103	-
77.5	31.6	313	1,560	37	0	936	-
72.5	29.2	335	1,560	20	0	540	-
67.5	27	431	1,560	0	8	0	41
62.5	24.5	468	1,560	0	16	0	94
57.5	21.4	303	1,560	0	24	0	92
52.5	18.7	308	1,560	0	33	0	126
47.5	16.2	308	1,560	0	41	0	159
42.5	14.4	331	1,560	0	50	0	206
37.5	12.6	516	1,560	0	58	0	375
32.5	10.7	370	1,560	0	67	0	308
27.5	8.6	169	1,560	0	75	0	158
22.5	6.8	127	1,560	0	83	0	133
17.5	5.5	63	1,560	0	92	0	72
12.5	4.1	24	1,560	0	100	0	30
7.5	2.6	11	1,560	0	109	0	15
2.5	1	7	1,560	0	117	0	10
-2.5	0	0	1,560	0		0	-
-7.5	-1.5	0	1,560	0		0	-
Total		4,420		545.5		3,110	1,818

	Total CFM	O.A. CFM	O.A. %	
Org. scheduled CFM	14,000	2,400	17%	
Heat Recovery Effectiveness	65%	1,560	←	OA CFM conditioned by ERV
SA Enthalpy	26.4	BTU/lbma	AA	
SA Set point, Winter	72.0	*F	BB	
SA Set point, Summer	72.0	*F		
Balance Point	60.0	*F	BP	
EER	12.2	btu/Wh		(Includes ancillary equipment)
Gas Heat Content	100,000	BTU/therm		
Boiler Efficiency	80%			
Electricity	$ 0.152	$/kWh blended		
Natural Gas	$ 1.38	$/Therm		
ERV Fan Motor Hp	3	ERV Fan kW	1.79	

Ventilation Energy Recovered		ERV Fan Energy	Total Energy Savings		
Therms	1,818		1,818	$ 2,509	
kWh	3,110	7,910	-4,800	$ (730)	
				$ 1,780	Total

AHU-3

A	B	C	D	E	F	G	H
			Energy Recovered				
Avg. DB Bin Temp *F	OA Enthalpy Btu/lb	Occupied Bin HOURS	OA CFM (Load Recovered)	Cooling Load MBH	Heating Load MBH	Cooling kWh	Heating therms
102.5	49.1	0	1,625	166	0	0	-
97.5	42.5	2	1,625	118	0	15	-
92.5	39.5	17	1,625	96	0	135	-
87.5	36.6	66	1,625	75	0	404	-
82.5	34	252	1,625	56	0	1,149	-
77.5	31.6	313	1,625	38	0	975	-
72.5	29.2	335	1,625	20	0	562	-
67.5	27	431	1,625	0	8	0	43
62.5	24.5	468	1,625	0	17	0	97
57.5	21.4	303	1,625	0	25	0	96
52.5	18.7	308	1,625	0	34	0	132
47.5	16.2	308	1,625	0	43	0	166
42.5	14.4	331	1,625	0	52	0	214
37.5	12.6	516	1,625	0	61	0	391
32.5	10.7	370	1,625	0	69	0	321
27.5	8.6	169	1,625	0	78	0	165
22.5	6.8	127	1,625	0	87	0	138
17.5	5.5	63	1,625	0	96	0	75
12.5	4.1	24	1,625	0	104	0	31
7.5	2.6	11	1,625	0	113	0	16
2.5	1	7	1,625	0	122	0	10
-2.5	0	0	1,625	0		0	-
-7.5	-1.5	0	1,625	0		0	-
Total		4,420		568.2		3,240	1,894

	Total CFM	O.A. CFM	O.A. %	
Org. scheduled CFM	25,000	2,500	10%	
Heat Recovery Effectiveness	65%	1,625	←	OA CFM conditioned by ERV
SA Enthalpy	26.4	BTU/lbma	AA	
SA Set point, Winter	72.0	*F	BB	
SA Set point, Summer	72.0	*F		
Balance Point	60.0	*F	BP	
EER	12.2	btu/Wh		(Includes ancillary equipment)
Gas Heat Content	100,000	BTU/therm		
Boiler Efficiency	80%			
Electricity	$ 0.152	$/kWh blended		
Natural Gas	$ 1.38	$/Therm		
ERV Fan Motor Hp	3	ERV Fan kW	1.79	

Ventilation Energy Recovered		ERV Fan Energy	Total Energy Savings		
Therms	1,894		1,894	$ 2,614	
kWh	3,240	7,910	-4,670	$ (710)	
				$ 1,904	Total

AHU-4

A	B	C	D	E	F	G	H
			Energy Recovered				
Avg. DB Bin Temp *F	OA Enthalpy Btu/lb	Occupied Bin HOURS	OA CFM (Load Recovered)	Cooling Load MBH	Heating Load MBH	Cooling kWh	Heating therms
102.5	49.1	0	650	66	0	0	-
97.5	42.5	3	650	47	0	12	-
92.5	39.5	34	650	38	0	107	-
87.5	36.6	131	650	30	0	320	-
82.5	34	500	650	22	0	911	-
77.5	31.6	620	650	15	0	773	-
72.5	29.2	664	650	8	0	446	-
67.5	27	854	650	0	3	0	34
62.5	24.5	927	650	0	7	0	77
57.5	21.4	600	650	0	10	0	76
52.5	18.7	610	650	0	14	0	104
47.5	16.2	611	650	0	17	0	131
42.5	14.4	656	650	0	21	0	170
37.5	12.6	1,023	650	0	24	0	310
32.5	10.7	734	650	0	28	0	254
27.5	8.6	334	650	0	31	0	130
22.5	6.8	252	650	0	35	0	109
17.5	5.5	125	650	0	38	0	60
12.5	4.1	47	650	0	42	0	25
7.5	2.6	22	650	0	45	0	12
2.5	1	13	650	0	49	0	8
-2.5	0	0	650	0		0	-
-7.5	-1.5	0	650	0		0	-
Total		**8,760**		**227.3**		**2,569**	**1,502**

	Total CFM	O.A. CFM	O.A. %	
Org. scheduled CFM	8,200	1,000	12%	
Heat Recovery Effectiveness	65%	650	←	OA CFM conditioned by ERV
SA Enthalpy	26.4	BTU/lbma	**AA**	
SA Set point, Winter	72.0	*F	**BB**	
SA Set point, Summer	72.0	*F		
Balance Point	60.0	*F	**BP**	
EER	12.2	btu/Wh		(Includes ancillary equipment)
Gas Heat Content	100,000	BTU/therm		
Boiler Efficiency	80%			
Electricity	$ 0.152	$/kWh blended		
Natural Gas	$ 1.38	$/Therm		
ERV Fan Motor Hp	1	ERV Fan kW	0.60	

Ventilation Energy Recovered		ERV Fan Energy	Total Energy Savings		
Therms	1,502		1,502	$ 2,072	
kWh	2,569	5,226	-2,657	$ (404)	
				$ 1,668	Total

Savings Summary				
Thermal Savings	8,245	therms	$ 11,378	
Electrical Savings	-3,059	kWh	$ (465)	
			$ 10,913	Total

North Brunswick
CHA #20418
Building: Municipal Building

ECM-6 Energy Recovery Ventilation

Multipliers	
Material:	0.98
Labor:	1.21
Equipment:	1.09

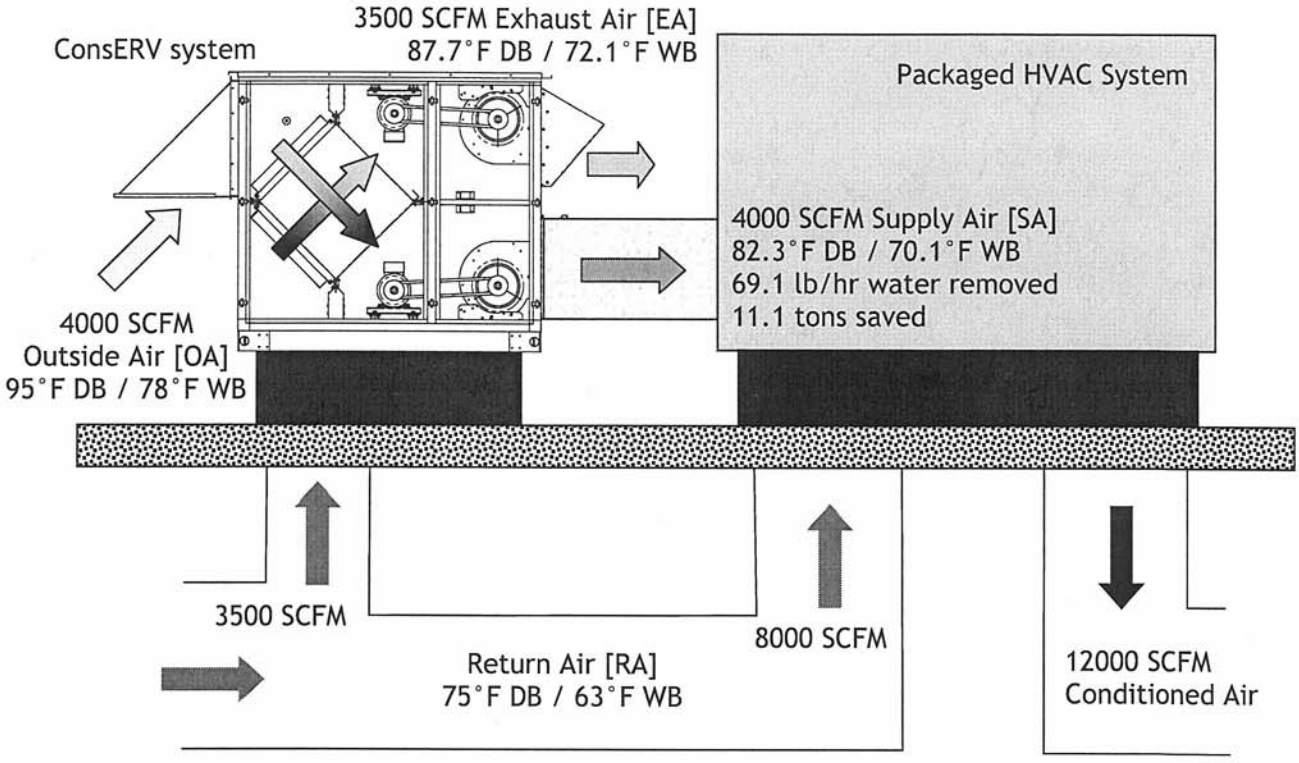
	QTY	UNIT	UNIT COSTS MAT.	UNIT COSTS LABOR	UNIT COSTS EQUIP.	SUBTOTAL COSTS MAT.	SUBTOTAL COSTS LABOR	SUBTOTAL COSTS EQUIP.	TOTAL COST	REMARKS
Ventilation Energy Recovery										
1000 CFM Energy Ventilation Recovery Unit	1	ea	$ 8,000	$ 6,500	$ 500	$ 7,840	$ 7,865	$ 545	$ 16,250	
2500 CFM Energy Ventilation Recovery Unit	2	ea	$ 13,000	$ 7,200	$ 500	$ 25,480	$ 17,424	$ 1,090	$ 43,994	
4000 CFM Energy Ventilation Recovery Unit	1	ea	$ 19,000	$ 8,000	$ 500	$ 18,620	$ 9,680	$ 545	$ 28,845	
Ductwork Modifications	1	ea	$ 5,000	$ 5,000	$ 500	$ 4,900	$ 6,050	$ 545	$ 11,495	
Control system programming	1	ea	$ 500	$ 4,000	$ -	$ 490	$ 4,840	$ -	$ 5,330	
electrical/wiring	4	ea	$ 2,000	$ 2,000	$ -	$ 7,840	$ 9,680	$ -	$ 17,520	

$123,434	Subtotal
$ 24,687	20% Contingency
$ 22,218	15% Contractor O&P
$ 20,441	12% Engineering
$ 190,780	**Total**

Sample

About ConsERV™...

Offering energy savings, rapid return on investment, and ease of use to consumers by pre-treating ventilation air.



