KINGWOOD TOWNSHIP SCHOOL
ENERGY ASSESSMENT

for

NEW JERSEY
BUREAU OF PUBLIC UTILITIES

KINGWOOD TOWNSHIP SCHOOL

ENERGY ASSESSMENT

for

NEW JERSEY
BUREAU OF PUBLIC UTILITIES

CHA PROJECT NO. 19860

May 2009

Prepared by:

CLOUGH HARBOUR & ASSOCIATES LLP

2001 Route 46
Suite 107
Parsippany, NJ 07054

(973) 299-1100

TABLE OF CONTENTS

Page

APPENDICES

1.0 INTRODUCTION AND BACKROUND

Kingwood Township School (Kingwood) is a 67,519 square foot facility located in Frenchtown, New Jersey. The school houses kindergarten through 8th grade and was originally built in 1948. The original three room school house has been expanded five times to its current footprint. Expansions were conducted in the 1950s, 1970s, 1980, 1992, and 2004.

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.

This report shall cover the energy audit for Kingwood Township School.

2.0 EXECUTIVE SUMMARY

This report details the results of Kingwood Township School (Kingwood). The 67,519 square foot facility located in Frenchtown, New Jersey, consists of kindergarten through 8th grade. The following areas were evaluated for energy conservation measures:

- Lighting and lighting control upgrades
- Night setback/shutdown
- Variable speed drives
- Window replacement
- Direct Digital Control upgrades
- Boiler replacement
- Door replacement

Various potential Energy Conservation Measures (ECMs) were identified for the above categories. Potential annual savings of $49,200 for the recommended ECMs may be realized with a payback of 3.9 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 Pay for Performance Program. A summary of the costs, savings, and paybacks for the recommended ECMs follows:

ECM - 3 Install Hot Water Pump Variable Speed Drive

Budgetary Cost	Annual Utility Savings				Total Savings	Potential Incentive	Payback (without incentive)	Payback (with incentive)
	Electricity		#2 Oil	Total				
$	kW	kWh	gallons	$	$	$	Years	Years
15,000	0	13,000	0	1,800	1,800	2,300	8.1	6.8

ECM - 8 Install Occupancy Sensors and Lighting Replacements

Budgetary Cost	Annual Utility Savings				Total Savings	Potential Incentive	Payback (without incentive)	Payback (with incentive)
	Electricity		#2 Oil	Total				
$	kW	kWh	gallons	$	$	$	Years	Years
46,000	15	60,100	0	9,700	9,700	7,600	4.7	4.0

ECM-13 All ECMs Associated with DDC Upgrade (ECMs-2, 10, 11)

Budgetary Cost	Annual Utility Savings				Total Savings	Potential Incentive	Payback (without incentive)	Payback (with incentive)
	Electricity		#2 Oil	Total				
$	kW	kWh	gallons	$	$	$	Years	Years
198,300	0	101,800	7,300	37,700	37,700	36,700	5.3	4.3

Kingwood Township is also considering the rebuilding or the replacing of the windows in D wing due to their age and reoccurring maintenance issues. These ECMs are summarized below:

ECM – 5A Rebuild Windows in D Wing

Budgetary Cost	Annual Utility Savings				Total Savings	Potential Incentive	Payback (without incentive)	Payback (with incentive)
	Electricity		#2 Oil	Total				
$	kW	kWh	gallons	$	$	$	Years	Years
11,700	0	1,941	199	890	890	870	13.1	12.2

ECM – 5B Replace Windows in D Wing

Budgetary Cost	Annual Utility Savings				Total Savings	Potential Incentive	Payback (without incentive)	Payback (with incentive)
	Electricity		#2 Oil	Total				
$	kW	kWh	gallons	$	$	$	Years	Years
41,600	0	1,941	199	890	890	870	46.7	45.8

3.0 EXISTING CONDITIONS

3.1 Building - General

Kingwood Township School in Frenchtown, New Jersey is a 67,519 square foot facility for kindergarten through 8th grade. The three room school house was built in 1948 and has been expanded five times to its current footprint.

The normal hours of operation of the office are approximately ten hours per day, five days a week, with the exception of multi-use spaces such as the meeting room and gymnasium which are occupied into the evening hours. Classroom areas are occupied nine hours per day during the school year. There is some after hours use for special events.

The building exterior consists of face brick on a concrete masonry unit foundation. Each addition was designed to resemble the existing structure; however, wall heights vary in different parts of the building. The roof is a combination of built up, rubber membrane, and shingles.

The HVAC systems consist of unit ventilators (UVs) and rooftop units (RTUs). The main, business, and maintenance offices; science room; cafeteria; and gymnasium are served by rooftop units. Classrooms are served by unit ventilators, and hallways by cabinet heaters. Older UVs are wall-mounted under window sills with outside air dampers, and hot water coils; some have split system cooling coils with condensers located outside. Units installed after 2004 are Airedale vertical UVs consisting of a single return, ceiling duct system, outside air damper, direct expansion cooling coil, and hot water coil. These units have built-in condensing units.

Kingwood's direct digital control (DDC) system was installed in 2004 with a planned expansion. The DDC system returns building information to a central computer for staff to monitor and set parameters. The DDC system utilizes control schedules to automatically turn systems on and off depending on the time of day. Older areas of the building still employ pneumatic thermostats and control valves, and maintenance has noted that the controls are in poor condition with little or no actual control.

3.2 Utility Usage

The building uses electricity and #2 fuel oil. The town's natural gas lines end approximately one mile from the facility site. Natural gas line expansion is likely in the future; however, no timeline has been established. Water for boiler make up and potable uses is pumped from an onsite well. Sewage is decomposed through a Rotating Biological Contactor which is used to break down waste and return it to nearby storm water infrastructure.

All water-utilizing fixtures are low flow type and have recently been replaced.

Electricity is supplied and delivered by Jersey Central Power and Lighting. Oil is currently delivered by Allied Oil. In 2008, Kingwood had an annual electricity consumption of 677,500 kWh and oil usage of 24,800 gallons. Using 2008's annual utility average of $0.165 per kWh and $2.861 per gallon, Kingwood's annual utility cost was $171,600. Utility data is provided in Appendix A.

Future consideration should be given to the possibility of energy procurement for electrical commodity supply. Oil for the facility is already purchased through the Hunterdon Educational Services Commission. This organization is a consortium of many educational entities throughout the area and is able to obtain lower oil prices than possible by negotiating with individual suppliers.

Electricity commodity supply and delivery is presently purchased from the Jersey Central Power and Lighting Corporation, a totally owned subsidiary of the First Energy Corporation. The delivery component will always be the responsibility of the utility that connects the facility to the power grid; however, electrical commodity supply kWh can be purchased from a third party. The electricity commodity supply entity will require submission of 1 to 3 years of past energy bills. Contract terms can vary among suppliers. A list of approved electrical energy commodity suppliers can be found in Appendix A.

3.3 HVAC System

3.3.1 Hot Water Heating System

The facility's heat is provided by two Weil-McLain oil-fired boilers located in the basement's mechanical room, which are fired on a lead/lag schedule. The lead boiler alternates daily and is the primary source of heating hot water, the lag boiler runs as needed. The boilers are enabled at an outside air temperature below 65°F and run to maintain a boiler hot water temperature of 190°F. A hot water reset schedule is used along with a mixing valve to control the building's hot water loop. The mixing valve combines return water from the building loop and heated water from the boilers to control loop temperature. A hot water reset schedule will reduce the temperature of the hot water loop as the outside air temperature increases allowing better control of the building's temperature and comfort level. Two 15 HP hot water pumps operate on a lead/lag system alternating daily; the same as the boilers. Hot water is provided to heating coils in unit ventilators, cabinet heaters, and rooftop air handling units throughout the building. A separate 400 gallon oil-fired hot water heater is used for domestic hot water generation and storage.

