FAIR HAVEN
BOROUGH HALL

ENERGY ASSESSMENT

for

NEW JERSEY
BOARD OF PUBLIC UTILITIES

CHA PROJECT NO. 21968

DECEMBER 2010

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1.0 INTRODUCTION

This report summarizes the energy audit for the Borough Hall in the Borough of Fair Haven, located at 748 River Road, which includes municipal offices, a meeting/town courtroom, and public library. Built in 1967, the structure is an approximately 4,040 square foot single story building with a basement which houses the courtroom and various 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 Borough Hall in the Borough of Fair Haven. The Borough Hall was constructed in 1967 and contains municipal offices, a meeting/town courtroom, and public library. The approximately 4,040 square foot, single story building also has a basement that houses the courtroom and various offices. The following areas were evaluated for energy conservation measures:

- Boiler Replacement
- Lighting upgrades
- Temperature setback

Various potential Energy Conservation Measures (ECMs) were identified for the above categories. Potential annual savings of $3,900 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-6 Cumulative Lighting Upgrades

Budgetary Cost	Annual Utility Savings					Estimated Maintenance Savings	Total Savings	ROI	Potential Incentive*	Payback (without Incentive)	Payback (with Incentive)
	Electricity		Natural Gas	Water	Total						
$	kW	kWh	Therms	kGals	$	$	$		$	Years	Years
17,400	2.2	13,580	0	0	2,500	0	2,500	1.14	1,900	7.0	6..2

*Incentive shown is per the New Jersey Smart Start Program, 2010 Prescriptive Lighting and Lighting Controls Applications.

ECM-7 Temperature Setback

Budgetary Cost	Annual Utility Savings					Estimated Maintenance Savings	Total Savings	ROI	Potential Incentive*	Payback (without Incentive)	Payback (with Incentive)
	Electricity		Natural Gas	Water	Total						
$	kW	kWh	Therms	kGals	$	$	$		$	Years	Years
400	0	1,800	730	0	1,400	0	1,400	55.3	NA	0.3	NA

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

In addition, the following measure is recommended if it qualifies for funding through the Direct Install Program (see section 5.2.4). Under this program, incentives can be potentially awarded for up to 60% of a project's budgetary cost up to a maximum incentive of $50,000, when the work is performed by a participating Direct Install contractor.

- ECM-1 Boiler Replacement

3.0 EXISTING CONDITIONS

3.1 Building – General

The Borough Hall is a single story, brick-and-masonry, flat-roofed building of approximately 4,040 square feet. The basement level consists of storage space; offices; and meeting rooms, including a large courtroom/community room which is used for land use board meetings, council meetings, and municipal court. In addition, the basement contains a daycare room for borough functions. The main level consists of offices, the public library, and public restroom facilities.

The building has forced air central heating and cooling systems using natural gas and electricity, respectively. There are three zones for heating and cooling, with separate equipment and thermostats for each zone. The thermostats located in the administrative offices and basement meeting rooms are programmable. The interior lighting is mainly fluorescent, although there are some incandescent fixtures. Light switches are located on walls in various halls and rooms. There are no central controls for lighting, cooling, or heating.

The roof was replaced in 2006/2007. At the same time, all of the windows were replaced with new double pane windows.

3.2 Utility Usage

Utility service includes electricity from Jersey Central Power and Light (JCP&L) and natural gas from South Jersey Energy (SJE). The Borough Hall utilizes a separate meter for electricity and natural gas consumption.

From December 2008 through December 2009, electric usage was approximately 50,790 kWh at a cost of $9,300. Analyzing electricity bills during this period showed that the Borough Hall was charged at a blended rate of $0.18/kWh. Electricity consumption is higher during the summer months and generally constant throughout the remaining months. Electricity consumption data and a graph of the previous year are provided in Appendix A.

From November 2008 through November 2009, natural gas consumption was approximately 3,000 therms at a cost of $4,500. Analyzing natural gas bills during this period showed that the Borough Hall was charged a blended rate of $1.51/therm. Natural gas consumption was generally higher during the winter heating months. Natural gas data and graph are included in Appendix A.

Electricity commodity supply and delivery is presently purchased from JCP&L. Natural gas commodity supply and delivery is presently purchased from SJE. The delivery component of both utilities will always be the responsibility of the utility that connects the facility to the power grid or gas line; however, the supply can be purchased from a third party. The electricity or natural gas commodity supply entity will require submission of one to three years of past energy bills. Contract terms can vary among suppliers. A list of approved electrical and natural gas energy commodity suppliers can be found in Appendix B. According to the U.S. Energy Information Administration, the average commercial unit costs of electricity and natural gas in New Jersey during July 2010 was $0.152 per kWh and $1.09 per therm. Based on the fact that the building is currently paying above the state average for electricity and natural gas, it is recommended that a third party supplier be pursued for both utilities.

3.3 HVAC Systems

The Borough Hall has four air conditioning systems and a central hot water heating system. The entrance to the Borough Hall is cooled by a Mitsubishi Mr. Slim, high efficiency air conditioning system. The area is heated by fin tube radiation. Air conditioning for the courtroom, library, and office area is provided by Lennox air conditioning systems. Each system utilizes a 5 ton condenser unit mounted on the north wall of the building. The library is served by a horizontal air handling unit (AHU) with a direct expansion refrigeration coil, hot water heating coil, and fan/filter section. Office and courtroom spaces are served by vertical AHUs with direct expansion refrigeration coils, hot water heating coils, and fan/filter sections. The administrative offices' AHU was replaced in 2008 and has a Honeywell programmable thermostat. The library and courtroom have manual thermostats.

Building heat is generated by a single Weil-McLain 305MBH input, 247MBH output, natural gas-fired heating hot water (HHW) boiler. Multiple heating hot water loops are utilized for individual zone heating. A single outside air temperature sensor enables the boiler during the winter months, and manual and programmable zone thermostats control loop water temperatures.

3.4 Lighting/Electrical Systems

The lighting system consists of a combination of 2 x 4, T-12 fixtures, 1 x 4, T-12 fixtures and some medium wattage incandescent bulbs. All lighting is manually controlled by wall switches. Outdoor lights are controlled from photocells. Some of the outdoor floodlights were on during the audit due to faulty photocells. The older exit signs are 24 watts each. Additionally, the building has a very old emergency generator that appeared to be out of service.

3.5 Control Systems

The building does not have a central control system. There is a single programmable Honeywell thermostat in the office area and manual thermostats in the courtroom and library. The library is controlled by a manual thermostat set to 72°F; the courtroom is set to approximately 68°F and normally stays at that temperature year around. The office areas operate at 68°F in the winter and approximately 72°F in the summer.

3.6 Plumbing Systems

The men's and women's restrooms utilize standard toilets and faucets. The hot water heater is an A.O. Smith Promat electric, 75 gallon unit and supplies hot water to the restrooms.

An equipment inventory is provided in Appendix O.

4.0 ENERGY CONSERVATION MEASURES

4.1 ECM-1 Boiler Replacement

Heating hot water for the AHU heating coils is provided by a Weil-McLain Model PFG - 6 - PIN gas-fired, boiler. The boiler is rated at 305,000 Btuh input, 247,000 Btuh output, with a rated efficiency of 81% and an operational efficiency of about 79%. This ECM evaluated replacing the original unit with a high efficiency, condensing boiler with a hot water (HW) temperature reset control system. By installing a HW reset system, heat losses from the building's HHW piping system can be greatly reduced. Additionally, combining the control system with a condensing boiler can improve firing efficiency up to 93%, or higher.

The benefits of applying HW temperature reset could be evaluated by generating a spreadsheet that would compare the existing piping system losses to those of the proposed system. With no building drawings available, it was not possible to determine the total linear footage and required line sizes. Therefore, savings for installing a HW temperature reset controller could not be quantified.

This ECM projects savings for replacing the existing boiler. Calculations determined that the boiler consumes about 2,900 therms annually. Applying an operational boiler efficiency of 79% to its annual natural gas usage established a baseline boiler load of approximately 229,100 MBH per year. With an efficiency of 93%, the proposed condensing boiler will require 2,460 therms to meet this load, resulting in a savings of about 440 therms of natural gas per year. The proposed boiler efficiency rating is based on the use of an Aerco MLX Series boiler for the calculation. Exact boiler selection and sizing cannot be completed without a more detailed analysis of the building's hydronic heating system and generation of a load profile.

For implementation of this measure, a new gas-fired, condensing, hot water boiler would be installed, along with a HW temperature reset control system. Minimal supply and return piping would be required to reconnect the new boiler. The existing hot water piping arrangement has already been optimized for the boiler installation. A new exhaust flue system will also be required.

Condensing boiler and hot water reset control system have an expected life of 25 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 11,000 therms and $17,500.