Example: D8R-FSE-xSHHVH system operating at AHRI Cooling conditions

Features and Benefits:

- **Advanced materials = highest latent and total effectiveness of any fixed plate ERV**
- **No moving parts eliminates the most costly maintenance**
- **Savings of up to 30% on installed HVAC capital costs and up to 50% on operating costs**
- Failsafe operation - transfers energy as long as there is airflow
- Reliability allows safer downsizing of attached HVAC equipment.
- Zero air stream leakage - core does not allow cross contamination
- No defrost needed in most climate zones
- Equally effective in both summer and winter = year-round savings
- Water stays in vapor phase = no liquid water
- Light, corrosion-resistant aluminum cabinets offer double wall construction, 6.3 R-value
- Steel cabinets offer single or double wall options
- Industry standard electrical and monitoring options
- Easy installation with flexible air flow configurations and a smaller installed footprint

Certifications and Awards:

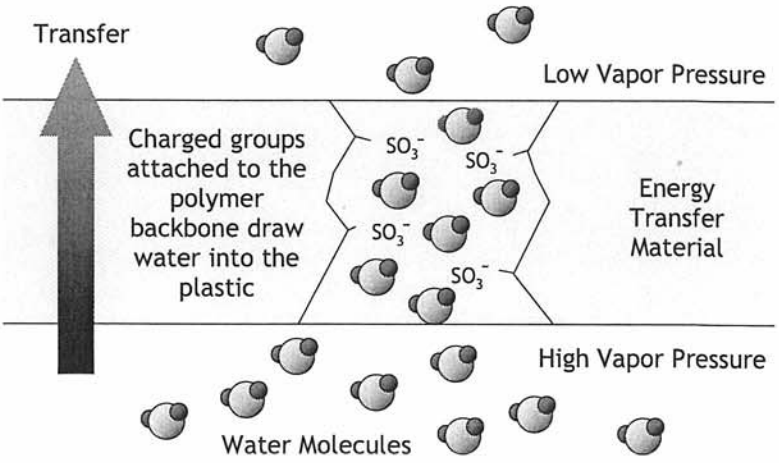
- UL 900 Recognized
- AHRI 1060 certified performance
- 2006 AHR Ventilation Innovation Award winner

Breakthrough technology...

Dais Analytic Corporation manufactures and sells the high performance ConsERV™ energy recovery ventilation system we introduced in 2002. Our patented polymer materials, grown out of space-age fuel cell research, are the key component of our revolutionary ConsERV™ air-to-air fixed-plate enthalpy exchangers. These unique materials provide the technology breakthrough that brings our customers unprecedented performance and energy savings in a reliable fixed-plate design.

An energy recovery ventilator ("ERV") features a heat exchanger combined with ventilation to provide pre-conditioned air into a building. Pre-conditioning the air saves energy – and money – by reducing the load on your HVAC system. During the summer, outside air is cooled and dehumidified before it enters the building and your air conditioning system. During winter, the opposite occurs as the outside air is heated and humidified by the outgoing exhaust air. In most applications, both sensible heat transfer (temperature exchange) and latent heat transfer (moisture exchange) within the exchanger are desired. Until now, energy recovery wheels have been the principal means of providing this total energy transfer, since fixed plate products did not have the ability to transfer latent heat very well.

Enter Dais Analytic. Dais has developed the ConsERV™ energy exchanger, which transfers high levels of both sensible and latent heat and can reduce energy consumption and HVAC loads from fresh air ventilation by up to 80%. No rotating or moving parts in the exchanger mean less energy consumption by the ERV, lower maintenance costs, and peace of mind when downsizing HVAC equipment capacity.



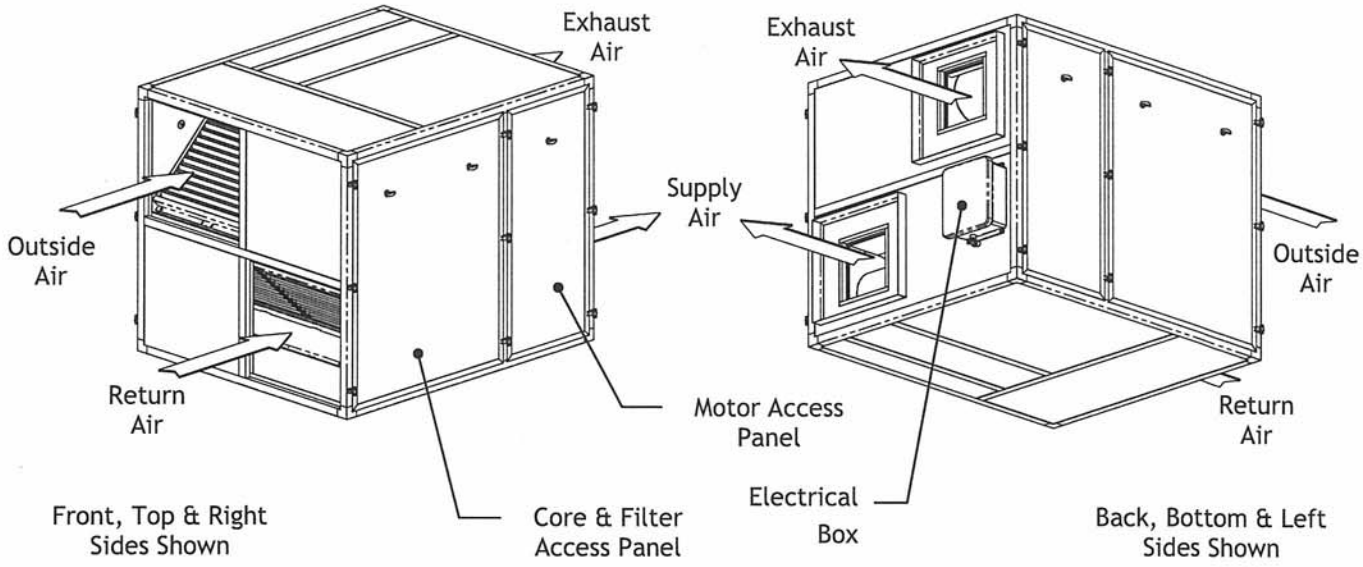
Our ConsERV™ exchanger doesn't depend on open pores or fragile surface-mounted desiccants to transfer water from one air stream to the other. Instead, the polymer separating the air streams is organized at a nanometer level to create highly charged regions that draw water molecules into the material. There is no physical opening, so the polymer is hermetic and prevents crossover of air molecules. The water molecules move easily between charges along the polymer backbone, passing through the material from the side with higher vapor pressure to the side with lower vapor pressure.

ARI PERFORMANCE CERTIFIED ™ www.ahridirectory.org

c UL us

D Series → Model i-FSS-xSHHHH

A standard-height indoor system offering a flexible duct connection pattern and integrated blowers supplying a wide range of pressures and flows. Construction is aluminum space frame with corrosion-resistant hardware and double-walled coated aluminum panels, whose closed-cell foam insulation results in a 6.3 R-value.



D2i-FSS -xSHHHH		ESP [in-H2O] 0	0.5	Max Weight = 367 lb 1	1.5
Airflow [SCFM]	600	1/2 hp	1/2 hp	1/2 hp	3/4 hp
	900	1/2 hp	1 hp	1 hp	1.5 hp
	1000	1/2 hp	3/4 hp	1.5 hp	1.5 hp
	1200	1 hp	1 hp	1.5 hp	2 hp

D3i-FSS -xSHHHH		ESP [in-H2O] 0	0.5	Max Weight = 459 lb 1	1.5
Airflow [SCFM]	800	1/2 hp	1/2 hp	3/4 hp	3/4 hp
	1200	1/2 hp	3/4 hp	1 hp	1.5 hp
	1500	3/4 hp	1 hp	1.5 hp	2 hp
	1800	1.5 hp	1.5 hp	2 hp	2 hp

D4i-FSS -xSHHHH		ESP [in-H2O] 0	0.5	Max Weight = 545 lb 1	1.5
Airflow [SCFM]	1000	1/2 hp	1/2 hp	3/4 hp	1 hp
	1800	1 hp	1.5 hp	1.5 hp	2 hp
	2000	1.5 hp	1.5 hp	2 hp	3 hp
	2400	1.5 hp	3 hp	3 hp	3 hp

D5i-FSS -xSHHHH		ESP [in-H2O] 0	0.5	Max Weight = 633 lb 1	1.5
Airflow [SCFM]	1500	1/2 hp	3/4 hp	1 hp	1.5 hp
	2000	1 hp	1.5 hp	2 hp	2 hp
	2500	1.5 hp	3 hp	3 hp	3 hp
	3000	3 hp	3 hp	5 hp	5 hp

D6i-FSS -xSHHHH		ESP [in-H2O] 0	0.5	Max Weight = 725 lb 1	1.5
Airflow [SCFM]	1800	3/4 hp	1 hp	1.5 hp	1.5 hp
	2400	1.5 hp	2 hp	3 hp	3 hp
	3000	2 hp	3 hp	3 hp	5 hp
	3400	3 hp	5 hp	5 hp	5 hp

D7i-FSS -xSHHHH		ESP [in-H2O] 0	0.5	Max Weight = 835 lb 1	1.5
Airflow [SCFM]	2000	3/4 hp	1.5 hp	1.5 hp	2 hp
	3000	2 hp	3 hp	3 hp	3 hp
	3500	3 hp	5 hp	5 hp	5 hp
	4000	3 hp	5 hp	5 hp	7.5 hp

D8i-FSS -xSHHHH		ESP [in-H2O] 0	0.5	Max Weight = 915 lb 1	1.5
Airflow [SCFM]	3000	1.5 hp	3 hp	3 hp	3 hp
	3500	2 hp	3 hp	3 hp	5 hp
	4000	3 hp	5 hp	5 hp	5 hp
	4500	5 hp	5 hp	5 hp	7.5 hp

D9i-fSS -xSHHHH		ESP [in-H2O] 0	0.5	Max Weight = 1003 lb 1	1.5
Airflow [SCFM]	3500	2 hp	3 hp	3 hp	5 hp
	4000	3 hp	3 hp	5 hp	5 hp
	4500	5 hp	5 hp	5 hp	5 hp
	5000	5 hp	7.5 hp	7.5 hp	7.5 hp

# CORES	MODEL #	A	B	C	D
2	D2i - FSS	29.18	26.72	11	10
3	D3i - FSS	41.52	39.06	17.17	15
4	D4i - FSS	53.87	51.41	23.34	21
5	D5i - FSS	66.21	63.75	29.51	27
6	D6i - FSS	78.55	76.09	35.68	33
7	D7i - FSS	90.9	88.44	41.86	39
8	D8i - FSS	103.24	100.78	48.03	45
9	D9i - FSS	115.59	113.13	54.2	51

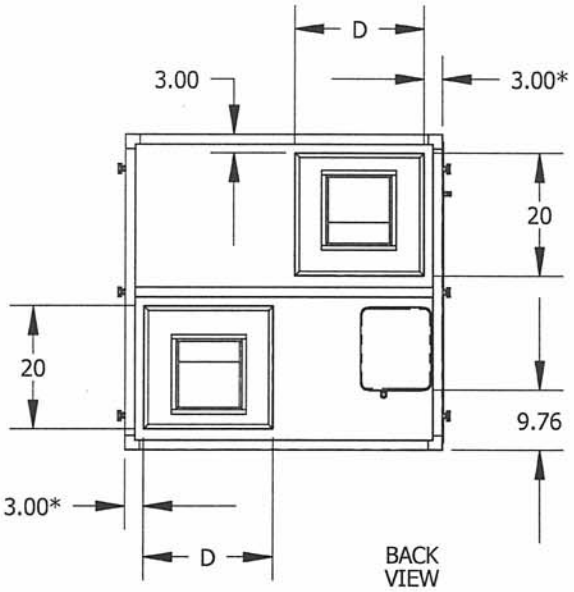
NOTES:

SYSTEM IS INTENDED FOR INDOOR USE ONLY

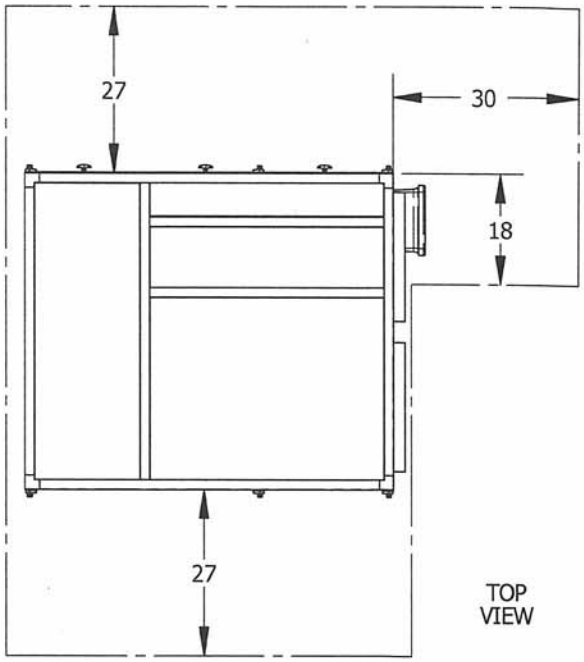
OA - OUTSIDE AIR INTAKE
SA - SUPPLY AIR EXIT
RA - RETURN AIR INTAKE
EA - EXHAUST AIR EXIT