3.3.2 Air Handling Systems

Kingwood utilizes several types of air handling systems for building ventilation. Rooftop units provide heating and cooling to the main, maintenance offices; science room; cafeteria; and gymnasium. No cooling is provided to the gymnasium or cafeteria. The business area is served with a split system unit. Unit ventilators (UVs) are the most common air handling system in the facility. All UVs are served with hot water from the boilers. Direct expansion split systems are installed in UVs to provide cooling. The age of the UVs varies widely throughout the building. Several new units are installed annually to upgrade the entire building. Older air handling units are controlled with pneumatic thermostats and valves; newer air handling units (AHUs) are part of the DDC system and use electronic actuators, valves, and thermostats for control.

3.4 Lighting/Electrical

Lighting is facilitated by a mixture of efficient T-8 fluorescent fixtures with electronic ballast and inefficient T-12 fixtures with magnetic ballasts. All observed locations have screw-in compact fluorescent lamps installed replacing the original incandescent bulbs. Some office areas and hallways utilize T-12 U-Tube fixtures with magnetic ballasts and T-8 U-Tube energy efficient fixtures. The gymnasium contains 24 high bay 400 watt metal halide fixtures. High efficiency LED exit signs are located throughout the facility.

The sections of the facility that were renovated or part of an addition utilize efficient lighting systems and lighting control strategies (occupancy sensors); older and non-renovated sections utilize inefficient fixtures without occupancy sensors.

Outdoor lighting consists of high pressure sodium and metal halide fixtures utilizing photo sensors which allow the fixtures to de-energize when the outside ambient light level meets the setpoint of the sensor and the fixtures shut off during daylight hours. Some outdoor lighting fixtures are controlled by timers.

3.5 Control System

A direct digital control (DDC) system is utilized in Kingwood. The DDC system returns building information to a central computer for staff to monitor and set parameters. This system allows for setpoint adjustment, real time monitoring, and has alarm capabilities. Based on building schedules used in the DDC system, the building is set to occupied mode at 6:30am and unoccupied mode at 4:30pm; the Business Unit Office’s split system is enabled until 6pm. Each year, upgraded AHUs modified by maintenance are connected to the DDC system. Connecting all units to the DDC system will allow the building to be entirely controlled from one central point. Approximately half of the building is controlled through the system while the other half uses local (in room) or pneumatic controls.

3.6 Baseline Energy Consumption

Due to the poor condition of some HVAC equipment, outside air to certain spaces is assumed to be significantly lower than current building code requires. This has the effect of lowering overall energy usage as the expense of required ventilation. In order to accurately model savings for the energy conservation measures (ECM), an adjusted baseline will be used, which will include the proper amount of ventilation for all spaces. The adjusted baseline will increase energy consumption for the facility but will accurately reflect the building’s energy use is the ventilation systems were operating properly.

Kingwood must fix the deficient equipment before they can realize the savings in the report.

3.7 Thermal Scans

A thermal scan of the building was completed using an infrared camera. The scan was performed on a morning when the outdoor air temperature was approximately 40°F. Taking infrared images in the early morning increases the temperature differences between well and poorly insulated areas and eliminates the effects of solar radiation. The same photos of the building were also taken with a standard digital camera during daylight hours. All photos are included in Appendix B as a side by side comparison. The heat loss as a result of inadequate door seals, windows, and improper installation are evident.

4.0 ENERGY CONSERVATION MEASURES

4.1 ECM-1 Schedule Night Setback

Kingwood utilizes a DDC system, which enables setpoint adjustment and real time monitoring, and has alarm capabilities. While the DDC system is well maintained and utilized, not all systems in the facility are controlled with the DDC. The systems not connected are manually controlled by the faculty or by inefficient pneumatic controls. Night setback is a method of control that schedules systems to reduce or increase the setpoints of the area when unoccupied. Some areas on the DDC system on currently utilizing night setback. It is proposed that all systems be connected to the DDC system and the night setback temperature be set to 58 F in the winter and 80F in the summer.

In order to project savings for this measure, a block load building model was created to approximate the existing energy load for the building. The block load, provided in Appendix C, models the maximum overall heating and cooling loads for the space, taking into account various parameters such as roof, wall, and window construction, total envelope surface area, ventilation loads, building occupancy, internal heat generation, and other sources of heat gain and loss. By entering this calculated maximum load into a spreadsheet containing BIN temperature data for Newark, New Jersey, the total accumulated year-round heating and cooling loads are determined. (BIN data is yearly temperature data organized in 5 degree increments or BINs.) The BIN temperature model is included in Appendix C.

To determine the proposed energy savings if setback temperatures and decreased occupied hours are scheduled, a second bin temperature spreadsheet was created for the new accumulated building load. This spreadsheet is identical to the existing usage spreadsheet except the heating and cooling unoccupied temperatures are modified. Some of the building is currently setback to 62ºF during the heating season while other parts, not on the DDC system, are not setback. The average is 66ºF. The proposed heating setback is 58ºF. For cooling, some of the building is setback to 80ºF but some parts are not. The average cooling setback is 77ºF. It is proposed that all systems be setback to 80ºF. The difference in fuel oil consumption, cooling energy, and fan energy between the two models is taken as the savings.

Performing night setback would result in cooling savings of 17,600 kWh per year and a heating savings of 5,700 gallons of oil.

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

ECM - 1 Schedule Night Setback

Budgetary Cost	Annual Utility Savings				Total Savings	Potential Incentive	Payback (without incentive)	Payback (with incentive)
	Electricity		#2 Oil	Total				
$	kW	kWh	gallons	$	$	$	Years	Years
151,100	0	16,300	5,500	18,600	18,600	16,900	8.1	7.2

This measure is not recommended in lieu of ECM-2.

4.2 ECM-2 Schedule Night Setback and Shutdown

Night shutdown schedules systems to turn off during unoccupied times, and will maintain a reduced setpoint similar to night setback; however, systems will be turned off once setpoint is met. Maintaining a reduced setpoint will generate savings and reduce warm up in the early hours of occupied times. Scheduling night shutdown will allow areas not currently controlled by the DDC system to reduce energy consumption during unoccupied times.

To project savings, a block load building model was created to approximate the existing energy load for the building. The block load, provided in Appendix B, models the maximum overall heating and cooling loads for the space. Various parameters such as roof, wall, and window construction, total envelope surface area, ventilation loads, building occupancy, internal heat generation, and other sources of heat gain and loss are considered. By entering this calculated maximum load into a spreadsheet containing bin temperature data for New Jersey, the total accumulated year-round heating and cooling loads are determined. The bin temperature spreadsheet is included in Appendix B.

To determine the proposed energy savings if night setback and shutdown are scheduled, a second bin temperature spreadsheet was created containing existing building loads. The heating and cooling setback temperatures were modified as discussed in Section 4.1 for Night Setback.

Performing night setback and shutdown would result in an annual savings of 4,600 gallons of oil and 105,000 kWh of electricity per year.

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

ECM - 2 Schedule Night Setback and Shutdown

Budgetary Cost	Annual Utility Savings				Total Savings	Potential Incentive	Payback (without incentive)	Payback (with incentive)
	Electricity		#2 Oil	Total				
$	kW	kWh	gallons	$	$	$	Years	Years
151,100	0	103,900	4,400	29,800	29,800	29,800	5.1	4.1

This measure is recommended.