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

ECM-1 Boiler Replacement

Budgetary Cost	Annual Utility Savings					Estimated Maintenance Savings	Total Savings	ROI	Potential Incentive*	Payback (without Incentive)	Payback (with Incentive)
	Electricity		Natural Gas	Water	Total						
$	kW	kWh	Therms	kGals	$	$	$		$	Years	Years
17,500	0	0	440	0	700	0	700	0.03	600	25.0	24.1

*Incentive shown is per the New Jersey Smart Start Program, 2010 Gas Heating Application. This measure is potentially eligible for Direct Install funding. See section 5.0 for other incentive opportunities.

This measure is recommended if deemed qualified for Direct Install funding.

4.2 ECM-2 Lighting Replacements

During the site visit, a comprehensive fixture survey was conducted of the entire building. Each switch and circuit was identified, as well as the number of fixtures, locations, approximate operating times, and existing wattage consumption. The Borough Hall utilizes a variety of lighting fixtures. The hallways, offices, library, and courtroom are lit with two lamp and four lamp T-12 fixtures, with magnetic ballasts, which is inefficient by current standards. Some of the existing floodlights in the courtroom/community room and daycare room are compact florescent.

This measure addresses the expected energy savings of replacing the T-12 fixtures with high output T-8 fluorescent lamps. Energy savings for this measure were calculated by applying the existing and proposed fixture wattages to the estimated time of operation to determine annual electricity consumption. The difference resulted in an annual savings of about 5,830 kWh per year. Supporting calculations, including all assumptions for lighting hours and annual energy usage for each fixture are provided in Appendix D.

Lighting has an expected life of 15 years, according to the manufacturer, and total energy savings over the life of the project are estimated at 87,500 kWh, totaling $16,000.

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

ECM-2 Lighting Replacements

Budgetary Cost	Annual Utility Savings					Estimated Maintenance Savings	Total Savings	ROI	Potential Incentive*	Payback (without Incentive)	Payback (with Incentive)
	Electricity		Natural Gas	Water	Total						
$	kW	kWh	Therms	kGals	$	$	$		$	Years	Years
10,700	2.0	5,830	0	0	1,100	0	1,100	0.5	1,300	9.7	8.5

*Incentive shown is per the New Jersey Smart Start Program, 2010 Prescriptive Lighting Application.

This measure is not recommended in lieu of ECM-6.

4.3 ECM-3 Occupancy Sensors for Interior Lighting

Most lighting fixtures throughout the building are manually switched on and off. The offices, library, and courtroom/community room all experience intermittent occupancy and could benefit from lighting controls such as occupancy sensors.

As previously stated, a comprehensive lighting fixture survey was conducted during the site visit to identify approximate operating times and existing wattage consumption of each fixture. By reviewing the building occupancy schedule and typical traffic patterns for each space, the necessary operating time for the lighting in each room was established. The energy savings for installing occupancy sensors were calculated by applying the known fixture wattages in each space to the existing and necessary times of operation for each fixture. Taking the difference between the two values, the electric savings was found to be about 4,400 kWh. Supporting calculations, including cost estimates and all assumptions for existing and proposed lighting hours per each space, can be found 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 66,000 kWh and $12,000.

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

ECM-3 Occupancy Sensors for Interior Lighting

Budgetary Cost	Annual Utility Savings						Estimated Maintenance Savings	Total Savings	ROI	Potential Incentive*	Payback (without Incentive)	Payback (with Incentive)
	Electricity		Natural Gas	Water	Total							
$	kW	kWh	Therms	kGals	$		$	$		$	Years	Years
3,600	0	4,400	0	0	800		0	800	2.3	500	4.5	3.9

*Incentive shown is per the New Jersey Smart Start Program, 2010 Lighting Controls Application.

This measure is not recommended in lieu of ECM-6.

4.4 ECM-4 Exit Sign Replacement

A building walkthrough noted 10 outdated and inefficient exit signs, which utilize two, 8 watt bulbs and have an overall consumption of 24 watts each. Replacing the fixtures with new, energy efficient LED signs will reduce electrical usage to approximately 1.7 watts/fixture.

The combined wattage of the 10 exit signs were applied to the hours in a year. The computation determined the annual electrical consumption for these signs to be about 2,100 kWh. Reapplying the calculation to the combined wattage for the proposed exit signs yielded an annual consumption of 150 kWh, resulting in a savings of approximately 1,950 kWh. The calculations are shown in Appendix F.

Lighting has an expected life of 15 years, according to the manufacturer, and total energy savings over the life of the project are estimated at 29,250 kWh and $6,000.

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

ECM-4 Exit Sign Replacement

Budgetary Cost	Annual Utility Savings				Estimated Maintenance Savings	Total Savings	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total					
$	kW	kWh	Therms	$	$	$	$	Years	Years
2,800	0.2	1,950	0	400	0	400	100	7.0	6.8

*Incentive shown is per the New Jersey Smart Start Program, Prescriptive Lighting Application.

This measure is not recommended in lieu of ECM-6.

4.5 ECM-5 Photocells for Exterior Lighting

There are two sets of exterior light fixtures for the south entrance to the Borough Hall. The fixtures use two 75 W incandescent floodlights. Presently, these lights are on all the time. This ECM would install a photocell on the light fixtures so that they would be turned off during daylight hours.

The combined wattage of the existing four 75W lights was applied to the hours in a year. The computation determined the annual electrical consumption for these floodlights to be about 2,600 kWh. The energy savings for installing the photocell were calculated by applying the known fixture wattages and necessary time of operation of approximately 4,100 hours per year. Taking the difference between the two values, the saving was found to be about 4,400 kWh. Supporting calculations, including cost estimates and all assumptions for existing and proposed lighting hours, can be found in Appendix G. Taking the annual operation of the existing floodlights and subtracting the daylight operating hours yielded an annual savings of 1,400 kWh.

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

ECM-5 Photocells for Exterior Lighting

Budgetary Cost	Annual Utility Savings					Estimated Maintenance Savings	Total Savings	ROI	Potential Incentive*	Payback (without Incentive)	Payback (with Incentive)
	Electricity		Natural Gas	Water	Total						
$	kW	kWh	Therms	kGals	$	$	$		$	Years	Years
300	0	1,400	0	0	300	0	300	11.5	NA	1.0	NA

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

This measure is not recommended in lieu of ECM-6.

4.6 ECM-6 Cumulative Lighting Upgrades

This measure is a combination of ECMs 2, 3, 4 and 5 to allow maximum energy and demand reduction. The values shown encompass all energy saving measures associated with the building lighting system.

ECM-6 Cumulative Lighting Upgrades

Budgetary Cost	Annual Utility Savings					Estimated Maintenance Savings	Total Savings	ROI	Potential Incentive*	Payback (without Incentive)	Payback (with Incentive)
	Electricity		Natural Gas	Water	Total						
$	kW	kWh	Therms	kGals	$	$	$		$	Years	Years
17,400	2.2	13,580	0	0	2,500	0	2,500	1.14	1,900	7.0	6..2

*Incentive shown is per the New Jersey Smart Start Program, 2010 Prescriptive Lighting and Lighting Controls Applications.

This measure is recommended.

4.7 ECM-7 Temperature Setback

The temperature in the building is controlled by four thermostats, one dedicated to each of the three HVAC units and one to the split system in the south entrance. All thermostats are programmable, with the exception of the library thermostat which is manually adjusted. Heating and cooling in the courtroom is utilized only when court is in session. The temperature in other areas of the building could be adjusted to decrease energy consumption, while maintaining comfort for the occupants.

This ECM proposes setting back the temperatures of the main floor office area, library, courtroom and basement offices. The unoccupied cooling setpoint of the administrative offices would be moved from 74°F to 80°F; the occupied heating setpoint from 71°F to 70°F, and the unoccupied heating setpoint from

68°F to 60°F. Two new programmable thermostats would be installed to replace exiting manual thermostats.

The library is set to a constant 72°F in cooling mode and 70°F in heating, regardless if the space is occupied. With installation of a programmable thermostat, the occupied setpoints would be set back to 74°F in cooling, and 68°F in heating. During unoccupied times, the heating setpoint would be 80°F in cooling and 60°F in heating modes.

To calculate the savings associated with setting the temperature back in these zones, a block load model was utilized. The temperature setpoints representing the existing conditions were changed to represent proposed conditions and energy savings were realized. By implementing temperature setback, the building could achieve a savings of about 730 therms and 1,820 kWh per year.

Programmable thermostats have an approximate life expectancy of 15 years according to ASHRAE. The savings over the life of the project would be about 10,950 therms, 27,300 kWh, and $19,500.

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

ECM-7 Temperature Setback

Budgetary Cost	Annual Utility Savings					Estimated Maintenance Savings	Total Savings	ROI	Potential Incentive*	Payback (without Incentive)	Payback (with Incentive)
	Electricity		Natural Gas	Water	Total						
$	kW	kWh	Therms	kGals	$	$	$		$	Years	Years
400	0	1,800	730	0	1,400	0	1,400	55.3	NA	0.3	NA

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

This measure is recommended.