OA & RA INPUTS CAN BE SWITCHED UPON REQUEST, CAUSING SA & EA TO REVERSE POSITIONS

D4i-FSS-xSHHHH MODEL PICTURED

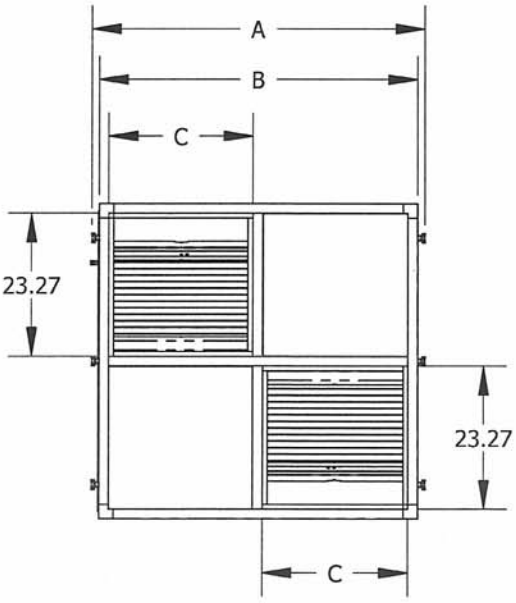


BACK VIEW

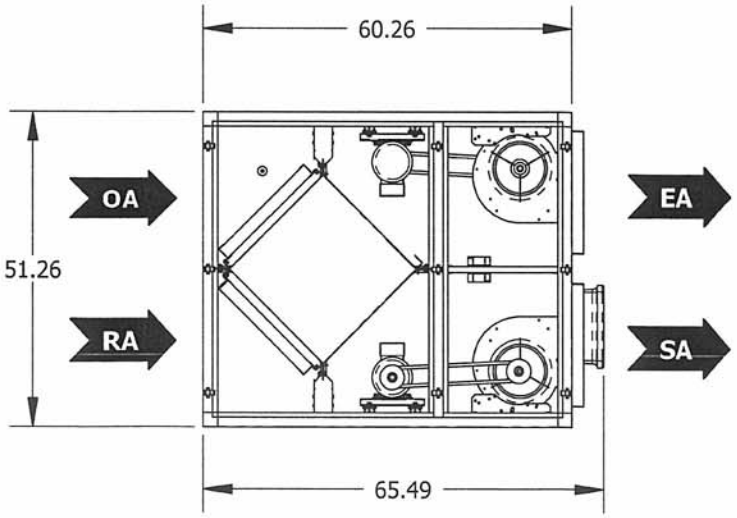


TOP VIEW

RECOMMENDED SERVICE AREA SHOWN



FRONT VIEW



RIGHT SIDE VIEW (ACCESS PANELS REMOVED)

* THESE DIMENSIONS ARE REDUCED TO 2.00 FOR THE D2i-FSS-xSHHHH MODEL

SIZE	REV.	MODIFIED		MODEL
A	1	11/10/2006	**INDOOR SYSTEM - STANDARD DUCT OPENINGS**	Dxi - FSS - xSHHHH

APPENDIX H

ECM-7 Door Seals

North Brunswick
CHA #20418
Building: Municipal Building

ECM-7 Door Seals

Existing: Lack of door seals result in excessive heat loss and infiltration
Proposed: Install door seals and/or weather-stripping to reduce air infiltration

Heating System Efficiency	80%	Ex Occupied Clng Temp.	72	°F	Ex Occupied Htg Temp.	72	°F
Cooling System Efficiency	1.20 kW/ton	Ex Unoccupied Clng Temp.	80	°F	Ex Unoccupied Htg Temp.	65	°F
		Prop Occupied Clng Temp.	72	°F	Prop Occupied Htg Temp.	72	°F
Linear Feet of Door Edge	321	Prop Unoccupied Clng Temp.	80	°F	Prop Unoccupied Htg Temp.	65	°F
Existing Infiltration Factor*	1.5 cfm/LF	Cooling Occ Enthalpy Setpoint	27.5	Btu/lb	Electricity	$ 0.15	$/kWh
Proposed Infiltration Factor*	0.45 cfm/LF	Cooling Unocc Enthalpy Setpoint	27.5	Btu/lb	Natural Gas	$ 1.38	$/therm

*Infiltration Factor per Carrier Handbook of Air Conditioning System Design based on average door seal gap calculated below.

					EXISTING LOADS		PROPOSED LOADS		COOLING ENERGY		HEATING ENERGY	
					Occupied	Unoccupied	Occupied	Unoccupied				
Avg Outdoor Air Temp. Bins °F	Avg Outdoor Air Enthalpy	Existing Equipment Bin Hours	Occupied Equipment Bin Hours	Unoccupied Equipment Bin Hours	Door Infiltration Load BTUH	Door Infiltration Load BTUH	Door Infiltration Load BTUH	Door Infiltration Load BTUH	Existing Cooling Energy kWh	Proposed Cooling Energy kWh	Existing Heating Energy therms	Proposed Heating Energy therms
A		B	C	D	E	F	G	H	I	J	K	L
102.5	49.1	0	0	0	-46,802	-46,802	-14,041	-14,041	0	0	0	0
97.5	42.5	3	2	1	-32,501	-32,501	-9,750	-9,750	10	3	0	0
92.5	39.5	34	17	17	-26,001	-26,001	-7,800	-7,800	88	27	0	0
87.5	36.6	131	66	65	-19,717	-19,717	-5,915	-5,915	258	77	0	0
82.5	34.0	500	252	248	-14,084	-14,084	-4,225	-4,225	704	211	0	0
77.5	31.6	620	313	307	-8,884	0	-2,665	0	278	83	0	0
72.5	29.2	664	335	329	-3,683	0	-1,105	0	123	37	0	0
67.5	27.0	854	431	423	2,340	0	702	0	0	0	13	4
62.5	24.5	927	468	459	4,940	1,300	1,482	390	0	0	36	11
57.5	21.4	600	303	297	7,540	3,900	2,262	1,170	0	0	43	13
52.5	18.7	610	308	302	10,140	6,500	3,042	1,950	0	0	64	19
47.5	16.2	611	308	303	12,740	9,100	3,822	2,730	0	0	84	25
42.5	14.4	656	331	325	15,341	11,700	4,602	3,510	0	0	111	33
37.5	12.6	1,023	516	507	17,941	14,301	5,382	4,290	0	0	206	62
32.5	10.7	734	370	364	20,541	16,901	6,162	5,070	0	0	172	52
27.5	8.6	334	169	165	23,141	19,501	6,942	5,850	0	0	89	27
22.5	6.8	252	127	125	25,741	22,101	7,722	6,630	0	0	75	23
17.5	5.5	125	63	62	28,341	24,701	8,502	7,410	0	0	41	12
12.5	4.1	47	24	23	30,941	27,301	9,282	8,190	0	0	17	5
7.5	2.6	22	11	11	33,541	29,901	10,062	8,970	0	0	9	3
2.5	1.0	13	7	6	36,141	32,501	10,842	9,750	0	0	6	2
-2.5	0.0	0	0	0	38,741	35,101	11,622	10,530	0	0	0	0
-7.5	-1.5	0	0	0	41,342	37,701	12,402	11,310	0	0	0	0
TOTALS		8,760	4,420	4,340					1,462	439	966	290

Existing Door Infiltration	482 cfm
Existing Unoccupied Door Infiltration	482 cfm
Proposed Door Infiltration	144 cfm
Proposed Unoccupied Door Infiltration	144 cfm

Savings			
	676	therms	$ 933
	1,023	kWh	$ 156
			$ 1,088

Door	Width (ft)	Height (ft)	Linear Feet (LF)	gap (in)	gap location	LF of gap	% door w/ gap	Average gap for door (in)
1a	3	7	20	0.25	bottom/seam	10	50%	0.125
1b	3	7	20	0.25	bottom/seam	10	50%	0.125
2a	3.5	7	21	0.25	all sides	21	100%	0.25
2b	3.5	7	21	0.25	all sides	21	100%	0.25
3a	2.5	7	19	0.125	all sides	19	100%	0.125
4a	3	7	20	0.125	all sides	20	100%	0.125
4b	3	7	20	0.125	all sides	20	100%	0.125
5	3	7	20	0.0625	all sides	20	100%	0.0625
6a	3	7	20	0.25	bottom/seam	10	50%	0.125
6b	3	7	20	0.25	bottom/seam	10	50%	0.125
7	3	7	20	0.0625	all sides	20	100%	0.0625
8a	3	7	20	0.25	bottom/seam	10	50%	0.125
8b	3	7	20	0.25	bottom/seam	10	50%	0.125
8c	3	7	20	0.25	bottom/seam	10	50%	0.125
8d	3	7	20	0.25	bottom/seam	10	50%	0.125
9	3	7	20	0.0625	all sides	20	100%	0.0625
Total	48.5	112	321	0.191		241	75%	0.129

Note: Doors labeled 'a', 'b', etc. are a part of the same door assembly.

New Jersey BPU Energy Audits
CHA #20418
Building: Municipal Building

ECM-7 Door Seals

Multipliers	
Material:	0.99
Labor:	1.22
Equipment:	1.09

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
									$ -	
36" Door Threshold Seal	16	ea	$ 50.00	$ 45.00	$ -	$ 792	$ 878	$ -	$ 1,670	
Side and Top Door Seal	275	ft	$ 3.00	$ 3.00		$ 825	$ 1,007	$ -	$ 1,832	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

$ 3,502	Subtotal
$ 525	15% Contingency
$ 604	15% Contractor O&P
$ -	0% Engineering
$ 4,631	**Total**

APPENDIX I

ECM-8 Lighting Occupancy Sensors

North Brunswick

CHA #20418

ECM-8 Install Occupancy Sensors

Cost of Electricity: $0.152 $/kWh Blended
$ 0.119 $/kWh Supply
$11.92 $/kW Demand