4.3 ECM-3 Install Hot Water Pump Variable Speed Drive

To provide building heating, two hot water pumps run at constant speed, regardless of necessary load. Each pump is 15 HP and operates on an alternating run system which changes the operating pump daily. Variable speed drives (VSDs) will allow the pump speed to slow to match the necessary heating load. The motor speed will be dictated by a pressure sensor in the supply line, and line pressure regulated by individual space setpoints. As temperature setpoint is met, individual space control valves located in each space will close, increasing the differential pressure in the hot water piping. The VSD will reduce the pump motor speed to maintain a loop pressure setpoint. VSDs require utilization of inverter duty rated motors to reduce motor speed safely and efficiently. The two existing pump motors are high efficiency and inverter duty rated and do not require replacement if a VSD is used.

Projected savings were calculated by determining the difference between the existing annual power consumption and proposed annual power consumption for pumps on VSDs. The proposed case was determined by using bin calculations to ramp the motor speed between 50% when the outside air temperature is at the building balance temperature, and 100% when outside air temperature is that of a design heating day.

Calculations determined that installing two VSDs, one on each hot water pump will save a projected 13,000 kWh annually. Cost calculations assume all units contain two way valves for use with VSDs.

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

ECM - 3 Install Hot Water Pump Variable Speed Drive

Budgetary Cost	Annual Utility Savings				Total Savings	Potential Incentive	Payback (without incentive)	Payback (with incentive)
	Electricity		#2 Oil	Total				
$	kW	kWh	gallons	$	$	$	Years	Years
15,000	0	13,000	0	1,800	1,800	2,300	8.1	6.8

This measure is recommended.

4.4 ECM-4 Replace Doors and Install Door Seals

Kingwood has added several expansions over the years to accommodate the increasing student population. Each addition marked the start of a lifecycle for air handling systems, windows, and doors. Most of these are original to the addition and present an energy loss. In particular, Kingwood's exterior doors have noticeable leaks which not only allow energy to escape but also generate uncomfortable drafts. The facility manager has been diligently replacing these doors as the budget allows; however, they are deteriorating at a faster rate than they can be replaced. Door seals can reduce infiltration if a door is positioned properly; however, because the doors at Kingwood are misaligned in places, door seals alone are not a viable option. This ECM will replace all existing doors that have not been replaced in the past 10 years as well as install door seals on all doors. This includes the pair of exit doors by the courtyard and the exterior doors in C-Hall.

This energy conservation measure assumes that the installation of new door and seals will reduce the total current door air infiltration by 80%, from approximately 380 CFM to 78 CFM. Weather bin data was used to determine heating hours and cooling hours and subsequent oil and electricity losses. The addition of door seals will reduce unnecessary air infiltration by an estimated 400 gallons of oil and 1,600 kWh annually.

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

ECM - 4 Replace Doors and Install Door Seals

Budgetary Cost	Annual Utility Savings				Total Savings	Potential Incentive	Payback (without incentive)	Payback (with incentive)
	Electricity		#2 Oil	Total				
$	kW	kWh	gallons	$	$	$	Years	Years
50,100	0	1,600	400	1,400	1,400	1,300	>30	>30

This measure is not recommended based on energy savings alone.

4.5 ECM-5 Rebuild Windows

Window seals throughout the building show signs of deterioration. Outside air infiltration is a result of the windows' condition and generates an energy loss. During the several times the building was expanded, different windows were installed. This results in a mix of sizes, shapes, and age of most windows throughout the facility. The frames all appear to be in good condition and a price quote was provided to Kingwood by an outside vendor to rebuild each window bay, to include the following:

- Exterior
  - Remove Mullion Cover
  - Install Insulation
  - Install Mullion Cover
  - Silicone Mullion Cover
  - Polyurethane Perimeter
- Interior
  - Polyurethane Perimeter
  - Install Weather-Stripping to Vents

Projected savings were calculated by comparing energy losses from existing windows to proposed windows. The existing condition was determined using current U-values for the windows along with window area and estimated infiltration. To determine the proposed conditions, all factors remain the same except infiltration rates are reduced.

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

ECM - 5 Rebuild Windows

Budgetary Cost	Annual Utility Savings				Total Savings	Potential Incentive	Payback (without incentive)	Payback (with incentive)
	Electricity		#2 Oil	Total				
$	kW	kWh	gallons	$	$	$	Years	Years
93,600	0	15,600	1,600	7,300	7,300	7,000	12.9	11.9

This measure is not recommended based on energy savings alone.

Kingwood School was also interested in seeing the payback for replacing the windows in D Wing with new windows (ECM-5B) versus rebuilding the windows in D Wing (ECM-5A). This wing has a total of 54 windows. The budgetary cost was for new windows was obtained from RS Means 2008 Building Construction Cost Data for an 8'x4' window, aluminum frame, insulated double pane glass with glazing, commercial grade window. New window unit price is $770 including overhead and profit. The existing windows are already double paned and replacing them in kind would not alter the energy savings already calculated by reducing air infiltration. Energy savings for the D wing window replacement or the D wing window rebuild would be proportional to the total building savings.

The implementation cost and savings related to these ECMs are summarized below:

ECM – 5A Rebuild Windows in D Wing

Budgetary Cost	Annual Utility Savings				Total Savings	Potential Incentive	Payback (without incentive)	Payback (with incentive)
	Electricity		#2 Oil	Total				
$	kW	kWh	gallons	$	$	$	Years	Years
11,700	0	1,941	199	890	890	870	13.1	12.2

ECM – 5B Replace Windows in D Wing

Budgetary Cost	Annual Utility Savings				Total Savings	Potential Incentive	Payback (without incentive)	Payback (with incentive)
	Electricity		#2 Oil	Total				
$	kW	kWh	gallons	$	$	$	Years	Years
41,600	0	1,941	199	890	890	870	46.7	45.8

These measures are not recommended based on energy savings alone. Kingwood Township is interested in upgrading windows in D wing due to their age and reoccurring maintenance issues.

4.6 ECM-6 Install Occupancy Sensors

It is proposed that occupancy sensors be installed in selected rooms to turn off the lights when the area is unoccupied. A lighting survey was conducted of all fixtures to determine the average time lights are presently on in each space, and analysis performed to determine the benefits of utilizing occupancy sensors to turn off lighting while the space is unoccupied. Occupancy sensors were not considered in mechanical areas due to safety concerns. Other areas were also not considered due to the proposed location of the occupancy sensor. If a sensor does not have a clear view of the room, it may darken even with people in the space, creating an unsafe condition. Low use areas were also not considered due to the long payback of a sensor installation.

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

ECM - 6 Install Occupancy Sensors

Budgetary Cost	Annual Utility Savings				Total Savings	Potential Incentive	Payback (without incentive)	Payback (with incentive)
	Electricity		#2 Oil	Total				
$	kW	kWh	gallons	$	$	$	Years	Years
6,100	0	29,000	0	4,100	4,100	800	1.5	1.3

This measure is not recommended in lieu of ECM-8.

4.7 ECM-7 Lighting Replacements

A comprehensive fixture survey was conducted of the entire building. Each switch and circuit was identified, and the number of fixtures, locations, and existing wattage established. The existing base case lighting energy consumption was calculated and compared to the proposed lighting replacements. The lighting in the areas of the facility that have been renovated contain T-8 lamps with electronic ballasts and compact fluorescent lamps, which are regarded as efficient by today's standards. The nonrenovated portion of the facility's lighting consists of T-12 fixtures with magnetic ballasts. Existing exit signs presently utilize high efficiency LED technology and all original incandescent lighting has been replaced with efficient compact fluorescent fixtures.