5.0 PROJECT INCENTIVES

5.1 Incentives Overview

5.1.1 New Jersey Pay For Performance Program

The building will be eligible for incentives from the New Jersey Office of Clean Energy. The most significant incentives will be from the New Jersey Pay for Performance (P4P) Program. The P4P program is designed for qualified energy conservation projects in facilities whose demand in any of the preceding 12 months exceeds 200 kW. However, the 200 kW/month average minimum has been waived for buildings owned by local governments or municipalities and non-profit organizations. Facilities that meet this criterion must also achieve a minimum performance target of 15% energy reduction by using the EPA Portfolio Manager benchmarking tool before and after implementation of the measure(s). If the participant is a municipal electric company customer, and a customer of a regulated gas New Jersey Utility, only gas measures will be eligible under the Program. American Recovery and Reinvestment Act (ARRA) funding, when available, may allow oil, propane and municipal electric customers to be eligible for the P4P Program. Available incentives are as follows:

Incentive #1: Energy Reduction Plan – This incentive is designed to offset the cost of services associated with the development of the Energy Reduction Plan (ERP). The standard incentive pays $0.10 per square foot, up to a maximum of $50,000, not to exceed 50% of facility annual energy cost, paid after approval of application. For building audits funded by the New Jersey Board of Public Utilities, which receive an initial 75% incentive toward performance of the energy audit, facilities are only eligible for an additional $0.05 per square foot, up to a maximum of $25,000, rather than the standard incentive noted above.

Incentive #2: Installation of Recommended Measures – This incentive is based on projected energy saving and designed to pay approximately 60% of the total performance-based incentive. Base incentives deliver $0.11/kWh and $1.10/therm not to exceed 30% of total project cost.

Incentive #3: Post-Construction Benchmarking Report – This incentive is paid after acceptance of a report proving energy savings over one year utilizing the Environmental Protection Agency (EPA) Portfolio Manager benchmarking tool. Incentive #3 base incentives deliver $0.07/kWh and $0.70/therm not to exceed 20% of total project cost.

5.1.2 New Jersey Smart Start Program

For this program, specific incentives for energy conservation measures are calculated on an individual basis utilizing the 2010 New Jersey Smart Start incentive program. This program provides incentives dependent upon mechanical and electrical equipment. If applicable, incentives from this program are reflected in the ECM summaries and attached appendices.

If the building qualifies and enters into the New Jersey Pay for Performance Program, all energy savings will be included in the total building energy reduction, and savings will be applied towards the Pay for Performance incentive. A project is not applicable for both New Jersey incentive programs.

5.1.3 Energy Efficient and Conservation Block Grant

Following is a brief summary of the Energy Efficient and Conservation Block Grant (EECBG) program. The Energy Efficiency and Conservation Block Grant Complete Program Application Package should be consulted for rules and regulations.

Additional funding is available to local government entities through the EECBG, a part of New Jersey's Clean Energy program (NJCEP). The grant is for local government entities only, and can offset the cost of energy reduction implementation to a maximum of $20,000.

This program is provided in conjunction with NJCEP funding and any utility incentive programs; the total amount of the three incentives combined cannot exceed 100% of project cost. Funds shall first be provided by NJCEP, followed by the EECBG and any utility incentives available to the customer. The total amount of the incentive shall be determined TRC Solutions, a third party technical consulting firm for the NJCEP.

In order to receive EECBG incentives, local governments must not have received a Direct Block Grant from the US Department of Energy. A list of the 512 qualifying municipalities and counties is provided on the NJCEP website. Qualifying municipalities must participate in at least one eligible Commercial & Industrial component of the NJCEP, utility incentive programs, or install building shell measures recommended by the Local Government Energy Audit Program. Eligible conservation programs through NJCEP include:

- Direct Install
- Pay for Performance
- NJ SmartStart Buildings for measures recommended by a Local Government Energy Audit (LGEA) or an equivalent audit completed within the last 12 months
- Applicants may propose to independently install building shell measures recommended by a LGEA or an equivalent audit. The audit must have been completed within the past 12 months.
- Any eligible utility energy efficiency incentive program

Most facilities owned or leased by an eligible local government within the State of New Jersey are eligible for this grant. Ineligible facilities include casinos or other gambling establishments, aquariums, zoos, golf courses, swimming pools, and any building owned or leased by the United States Federal Government. New construction is also ineligible.

5.1.4 ARRA Initiative "Energy Efficiency Programs through the Clean Energy Program"

The American Recovery and Reinvestment Act (ARRA) Initiative is available to New Jersey oil, propane, cooperative and municipal electric customers who do not pay the Societal Benefits Charge. This charge can be seen on any electric bill as the line item "SBC Charge." Applicants can participate in this program in conjunction with other New Jersey Clean Energy Program initiatives including Pay for Performance, Local Government Energy Audits, and Direct Install programs.

Funding for this program is dispersed on a first come, first serve basis until all funds are exhausted. The program does not limit the municipality to a minimum or maximum incentive, and the availability of funding cannot be determined prior to application. If the municipality meets all qualifications, the application must be submitted to TRC Energy Solutions for review. TRC will then determine the amount of the incentive based on projected energy savings of the project. It is important to note that all applications for this incentive must be submitted before implementation of energy conservation measures.

Additional information is available on New Jersey's Clean Energy Program website.

5.1.5 Direct Install Program

The Direct Install Program targets small and medium sized facilities where the peak electrical demand does not exceed 200 kW in any of the previous 12 months. Buildings must be located in New Jersey and served by one of the state's public, regulated electric or natural gas utility companies. On a case-by-case basis, the program manager may accept a project for a customer that is within 10% of the 200 kW peak demand threshold.

The 200 kW peak demand threshold has been waived for local government entities that receive and utilize their Energy Efficiency and Conservation Block Grant as discussed in section 5.1.3 in conjunction with Direct Install.

Direct Install is funded through New Jersey's Clean Energy Program and is designed to provide capital for building energy upgrade projects to fast track implementation. The program will pay up to 60% of the costs for lighting, HVAC, motors, natural gas, refrigeration, and other equipment upgrades with higher efficiency alternatives. If a building is eligible for this funding, the Direct Install Program can significantly reduce the implementation cost of energy conservation projects.

The program pays a maximum amount of $50,000 per building, and up to $250,000 per customer per year. Installations must be completed by a Direct Install participating contractor, a list of which can be found on the New Jersey Clean Energy Website at http://www.njcleanenergy.com. Contractors will coordinate with the applicant to arrange installation of recommended measures identified in a previous energy assessment, such as this document.

5.2 Building Incentives

5.2.1 New Jersey Pay For Performance Program

Under incentive #1 of the New Jersey Pay for Performance Program, the 4,000 square foot building is eligible for about $200 toward development of an Energy Reduction Plan. When calculating the total amount under Incentives #2 and #3, 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 to exceed the 15% minimum, the building is eligible to receive monies based as discussed above in section 5.1.1. In total, incentives through the NJ P4P program are expected to total about $5,100, reducing the total project payback from 7.7 years to 6.6 years. See Appendix I for calculations.

5.2.2 New Jersey Smart Start Program

The Fair Haven Borough Hall building is eligible for several incentives available under New Jersey Smart Start Programs. The total amount of all qualified incentives is about $2,500 and includes installing a high efficiency gas-fired boiler and upgrades to the lighting system

5.2.3 Energy Efficient and Conservation Block Grant

The Fair Haven Borough Hall is owned by local government which makes it eligible for this incentive. The incentive amount has a maximum of $20,00 and is determined by TRC Solutions.Further information about this incentive, including the application, can be found at:
http://www.njcleanenergy.com/commercial-industrial/programs/energy-efficiency-and-conservation-block-grants

5.2.4 Direct Install Program

The Fair Haven Borough Hall will be eligible to receive funding from the Direct Install Program. This money will be in conjunction with the Energy Efficiency and Conservation Block Grant. The total implementation cost for all ECMs in Borough Hall is about $35,300. This program would pay 60%, or about $21,200 of these initial costs. This funding has the potential to significantly affect the payback periods of Energy Conservation Measures. For Borough Hall, the Direct Install Program brings the simple payback from about 7.7 years, to approximately 3.1 years.

In order to apply for this program the borough must contact the Direct Install contractor for Monmouth County, Hutchinson Mechanical Services. Contact information is available on the New Jersey Clean Energy Website.

6.0 ALTERNATIVE ENERGY SCREENING EVALUATION

6.1 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 50s°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 uses a gas-fired boiler and split air conditioning systems to meet its HVAC needs. None of which are compatible with a geothermal energy source. Therefore, to take advantage of a GHP system, the existing mechanical equipment would have to be removed or overhauled; and either a low temperature closed loop water source heat pump system or a water to water heat pump system would have to be installed to realize the benefit of the consistent temperature of the ground.