		RETROFIT CONDITIONS																COST & SAVINGS ANALYSIS					
	Area Description	No. of Fixtures	Standard Fixture Code	NYSERDA Fixture Code	Watts per Fixture	kW/Space	Exist Control	Annual Hours	Annual kWh	Number of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Retrofit Control	Annual Hours	Annual kWh	Annual kWh Saved	Annual $ Saved	Retrofit Cost	NJ Lighting Incentive	Simple Payback With Out Incentive	Simple Payback With Incentive
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	No. of fixtures before the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	No. of fixtures after the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Number of Fixtures)	Retrofit control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	(Original Annual kWh) - (Retrofit Annual kWh)	(kW Saved) * ($/kWh)	Cost for renovations to lighting system		Length of time for renovations cost to be recovered	Length of time for renovations cost to be recovered
	Basement																						
213	Archives	6	T 32 R F 2 (ELE)	F42SILL	53	0.3	SW	2860	909	6	T 32 R F 2 (ELE)	F42SILL	53	0.3	OCC	780	248	661	$78.65	$118.75	$20.00	1.5	1.3
201	Lounge	8	T 32 R F 3 (ELE)	F43SILL	78	0.6	SW	3120	1,947	8	T 32 R F 3 (ELE)	F43SILL	78	0.6	OCC	1560	973	973	$115.74	$118.75	$20.00	1.0	0.9
5	Lounge	3	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.2	SW	3120	496	3	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.2	OCC	1560	248	248	$29.49	$118.75	$20.00	4.0	3.3
213	Storage	4	T 32 R F 2 (ELE)	F42SILL	53	0.2	SW	2600	551	4	T 32 R F 2 (ELE)	F42SILL	53	0.2	OCC	780	165	386	$45.88	$118.75	$20.00	2.6	2.2
5	Mens Restroom	1	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.1	SW	3120	165	1	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.1	OCC	1820	96	69	$8.19	$118.75	$20.00	14.5	12.1
5	Ladies Restroom	1	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.1	SW	3120	165	1	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.1	OCC	1820	96	69	$8.19	$118.75	$20.00	14.5	12.1
213	Maintenance Supervisor Office	2	T 32 R F 2 (ELE)	F42SILL	53	0.1	SW	2600	276	2	T 32 R F 2 (ELE)	F42SILL	53	0.1	OCC	2080	220	55	$6.55	$118.75	$20.00	18.1	15.1
213	Storage	6	T 32 R F 2 (ELE)	F42SILL	53	0.3	SW	3120	992	6	T 32 R F 2 (ELE)	F42SILL	53	0.3	C-OCC	780	248	744	$88.48	$202.50	$35.00	2.3	1.9
	1st Floor																						
5	Office	6	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.3	SW	2860	909	6	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.3	OCC	2080	661	248	$29.49	$118.75	$20.00	4.0	3.3
201	Secretary/Recpt.	6	T 32 R F 3 (ELE)	F43SILL	78	0.5	SW	2860	1,338	6	T 32 R F 3 (ELE)	F43SILL	78	0.5	OCC	2080	973	365	$43.40	$118.75	$20.00	2.7	2.3
5	Office	4	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.2	SW	2860	606	4	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.2	OCC	2080	441	165	$19.66	$118.75	$20.00	6.0	5.0
201	Tax Collector and Water Dept.	17	T 32 R F 3 (ELE)	F43SILL	78	1.3	SW	3120	4,137	17	T 32 R F 3 (ELE)	F43SILL	78	1.3	C-OCC	2340	3,103	1,034	$122.98	$202.50	$35.00	1.6	1.4
5	Tax Collector and Water Dept.	3	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.2	SW	3120	496	3	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.2	OCC	2340	372	124	$14.75	$118.75	$20.00	8.1	6.7
213	Vault	2	T 32 R F 2 (ELE)	F42SILL	53	0.1	SW	2860	303	2	T 32 R F 2 (ELE)	F42SILL	53	0.1	OCC	780	83	220	$26.22	$118.75	$20.00	4.5	3.8
201	Finance	10	T 32 R F 3 (ELE)	F43SILL	78	0.8	SW	3120	2,434	10	T 32 R F 3 (ELE)	F43SILL	78	0.8	C-OCC	2340	1,825	608	$72.34	$202.50	$35.00	2.8	2.3
5	Office	4	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.2	SW	2860	606	4	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.2	OCC	2080	441	165	$19.66	$118.75	$20.00	6.0	5.0
5	Payroll	4	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.2	SW	2860	606	4	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.2	OCC	2080	441	165	$19.66	$118.75	$20.00	6.0	5.0
5	Office	4	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.2	SW	2860	606	4	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.2	OCC	2080	441	165	$19.66	$118.75	$20.00	6.0	5.0
201	Welfare	6	T 32 R F 3 (ELE)	F43SILL	78	0.5	SW	2860	1,338	6	T 32 R F 3 (ELE)	F43SILL	78	0.5	OCC	2080	973	365	$43.40	$118.75	$20.00	2.7	2.3
5	Director	6	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.3	SW	2860	909	6	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.3	OCC	2080	661	248	$29.49	$118.75	$20.00	4.0	3.3
5	Conference Room	4	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.2	SW	2080	441	4	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.2	OCC	1040	220	220	$26.22	$118.75	$20.00	4.5	3.8
5	Office	4	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.2	Sw	2860	606	4	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.2	OCC	2080	441	165	$19.66	$118.75	$20.00	6.0	5.0
201	Files	1	T 32 R F 3 (ELE)	F43SILL	78	0.1	Sw	2600	203	1	T 32 R F 3 (ELE)	F43SILL	78	0.1	OCC	780	61	142	$16.88	$118.75	$20.00	7.0	5.9
201	Human Services	29	T 32 R F 3 (ELE)	F43SILL	78	2.3	SW	3120	7,057	29	T 32 R F 3 (ELE)	F43SILL	78	2.3	C-OCC	2340	5,293	1,764	$209.78	$202.50	$35.00	1.0	0.8
201	Storage	2	T 32 R F 3 (ELE)	F43SILL	78	0.2	SW	2600	406	2	T 32 R F 3 (ELE)	F43SILL	78	0.2	OCC	780	122	284	$33.76	$118.75	$20.00	3.5	2.9
5	Storage	1	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.1	SW	2600	138	1	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.1	OCC	780	41	96	$11.47	$118.75	$20.00	10.4	8.6
5	Conference Room	4	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.2	SW	2080	441	4	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.2	OCC	1040	220	220	$26.22	$118.75	$20.00	4.5	3.8
201	Tax Assesor	6	T 32 R F 3 (ELE)	F43SILL	78	0.5	SW	2860	1,338	6	T 32 R F 3 (ELE)	F43SILL	78	0.5	OCC	2080	973	365	$43.40	$118.75	$20.00	2.7	2.3
201	Janitor	1	T 32 R F 3 (ELE)	F43SILL	78	0.1	SW	2600	203	1	T 32 R F 3 (ELE)	F43SILL	78	0.1	OCC	1300	101	101	$12.06	$118.75	$20.00	9.8	8.2
5	Mens Restroom	3	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.2	SW	3120	496	3	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.2	OCC	1820	289	207	$24.58	$118.75	$20.00	4.8	4.0
5	Ladies Restroom	3	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.2	SW	3120	496	3	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.2	OCC	1820	289	207	$24.58	$118.75	$20.00	4.8	4.0
201	Conference Room	8	T 32 R F 3 (ELE)	F43SILL	78	0.6	SW	2080	1,298	8	T 32 R F 3 (ELE)	F43SILL	78	0.6	C-OCC	1040	649	649	$77.16	$202.50	$35.00	2.6	2.2
5	Council Room	6	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.3	SW	2080	661	6	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.3	OCC	1040	331	331	$39.32	$118.75	$20.00	3.0	2.5
213	Shipping	8	T 32 R F 2 (ELE)	F42SILL	53	0.4	SW	2860	1,213	8	T 32 R F 2 (ELE)	F42SILL	53	0.4	OCC	1560	661	551	$65.54	$118.75	$20.00	1.8	1.5
5	Caucus Room	21	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	1.1	SW	2080	2,315	21	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	1.1	C-OCC	1040	1,158	1,158	$137.63	$202.50	$35.00	1.5	1.2
5	Prosecuter	4	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.2	SW	2340	496	4	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.2	OCC	1040	220	276	$32.77	$118.75	$20.00	3.6	3.0
5	Judge	4	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.2	SW	2340	496	4	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.2	OCC	1040	220	276	$32.77	$118.75	$20.00	3.6	3.0
5	Court Clerk	6	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.3	SW	2340	744	6	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.3	OCC	1040	331	413	$49.15	$118.75	$20.00	2.4	2.0
5	Violations Payment	4	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.2	SW	2860	606	4	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.2	OCC	2080	441	165	$19.66	$118.75	$20.00	6.0	5.0
201	Violations	9	T 32 R F 3 (ELE)	F43SILL	78	0.7	SW	2860	2,008	9	T 32 R F 3 (ELE)	F43SILL	78	0.7	C-OCC	2080	1,460	548	$65.10	$202.50	$35.00	3.1	2.6
201	Storage	3	T 32 R F 3 (ELE)	F43SILL	78	0.2	SW	2600	608	3	T 32 R F 3 (ELE)	F43SILL	78	0.2	OCC	780	183	426	$50.64	$118.75	$20.00	2.3	2.0
5	Copy Room	4	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.2	SW	3120	661	4	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.2	OCC	1560	331	331	$39.32	$118.75	$20.00	3.0	2.5
3	Mail Room	3	W 34 W F 1 (MAG)	F41EE	43	0.1	SW	3120	402	3	W 34 W F 1 (MAG)	F41EE	43	0.1	DCC	1560	201	201	$23.93	$118.75	$20.00	5.0	4.1
	2nd Floor																						
5	Office	4	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.2	SW	2860	606	4	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.2	OCC	2080	441	165	$19.66	$118.75	$20.00	6.0	5.0
5	Office	4	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.2	SW	2860	606	4	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.2	OCC	2080	441	165	$19.66	$118.75	$20.00	6.0	5.0
201	Community Development	10	T 32 R F 3 (ELE)	F43SILL	78	0.8	SW	3120	2,434	10	T 32 R F 3 (ELE)	F43SILL	78	0.8	C-OCC	2340	1,825	608	$72.34	$202.50	$35.00	2.8	2.3
5	Office	4	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.2	SW	2860	606	4	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.2	OCC	2080	441	165	$19.66	$118.75	$20.00	6.0	5.0
201	Copy Room	1	T 32 R F 3 (ELE)	F43SILL	78	0.1	SW	3120	243	1	T 32 R F 3 (ELE)	F43SILL	78	0.1	DCC	2340	183	61	$7.23	$118.75	$20.00	16.4	13.7
201	Administrative Assist Office	6	T 32 R F 3 (ELE)	F43SILL	78	0.5	SW	2860	1,338	6	T 32 R F 3 (ELE)	F43SILL	78	0.5	DCC	2080	973	365	$43.40	$118.75	$20.00	2.7	2.3
201	Secretary	4	T 32 R F 3 (ELE)	F43SILL	78	0.3	SW	2860	892	4	T 32 R F 3 (ELE)	F43SILL	78	0.3	DCC	2080	649	243	$28.94	$118.75	$20.00	4.1	3.4
5	Administrator	6	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.3	SW	2860	909	6	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.3	OCC	2080	661	248	$29.49	$118.75	$20.00	4.0	3.3
5	Mayor	11	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.6	SW	3120	1,819	11	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.6	OCC	2340	1,364	455	$54.07	$118.75	$20.00	2.2	1.8
201	Secretary	6	T 32 R F 3 (ELE)	F43SILL	78	0.5	SW	2860	1,338	6	T 32 R F 3 (ELE)	F43SILL	78	0.5	OCC	2080	973	365	$43.40	$118.75	$20.00	2.7	2.3
5	Conference Room	9	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.5	SW	2080	992	9	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.5	OCC	1040	496	496	$58.98	$118.75	$20.00	2.0	1.7
201	Copy Room / Computer Area	9	T 32 R F 3 (ELE)	F43SILL	78	0.7	SW	3120	2,190	9	T 32 R F 3 (ELE)	F43SILL	78	0.7	OCC	2340	1,643	548	$65.10	$118.75	$20.00	1.8	1.5
5	Engineer	6	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.3	SW	2860	909	6	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.3	OCC	2080	661	248	$29.49	$118.75	$20.00	4.0	3.3
201	Engineering / Construction	43	T 32 R F 3 (ELE)	F43SILL	78	3.4	SW	3120	10,464	43	T 32 R F 3 (ELE)	F43SILL	78	3.4	C-OCC	2340	7,848	2,616	$311.06	$405.00	$35.00	1.3	1.2
5	Conference Room	12	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.6	SW	2080	1,323	12	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.6	C-OCC	1040	661	661	$78.65	$202.50	$35.00	2.6	2.1
5	Office	4	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.2	SW	2860	606	4	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.2	OCC	2080	441	165	$19.66	$118.75	$20.00	6.0	5.0
5	Office	6	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.3	SW	2860	909	6	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.3	OCC	2080	661	248	$29.49	$118.75	$20.00	4.0	3.3
201	Archives	4	T 32 R F 3 (ELE)	F43SILL	78	0.3	SW	2340	730	4	T 32 R F 3 (ELE)	F43SILL	78	0.3	OCC	780	243	487	$57.87	$118.75	$20.00	2.1	1.7
5	Mens Restroom	3	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.2	SW	3120	496	3	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.2	OCC	1820	289	207	$24.58	$118.75	$20.00	4.8	4.0
5	Ladies Restroom	3	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.2	SW	3120	496	3	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.2	OCC	1820	289	207	$24.58	$118.75	$20.00	4.8	4.0
5	Janitor	1	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.1	SW	2600	138	1	2T 32 R F 2 (u) (ELE)	FU2SILL-R	53	0.1	OCC	1300	69	69	$8.19	$118.75	$20.00	14.5	12.1
	Total	**397**				**25.7**			**73,177**	**397**							**48,207**	**24,970**	**$ 2,969**	**$ 8,640**	**$ 1,430**		

Demand Savings	**0.0**	**$0**		
kWh Savings	**24,970**	**$2,969**		
Total Savings		**$2,969**		**2.9**	**2.4**

APPENDIX J

ECM-9 Occupancy Sensors for VAV Control

North Brunswick
CHA #20418
Building: Municipal Building

ECM-9 Occupancy Sensors for VAV Control

Description:
VAV boxes are presently set with a minimum air flow and air is constantly flowing to a room or zone regardless of occupancy.
This ECM evaluates the use of occupancy sensors to lower the VAV box CFM to zero when a room or zone is unoccupied.
Savings in cooling, heating, and air supply fan energy will result.

Method:
The lighting occupancy sensors proposed in ECM-9 will be used as the control signal device to close the supply air damper in a corresponding room or zone VAV box.
Minimum VAV box air flow rates and the associated heating, cooling and fan HP was used as a baseline for existing energy usage.
Heating and cooling load reductions are based on reduced outside air ventilation and supply air reheat loads.