The following lighting upgrades were also considered where appropriate:

- T-12 34-watt 2 & 4 lamp with magnetic ballast retrofitted to T-8 28-watt lamps and electronic ballasts
- T-12 20–watt 1 & 2 lamp fixtures with magnetic ballast retrofitted to T-8 17-watt lamps and electronic ballasts
- 2' x 2' U-Tube 34 watt 2 lamp fixtures with magnetic ballast retrofitted to 2' 17-W 2 lamp fixtures with a reflector kit
- 400 watt metal halide high bay fixtures in the gymnasium replaced with new energy efficient high output T-5 (5) lamp fixtures with electronic ballasts

The above measures will allow the facility to stock only T-8 fixtures in the future, with the exception of the gymnasium. Presently, the facility has a mixture of T-12 and T-8 lamps with numerous ballast combinations. Maintenance staff must identify what lamp or ballast type to retrieve before the proper lamp and ballast can be installed. In the future, the facility should only purchase low wattage super T-8 lamps and ballasts such as the low wattage 4' 28 watt units. These lamps may be directly installed into any existing 32 watt fixture when lamps fail. By installing these lamps, over time the most efficient lighting system available will be consistent throughout the facility.

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

ECM - 7 Lighting Replacements

Budgetary Cost	Annual Utility Savings				Total Savings	Potential Incentive	Payback (without incentive)	Payback (with incentive)
	Electricity		#2 Oil	Total				
$	kW	kWh	gallons	$	$	$	Years	Years
40,000	15	40,800	0	6,900	6,900	6,900	5.8	4.8

This measure is not recommended in lieu of ECM-8.

Maintenance staff requested CHA perform calculations for a proposed lighting fixture replacement for the gymnasium area. The cost for this retrofit was provided by PB Lighting Design on October 25, 2008.

The implementation cost and savings related to the proposed gymnasium fixture replacement presented in Appendix I and summarized below:

ECM - 7a Lighting Replacements – Gymnasium

Budgetary Cost	Annual Utility Savings				Total Savings	Potential Incentive	Payback (without incentive)	Payback (with incentive)
	Electricity		#2 Oil	Total				
$	kW	kWh	gallons	$	$	$	Years	Years
7,200	4	13,000	0	2,100	2,100	0	3.4	3.4

This measure is not recommended as it is already included in ECM-8.

4.8 ECM-8 Install Occupancy Sensors and Lighting Replacements

This measure is a combination of ECMs 6, 7, and 7a to allow for maximum energy and demand reduction. Due to interactive effects, the energy and cost savings for occupancy sensors and lighting upgrades are not cumulative. Presently the facility has numerous fixtures with that contain T-8, T-12 lamps with magnetic and electric ballasts. To increase reliability and ease of maintenance the staff responsible for has requested that all fixtures with the older technology be upgraded so they have common T-8 lamps with electronic ballasts throughout the facility, with the exception of the gymnasium. In combination with the above measures the facility should consider stocking low wattage super low wattage 28-Watt T-8s 4 foot lamps to replace the existing 32-Watt lamps when they fail. These lamps can be installed in the existing efficient T-8 electronic ballasted fixtures and will increase energy efficiency of the system.

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

ECM - 8 Install Occupancy Sensors and Lighting Replacements

Budgetary Cost	Annual Utility Savings				Total Savings	Potential Incentive	Payback (without incentive)	Payback (with incentive)
	Electricity		#2 Oil	Total				
$	kW	kWh	Gallons	$	$	$	Years	Years
46,000	15	60,100	0	9,700	9,700	7,600	4.7	4.0

This measure is recommended.

4.9 ECM-9 Condensing Natural Gas Boiler Upgrade

Kingwood utilizes two #2 fuel oil-fired hot water boilers for building heat. The boilers are operated on an alternating lead/lag system which changes daily. They were installed with the facility renovations in 2004. The boilers operate to maintain 190°F and a mixing valve controls the building hot water loop at 140°F. It is understood that there is currently no access to natural gas; however, it was noted that it may in the future be available to the school. Natural gas is a cleaner burning fuel and current technology also makes natural gas a more efficient method when utilizing condensing boilers. Condensing boilers extract a higher amount of energy from combustion gases before leaving the boiler. This ECM identifies savings associated with installation of a condensing natural gas boiler for building heat.

Savings were calculated from the required quantities of fuel oil compared to the required quantity of natural gas to produce the same amount of heat. An average fuel oil and natural gas boiler have an efficiency of 80% and 90%, respectively. BTUs consumed per year were calculated with the corresponding efficiency for an oil burning boiler. This quantity of BTUs was then converted to therms of natural gas, also with the corresponding boiler efficiency. The calculated quantity of natural gas was then converted to gallons. The difference is taken as the savings.

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

ECM - 9 Condensing Natural Gas Boiler Upgrade

Budgetary Cost	Annual Utility Savings				Total Savings	Potential Incentive	Payback (without incentive)	Payback (with incentive)
	Electricity		#2 Oil	Total				
$	kW	kWh	gallons	$	$	$	Years	Years
182,700	0	0	34,200	45,600	45,600	9,600	4.0	3.8

This measure is recommended when natural gas becomes available.

4.10 ECM-10 Install Demand Control Ventilation

Due to the deteriorated condition of the HVAC equipment, various areas of the building may not meet the minimum ventilation required by building code, while other areas are overventilated.

A viable 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 open and allow additional fresh air into the building. By controlling the ventilation based on occupancy, savings of oil and electricity can be achieved.

To determine savings, the current outside air CFM was determined as well as the ventilation required to match the average building occupancy. The current building ventilation rates were determined from design drawings. Hourly weather bin data for heating and cooling periods along with current building setpoints were used to determine required building ventilation for average occupancy. The derated building CFM used for DCV is 33% of the building maximum.

The cost for this ECM was developed assuming ECM-2 has been implemented and all equipment is controlled by the DDC system. The budgetary cost shown is for the incremental costs above those required for ECM-2.

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

ECM - 10 Install Demand Control Ventilation

Budgetary Cost	Annual Utility Savings				Total Savings	Available Incentive	Payback (without incentive)	Payback (with incentive)
	Electricity		#2 Oil	Total				
$	kW	kWh	gallons	$	$	$	Years	Years
50,000	0	5,000	2,900	9,100	9,100	8,200	5.5	4.6

This measure is not recommended in lieu of ECM-13.

4.11 ECM-11 Unit Ventilator Repair

Kingwood does not have a central air handling system. Six rooftop units and multiple unit ventilators serve spaces throughout the building. As expansions to the building were constructed, unit ventilators were placed in appropriate spaces to heat, cool, and bring in outside air. Many units are past their useful life (approximately 15 years) and running inefficiently on the building's old pneumatic control system. While maintenance staff has been rebuilding several units a year, many units are still in need of repair. It was observed that due to nonfunctioning pneumatic actuators, outside air is not reaching some of the spaces. Repairing the malfunctioning unit ventilators will allow for an economizer mode to be used. An economizer will circulate outside air into the space when outside air temperatures are sufficiently low and cooling in the building is required.

Savings for this ECM are generated using the existing building energy consumption data and weather bin data. The existing consumption includes cooling between the building balance temperatures and cooling occupied setpoint. This energy consumption is removed and taken as savings.