This measure is not recommended due to the extent of HVAC system renovation needed for implementation. Additionally, the project would not payback within the useful life of the equipment.

6.2 Solar

6.2.1 Photovoltaic Rooftop Solar Power Generation

The Borough Hall 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 building's roof has sufficient room to install a solar cell array above the library and Borough Offices but it would need to be angled south for maximum efficiency. A structural analysis would be required to determine if the roof framing could support a cell array.

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 PVWATT 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 PVWATT solar power generation model is provided in Appendix J.

The State of New Jersey incentives for non-residential PV applications is \$0.75/watt up to 30 kW of installed PV array. Projects up to 50 kW are eligible to apply. Federal tax credits are also available for renewable energy projects up to 30% of installation cost. Municipalities do not pay federal taxes and would not be able to utilize the federal tax credit incentive.

Installation of (PV) arrays in the state of 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 periods of 15 years from the date of installation. The cost of the ACP penalty for 2009 was $700; 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 2010 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.

There was no kW usage data available for determining the size of the PV solar array, so a 10 kW system was used for the calculations. Incentives for a 10 kW PV solar array were used in the payback calculation.

The system costs for PV installations were derived from the most recent Solar Center of New Jersey, estimates of total cost of system installation (see Appendix J). It should be noted that the cost of installation is approximately $6.33 per watt or $6,330 per kW of installed system. This cost has decreased 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.

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

Photovoltaic (PV) Rooftop Solar Power Generation – 10 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
63,300	0	11,830	0	2,200	2,200	7,500	5,800	28.8	7.0

*Incentive based on New Jersey Renewable Energy Program for non-residential applications of $0.75 per Watt of installed capacity
** Estimated Solar Renewable Energy Certificate Program (SREC) for 15 years at $487/1000 kWh

The Fair Haven Borough Hall has a very attractive roof for photovoltaics above the library and office area. These roofs are flat, and do not have many nearby structures to cast shadows over the solar cells. The structural integrity of the roof would have to be evaluated before a solar photovoltaic system could be installed.

While the payback period is within the parameters for recommended measures, further investigation of possible installation locations, required system maintenance, and local installation costs are suggested prior to consideration for implementation.

6.2.2 Solar Thermal Hot Water Plant

Active solar thermal systems use solar collectors to gather the sun's energy to heat water, other fluids, 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, a heat storage vessel, piping, circulators, and controls. 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 would transfer the heat from the panels to thermal storage tanks and transfer solar produced thermal energy to use for domestic hot water production. DHW is presently produced by an electric water heater and a solar DHW system would save site electric usage.

Currently, an incentive is not available for installation of thermal solar systems. A federal tax credit of 30% of installation cost for the thermal applications is available; however, Fair Haven does not pay federal taxes and, therefore, would not benefit from this program.

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

Solar Thermal Domestic Hot Water Plant

Budgetary Cost	Annual Utility Savings				Total Savings	New Jersey Renewable Energy Incentive	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$	$	$	Years	Years
27,100	0	580	0	100	100	NA	>25	NA

* No incentive is available in New Jersey at this time.

This measure is not recommended.

6.3 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 are 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 Fair Haven Borough area, the map shown in the appendices indicates a mean annual wind speed of about 11.9 miles per hour. For the building, there are site restrictions, such as parking lots, trees and surrounding structures that would greatly affect a tower location.

A wind speed map is included in Appendix L.

If a site could be identified near the building with limited obstructions, a meteorological tower could be installed to gain a more accurate representation of wind speed for the area.

6.4 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, 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 building does not have an excessively large electricity demand, and it does not have a heating load to use the thermal byproduct in the summer. 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. Purchasing this system and performing modifications to the existing HVAC and electrical systems would greatly outweigh the savings over the life of the equipment.

This measure is not recommended.

6.5 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 due to the extent of HVAC system renovation needed for implementation. Additionally, the building's heating requirements do not justify such an extensive renovation and the project would not payback within the useful life of the equipment.

6.6 Demand Response Curtailment

Utility Curtailment is an agreement with the 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 incentives are offered 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 emergencies. Part of the program also will require that participants reduce their required load or run emergency generators with notice to test the system.

JCP&L does not currently have a Demand Response Curtailment, or load shedding program for its customers so this is not an option for the Borough Hall.

7.0 EPA PORTFOLIO MANAGER

The United States Environmental 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 as 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.

The Fair Haven Borough building is considered a below average energy consumer per the Portfolio Manager with a Site Energy Usage Index (EUI) of 114 kBTU/ft^2/year. The EUI can be improved by addressing wasted energy from inefficient HVAC equipment and inefficient lighting systems. By implementing the measures discussed in this report, it is expected that the EUI can be reduced to approximately 72 kBTU/ft^2/year; the national average for this building type is 182 kBTU/ft^2/year. The EPA Portfolio Manager did not generate an energy rating score for this building because the building type is not eligible for an energy star rating.

A full EPA Energy Star Portfolio Manager Report is located in Appendix M.

The user name and password for the building's EPA Portfolio Manager Account will be provided to the supervisor of the Borough of Fair Haven.

8.0 CONCLUSIONS & RECOMMENDATIONS

The energy audit conducted by CHA at the Borough Hall in the Borough of Fair Haven, New Jersey identified potential ECMs for lighting upgrades and temperature setback. Potential annual savings of $3,900 may be realized for the recommended ECMs, with a summary of the costs, savings, and paybacks as follows:

ECM-6 Cumulative Lighting Upgrades

Budgetary Cost	Annual Utility Savings					Estimated Maintenance Savings	Total Savings	ROI	Potential Incentive*	Payback (without Incentive)	Payback (with Incentive)
	Electricity		Natural Gas	Water	Total						
$	kW	kWh	Therms	kGals	$	$	$		$	Years	Years
17,400	2.2	13,580	0	0	2,500	0	2,500	1.14	1,900	7.0	6..2

*Incentive shown is per the New Jersey Smart Start Program, 2010 Prescriptive Lighting and Lighting Controls Applications.

ECM-7 Temperature Setback

Budgetary Cost	Annual Utility Savings					Estimated Maintenance Savings	Total Savings	ROI	Potential Incentive*	Payback (without Incentive)	Payback (with Incentive)
	Electricity		Natural Gas	Water	Total						
$	kW	kWh	Therms	kGals	$	$	$		$	Years	Years
400	0	1,800	730	0	1,400	0	1,400	55.3	NA	0.3	NA

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

In addition, the following measure is recommended if it qualifies for funding through the Direct Install Program (see section 5.2.4). Under this program, incentives can be potentially awarded for up to 60% of a project's budgetary cost up to a maximum incentive of $50,000, when the work is performed by a participating Direct Install contractor.