AHU	CFM	Min OA CFM	VAV Box Min CFM	Air Flow Control
1	13500	4000	6375	VFD
2	14000	2400	9310	Damper
3	25000	2500	9500	Damper
4	8200	1000	4000	Damper

AHU-1

			Existing Energy											Proposed Energy										Savings	
Avg. DB Bin Temp °F	OA Enthalpy Btu/lb	Occupied Bin HOURS	VAV Box CFM	OA CFM	Cooling Load MBH	Reheat Load MBH	Heating Load MBH	Cooling kWh	% CFM	% Fan HP (Damper)	Fan kWh	Total KWH	Heating therms	VAV CFM	OA CFM	Cooling Load MBH	Reheat Load MBH	Heating Load MBH	Cooling kWh	% CFM	% Fan HP (VFD)	Fan kWh	Total kWh	Heating therms	kWh	Heating therms
102.5	49.1	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0	0	0	0	0	0	-	0	-
97.5	42.5	2	13,500	4000	290	0	0	36	100%		0	36	-	11,475	3400	246	0	0	31	85%	61%	6	36	-	0	-
92.5	39.5	17	12,609	4000	236	0	0	332	93%	99%	101	433	-	10,718	3400	200	0	0	282	79%	50%	51	333	-	100	-
87.5	36.6	66	11,719	4000	184	0	0	995	87%	98%	385	1,379	-	9,961	3400	156	0	0	846	74%	40%	158	1,004	-	375	-
82.5	34	252	10,828	4000	137	0	0	2,829	80%	96%	1,445	4,274	-	9,204	3400	116	0	0	2,405	68%	32%	477	2,882	-	1393	-
77.5	31.6	313	9,938	4000	94	0	0	2,400	74%	94%	1,755	4,155	-	8,447	3400	80	0	0	2,040	63%	24%	457	2,497	-	1658	-
72.5	29.2	335	9,047	4000	0	26	0	0	67%	91%	1,820	1,820	108	7,690	3400	0	22	0	0	57%	18%	370	370	92	1450	16
67.5	27	431	8,156	4000	0	52	0	0	60%	93%	2,392	2,392	278	6,933	3400	0	44	0	0	51%	14%	348	348	236	2043	42
62.5	24.5	468	7,266	4000	0	77	0	0	54%	83%	2,303	2,303	453	6,176	3400	0	66	0	0	46%	10%	267	267	385	2036	68
57.5	21.4	303	6,375	4000	0	103	0	0	47%	78%	1,409	1,409	391	5,419	3400	0	88	0	0	40%	6%	117	117	332	1292	59
52.5	18.7	308	6,375	4000	0	0	84	0	47%	78%	1,433	1,433	324	5,419	3400	0	0	72	0	40%	6%	119	119	275	1314	49
47.5	16.2	308	6,375	4000	0	0	106	0	47%	78%	1,435	1,435	408	5,419	3400	0	0	90	0	40%	6%	119	119	347	1316	61
42.5	14.4	331	6,375	4000	0	0	127	0	47%	78%	1,541	1,541	527	5,419	3400	0	0	108	0	40%	6%	128	128	448	1413	79
37.5	12.6	516	6,375	4000	0	0	149	0	47%	78%	2,403	2,403	962	5,419	3400	0	0	127	0	40%	6%	199	199	817	2204	144
32.5	10.7	370	6,375	4000	0	0	171	0	47%	78%	1,724	1,724	790	5,419	3400	0	0	145	0	40%	6%	143	143	671	1581	118
27.5	8.6	169	6,375	4000	0	0	192	0	47%	78%	784	784	405	5,419	3400	0	0	163	0	40%	6%	65	65	344	719	61
22.5	6.8	127	6,375	4000	0	0	214	0	47%	78%	592	592	340	5,419	3400	0	0	182	0	40%	6%	49	49	289	543	51
17.5	5.5	63	6,375	4000	0	0	235	0	47%	78%	294	294	186	5,419	3400	0	0	200	0	40%	6%	24	24	158	269	28
12.5	4.1	24	6,375	4000	0	0	257	0	47%	78%	110	110	76	5,419	3400	0	0	218	0	40%	6%	9	9	65	101	11
7.5	2.6	11	6,375	4000	0	0	279	0	47%	78%	52	52	39	5,419	3400	0	0	237	0	40%	6%	4	4	33	47	6
2.5	1	7	6,375	4000	0	0	300	0	47%	78%	31	31	25	5,419	3400	0	0	255	0	40%	6%	3	3	21	28	4
-2.5	0	0	0	0	0	0	0	0	0	0	0	0	-	0	3400	0	0	0	0	0		0	0	-	0	-
-7.5	-1.5	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0	0	0		0	0	-	0	-
Total		**4,420**			**940**	**258**	**2115**	**6,591**			**22,008**	**28,599**	**5,311**			**799**	**219**	**1797**	**5,603**			**3,114**	**8,716**	**4,514**	**19,883**	**797**

	Existing	Proposed	Percent Occupied
Total AHU Air Flow	13,500	11,475	85%
Minimum VAV Box CFM	6,375	5,419	85%
Ventilation CFM	4000	3400	85%
SA Enthalpy	26.4	BTU/lbma	
Space Set point, Winter	72.0	°F	
Space Set point, Summer	72.5	°F	
Supply Air Temp, Summer	57.5	°F	
Max Reheat Temp	77.5	°F	
Balance Point	60.0	°F	
Supply Fan HP	10.0	HP	
Supply Fan Motor Efficiency	87.5%		
Supply Fan kW	6.0	kW	
Gas Heat Content	100,000	BTU/therm	
Boiler Efficiency	80%		
Electricity	$ 0.152	$/kWh blended	
Natural Gas	$ 1.38	$/Therm	
EER	12.2	btu/Wh	

100% Energy Cost Savings

Therm Savings	797	therms	$ 1,099	
Electrical Savings	19,883	kWh	$ 3,022	
			$ 4,121	Total

AHU-2

			Existing Energy											Proposed Energy										Savings	
Avg. DB Bin Temp °F	OA Enthalpy Btu/lb	Occupied Bin HOURS	VAV Box CFM	OA CFM	Cooling Load MBH	Reheat Load MBH	Heating Load MBH	Cooling kWh	% CFM	% Fan HP (Damper)	Fan kWh	Total KWH	Heating therms	VAV CFM	OA CFM	Cooling Load MBH	Reheat Load MBH	Heating Load MBH	Cooling kWh	% CFM	% Fan HP (Damper)	Fan kWh	Total kWh	Heating therms	kWh	Heating therms
102.5	49.1	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0	0	0	0	0	0	-	0	-
97.5	42.5	2	14,000	2400	174	0	0	22	100%	100%	14	35	-	11,900	2040	148	0	0	18	85%	97%	13	31	-	4	-
92.5	39.5	17	13,414	2400	141	0	0	199	96%	99%	152	351	-	11,402	2040	120	0	0	169	81%	96%	148	317	-	34	-
87.5	36.6	66	12,828	2400	110	0	0	597	92%	98%	577	1,174	-	10,903	2040	94	0	0	507	78%	95%	562	1,069	-	104	-
82.5	34	252	12,241	2400	82	0	0	1,697	87%	98%	2,202	3,899	-	10,405	2040	70	0	0	1,443	74%	94%	2,116	3,559	-	340	-
77.5	31.6	313	11,655	2400	56	0	0	1,440	83%	97%	2,702	4,142	-	9,907	2040	48	0	0	1,224	71%	92%	2,576	3,800	-	342	-
72.5	29.2	335	11,069	2400	0	38	0	0	79%	95%	2,849	2,849	158	9,408	2040	0	32	0	0	67%	91%	2,729	2,729	134	120	24
67.5	27	431	10,483	2400	0	75	0	0	75%	94%	3,626	3,626	406	8,910	2040	0	64	0	0	64%	89%	3,433	3,433	345	193	61
62.5	24.5	468	9,896	2400	0	113	0	0	71%	83%	3,454	3,454	661	8,412	2040	0	96	0	0	60%	88%	3,664	3,664	562	-209	99
57.5	21.4	303	9,310	2400	0	151	0	0	67%	91%	2,466	2,466	571	7,914	2040	0	128	0	0	57%	84%	2,277	2,277	485	190	86
52.5	18.7	308	9,310	2400	0	0	51	0	67%	91%	2,507	2,507	194	7,914	2040	0	0	43	0	57%	84%	2,314	2,314	165	193	29
47.5	16.2	308	9,310	2400	0	0	64	0	67%	91%	2,511	2,511	245	7,914	2040	0	0	54	0	57%	84%	2,318	2,318	208	193	37
42.5	14.4	331	9,310	2400	0	0	76	0	67%	91%	2,696	2,696	316	7,914	2040	0	0	65	0	57%	84%	2,489	2,489	269	207	47
37.5	12.6	516	9,310	2400	0	0	89	0	67%	91%	4,205	4,205	577	7,914	2040	0	0	76	0	57%	84%	3,881	3,881	490	323	87
32.5	10.7	370	9,310	2400	0	0	102	0	67%	91%	3,017	3,017	474	7,914	2040	0	0	87	0	57%	84%	2,785	2,785	403	232	71
27.5	8.6	169	9,310	2400	0	0	115	0	67%	91%	1,373	1,373	243	7,914	2040	0	0	98	0	57%	84%	1,267	1,267	207	106	36
22.5	6.8	127	9,310	2400	0	0	128	0	67%	91%	1,036	1,036	204	7,914	2040	0	0	109	0	57%	84%	956	956	173	80	31
17.5	5.5	63	9,310	2400	0	0	141	0	67%	91%	514	514	111	7,914	2040	0	0	120	0	57%	84%	474	474	95	40	17
12.5	4.1	24	9,310	2400	0	0	154	0	67%	91%	193	193	46	7,914	2040	0	0	131	0	57%	84%	178	178	39	15	7
7.5	2.6	11	9,310	2400	0	0	167	0	67%	91%	90	90	23	7,914	2040	0	0	142	0	57%	84%	83	83	20	7	3
2.5	1	7	9,310	2400	0	0	180	0	67%	91%	53	53	15	7,914	2040	0	0	153	0	57%	84%	49	49	13	4	2
-2.5	0	0	0	0	0	0	0	0	0%	0	0	0	-	0	2040	0	0	164	0	0		0	0	-	0	-
-7.5	-1.5	0	0	0	0	0	0	0	0%	0	0	0	-	0	0	0	0	0	0	0		0	0	-	0	-
Total		**4,420**			**564**	**377**	**1269**	**3,955**			**36,239**	**40,194**	**4,245**			**479**	**320**	**1243**	**3,362**			**34,315**	**37,677**	**3,608**	**2,517**	**637**

	Existing	Proposed	Percent Occupied
Total AHU Air Flow	14,000	11,900	85%
Minimum VAV Box CFM	9,310	7,914	85%
Ventilation CFM	2400	2040	85%
SA Enthalpy	26.4	BTU/lbma	
Space Set point, Winter	72.0	°F	
Space Set point, Summer	72.5	°F	
Supply Air Temp, Summer	57.5	°F	
Max Reheat Temp	77.5	°F	
Balance Point	60.0	°F	
Supply Fan HP	15.0	HP	
Supply Fan Motor Efficiency	87.5%		
Supply Fan kW	9.0	kW	
Gas Heat Content	100,000	BTU/therm	
Boiler Efficiency	80%		
Electricity	$ 0.152	$/kWh blended	
Natural Gas	$ 1.38	$/Therm	
EER	12.2	btu/Wh	

100% Energy Cost Savings

Therm Savings	637	therms	$ 879	
Electrical Savings	2,517	kWh	$ 383	
			$ 1,261	Total