This measure will increase outside air to the spaces during normal operation, indoor air quality, and occupant comfort. Utility costs will also rise due to the increase in conditioned air.

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

ECM-11 Unit Ventilator Repair

Budgetary Cost	Annual Utility Savings				Total Savings	Available Incentive	Payback (without incentive)	Payback (with incentive)
	Electricity		#2 Oil	Total				
$	kW	kWh	gallons	$	$	$	Years	Years
128,000	0	10,800	0	1,800	1,800	2,000	>30	>30

This measure is not recommended on energy savings alone. However, consideration should be based on corrective maintenance and ventilation code requirements.

4.12 ECM-12 Increase Roof Insulation

The roof at Kingwood is a combination of shingles, built up roofing, and rubber membrane. Current drawings show approximately 3 inches of insulation which results in excessive energy loss during the winter months. Generally, in the older sections of the building, only a few inches of insulation were installed. This is a contributing factor to the high utility costs.

This ECM proposes to increase the thickness of the existing insulation by 3 inches, effectively reducing heat loss and infiltration through the roof. This ECM does not consider the cost of roof replacement which would be required. The cost estimate is the additional cost of the insulation if a roof replacement is undertaken.

Savings from increasing roof insulation was calculated by increasing the U-value, or insulation value, of the roof line. The current U-value included 3 inches of insulation and a steel deck. The proposed insulation includes the addition of 3 inches of extruded polystyrene. A proposed savings of 2,300 gallons of oil and 500 kWh from cooling can be achieved with additional roof insulation.

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

ECM-12 Increase Roof Insulation

Budgetary Cost	Annual Utility Savings				Total Savings	Available Incentive	Payback (without incentive)	Payback (with incentive)
	Electricity		#2 Oil	Total				
$	kW	kWh	gallons	$	$	$	Years	Years
172,500	0	500	2,300	6,600	6,600	5,800	>25	>25

This measure is not recommended

4.13 ECM-13 All ECMs Associated with DDC Upgrade

Kingwood's DDC system controls approximately 60% of the facility's air HVAC systems. To control the entire building from a central computer, a system upgrade is required. The upgrade would include the addition of controls to unit ventilators, exhaust fans, and rooftop units that are not currently controlled by the DDC system. A complete system upgrade will allow ECM-2 Schedule Night Setback and Shutdown, ECM-10 Install Demand Control Ventilation, and ECM-11 Unit Ventilator Repair to be combined into one ECM and share the construction costs with multiple sources of savings.

It is recommended that a complete controls upgrade be installed to take advantage of multiple energy conservation measures available. Savings will be reduced and paybacks increased if full system upgrade is not completely installed or programmed for all ECMs.

Savings for this ECM were calculated by the addition of each individual ECMs savings.

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

ECM-13 All ECMs Associated with DDC Upgrade (ECMs-2, 10, 11)

Budgetary Cost	Annual Utility Savings				Total Savings	Available Incentive	Payback (without incentive)	Payback (with incentive)
	Electricity		#2 Oil	Total				
$	kW	kWh	gallons	$	$	$	Years	Years
198,300	0	101,800	7,300	37,700	37,700	36,700	5.3	4.3

This measure is recommended.

4.14 Potential Incentives

The Kingwood energy conservation project may be eligible for numerous incentives from the New Jersey Office of Clean Energy. The most significant incentives may be through 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). Kingwood over the period from July 2007 to February 2009 had an average electric demand of 203 kW. Facilities that meet this criterion must also achieve a minimum performance target of 15% energy reduction which would need to be demonstrated 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. Incentives for this program include the following:

- Incentive #1: The P4P Program pays $0.10 per square foot to a maximum of $50,000 or 50% 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.

Lighting energy reduction incentives were calculated utilizing the New Jersey SmartStart Building prescriptive lighting measures and incentive program. This program provides incentives dependent upon the existing fixture type and proposed lighting retrofit measure. Prescriptive lighting incentives were utilized for this report to show savings and incentives that would be received if only lighting implementation was selected. If Kingwood qualifies and enters into the New Jersey Pay for Performance Program, lighting savings will be included in total building energy usage and savings. Applicants cannot apply for both programs for the same project.

5.0 ALTERNATIVE ENERGY SCREENING EVALUATION

5.1 Geothermal

Geothermal heat pumps 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 geothermal heat pump systems, water is circulated between the building and the ground-loop piping buried in the ground. In the summer, the water picks up heat from the building and moves it to the ground. In the winter, the water picks up heat from the ground and moves it to the building. Heat pumps facilitate collection and transfer of the heat to and from the building.

Kingwood is positioned over an area containing bedrock, which will not be conducive to boring operations required to install a ground source geothermal heat pump loop. The facility also has limited ability to transfer thermal energy from the ground to the existing systems used to heat and cool the conditioned space during the summer months.

This measure is not recommended due to the issues associated with installing a geothermal system in bedrock.

5.2 Solar

5.2.1 Photovoltaic Rooftop Solar Power Generation

Kingwood 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 roof of Kingwood has sufficient room to install a large solar cell array in numerous areas. The flat roof of the gymnasium or the 2004 addition would be feasible locations for installation due to minimum rooftop obstructions such as rooftop units and dome exhaust fans.

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. PVWAT solar power generation model is provided in Appendix P.

The State of New Jersey incentives for non residential solar 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. Kingwood does 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 SREC 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. R R 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. R R Renewable Energy Consultants estimated an average of $487/ SREC per year and this number was utilized in the cash flow for this report.

Kingwood had a maximum kW demand of 253 kW and a minimum kW of 146 kW over the previous year. The monthly average over the year observed was 203 kW. The facility's existing load should 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 increase 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		#2 Oil	Total					
$	kW	kWh	gallons	$	$	$	$	Years	Years
500,000	0	59,150	0	8,281	8281	50,000	28,786	>30	12.1

*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 is a potentially viable renewable measure that Kingwood may want to consider investigating further. However, due to asbestos material contained in the roofing material this measure is not recommended at this time.

5.2.2 Solar Thermal Heating

Active solar thermal systems use solar collectors to gather the sun's energy to heat water, another fluid, or air. An absorber in the collector converts the sun's energy into heat. The heat is then transferred by circulating water, antifreeze, or sometimes air to another location for immediate use or storage for later utilization. Applications for active solar thermal energy include providing hot water, heating swimming pools, space heating, and preheating air in residential and commercial buildings.

A standard solar hot water system is typically composed of solar collectors, heat storage vessel, piping, circulators, and controls. Solar radiation is absorbed by the collector, and the heat collected is commonly used to heat or preheat water or air. Systems are typically integrated to work alongside a conventional heating system that provides heat when solar resources are not sufficient. The solar collectors are usually placed on the roof of the building, oriented south, and tilted around the site's latitude, to maximize the amount of radiation collected on a yearly basis.

Several options exist for using active solar thermal systems for space heating. The most common method involves using glazed collectors to heat a liquid held in a storage tank (similar to an active solar hot water system). The most practical system for Kingwood would transfer the heat from the panels to thermal storage tanks and transfer solar produced thermal energy to use for domestic hot water production.

Energy savings for this measure were performed with the use of a thermal solar water heating calculator provided by the InfinitePower Corporation. Assumptions were entered that closely match Kingwood's domestic hot water heating profile. Installation costs were derived from an actual project of similar size by the SOLAR-TEC Corporation incorporating all aspects of a complete installation. This system will include eight hot water heating collectors, rack mounting system, (4) 120 gallon storage tanks and all pumping and heat transfer devices required to connect to the existing domestic hot water system.