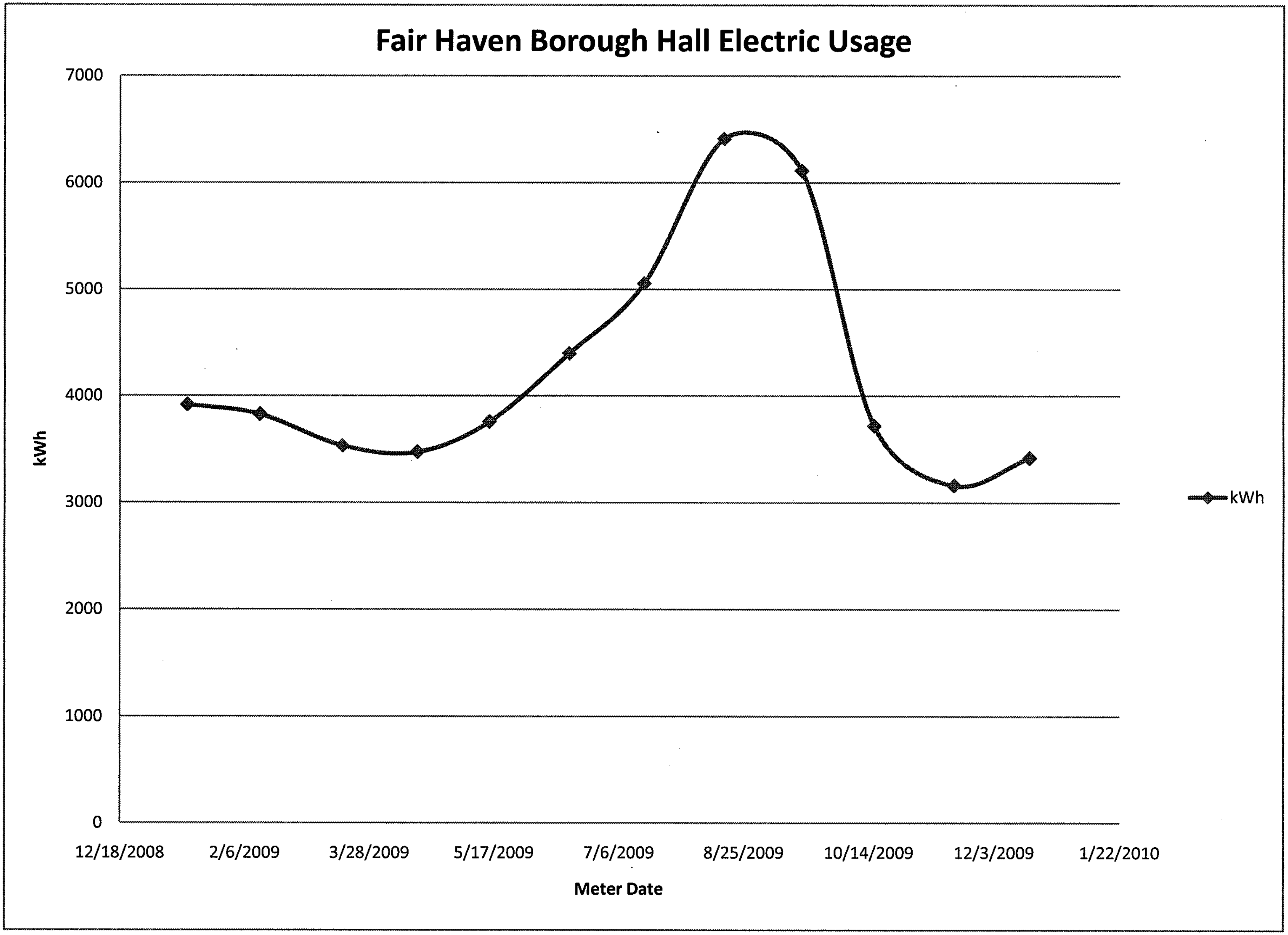
- ECM-1 Boiler Replacement

APPENDIX A

Utility Usage Analysis

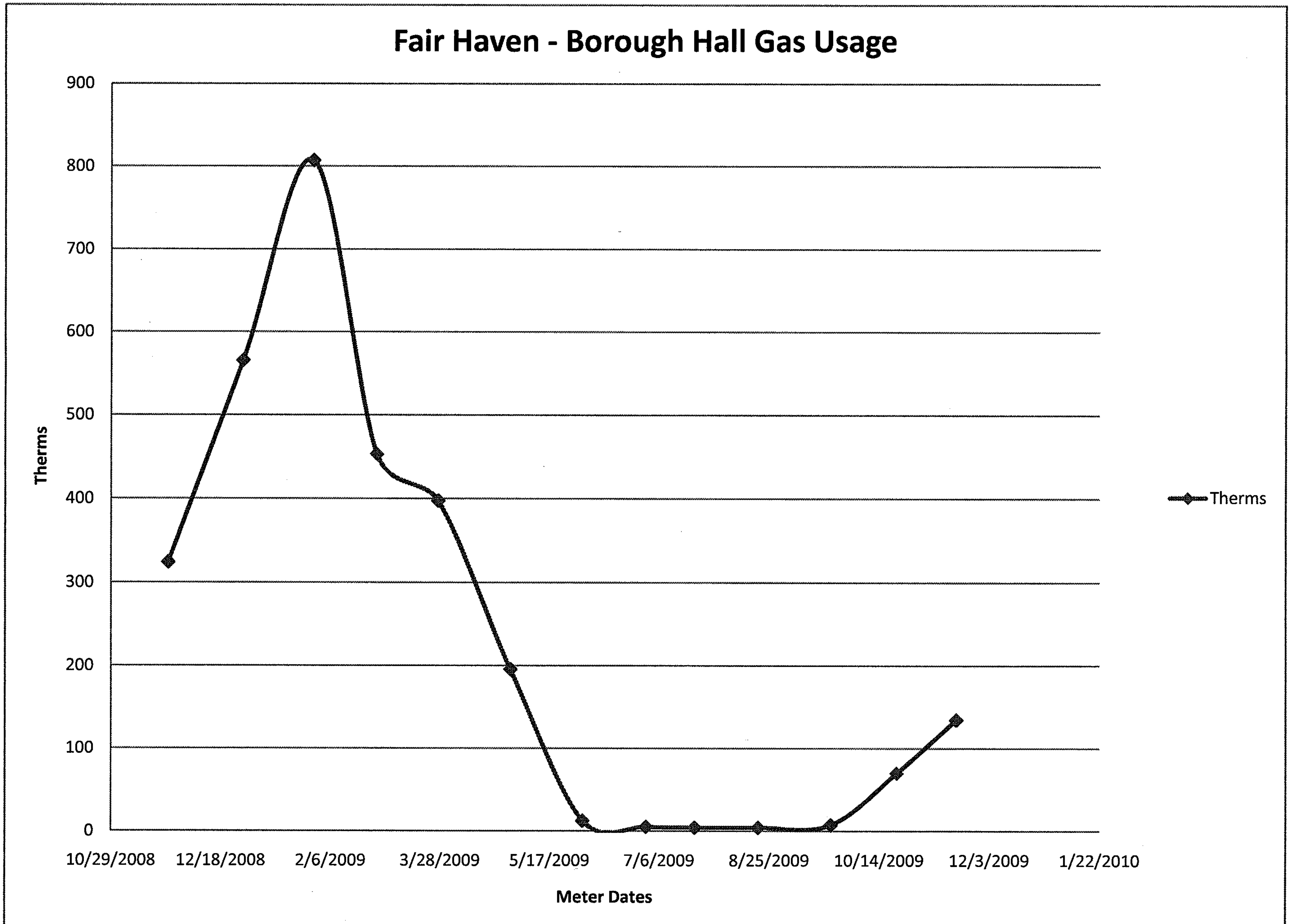
Account Number 20 00 00 0010 12
Meter number General Service Secondary 3 Phase TOTAL $83,861.57
Address Master Bill Rate S - JC_GS3_01F

	Traffic Light								Police Department		DPW		Borough Hall	
	ACCT #:		ACCT #:		ACCT #:		ACCT #:		ACCT #:		ACCT #:		ACCT #:	
	10 00 12 8183 22		10 00 13 0083 29		100 00 13 0437 63		10 00 13 2805 30		10 00 13 3942 65		10 00 13 4312 65		10 00 13 4388 07	
	Meter:	W33736243	Meter:	S76264615	Meter:	G28568336	Meter:	A86561615	Meter:	G17995173	Meter:	G16566408	Meter:	S07032891
Meter Date	Billing kWH	Charge	Billing kWH	Charge	Billing kWH	Charge	Billing kWH	Charge	Billing kWH	Charge	Billing kWH	Charge	Billing kWH	Charge
1/14/2008	24	$7.74	397	$71.87	100	$30.33	654	$108.44	6474	$998.42	6253	$942.83	5381	$843.71
2/13/2008	22	$7.34	401	$72.17	14	$14.25	627	$104.22	6471	$993.95	4320	$702.44	2817	$497.55
3/18/2008	24	$7.67	503	$85.45	9	$24.98	690	$115.52	7262	$1,083.16	2613	$459.03	4683	$736.01
4/14/2008	23	$7.36	471	$78.56	14	$49.35	651	$102.70	6823	$989.53	4866	$713.48	4371	$672.33
5/14/2008	26	$7.90	436	$73.84	0	$11.65	716	$111.42	7691	$1,099.00	3294	$509.99	4136	$643.37
6/13/2008	23	$8.08	98	$30.93	1426	$283.75	640	$117.31	8051	$1,385.14	2549	$479.70	5529	$999.46
7/15/2008	24	$8.46	89	$30.33	678	$158.90	643	$123.48	9946	$1,784.87	2243	$453.27	7381	$1,351.93
8/14/2008	25	$8.67	591	$114.74	394	$97.21	686	$130.71	11360	$2,014.77	2319	$465.43	7138	$1,310.25
9/15/2008	23	$8.20			3569	$632.55	649	$123.09	10331	$1,825.74	2179	$438.36	6112	$1,149.49
10/15/2008	22	$7.38	1268	$281.29	359	$79.25	607	$102.72	7112	$1,116.72	1916	$349.88	3824	$652.37
11/13/2008	26	$8.16	266	$53.80	443	$95.34	715	$118.70	7351	$1,135.59	3833	$641.07	4239	$712.67
12/15/2008	24	$7.86	244	$51.35	776	$160.59	644	$110.38	6493	$1,027.70	4039	$653.35	4254	$710.03
1/14/2009	25	$8.16	267	$56.09	3	$12.25	706	$123.09	6891	$1,118.14	7564	$1,206.16	3917	$682.81
2/12/2009	23	$7.80	243	$52.60			636	$112.82	6553	$1,085.65	6216	$1,032.18	3827	$672.33
3/17/2009	23	$7.76	235	$50.95	76268	$11,061.33	593	$105.25	6099	$997.93	3795	$644.51	3533	$623.75
4/16/2009	21	$7.32	218	$47.92	4	$12.44	594	$104.09	6014	$972.03	3334	$568.99	3474	$607.31
5/15/2009	26	$8.29	256	$53.61	6	$24.47	682	$117.25	6968	$1,112.61	2556	$453.05	3758	$690.48
6/16/2009	27	$9.07	281	$62.19			753	$140.88	8727	$1,529.85	2294	$460.35	4398	$854.72
7/16/2009	24	$8.39	243	$55.49	3228	$580.94	641	$121.19	9460	$1,684.54	1866	$389.44	5057	$950.54
8/17/2009	23	$8.18	247	$56.14	7	$24.82	641	$121.19	11406	$2,007.59	2062	$420.23	6412	$1,202.26
9/17/2009	23	8.2	0	0	3569	632.55	649	123.09	10331	1825.74	2179	438.36	6112	1149.49
10/16/2009	23	$7.68	240	$50.97	4126	$744.82	624	$107.96	6976	$1,140.37	1816	$346.62	3719	$668.28
11/17/2009	23	$7.68	228	$49.17	2654	$436.24	640	$110.24	5540	$907.95	2687	$468.49	3162	$566.57
12/17/2009	25	$8.14	268	$55.81			679	$117.92	6091	$1,002.33	3194	$556.54	3420	$612.36
Total	572	$191.49	7490	$1,535.27	97647	$15,168.01	15760	$2,773.66	186421	$30,839.32	79987	$13,793.75	110654	$19,560.07
Previous 12 Months	286	$96.67	2726	$590.94	89865	$13,529.86	7838	$1,404.97	91056	$15,384.73	39563	$6,984.92	50789	$9,280.90
Blended 12 months		$0.34		$0.22		$0.15		$0.18		$0.169		$0.18		$0.18