AHU-3

			Existing Energy											Proposed Energy											Savings	
Avg. DB Bin Temp °F	OA Enthalpy Btu/lb	Occupied Bin HOURS	VAV Box CFM	OA CFM	Cooling Load MBH	Reheat Load MBH	Heating Load MBH	Cooling kWh	% CFM	% Fan HP (Damper)	Fan kWh	Total KWH	Heating therms	VAV CFM	OA CFM	Cooling Load MBH	Reheat Load MBH	Heating Load MBH	Cooling kWh	% CFM	% Fan HP (Damper)	Fan kWh	Total kWh	Heating therms	kWh	Heating therms
102.5	49.1	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0	0			0	0	-	0	-
97.5	42.5	2	25,000	2500	181	0	0	22	100%	100%	27	50	-	21,250	2125	154	0	0	19	85%	97%	13	32	-	17	-
92.5	39.5	17	23,063	2500	147	0	0	207	92%	99%	304	511	-	19,603	2125	125	0	0	176	78%	96%	147	323	-	188	-
87.5	36.6	66	21,125	2500	115	0	0	622	85%	97%	1,148	1,770	-	17,956	2125	98	0	0	528	72%	93%	550	1,079	-	691	-
82.5	34	252	19,188	2500	86	0	0	1,768	77%	95%	4,268	6,036	-	16,309	2125	73	0	0	1,503	65%	90%	2,033	3,535	-	2501	-
77.5	31.6	313	17,250	2500	59	0	0	1,500	69%	92%	5,153	6,653	-	14,663	2125	50	0	0	1,275	59%	87%	2,448	3,723	-	2930	-
72.5	29.2	335	15,313	2500	0	38	0	0	61%	88%	5,279	5,279	161	13,016	2125	0	33	0	0	52%	82%	2,444	2,444	137	2834	24
67.5	27	431	13,375	2500	0	77	0	0	54%	83%	6,403	6,403	414	11,369	2125	0	65	0	0	45%	78%	2,989	2,989	352	3414	62
62.5	24.5	468	11,438	2500	0	115	0	0	46%	78%	6,490	6,490	675	9,722	2125	0	98	0	0	39%	74%	3,098	3,098	574	3392	101
57.5	21.4	303	9,500	2500	0	154	0	0	38%	70%	3,794	3,794	582	8,075	2125	0	131	0	0	32%	65%	1,762	1,762	495	2033	87
52.5	18.7	308	9,500	2500	0	0	53	0	38%	70%	3,857	3,857	203	8,075	2125	0	0	45	0	32%	65%	1,791	1,791	172	2066	30
47.5	16.2	308	9,500	2500	0	0	66	0	38%	70%	3,864	3,864	255	8,075	2125	0	0	56	0	32%	65%	1,794	1,794	217	2070	38
42.5	14.4	331	9,500	2500	0	0	80	0	38%	70%	4,148	4,148	330	8,075	2125	0	0	68	0	32%	65%	1,926	1,926	280	2222	49
37.5	12.6	516	9,500	2500	0	0	93	0	38%	70%	6,469	6,469	601	8,075	2125	0	0	79	0	32%	65%	3,003	3,003	511	3466	90
32.5	10.7	370	9,500	2500	0	0	107	0	38%	70%	4,642	4,642	494	8,075	2125	0	0	91	0	32%	65%	2,155	2,155	420	2487	74
27.5	8.6	169	9,500	2500	0	0	120	0	38%	70%	2,112	2,112	253	8,075	2125	0	0	102	0	32%	65%	981	981	215	1131	38
22.5	6.8	127	9,500	2500	0	0	134	0	38%	70%	1,594	1,594	212	8,075	2125	0	0	114	0	32%	65%	740	740	181	854	32
17.5	5.5	63	9,500	2500	0	0	147	0	38%	70%	790	790	116	8,075	2125	0	0	125	0	32%	65%	367	367	99	423	17
12.5	4.1	24	9,500	2500	0	0	161	0	38%	70%	297	297	48	8,075	2125	0	0	137	0	32%	65%	138	138	40	159	7
7.5	2.6	11	9,500	2500	0	0	174	0	38%	70%	139	139	24	8,075	2125	0	0	148	0	32%	65%	65	65	21	75	4
2.5	1	7	9,500	2500	0	0	188	0	38%	70%	82	82	15	8,075	2125	0	0	160	0	32%	65%	38	38	13	44	2
-2.5	0	0	9,500	0	0	0	0	0	0	0	0	0	-	8,075	2125	0	0	0	0	0		0	0	-	0	-
-7.5	-1.5	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0	0	0		0	0	-	0	-
Total		**4,420**			**587**	**385**	**1322**	**4,120**			**60,861**	**64,981**	**4,383**			**499**	**327**	**1123**	**3,502**			**28,482**	**31,983**	**3,726**	**32,997**	**657**

	Existing	Proposed	Percent Occupied
Total AHU Air Flow	25,000	21,250	85%
Minimum VAV Box CFM	9,500	8,075	85%
Ventilation CFM	2500	2125	85%
SA Enthalpy	26.4	BTU/lbma	
Space Set point, Winter	72.0	°F	
Space Set point, Summer	72.5	°F	
Supply Air Temp, Summer	57.5	°F	
Max Reheat Temp	77.5	°F	
Balance Point	60.0	°F	
Supply Fan HP	30.0	HP	
Supply Fan Motor Efficiency	87.5%		
Supply Fan kW	17.9	kW	
Gas Heat Content	100,000	BTU/therm	
Boiler Efficiency	80%		
Electricity	$ 0.152	$/kWh blended	
Natural Gas	$ 1.38	$/Therm	
EER	12.2	btu/Wh	

100% Energy Cost Savings

Therm Savings	657	therms	$ 907	
Electrical Savings	32,997	kWh	$ 5,016	
			$ 5,923	Total

AHU-4

			Existing Energy											Proposed Energy											Savings	
Avg. DB Bin Temp °F	OA Enthalpy Btu/lb	Occupied Bin HOURS	VAV Box CFM	OA CFM	Cooling Load MBH	Reheat Load MBH	Heating Load MBH	Cooling kWh	% CFM	% Fan HP (Damper)	Fan kWh	Total KWH	Heating therms	VAV CFM	OA CFM	Cooling Load MBH	Reheat Load MBH	Heating Load MBH	Cooling kWh	% CFM	% Fan HP (Damper)	Fan kWh	Total kWh	Heating therms	kWh	Heating therms
102.5	49.1	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0	0	0	0	0	0	-	0	-
97.5	42.5	3	8,200	1000	72	0	0	18	100%	100%	27	45	-	6,970	850	62	0	0	15	85%	97%	26	41	-	3	-
92.5	39.5	34	7,675	1000	59	0	0	164	94%	99%	301	466	-	6,524	850	50	0	0	140	80%	96%	292	432	-	34	-
87.5	36.6	131	7,150	1000	46	0	0	493	87%	98%	1,143	1,636	-	6,078	850	39	0	0	419	74%	94%	1,102	1,521	-	115	-
82.5	34	500	6,625	1000	34	0	0	1,402	81%	97%	4,319	5,721	-	5,631	850	29	0	0	1,191	69%	92%	4,109	5,300	-	421	-
77.5	31.6	620	6,100	1000	23	0	0	1,189	74%	94%	5,217	6,406	-	5,185	850	20	0	0	1,011	63%	89%	4,940	5,951	-	456	-
72.5	29.2	664	5,575	1000	0	16	0	0	68%	92%	5,439	5,439	134	4,739	850	0	14	0	0	58%	85%	5,053	5,053	114	386	20
67.5	27	854	5,050	1000	0	32	0	0	62%	88%	6,728	6,728	346	4,293	850	0	28	0	0	52%	82%	6,231	6,231	294	497	52
62.5	24.5	927	4,525	1000	0	49	0	0	55%	83%	6,888	6,888	563	3,846	850	0	41	0	0	47%	79%	6,556	6,556	479	332	84
57.5	21.4	600	4,000	1000	0	65	0	0	49%	80%	4,297	4,297	486	3,400	850	0	55	0	0	41%	75%	4,002	4,002	413	295	73
52.5	18.7	610	4,000	1000	0	0	21	0	49%	80%	4,369	4,369	161	3,400	850	0	0	18	0	41%	75%	4,068	4,068	136	300	24
47.5	16.2	611	4,000	1000	0	0	26	0	49%	80%	4,376	4,376	202	3,400	850	0	0	22	0	41%	75%	4,075	4,075	172	301	30
42.5	14.4	656	4,000	1000	0	0	32	0	49%	80%	4,698	4,698	261	3,400	850	0	0	27	0	41%	75%	4,375	4,375	222	323	39
37.5	12.6	1,023	4,000	1000	0	0	37	0	49%	80%	7,326	7,326	476	3,400	850	0	0	32	0	41%	75%	6,823	6,823	405	504	71
32.5	10.7	734	4,000	1000	0	0	43	0	49%	80%	5,257	5,257	391	3,400	850	0	0	36	0	41%	75%	4,895	4,895	333	361	59
27.5	8.6	334	4,000	1000	0	0	48	0	49%	80%	2,392	2,392	201	3,400	850	0	0	41	0	41%	75%	2,228	2,228	171	164	30
22.5	6.8	252	4,000	1000	0	0	53	0	49%	80%	1,805	1,805	168	3,400	850	0	0	45	0	41%	75%	1,681	1,681	143	124	25
17.5	5.5	125	4,000	1000	0	0	59	0	49%	80%	895	895	92	3,400	850	0	0	50	0	41%	75%	834	834	78	62	14
12.5	4.1	47	4,000	1000	0	0	64	0	49%	80%	337	337	38	3,400	850	0	0	55	0	41%	75%	313	313	32	23	6
7.5	2.6	22	4,000	1000	0	0	70	0	49%	80%	158	158	19	3,400	850	0	0	59	0	41%	75%	147	147	16	11	3
2.5	1	13	4,000	1000	0	0	75	0	49%	80%	93	93	12	3,400	850	0	0	64	0	41%	75%	87	87	10	6	2
-2.5	0	0	0	0	0	0	0	0	0%	0	0	0	-	0	0	0	0	0	0	0		0	0	-	0	-
-7.5	-1.5	0	0	0	0	0	0	0	0%	0	0	0	-	0	0	0	0	0	0	0		0	0	-	0	-
Total		**8,760**			**235**	**162**	**529**	**3,266**			**66,064**	**69,330**	**3,551**			**200**	**138**	**449**	**2,776**			**61,835**	**64,610**	**3,019**	**4,719**	**533**

	Existing	Proposed	Percent Occupied
Total AHU Air Flow	8,200	6,970	85%
Minimum VAV Box CFM	4,000	3,400	85%
Ventilation CFM	1000	850	85%
SA Enthalpy	26.4	BTU/lbma	
Space Set point, Winter	72.0	°F	
Space Set point, Summer	72.5	°F	
Supply Air Temp, Summer	57.5	°F	
Max Reheat Temp	77.5	°F	
Balance Point	60.0	°F	
Supply Fan HP	15.0	HP	
Supply Fan Motor Efficiency	87.5%		
Supply Fan kW	9.0	kW	
Gas Heat Content	100,000	BTU/therm	
Boiler Efficiency	80%		
Electricity	$ 0.152	$/kWh blended	
Natural Gas	$ 1.38	$/Therm	
EER	12.2	btu/Wh	

100% Energy Cost Savings

Therm Savings	533	therms	$ 735	
Electrical Savings	4,719	kWh	$ 717	
			$ 1,452	Total

Savings Summary

Therm Savings	2,624	therms	$ 3,620	
Electrical Savings	60,117	kWh	$ 9,138	
			$ 12,758	Total

North Brunswick
CHA #20418
Building: Municipal Building

ECM-9 Occupancy Sensors for VAV Control

Multipliers	
Material:	0.98
Labor:	1.21
Equipment:	1.09

	QTY	UNIT	UNIT COSTS MAT.	UNIT COSTS LABOR	UNIT COSTS EQUIP.	SUBTOTAL COSTS MAT.	SUBTOTAL COSTS LABOR	SUBTOTAL COSTS EQUIP.	TOTAL COST	REMARKS
Damper Actuator Modifications	140	ea		$ 100		$ -	$ 16,940	$ -	$ 16,940	
Control system programming	4	ea	$ 500	$ 2,000	$ -	$ 1,960	$ 9,680	$ -	$ 11,640	
electrical/wiring	140	ea	$ 60	$ 150	$ -	$ 8,232	$ 25,410	$ -	$ 33,642	
Occupancy sensors for Public Safety and Police Department *	30	ea	$ 100	$ 150	$ -	$ 2,940	$ 5,445	$ -	$ 8,385	

* Lighting occupancy sensors not proposed

$70,607	Subtotal
$ 14,121	20% Contingency
$ 12,709	15% Contractor O&P
$ -	Engineering
$ 97,438	**Total**

APPENDIX K

New Jersey Pay for Performance Incentive Program

North Brunswick
CHA #20418
Building: Municipal Building

New Jersey Pay For Performance Incentive Program

Note: The following calculation is based on the New Jersey Pay For Performance Incentive Program per September, 2009.
The values represented below are only applicable through December 31, 2009.

	Annual Utilities	
	kWh	Therms
Existing Usage	1,439,000	41,796
Proposed Savings	282,468	16,154
Existing Total MMBtus	9,091	
Proposed Savings MMBtus	2,580	
% Reduction	28.4%	
Proposed Annual Savings	$64,649	

	≥ %15 - < 20%	
	$/kWh	$/therm
Incentive #2	$0.11	$1.10
Incentive #3	$0.07	$0.70

	≥ 20%	
	$/kWh	$/therm
Incentive #2	$0.22	$2.20
Incentive #3	$0.14	$1.40

	Incentives $		
	Elec	Gas	Total
Incentive #2	$62,143	$35,540	$97,683
Incentive #3	$39,545	$22,616	$62,162
Totals	**$101,688**	**$58,156**	**$159,844**

Total Project Cost	$277,624
% Incentives of Project Cost*	57.6%
50 % Maximum Incentive	$138,812
Project Cost w/ Incentives*	$138,812

Project Payback (years)	
w/o Incentives	w/ Incentives
4.3	2.1

* Maximum allowable incentive is 50% of total project cost

Note: ECM - 5 is recommend in lieu of ECM - 6
Values for ECM-6 are not included in the P4P calculation.