No incentive is currently available for installation of thermal solar systems. Presently, a federal tax credit of 30% of installation cost for thermal applications is available; since Kingwood does not pay federal taxes, this is not applicable.

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

Solar Thermal Domestic Hot Water Plant

Budgetary Cost	Annual Utility Savings				Total Savings	Potential Incentive	Payback (without incentive)	Payback (with incentive)
	Electricity		#2 Oil	Total				
$	kW	kWh	gallons	$	$	$	Years	Years
26,500	0	0	890	2,600	2,600	0	10.4	NA

This is a potentially viable renewable measure that should be investigated further.

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, Kingwood does 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. For Kingwood, a turbine at a height of 30 meters located on the north side the property is the only feasible location due to tree lines, building structures, and location of athletic fields. A wind resource map downloaded from the AWS Truewind Corporation indicated that that mean annual wind speed at 30 meters in the Frenchtown area is less than 10.1 miles per hour. Most small wind turbines become financially viable over 10 miles per hour of mean annual wind speed. Therefore, the ASW Truewind model indicates that installation of a wind turbine may not be applicable at this location.

The model was designed to provide a good indication of wind speeds at applicable locations throughout the state. Before moving forward with a small wind production project at the Kingwood location, a wind test tower will need to be installed at the 30 meter tower height and monitored for a year. Consideration should also be given to the effects of the turbine location on school operations and Kingwood neighbors.

An aerial satellite image of Kingwood and a wind resource map are included in Appendix R. This measure is not recommended due to low mean annual wind speed of the proposed location.

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. Kingwood has sufficient need for electrical generation and the ability to use most of the thermal byproduct during the winter, thermal usage during the summer months is low. Thermal energy produced by the CHP plant in the warmer months will be wasted. An absorption chiller could be installed to utilize the heat to produce chilled water; however, there is no chilled water distribution system in the building.

The most viable selection for a CHP plant at this location would be a reciprocating engine natural gas-fired unit. Presently, there is no natural gas available at the facility, and emission standards do not allow diesel fired CHP units to run continuously.

This measure is not recommended because natural gas is not available at the present time, and the limited use of summertime heat.

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 since Kingwood does not have a reliable waste stream that can be utilized for production of electricity or thermal energy.

5.5 Demand Response Curtailment

Presently the Kingwood School has its electricity delivered and supplied by the New Jersey Power and Light Corporation (PJM). PJM 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 PJM regional transmission organization and an approved Curtailment Service Providers (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 PJM 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 their emergency generators during high electrical demand conditions or during emergencies. Part of the program also will require that program participants to reduce their required load or run their emergency generators with notice to test the system.

Presently the Kingwood School facility has no backup generation and an average kW demand during the observed period of 203 kW/month. PJM utilizes curtailment providers to bundle and organize demand reduction load. A PJM pre-approved CSP will require a minimum of 100 kW of load reduction to participate in any curtailment program. The Kingwood School would need to de-energize the facility during the periods of high grid demand and therefore they do not have the ability to reduce the electrical load by the required 100 kW minimum to enter the PJM demand response program.

This ECM is not recommended due to the facility not being able to satisfy the Curtailment Service Provider required 100kW minimum.

6.0 EPA PORTFOLIO MANAGER

The United State Energy Protection Agency (EPA) is a federal agency in charge of regulating environment waste and policy in the United States. The EPA has released the EPA Portfolio Manager for public use. The 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. 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.

Kingwood is considered a high energy consumer per Portfolio Manager. With a Source Energy Intensity of 159kBTU/ft^2/year the EPA has scored Kingwood at 28 out of 100. The national average is 50. Several factors are attributable to this score, including wasted energy from several factors including multiple air systems that are past their useful life and lack adequate control and inefficient lighting.

Reducing energy loss associated with infiltration, equipment, and occupancy run hours will increase Kingwood's score. If all the measures identified in this report are fully implemented, it is projected that an energy star rating of 68 can be obtained. Obtaining a score of 75 or higher out of 100 would be required to make Kingwood eligible for an Energy Star Rating.

A full EPA Energy Star Portfolio Manager Report is located in Appendix S. The user name and password for Kingwood's EPA Portfolio Manager Account was given to Eric Carr, Supervisor of Building and Grounds, Kingwood Township School.

7.0 CONCLUSIONS & RECOMMENDATIONS

The energy audit conducted by CHA at the Kingwood Township School in Frenchtown, New Jersey identified potential ECMs for variable speed drives, lighting replacements and controls, and direct digital control upgrades and strategies. Potential annual savings of $49,200 may be realized for the recommended ECMs, with a summary of the costs, savings, and paybacks as follows:

ECM - 3 Install Hot Water Pump Variable Speed Drive

Budgetary Cost	Annual Utility Savings				Total Savings	Potential Incentive	Payback (without incentive)	Payback (with incentive)
	Electricity		#2 Oil	Total				
$	kW	kWh	gallons	$	$	$	Years	Years
15,000	0	13,000	0	1,800	1,800	2,300	8.1	6.8

ECM - 8 Install Occupancy Sensors and Lighting Replacements

Budgetary Cost	Annual Utility Savings				Total Savings	Potential Incentive	Payback (without incentive)	Payback (with incentive)
	Electricity		#2 Oil	Total				
$	kW	kWh	gallons	$	$	$	Years	Years
46,000	15	60,100	0	9,700	9,700	7,600	4.7	4.0

ECM-13 All ECMs Associated with DDC Upgrade

Budgetary Cost	Annual Utility Savings				Total Savings	Potential Incentive	Payback (without incentive)	Payback (with incentive)
	Electricity		#2 Oil	Total				
$	kW	kWh	gallons	$	$	$	Years	Years
198,300	0	101,800	7,300	37,700	37,700	36,700	5.3	4.3

An additional $890 in energy savings would be realized by Kingwood Township if they elected to rebuild (ECM-5A) or replace (ECM-5B) the windows in D Wing with a summary of the costs, savings, and payback as follows:

ECM – 5A Rebuild Windows in D Wing

Budgetary Cost	Annual Utility Savings				Total Savings	Potential Incentive	Payback (without incentive)	Payback (with incentive)
	Electricity		#2 Oil	Total				
$	kW	kWh	gallons	$	$	$	Years	Years
11,700	0	1,941	199	890	890	870	13.1	12.2

ECM – 5B Replace Windows in D Wing

Budgetary Cost	Annual Utility Savings				Total Savings	Potential Incentive	Payback (without incentive)	Payback (with incentive)
	Electricity		#2 Oil	Total				
$	kW	kWh	gallons	$	$	$	Years	Years
41,600	0	1,941	199	890	890	870	46.7	45.8