Fair Haven Borough Hall Electric Usage
7000
6000
5000
4000
3000
2000
1000
0
kWh
12/18/2008
2/6/2009
3/28/2009
5/17/2009
7/6/2009
8/25/2009
10/14/2009
12/3/2009
1/22/2010
Meter Date
kWh

Account Number 03-2106-6800-15
Meter number 514384
Address 748 River Road FRHVN Borough Hall

Meter Date	100's of Cubic Feet	Conversion	Billing Therms	Charge	Unit Cost
11/24/2008	308	1.052	324.11	$ 534.92	$ 1.65
12/28/2008	537.5	1.052	565.535	$ 834.22	$ 1.48
1/29/2009	767	1.052	806.96	$ 1,133.52	$ 1.40
2/27/2009	429	1.057	453.24	$ 647.61	$ 1.43
3/27/2009	377	1.054	397.47	$ 550.58	$ 1.39
4/29/2009	186	1.051	195.47	$ 332.53	$ 1.70
6/1/2009	12	1.05	12.6	$ 44.82	$ 3.56
6/30/2009	5	1.047	5.23	$ 33.23	$ 6.35
7/22/2009	4	1.047	4.19	$ 24.09	$ 5.75
8/20/2009	4	1.046	4.18	$ 31.62	$ 7.56
9/22/2009	7	1.046	7.32	$ 36.15	$ 4.94
10/22/2009	67	1.045	70.02	$ 113.44	$ 1.62
11/18/2009	129	1.042	134.42	$ 194.10	$ 1.44
Total	2832.5		2,981	$4,511	$1.51


Fair Haven - Borough Hall Gas Usage
900
800
700
600
500
400
300
200
100
0
Therms
10/29/2008
12/18/2008
2/6/2009
3/28/2009
5/17/2009
7/6/2009
8/25/2009
10/14/2009
12/3/2009
1/22/2010
Meter Dates
Therms

APPENDIX B

Approved Electrical and Natural Gas Energy Commodity Suppliers

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

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

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

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

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

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

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

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

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

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

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

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

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

RPL Holdings, Inc
601 Carlson Pkwy
Minnetonka, MN 55305

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

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

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

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

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

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

APPENDIX C

ECM-1 Boiler Replacement

Fair Haven
CHA #21968
Building: Borough Hall

ECM-1 Boiler Replacement

Existing Fuel	Nat.Gas
Proposed Fuel	Nat.Gas

Item	Value	Units	Formula/Comments
Baseline Fuel Cost	$ 1.51		
Proposed Fuel Cost	$ 1.51		
Baseline Fuel Use	2,900	Therms	Based on historical utility data
Existing Boiler Plant Efficiency	79%		Estimated or Measured
Baseline Boiler Load	229,100	Mbtu/yr	Baseline Fuel Use x Existing Efficiency x 100 Mbtu/Therms
Baseline Fuel Cost	$ 4,379		
Proposed Boiler Plant Efficiency	93%		New Boiler Efficiency
Proposed Fuel Use	2,463	Therms	Baseline Boiler Load / Proposed Efficiency / 100 Mbtu/Therms
Proposed Fuel Cost	$ 3,720		
Annual Savings	437	Therms	
Annual Savings	**$ 659**	**/yr**	

*Note to engineer: Link savings back to summary sheet in appropriate column.

Fair Haven
CHA #21968
Building: Borough Hall

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.		
New high efficiency boiler	1	ea.			$ 9,000	$ -	$ -	$ 9,810	$ 9,810	Based on an Aerco MLX Boiler.
Boiler removal. Disconnect water and gas piping.	1	Lot		$ 500		$ -	$ 605	$ -	$ 605	
Disconnect electrical wiring.	1	Lot		$ 200		$ -	$ 242	$ -	$ 242	
Install new boiler. Reconnect the gas and hot water piping. Install new stack material. Reconnect electrical.	1	Lot	$ 700	$ 1,000		$ 686	$ 1,210	$ -	$ 1,896	
Startup	1	Lot		$ 500		$ -	$ 605	$ -	$ 605	
						$ -	$ -	$ -	$ -	

$ 13,158	Subtotal
$ 658	5% Contingency
$ 1,382	Contractor 10% O&P
$ 2,280	15% Engineering
$ 17,477	**Total**

New Jersey Smart Start Incentive	Total MBH	UNIT	$ / UNIT	TOTAL SAVINGS	Cost W/O INCENTIVE	Cost W/ INCENTIV
(1) 350 MBH Aerco Boiler	350	EA	$1.75	$613	$17,477	$ 16,865
				$613	$17,477	$16,865

Total ECM Cost w/ Incentives	**$16,865**

APPENDIX D

ECM-2 Lighting Replacements

Fair Haven
CHA #21968
Building: Borough Hall

ECM-2 Replacement of incandescent and T-12 lights

Building Schedule:
Existing conditions (master switch): hrs/week
Supply Electric Rate $ 0.183 /kWh
Demand Rate $ - /kW

Instructions and notes:
Input existing fixtures and retrofit fixtures. Use light table