APPENDIX L

Photovoltaic (PV) Rooftop Solar Power Generation

PVWatts *** AC Energy & Cost Savings

Cautions for Interpreting the Results

Station Identification	
City:	Newark
State:	New_Jersey
Latitude:	40.70° N
Longitude:	74.17° W
Elevation:	9 m
PV System Specifications	
DC Rating:	50.0 kW
DC to AC Derate Factor:	0.770
AC Rating:	38.5 kW
Array Type:	Fixed Tilt
Array Tilt:	40.7°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	15.4 ¢/kWh

Results			
Month	Solar Radiation ($kWh/m^2/day$)	AC Energy (kWh)	Energy Value ($)
1	3.36	4139	637.41
2	4.05	4469	688.23
3	4.58	5422	834.99
4	4.84	5299	816.05
5	5.30	5838	899.05
6	5.33	5506	847.92
7	5.27	5561	856.39
8	5.25	5503	847.46
9	5.06	5338	822.05
10	4.46	5027	774.16
11	3.15	3588	552.55
12	2.87	3460	532.84
Year	4.46	59150	9109.10

Output Hourly Performance Data

*

Output Results as Text

About the Hourly Performance Data

Saving Text from a Browser

Run PVWATTS v.1 for another US location or an International location
Run PVWATTS v.2 (US only)

Please send questions and comments regarding PVWATTS to Webmaster

Disclaimer and copyright notice

Cautions for Interpreting the Results

The monthly and yearly energy production are modeled using the PV system parameters you selected and weather data that are typical or representative of long-term averages. For reference, or comparison with local information, the solar radiation values modeled for the PV array are included in the performance results.

Because weather patterns vary from year-to-year, the values in the tables are better indicators of long-term performance than performance for a particular month or year. PV performance is largely proportional to the amount of solar radiation received, which may vary from the long-term average by ± 30% for monthly values and ± 10% for yearly values. How the solar radiation might vary for your location may be evaluated by examining the tables in the *Solar Radiation Data Manual for Flat-Plate and Concentrating Collectors* (*http://rredc.nrel.gov/solar/old_data/nsrdb/redbook/*).

For these variations and the uncertainties associated with the weather data and the model used to model the PV performance, future months and years may be encountered where the actual PV performance is less than or greater than the values shown in the table. The variations may be as much as 40% for individual months and up to 20% for individual years. Compared to long-term performance over many years, the values in the table are accurate to within 10% to 12%.

If the default overall DC to AC derate factor is used, the energy values in the table will overestimate the actual energy production if nearby buildings, objects, or other PV modules and array structure shade the PV modules; if tracking mechanisms for one- and two-axis tracking systems do not keep the PV arrays at the optimum orientation with respect to the sun's position; if soiling or snow cover related losses exceed 5%; or if the system performance has degraded from new. (PV performance typically degrades 1% per year.) If any of these situations exist, an overall DC to AC derate factor should be used with PVWATTS that was calculated using system specific component derate factors for *shading*, *sun-tracking*, *soiling*, and *age*.

The PV system size is the nameplate DC power rating. The energy production values in the table are valid only for crystalline silicon PV systems.

The cost savings are determined as the product of the number of kilowatt hours (kWh) and the cost of electricity per kWh. These cost savings occur if the owner uses all the electricity produced by the PV system, or if the owner has a net-metering agreement with the utility. With net-metering, the utility bills the owner for the net electricity consumed. When electricity flows from the utility to the owner, the meter spins forward. When electricity flows from the PV system to the utility, the meter spins backwards.

If net-metering isn't available and the PV system sends surplus electricity to the utility grid, the utility generally buys the electricity from the owner at a lower price than the owner pays the utility for electricity. In this case, the cost savings shown in the table should be reduced.

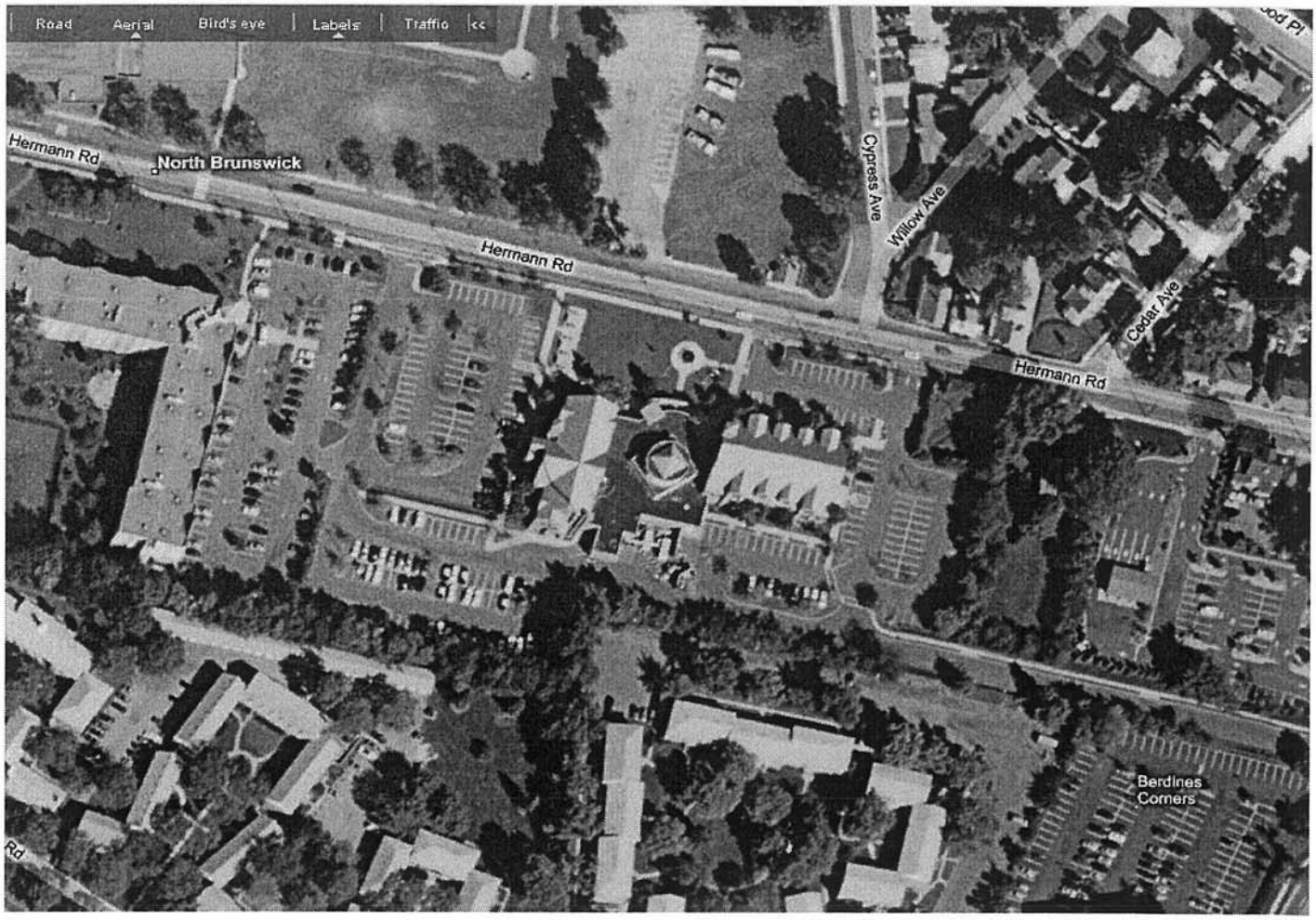
Besides the cost savings shown in the table, other benefits of PV systems include greater energy independence and a reduction in fossil fuel usage and air pollution. For commercial customers, additional cost savings may come from reducing demand charges. Homeowners can often include the cost of the PV system in their home mortgage as a way of accommodating the PV system's initial cost.

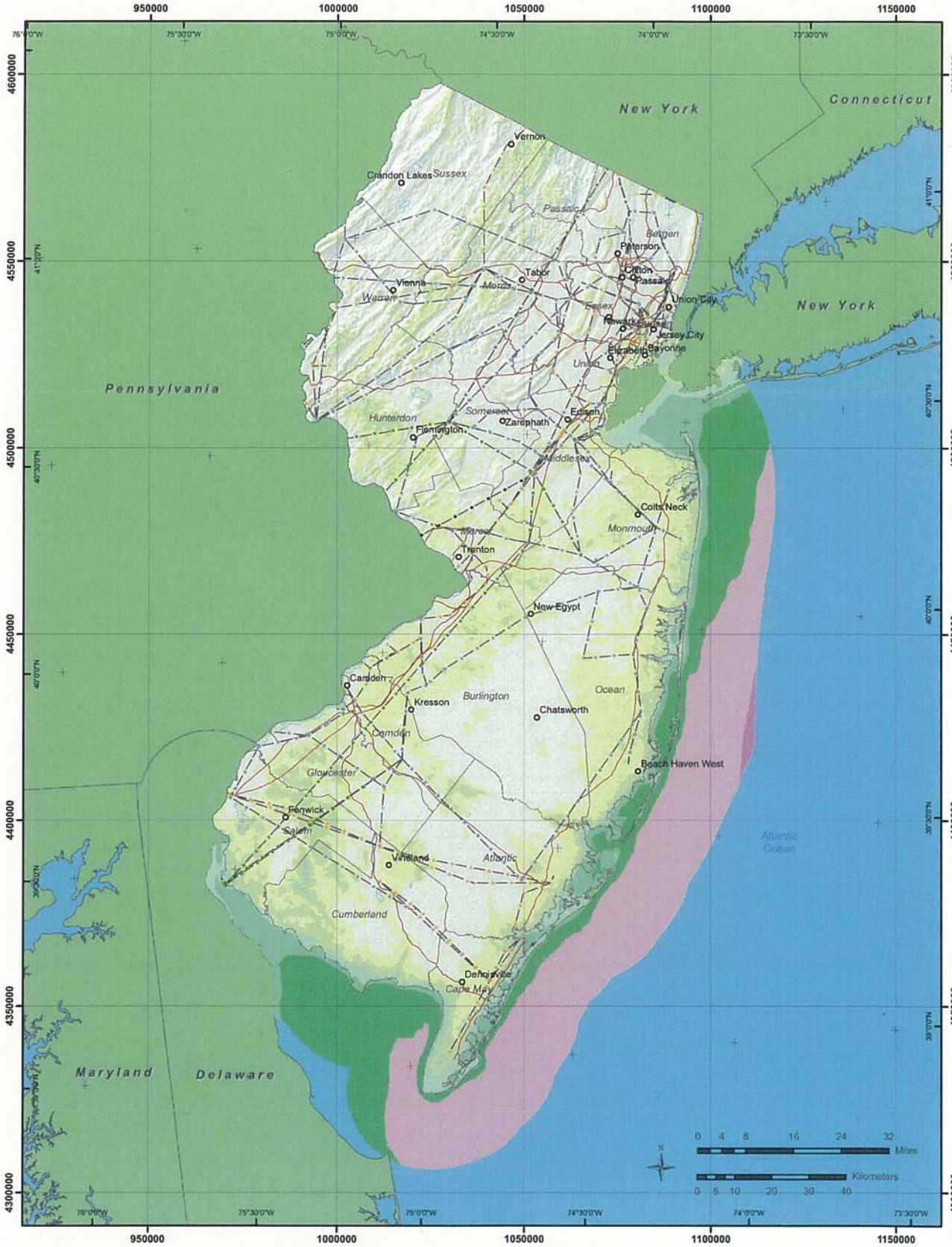
To accelerate the use of PV systems, many state and local governments offer financial incentives and programs. Go to http://www.nrel.gov/stateandlocal for more information.

Road
Aerial
Bird's eye
Labels
Traffic
Cypress Ave
Willow Ave
Hermann Rd
Hermann Rd

APPENDIX M

Wind


Road
Aerial
Bird's eye
Labels
Traffic
<<
Hermann Rd
North Brunswick
Hermann Rd
Cypress Ave
Willow Ave
Cedar Ave
Hermann Rd
Berdines
Corners
Rd



Wind Resource of New Jersey

Mean Annual Wind Speed at 30 Meters

Features
- City
- Interstate Highway
- County Boundary
- Water Body

Generalized Transmission Line

Category	
Under 100 kV	500 kV
100 kV-161 kV	735 kV +
230 kV-287 kV	Step-Up
345 kV	DC Line

Mean Speed at 30 m		
mph	m/s	
< 10.1	< 4.5	
10.1 - 11.2	4.5 - 5.0	
11.2 - 12.3	5.0 - 5.5	
12.3 - 13.4	5.5 - 6.0	
13.4 - 14.5	6.0 - 6.5	
14.5 - 15.7	6.5 - 7.0	
15.7 - 16.8	7.0 - 7.5	
16.8 - 17.9	7.5 - 8.0	
17.9 - 19.0	8.0 - 8.5	
> 19.0	> 8.5	

AWS Truewind

Projection: Tranverse Mercator,
UTM Zone 17 WGS84
Spatial Resolution of Wind Resource Data: 200m
This map was created by AWS Truewind using the MesoMap system and historical weather data. Although it is believed to represent an accurate overall picture of the wind energy resource, estimates at any location should be confirmed by measurement.