Appendix A

Utility Usage Analysis

Kingwood New Jersey
CHA #19860
Building: Kingwood Township School

Account Number: **10 00 03 9492 0 1**
Jersey Central Power and Lighting

Electricity					
Period	kWH	KW	Cost ($)	Unit Cost ($/kWH)	Unit Cost ($/kW)
7/20/2007	43,360.00	207.30	8,021.83	$0.15	$6.61
8/20/2007	41,520.00	168.00	7,469.70	$0.15	$6.53
9/17/2007	45,520.00	248.20	8,384.69	$0.15	$6.66
10/16/2007	52,000.00	239.80	7,955.41	$0.12	$6.20
11/15/2007	55,040.00	200.60	8,094.68	$0.12	$6.15
12/15/2007	60,960.00	192.50	9,111.43	$0.13	$6.13
1/18/2008	64,560.00	188.60	9,877.71	$0.14	$6.13
2/18/2008	66,160.00	199.00	10,132.28	$0.13	$6.14
3/18/2008	60,320.00	190.30	9,012.60	$0.13	$6.13
4/17/2008	55,120.00	184.80	8,148.03	$0.13	$6.12
5/19/2008	61,200.00	196.60	8,991.31	$0.13	$6.14
6/19/2008	62,960.00	270.40	11,606.26	$0.16	$6.68
7/21/2008	45,040.00	174.70	8,423.98	$0.16	$6.54
8/19/2008	37,040.00	145.50	6,940.28	$0.16	$6.46
9/19/2008	51,680.00	252.90	9,844.61	$0.16	$6.67
10/17/2008	49,680.00	206.20	8,089.57	$0.14	$6.16
11/19/2008	63,280.00	194.60	9,909.09	$0.14	$6.14
1/20/2009	60,480.00	202.40	10,066.64	$0.15	$6.15
2/19/2009	62,240.00	199.20	10,327.36	$0.15	$6.15
Total	1,038,160	3,862	$170,407.46		
Average	54,640	203.2421	$8,969	$0.1417	$6.3095
			($)	($/kWH)	($/kW)

Kingwood New Jersey
CHA #19860
Building: Kingwood Township School

Account Number: 10 00 03 9492 0 1
Jersey Central Power and Lighting

Electricity										
Customer Charge	Energy Charge	Transmission charge	Reconciliation Charge	Delivery Charge kWH	Delivery Charge kW	Non-Utility Gen. Chg	Societal Benefit	Transitional Assessment Charge	System Control Charge	Total
$11.65	$4,963.51	$258.21	$62.13	$272.02	$1,369.26	$735.39	$219.27	$126.96	$3.43	$8,021.83
$11.65	$4,752.88	$247.25	$59.50	$262.90	$1,096.52	$704.18	$209.97	$121.57	$3.28	$7,469.70
$11.65	$5,210.77	$271.07	-$183.73	$282.73	$1,653.11	$772.02	$230.19	$133.28	$3.60	$8,384.69
$11.65	$4,912.65	$309.66	-$393.17	$310.23	$1,486.81	$881.92	$279.29	$152.26	$4.11	$7,955.41
$11.65	$5,199.85	$327.76	-$416.16	$325.30	$1,233.18	$933.48	$314.11	$161.16	$4.35	$8,094.68
$11.65	$5,759.14	$363.02	-$122.90	$354.65	$1,180.78	$1,033.88	$347.90	$178.49	$4.82	$9,111.43
$11.65	$6,099.24	$353.44	$227.83	$372.50	$1,155.54	$1,094.94	$368.44	$189.03	$5.10	$9,877.71
$11.65	$6,250.40	$334.89	$233.48	$380.43	$1,222.83	$1,122.07	$377.58	$193.72	$5.23	$10,132.28
$11.65	$5,698.67	$305.88	-$70.29	$351.48	$1,166.54	$1,023.03	$344.25	$176.62	$4.77	$9,012.60
$11.65	$5,207.41	$279.51	-$222.35	$325.70	$1,130.96	$934.84	$314.57	$161.39	$4.35	$8,148.03
$11.65	$5,781.81	$310.35	-$246.88	$355.84	$1,207.30	$1,037.95	$349.27	$179.19	$4.83	$8,991.31
$11.65	$7,691.02	$319.27	-$208.49	$369.20	$1,807.18	$1,067.80	$359.31	$184.35	$4.97	$11,606.26
$11.65	$5,731.75	$228.40	-$127.55	$280.35	$1,143.02	$763.88	$257.04	$131.88	$3.56	$8,423.98
$11.65	$4,713.67	$187.83	-$104.90	$240.69	$940.37	$628.20	$211.39	$108.45	$2.93	$6,940.28
$11.65	$6,576.75	$262.07	-$331.69	$313.27	$1,685.73	$876.49	$294.94	$151.32	$4.08	$9,844.61
$11.65	$5,405.33	$260.30	-$431.32	$298.73	$1,269.41	$842.57	$283.52	$145.46	$3.92	$8,089.57
$11.65	$6,885.05	$338.42	-$549.40	$366.15	$1,194.36	$1,073.23	$399.35	$185.28	$5.00	$9,909.09
$11.65	$6,580.41	$363.36	-$83.22	$352.27	$1,244.83	$1,025.74	$389.73	$177.09	$4.78	$10,066.64
$11.65	$6,771.90	$400.51	-$85.64	$361.00	$1,224.12	$1,055.59	$401.07	$182.24	$4.92	$10,327.36
										$0.00
$221.35	$110,192.21	$5,721.20	-$2,994.75	$6,175.44	$24,411.85	$17,607.20	$5,951.19	$3,039.74	$82.03	

Kingwood New Jersey
CHA #19860
Building: Kingwood Township School

Account Number: **10 00 03 9492 0 9**
Jersey Central Power and Lighting

Period	kWH	KW	Cost ($)	Unit Cost ($/kWH)
7/19/2007	620		$170.71	$0.28
8/20/2007	620		$170.71	$0.28
9/19/2007	620		$170.71	$0.28
10/18/2007	620		$170.71	$0.28
11/16/2007	620		$170.71	$0.28
12/17/2007	620		$170.71	$0.28
1/17/2008	620		$170.71	$0.28
2/18/2007	620		$170.71	$0.28
3/18/2008	620		$170.71	$0.28
4/17/2008	620		$170.71	$0.28
5/18/2009	620		$170.71	$0.28
7/18/2008	620		$170.71	$0.28
8/18/2008	620		$170.71	$0.28
9/18/2008	620		$170.71	$0.28
10/20/2008	620		$170.71	$0.28
11/18/2008	620		$170.71	$0.28
12/18/2008	620		$170.71	$0.28
1/19/2009	620		$170.71	$0.28
Total	11,160		$3,072.78	
Average	620		$170.71	$0.28