	EXISTING CONDITIONS										RETROFIT CONDITIONS								COST ANALYSIS				
Area Description	**Number of Fixtures**	**Fixture Code**	**Watts per Fixture**	**Number of Non-Operational Fixtures**	**Watts per Non-Operational Fixtures**	**kW/Space**	**Exist Control**	**Daily Hours**	**Annual Hours**	**Annual kWh**	**Number of Fixtures**	**Fixture Code**	**Watts per Fixture**	**kW/Space**	**Retrofit Control**	**Daily Hours**	**Annual Hours**	**Annual kWh**	**kW Saved**	**Annual kWh Saved**	**Annual $ Saved**	**Retrofit Cost**	**Simple Payback**
Hallway	2	F44EE	144	0	146.88	0.288	switch	8	2,920	841	2	F44ILL	112	0.224	switch	8	2,920	654	0	187	$ 34	$ 251	7.3
Hallway	7	F42ES	80	0	81.6	0.56	switch	8	2,920	1,635	7	F42ILL	59	0.413	switch	8	2,920	1,206	0	429	$ 78	$ 878	11.2
Main Office	6	F42ES	80	0	81.6	0.48	switch	8	2,920	1,402	6	F42ILL	59	0.354	OS	8	2,920	1,034	0	368	$ 67	$ 753	11.2
Tax Office	6	F42ES	80	0	81.6	0.48	switch	8	2,920	1,402	6	F42ILL	59	0.354	OS	8	2,920	1,034	0	368	$ 67	$ 753	11.2
Conf. Rm.	2	F42ES	80	0	81.6	0.16	switch	8	2,920	467	2	F42ILL	59	0.118	OS	8	2,920	345	0	123	$ 22	$ 251	11.2
Administrator	2	F42ES	80	0	81.6	0.16	switch	8	2,920	467	2	F42ILL	59	0.118	OS	8	2,920	345	0	123	$ 22	$ 251	11.2
1st. Fl. MR	3	F42ES	80	0	81.6	0.24	switch	8	2,920	701	3	F42ILL	59	0.177	switch	8	2,920	517	0	184	$ 34	$ 376	11.2
1st. Fl. WR	3	F42ES	80	0	81.6	0.24	switch	8	2,920	701	3	F42ILL	59	0.177	switch	8	2,920	517	0	184	$ 34	$ 376	11.2
Fianance	2	F42ES	80	0	81.6	0.16	switch	8	2,920	467	2	F42ILL	59	0.118	OS	8	2,920	345	0	123	$ 22	$ 251	11.2
Back Entrance	10	CFQ13/2-L	28	0	28.56	0.28	switch	8	2,920	818	10	CFQ13/2-L	28	0.28	switch	8	2,920	818	-	-	$ -	$ -	
Basement Hallway	6	CFQ13/2-L	28	0	28.56	0.168	switch	8	2,920	491	6	CFQ13/2-L	28	0.168	switch	8	2,920	491	-	-	$ -	$ -	
Basement	5	F42ES	80	0	81.6	0.4	switch	8	2,920	1,168	5	F42ILL	59	0.295	switch	8	2,920	861	0	307	$ 56	$ 627	11.2
Basement Closet	2	CFQ13/2-L	28	0	28.56	0.056	switch	8	100	6	2	CFQ13/2-L	28	0.056	switch	8	100	6	-	-	$ -	$ -	
Court Room	12	F42ES	80	0	81.6	0.96	switch	8	2,920	2,803	12	F42ILL	59	0.708	switch	8	2,920	2,067	0	736	$ 134	$ 1,506	11.2
Court Room	10	CFQ13/2-L	28	0	28.56	0.28	switch	8	2,920	818	10	CFQ13/2-L	28	0.28	switch	8	2,920	818	-	-	$ -	$ -	
Daycare Room	4	CFQ13/2-L	28	0	28.56	0.112	switch	8	2,920	327	4	CFQ13/2-L	28	0.112	OS	8	2,920	327	-	-	$ -	$ -	
Library	21	F44EE	144	0	146.88	3.024	switch	8	2,920	8,830	21	F44ILL	112	2.352	OS	8	2,920	6,868	1	1,962	$ 359	$ 2,635	7.3
Library Office	2	F42ES	80	0	81.6	0.16	switch	8	2,920	467	2	F42ILL	59	0.118	OS	8	2,920	345	0	123	$ 22	$ 251	11.2
Basement Office	4	F42ES	80	0	81.6	0.32	switch	8	2,920	934	4	F42ILL	59	0.236	OS	8	2,920	689	0	245	$ 45	$ 502	11.2
Recreation Office	4	F42ES	80	0	81.6	0.32	switch	8	2,920	934	4	F42ILL	59	0.236	OS	8	2,920	689	0	245	$ 45	$ 502	11.2
Storage	2	F42ES	80	0	81.6	0.16	switch	0	100	16	2	F42ILL	59	0.118	switch	0	100	12	0	4	$ 1	$ 251	327.0
Zoning Office	2	F42ES	80	0	81.6	0.16	switch	8	2,920	467	2	F42ILL	59	0.118	OS	8	2,920	345	0	123	$ 22	$ 251	11.2
TOTALS -	**117**			**0**		**9.2**				**26,161**	**117**			**7.1**				**20,329**	**2.0**	**5,833**	**$ 1,066**	**$ 10,665**	**10.0**

New Jersey Smart Start Incentive	QTY	UNIT	$ / UNIT	TOTAL SAVINGS	Cost W/O INCENTIVE	Cost W/ INCENTIVE
1 & 2 Lamp T-12 Retrofit < 250 Watt	62	EA	15	$ 930.00	$ -	$ -
3 & 4 Lamp T-12 Retrofit < 250 Watt	23	EA	15	$ 345.00	$ -	$ -
				$ 1,275	$ 10,665	$ 9,390

Total ECM Cost w/ Incentives		$ 9,390

APPENDIX E

ECM-3 Occupancy Sensors for Interior Lighting

Fair Haven
CHA #21968
Building: Borough Hall

ECM-3 - Use of motion sensors for interior lighting

Instructions and notes:
Input all applicable fixture codes from Light Table. In retrofit conditions indicate "Yes" if motion sensor is applicable
Use weekly hours if all fixtures on this sheet can be retrofitted with motion sensors, else use daily hours
*Motion sensor = Evaluate operating hours (location, traffic, etc.)
Tip: Motion sensors stays On for approx. 10 minutes when activated. It may save operating hours by 25%,30% or more.
Make sure that security or safety does not prevent installation of motion sensors
Make judgment when using Cost Tables

Building Schedule:

Existing conditions (master switch):	40	hrs/week
Retrofit conditions (motion sensors):	20	hrs/week
Cost of Electricity:	0.183	$/kWh

	EXISTING CONDITIONS									RETROFIT CONDITION				COST ANALYSIS			
Area Description	**Number of Fixtures**	**Fixture Code**	**Watts per Fixture**	**Number of Non-Operational Fixtures**	**Watts per Non-Operational Fixtures**	**kW/Space**	**Daily Hours**	**Annual Hours**	**Annual kWh**	**Motion sensor Yes or No**	**Number of Sensors Required**	**Annual Hours**	**Annual kWh**	**Annual kWh Saved**	**Annual $ Saved**	**Retrofit Cost**	**Simple Payback**
Main Office	6	F42ILL	59	0	60.18	0.4	8	2,080	736	Yes	1	1,040	368	368	$ 67	$ 259	3.8
Tax Office	6	F42ILL	59	0	60.18	0.354	8	2,080	736	Yes	1	1,040	368	368	$ 67	$ 259	3.8
Conf. Rm.	2	F42ILL	59	0	60.18	0.118	8	2,080	245	Yes	1	1,040	123	123	$ 22	$ 259	11.5
Administrator	2	F42ILL	59	0	60.18	0.118	8	2,080	245	Yes	1	1,040	123	123	$ 22	$ 259	11.5
Fianance	2	F42ILL	59	0	60.18	0.118		2,080	245	Yes	1	1,040	123	123	$ 22	$ 259	11.5
Daycare Room	4	CFQ13/2-L	28	0	28.56	0.112		2,080	233	Yes	1	1,040	116	116	$ 21	$ 259	12.1
Library	21	F44ILL	112	0	114.24	2.352		2,080	4,892	Yes	4	1,040	2,446	2,446	$ 447	$ 1,034	2.3
Library Office	2	F42ILL	59	0	60.18	0.118		2,080	245	Yes	1	1,040	123	123	$ 22	$ 259	11.5
Basement Office	4	F42ILL	59	0	60.18	0.236		2,080	491	Yes	1	1,040	245	245	$ 45	$ 259	5.8
Recreation Office	4	F42ILL	59	0	60.18	0.236		2,080	491	Yes	1	1,040	245	245	$ 45	$ 259	5.8
Zoning Office	2	F42ILL	59	0	60.18	0.118		2,080	245	Yes	1	1,040	123	123	$ 22	$ 259	11.5
TOTALS -	**55**			**0**		**4.2**		**22,880**	**8,807**		**14.0**	**11,440**	**4,403.4**	**4,403**	**$ 804**	**$ 3,619**	**4.5**

New Jersey Smart Start Incentive	QTY	UNIT	$ / UNIT	TOTAL SAVINGS	Cost W/O INCENTIVE	Cost W/ INCENTIVE
Remote Motion Sensors	14	EA	35	$ 490	$ 3,619	$ 3,129
				$ 490	$ 3,619	$ 3,129

Total ECM Cost w/ Incentives	**$3,129**

APPENDIX F

ECM-4 Exit Sign Replacement

Fair Haven
CHA #21968
Building: Borough Hall

ECM-4 Replace EXIT signs with LED type

Analysis

Referenced Data

Demand Rate	$	/kW
Supply Electrical Rate	$ 0.183	/kWh

Inputs

	Material	Labor
Demolition	$ -	$ 5
New Sign Install	$ 85	$ 10

Contingency	10%	of Sub-Total
Contractor O&P	12%	of Sub-Total
Engineering	0%	of Sub-Total

Replacement Power 1.7 watts/sign

Sign Type	Wattage Per Side	Sides	Quantity
A	24	1	10
B	0	1	0
C	0	1	0

Results

Utility Savings	Electrical		1,953 kWh
	Demand		0.2 kW
	Steam		- klbs
	Savings	**$357**	
	Implementation Cost	**$2,815**	
	Simple Payback (Yrs)	**7.9**	

Calculations

Current Power Consumption = [(24 W/side x 1 side x 10 signs) + (0 W/side x 1 side x 0 signs) + (0 W/side x 1 side x 0 sign)] x 8,760 hrs/yr