The transmission line information was obtained by AWS Truewind from the Global Energy Decisions Velocity Suite. AWS does not warrant the accuracy of the transmission line information.

AWS Truewind, LCC

APPENDIX N

EPA Portfolio Manager

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
North Brunswick Municipal Building

Building ID: 1907049
For 12-month Period Ending: December 31, 2008[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: October 22, 2009

Facility
North Brunswick Municipal Building
710 Herman Road
North Brunswick, NJ 08902

Facility Owner
Township of North Brunswick
710 Herman Road
North Brunswick, NJ 08902

Primary Contact for this Facility
Harry Rossmann
710 Herman Road
North Brunswick, NJ 08902

Year Built: 1991
Gross Floor Area (ft²): 86,460

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

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	4,954,224
Natural Gas (kBtu)[4]	4,132,700
Total Energy (kBtu)	9,086,924
Energy Intensity[5]	
Site (kBtu/ft²/yr)	105
Source (kBtu/ft²/yr)	241
Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	974
Electric Distribution Utility	
PSE&G - Public Service Elec & Gas Co	
National Average Comparison	
National Average Site EUI	90
National Average Source EUI	189
% Difference from National Average Source EUI	28%
Building Type	Public Order and Safety

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.

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

ENERGY STAR® Data Checklist for Commercial Buildings

In order for a building to qualify for the ENERGY STAR, a Professional Engineer (PE) must validate the accuracy of the data underlying the building's energy performance rating. This checklist is designed to provide an at-a-glance summary of a property's physical and operating characteristics, as well as its total energy consumption, to assist the PE in double-checking the information that the building owner or operator has entered into Portfolio Manager.

Please complete and sign this checklist and include it with the stamped, signed Statement of Energy Performance.
NOTE: You must check each box to indicate that each value is correct, OR include a note.

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☑
Building Name	North Brunswick Municipal Building	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	Public Order and Safety	Is this an accurate description of the space in question?		☐
Location	710 Herman Road, North Brunswick, NJ 08902	Is this address accurate and complete? Correct weather normalization requires an accurate zip code.		☐
Single Structure	Single Facility	Does this SEP represent a single structure? SEPs cannot be submitted for multiple-building campuses (with the exception of acute care or children's hospitals) nor can they be submitted as representing only a portion of a building		☐

Municipal Building (Other)

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☑
Gross Floor Area	86,460 Sq. Ft.	Does this square footage include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, atria, vent shafts, etc. Also note that existing atriums should only include the base floor area that it occupies. Interstitial (plenum) space between floors should not be included in the total. Finally gross floor area is not the same as leasable space. Leasable space is a subset of gross floor area.		☐
Number of PCs	65 (Optional)	Is this the number of personal computers in the space?		☐
Weekly operating hours	85 Hours(Optional)	Is this the total number of hours per week that the space is 75% occupied? This number should exclude hours when the facility is occupied only by maintenance, security, or other support personnel. For facilities with a schedule that varies during the year, "operating hours/week" refers to the total weekly hours for the schedule most often followed.		☐
Workers on Main Shift	90 (Optional)	Is this the number of employees present during the main shift? Note this is not the total number of employees or visitors who are in a building during an entire 24 hour period. For example, if there are two daily 8 hour shifts of 100 workers each, the Workers on Main Shift value is 100.		☐

ENERGY STAR® Data Checklist for Commercial Buildings

Energy Consumption

Power Generation Plant or Distribution Utility: PSE&G - Public Service Elec & Gas Co

Fuel Type: Electricity

Meter: Electric Meter (kWh (thousand Watt-hours))
Space(s): Entire Facility
Generation Method: Grid Purchase

Start Date	End Date	Energy Use (kWh (thousand Watt-hours))
12/01/2008	12/31/2008	147,400.00
11/01/2008	11/30/2008	97,600.00
10/01/2008	10/31/2008	116,200.00
09/01/2008	09/30/2008	86,600.00
08/01/2008	08/31/2008	199,600.00
07/01/2008	07/31/2008	160,000.00
06/01/2008	06/30/2008	150,400.00
05/01/2008	05/31/2008	110,400.00
04/01/2008	04/30/2008	102,800.00
03/01/2008	03/31/2008	87,600.00
02/01/2008	02/29/2008	97,600.00
01/01/2008	01/31/2008	95,800.00
Electric Meter Consumption (kWh (thousand Watt-hours))		**1,452,000.00**
Electric Meter Consumption (kBtu (thousand Btu))		**4,954,224.00**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		**4,954,224.00**
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?		☐

Fuel Type: Natural Gas

Meter: Natural Gas (therms)
Space(s): Entire Facility

Start Date	End Date	Energy Use (therms)
12/01/2008	12/31/2008	5,218.00
11/01/2008	11/30/2008	3,379.00
10/01/2008	10/31/2008	2,483.00
09/01/2008	09/30/2008	2,158.00
08/01/2008	08/31/2008	1,927.00
07/01/2008	07/31/2008	1,746.00
06/01/2008	06/30/2008	2,049.00
05/01/2008	05/31/2008	2,602.00
04/01/2008	04/30/2008	3,152.00
03/01/2008	03/31/2008	4,505.00

02/01/2008	02/29/2008	6,348.00
01/01/2008	01/31/2008	5,760.00
Natural Gas Consumption (therms)		**41,327.00**
Natural Gas Consumption (kBtu (thousand Btu))		**4,132,700.00**
Total Natural Gas Consumption (kBtu (thousand Btu))		**4,132,700.00**
Is this the total Natural Gas consumption at this building including all Natural Gas meters?		☐

Additional Fuels	
Do the fuel consumption totals shown above represent the total energy use of this building? Please confirm there are no additional fuels (district energy, generator fuel oil) used in this facility.	☐

On-Site Solar and Wind Energy	
Do the fuel consumption totals shown above include all on-site solar and/or wind power located at your facility? Please confirm that no on-site solar or wind installations have been omitted from this list. All on-site systems must be reported.	☐

Certifying Professional

(When applying for the ENERGY STAR, the Certifying Professional must be the same as the PE that signed and stamped the SEP.)

Name: _____ Date: _____

Signature: _____

Signature is required when applying for the ENERGY STAR.

FOR YOUR RECORDS ONLY. DO NOT SUBMIT TO EPA.

Please keep this Facility Summary for your own records; do not submit it to EPA. Only the Statement of Energy Performance (SEP), Data Checklist and Letter of Agreement need to be submitted to EPA when applying for the ENERGY STAR.

Facility
North Brunswick Municipal Building
710 Herman Road
North Brunswick, NJ 08902

Facility Owner
Township of North Brunswick
710 Herman Road
North Brunswick, NJ 08902

Primary Contact for this Facility
Harry Rossmann
710 Herman Road
North Brunswick, NJ 08902

General Information

North Brunswick Municipal Building	
Gross Floor Area Excluding Parking: (ft²)	86,460
Year Built	1991
For 12-month Evaluation Period Ending Date:	December 31, 2008

Facility Space Use Summary

Municipal Building	
Space Type	Other - Public Order and Safety
Gross Floor Area(ft²)	86,460
Number of PCs°	65
Weekly operating hours°	85
Workers on Main Shift°	90

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 12/31/2008)	**Baseline** (Ending Date 12/31/2008)	**Rating of 75**	**Target**	**National Average**
Energy Performance Rating	N/A	N/A	75	N/A	N/A
Energy Intensity					
Site (kBtu/ft²)	105	105	0	N/A	90
Source (kBtu/ft²)	241	241	0	N/A	189
Energy Cost					
$/year	$ 277,953.00	$ 277,953.00	N/A	N/A	$ 238,018.74
$/ft²/year	$ 3.21	$ 3.21	N/A	N/A	$ 2.75
Greenhouse Gas Emissions					
$MtCO_2e$/year	974	974	0	N/A	834
$kgCO_2e$/ft²/year	11	11	0	N/A	9

More than 50% of your building is defined as Public Order and Safety. This building is currently ineligible for a rating. Please note the National Average column represents the CBECS national average data for Public Order and Safety. This building uses X% less energy per square foot than the CBECS national average for Public Order and Safety.

Notes:
o - This attribute is optional.
d - A default value has been supplied by Portfolio Manager.

APPENDIX O

Equipment Inventory

New Jersey BPU Energy Audit Program
CHA #20418
Township of North Brunswick
Equipment Inventory - Municipal Building

Description	Manufacturer Name	Model No.	Equipment Type	Capacity/Size	Location	Areas Served	Date Installed	Useable Life Expectancy	Other Info.
Boilers	Hydro Therm	MR900B (S/N R-2009-2948)	Hot Water Heating Boiler	3 sections at 300 MBH input (each)	Basement Mech. Room	Entire Building	1992	20 Years	Natural Gas fired
Boilers	Hydro Therm	MR900B (S/N R-2009-2949)	Hot Water Heating Boiler	3 sections at 300 MBH input (each)	Basement Mech. Room	Entire Building	1992	20 Years	Natural Gas fired
Boilers	Hydro Therm	MR600B (S/N R-2009-2856)	Hot Water Heating Boiler	2 sections at 300 MBH input (each)	Basement Mech. Room	Domestic Hot Water (Standby)	1992	20 Years	Natural Gas fired. No longer in use. Replaced by solar DHW system
Chiller	McQuay Snyder-General	ALR075C (S/N 5WA0183700)	Chiller	75 ton	Outside, behind building		1992	20 Years	73 lbs R22 2 x 40 Hp compressors 8 x 1 Hp fans
Chiller	McQuay Snyder-General	ALR125C (S/N 5WA0185200)	Chiller	125 ton	Outside, behind building		1992	20 Years	141 lbs R22 4 x 35 Hp compressors 12 x 1 Hp fans
Modine Fluid Cooler	Marathon Electric (motor)	WM 215TTFL7726AP L	Cooling unit for generator diesel engine	10 Hp fan	Outside, behind building	Cooling for Diesel Generator	1992	20 Years	1740 RPM, Nominal Efficiency 86.5%
Air Handler #1	McQuay Snyder-General	LSL128DH (S/N 3WA00664-04)	Air Handler	13,500 CFM 15 HP Motor	Basement Mech. Room	Police Dept., jail and basement	1992	20 Years	Has VFD
Air Handler #2	McQuay Snyder-General	LSL128DH (S/N 3WA00665-04)	Air Handler	14,000 CFM 15 HP Motor	Basement Mech. Room	Basement, 1st floor on Municipal side	1992	20 Years	611.6 MBH chilled water coil
Air Handler #3	McQuay Snyder-General	LXF150DH (S/N 9WB05565-04)	Air Handler	25,000 CFM 30 HP Motor	3rd Fl. Mech. Room	Courtroom, hallways, council room, 2nd floor	1992	20 Years	550.1 MBH chilled water coil
Air Handler #4	McQuay Snyder-General	LSL117DH (S/N 3WB00074-04)	Air Handler	8,000 CFM 10 HP Motor	3rd Fl. Mech. Room (Police Side)	Police Dept.	1992	20 Years	817.6 MBH chilled water coil
Liebert Split System	Liebert	MME024E	Split System AC	2 ton	Roof	Police Dept. Server Room	1992	20 Years	286.6 MBH chilled water coil
Sanyo Split System	Sanyo	CH1822 (S/N 0006721)	Split System AC	16,000 Btu/hr	Outside, behind building	Police Dispatch	2002	20 Years	4.25 lbs R22
Mitsubishi Split System	Mitsubishi	PUY-A36NHA2 (S/N 84U00383C)	Split System AC	3 ton	Outside, behind building	Police Admin, offices, UPS	2002	20 Years	6 lbs R410A
UPS Power Backup	Liebert	40 KVA	Uninterruptible power supply	40 KVA	3rd Fl. Mech. Room (Police Side)	Network	1992	15 Years	
Hot Water Unit Heaters (3rd floor)	Sterling	HS-24	Wall Mount Hot Water Unit Heat	14.9 MBH	3rd Floor	3rd Floor Storage Room	1992	20 Years	Space heating for 3rd floor storage primarily for water pipes freeze protection
Emergency Generator	Caterpillar	GenSet 73406	Emergency Generator	350 kW	Basement Mech. Room	Police Dept., emergency lighting, elevator	1992		Cycles on 45 minutes per week. 614 gallon diesel tank.
3 Domestic Water Pumps w/ Motors	U.S. Electrical Motors	Unimount 125 H.E. Motor	Motor	5 Hp	Basement Mech. Room	Entire Building		20 Years	84% Efficiency Only turn on if pressure needed (very rare)
Solar Water Heater Storage Tank	Rheem / SolarHot	Solaraide 81VR120TC-1 (4500 W tank)	HW Heater/Tank	120 gallons	Basement Mech. Room	Entire Building	2008	20 Years	Storage for water heated by 4 solar panels on roof. (Electric backup)