Kingwood New Jersey
CHA #19860
Building: Kingwood Township School

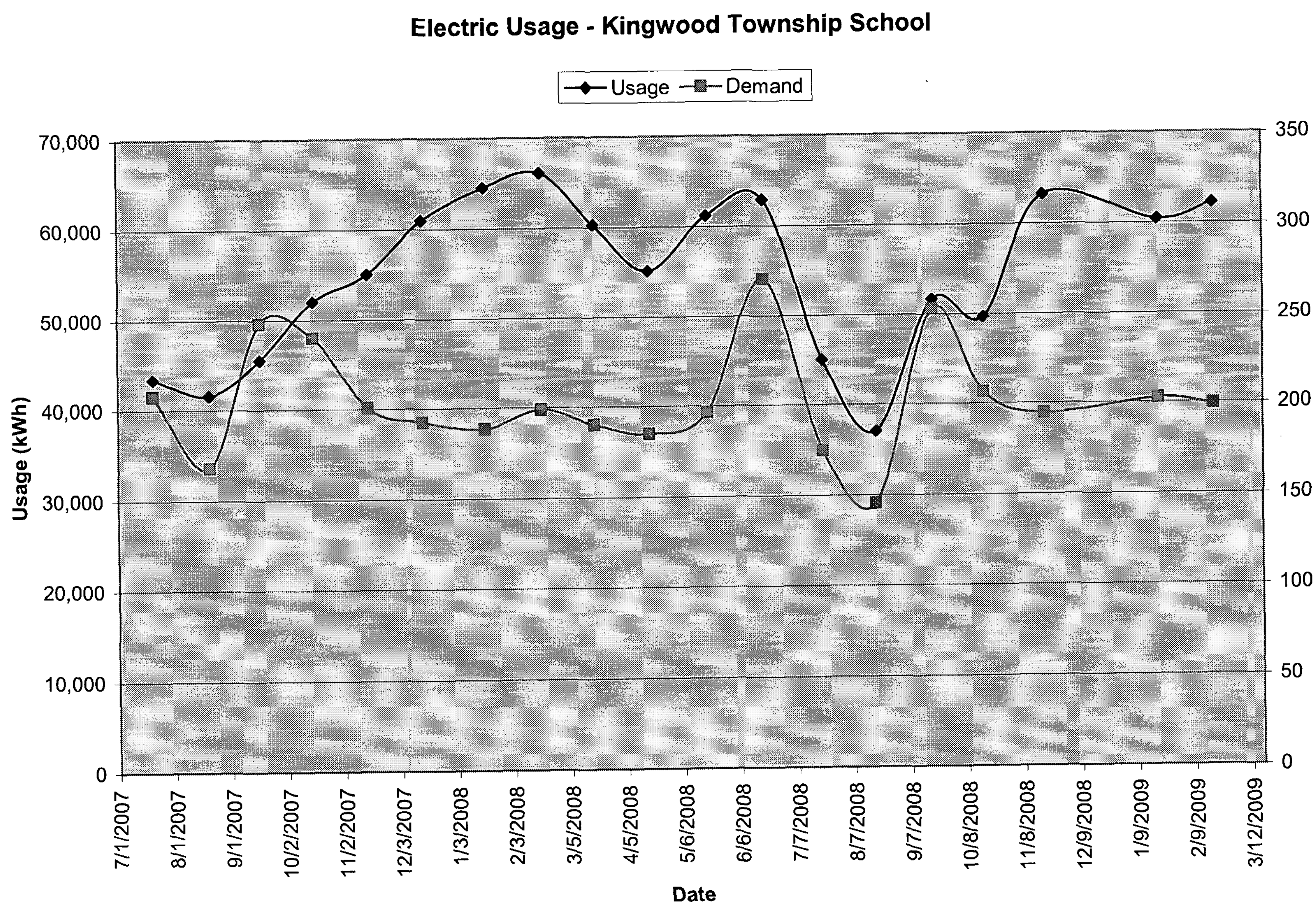
Account Number: 10 00 03 9492 0 9
Jersey Central Power and Lighting

Customer Charge	Energy Charge	Transmission charge	Reconciliation Charge	Delivery Charge	Non-Utility Gen. Chg	Societal Benefit	Transitional Assessment Charge	System Control Charge		Total
$53.05	$2.96	$0.89	$31.16	$10.52	$3.14	$4.14	$64.80	$0.05		$170.71
$53.05	$2.96	$0.89	$31.16	$10.52	$3.14	$4.14	$64.80	$0.05		$170.71
$53.05	$2.96	$0.89	$31.16	$10.52	$3.14	$4.14	$64.80	$0.05		$170.71
$53.05	$2.96	$0.89	$31.16	$10.52	$3.14	$4.14	$64.80	$0.05		$170.71
$53.05	$2.96	$0.89	$31.16	$10.52	$3.14	$4.14	$64.80	$0.05		$170.71
$53.05	$2.96	$0.89	$31.16	$10.52	$3.14	$4.14	$64.80	$0.05		$170.71
$53.05	$2.96	$0.89	$31.16	$10.52	$3.14	$4.14	$64.80	$0.05		$170.71
$53.05	$2.96	$0.89	$31.16	$10.52	$3.14	$4.14	$64.80	$0.05		$170.71
$53.05	$2.96	$0.89	$31.16	$10.52	$3.14	$4.14	$64.80	$0.05		$170.71
$53.05	$2.96	$0.89	$31.16	$10.52	$3.14	$4.14	$64.80	$0.05		$170.71
$53.05	$2.96	$0.89	$31.16	$10.52	$3.14	$4.14	$64.80	$0.05		$170.71
$53.05	$2.96	$0.89	$31.16	$10.52	$3.14	$4.14	$64.80	$0.05		$170.71
$53.05	$2.96	$0.89	$31.16	$10.52	$3.14	$4.14	$64.80	$0.05		$170.71
$53.05	$2.96	$0.89	$31.16	$10.52	$3.14	$4.14	$64.80	$0.05		$170.71
$53.05	$2.96	$0.89	$31.16	$10.52	$3.14	$4.14	$64.80	$0.05		$170.71
$53.05	$2.96	$0.89	$31.16	$10.52	$3.14	$4.14	$64.80	$0.05		$170.71
$53.05	$2.96	$0.89	$31.16	$10.52	$3.14	$4.14	$64.80	$0.05		$170.71
$848.80	$47.36	$14.24	$498.56	$168.32	$50.24	$66.24	$1,036.80	$0.80		

Kingwood New Jersey
CHA #19860
Building: Kingwood Township School
Number 2 Fuel Oil

Date	Gallons	Price	Charge
January	2,675	3.1333	$ 8,381.58
January	1,417	3.5910	$ 5,088.47
February	1,406	5.0114	$ 7,046.07
March	2,675	2.9523	$ 7,897.41
April	2,400	3.2658	$ 7,837.92
April	2,503	3.1908	$ 7,986.57
April	2,500	2.6558	$ 6,640.03
June	1,500	4.1253	$ 6,187.89
November	2,500	2.1285	$ 5,321.25
December	2,500	1.6985	$ 4,246.25
December	2,783	1.6093	$ 4,478.59
Total	24,859	$3.033	$71,112.03

6 Bill Average	2.5680


Electric Usage - Kingwood Township School
Usage
Demand
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
Usage (kWh)
350
300
250
200
150
100
50
0
Demand (kW)
7/1/2007
8/1/2007
9/1/2007
10/2/2007
11/2/2007
12/3/2007
1/3/2008
2/3/2008
3/5/2008
4/5/2008
5/6/2008
6/6/2008
7/7/2008
8/7/2008
9/7/2008
10/8/2008
11/8/2008
12/9/2008
1/9/2009
2/9/2009
3/12/2009
Date

Licensed Electric Generation Suppliers

(March 2009)

To sell electric generation service in New Jersey, electric power suppliers must be licensed by the New Jersey Board of Public Utilities (NJ BPU). They must also be registered with the local public utility to sell electric generation service in that utility's service area. Below is a list of suppliers who are licensed with the NJ BPU and are registered to sell electric generation service in the Jersey Central Power & Light Company service territory.

Supplier Name	Phone No.
Amerada Hess Corp	800-437-7872
BOC Energy Services	800-247-2644
Commerce Energy, Inc.	800-556-8457
Con Edison Solutions, Inc.	888-686-1383
Constellation NewEnergy, Inc.	888-635-0827
Direct Energy, LLC	800-260-0300
FirstEnergy Solutions Corp.	800-977-0500
Glacial Energy	877-569-2841
Integrys Energy Services, Inc.	877-763-9977
Liberty Power Holdings, LLC	866-POWER-9
Pepco Energy Services, Inc.	800-ENERGY-9
PP&L EnergyPlus, LLC	800-281-2000
Sempra Energy Solutions	877-2SEMPRA
South Jersey Energy	800-756-3749
Suez Energy Resources NA, Inc	888-644-1014
UGI Energy Services	800-427-8545

Contact the supplier directly to verify whether or not new customers are being accepted.