= 0.24 kW x 8,760 hrs/yr

= 2,102 kWh

Proposed Power Consumption = (1.7 W/sign x 10 signs) x 8,760 hrs/yr

= 0. kW x 8,760 hrs/yr

= 149 kWh

Fair Haven
CHA #21968
Building: Borough Hall

ECM-4 Replace EXIT signs with LED type

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.		
						$ -	$ -	$ -	$ -	
Demolition	10	Ea	$ -	$ 5		$ -	$ 61	$ -	$ 61	
Install new exit signs	10	Ea.	$ 138	$ 86		$ 1,352	$ 1,035	$ -	$ 2,387	
						$ -	$ -	$ -	$ -	

$ 2,447	Subtotal
$ 122	5% Contingency
$ 245	Contractor 10% O&P
$ -	0% Engineering
$ 2,815	**Total**

New Jersey Smart Start Incentive	QTY	UNIT	$ / UNIT	TOTAL SAVINGS	Cost W/O INCENTIVE	Cost W/ INCENTIVE
LED Exit Signs	10	EA	10	100	$ 2,815	$ 2,715
				100	$ 2,815	$ 2,715

Total ECM Cost w/ Incentives	$ 2,715
Payback with incentive	7.61

APPENDIX G

ECM-5 Photo Cells for Exterior Lighting

Fair Haven
CHA #21968
Building: Borough Hall

ECM-5 - Use of photo cells for exterior lighting

Building Schedule:
Existing conditions (master switch): 168 hrs/week
Retrofit conditions (photo cells): 80 hrs/week

Cost of Electricity: 0.1827 $/kWh

Instructions and notes:
Input all applicable fixture codes from Light Table (hidden sheet). In retrofit conditions indicate "Yes" if photo cell is applicable
Use weekly hours if all fixtures on this sheet can be retrofitted with photo cells, else use columns for Daily Hours
*Photo Cells = Dusk to dawn lights operate approx. 4100 hour per year (this is average over a year that is independent of latitude)
If the existing light fixture is utilized less than stated above photo cell will not save energy
Make sure that security reason does not prevent installation of photo cells
Make judgment when using Cost Tables

	EXISTING CONDITIONS									RETROFIT CONDITION			COST ANALYSIS			
Area Description	**Number of Fixtures**	**Fixture Code**	**Watts per Fixture**	**Number of Non-Operational Fixtures**	**Watts per Non-Operational Fixtures**	**kW/Space**	**Daily Hours**	**Annual Hours**	**Annual kWh**	**Photo-Cell Yes or No**	**Annual Hours**	**Annual kWh**	**Annual kWh Saved**	**Annual $ Saved**	**Retrofit Cost**	**Simple Payback**
South Wall	2	H75/2	150	0	153	0.3		8,736	2,621	Yes	4,160	1,248	1,373	$ 251	$ 300	1.2
TOTALS -	**2**			**0**		**0.3**			**2,621**		**4,160**	**1,248**	**1,373**	**251**	**$ 300**	**1.2**

APPENDIX H

ECM-6 Temperature Setback

Fair Haven
CHA #21968
Building: Borough Hall

ECM-6 Temperature Setback

Building Footprint	7,284	SF
Heating Efficiency	79%	
Cooling Efficiency	1.2	kW/ton
Building Balance Temp.	60	*F
Internal Gains	45,612	btu/h
Unoc Internal Gain factor	0.03	
Ave Occ Internal Gain Factor	0.7	

Ex Occupied Clng Temp.	74	*F
Ex Unoccupied Clng Temp.	74	*F
Prop Occupied Clng Temp.	74	*F
Prop Unoccupied Clng Temp.	82	*F
Occupied Cooling UA	-2,713	btu/hr/°F
Unoccupied Cooling UA	-1,724	btu/hr/°F
Cooling Occ Enthalpy Setpoint	27	Btu/lb
Cooling Unocc Enthalpy Setpoint	27	Btu/lb

Ex Occupied Htg Temp.	68	*F
Ex Unoccupied Htg Temp.	68	*F
Prop Occupied Htg Temp.	68	*F
Prop Unoccupied Htg Temp.	60	*F
Occupied Heating UA	1,039	btu/hr/°F
Unoccupied Heating UA	1,039	btu/hr/°F

Heating Energy Savings	733	**therms**
Cooling Energy Savings	1,821	**kWh**
Heating Cost Savings	**$ 1,106**	
Cooling Cost Savings	**$ 333**	
Total Cost Savings	**$ 1,439**	

Heating and cooling energy are unrelated in this model. If the building being analyzed is not cooled, disregard cooling energy calculations

					EXISTING LOADS						PROPOSED LOADS										
					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	Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Unoccupied Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Unoccupied Envelope Load BTUH	Ventilation Load BTUH	Internal Gain 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	M	N	O	P	K	L	M	N
102.5	49.1	0	0	0	-77,330	-101,788	-31,928	-49,138	-101,788	-1,368	-77,330	-101,788	-31,928	-35,345	-101,788	-1,368	0	0	0	0
97.5	42.5	3	1	2	-63,764	-71,390	-31,928	-40,518	-71,390	-1,368	-63,764	-71,390	-31,928	-26,724	-71,390	-1,368	38	35	0	0
92.5	39.5	34	8	26	-50,197	-57,573	-31,928	-31,897	-57,573	-1,368	-50,197	-57,573	-31,928	-18,104	-57,573	-1,368	348	313	0	0
87.5	36.6	131	31	100	-36,630	-44,216	-31,928	-23,276	-44,216	-1,368	-36,630	-44,216	-31,928	-9,483	-44,216	-1,368	1,039	901	0	0
82.5	34	500	119	381	-23,063	-32,241	-31,928	-14,655	-32,241	-1,368	-23,063	-32,241	-31,928	-862	-32,241	-1,368	2,877	2,352	0	0
77.5	31.6	620	148	472	-9,497	-21,187	-31,928	-6,035	-21,187	-1,368	-9,497	-21,187	-31,928	0	0	-1,368	2,275	989	0	0
72.5	29.2	664	158	506	0	0	-31,928	0	0	-1,368	0	0	-31,928	0	0	-1,368	574	574	0	0
67.5	27	854	203	651	520	553	-31,928	520	553	-1,368	520	553	-31,928	0	0	-1,368	647	716	0	0
62.5	24.5	927	221	706	5,716	6,080	-31,928	5,716	6,080	-1,368	5,716	6,080	-31,928	0	0	-1,368	444	541	0	0
57.5	21.4	600	143	457	10,912	11,607	-31,928	10,912	11,607	-1,368	10,912	11,607	-31,928	2,598	2,763	-1,368	134	134	0	0
52.5	18.7	610	145	465	16,108	17,134	-31,928	16,108	17,134	-1,368	16,108	17,134	-31,928	7,794	8,290	-1,368	0	0	190	89
47.5	16.2	611	145	466	21,305	22,661	-31,928	21,305	22,661	-1,368	21,305	22,661	-31,928	12,991	13,817	-1,368	0	0	273	172
42.5	14.4	656	156	500	26,501	28,188	-31,928	26,501	28,188	-1,368	26,501	28,188	-31,928	18,187	19,344	-1,368	0	0	382	274
37.5	12.6	1,023	244	779	31,697	33,715	-31,928	31,697	33,715	-1,368	31,697	33,715	-31,928	23,383	24,871	-1,368	0	0	735	566
32.5	10.7	734	175	559	36,893	39,241	-31,928	36,893	39,241	-1,368	36,893	39,241	-31,928	28,579	30,398	-1,368	0	0	627	506
27.5	8.6	334	80	254	42,089	44,768	-31,928	42,089	44,768	-1,368	42,089	44,768	-31,928	33,775	35,925	-1,368	0	0	331	275
22.5	6.8	252	60	192	47,286	50,295	-31,928	47,286	50,295	-1,368	47,286	50,295	-31,928	38,972	41,452	-1,368	0	0	284	242
17.5	5.5	125	30	95	52,482	55,822	-31,928	52,482	55,822	-1,368	52,482	55,822	-31,928	44,168	46,979	-1,368	0	0	158	137
12.5	4.1	47	11	36	57,678	61,349	-31,928	57,678	61,349	-1,368	57,678	61,349	-31,928	49,364	52,506	-1,368	0	0	66	58
7.5	2.6	22	5	17	62,874	66,876	-31,928	62,874	66,876	-1,368	62,874	66,876	-31,928	54,560	58,033	-1,368	0	0	34	30
2.5	1	13	3	10	68,071	72,403	-31,928	68,071	72,403	-1,368	68,071	72,403	-31,928	59,757	63,560	-1,368	0	0	22	20
-2.5	0	0	0	0	73,267	77,930	-31,928	73,267	77,930	-1,368	73,267	77,930	-31,928	64,953	69,087	-1,368	0	0	0	0
-7.5	-1.5	0	0	0	78,463	83,457	-31,928	78,463	83,457	-1,368	78,463	83,457	-31,928	70,149	74,614	-1,368	0	0	0	0
TOTALS		**8,760**	**2,086**	**6,674**													**8,377**	**6,555**	**3,101**	**2,368**

Existing Building Ventilation & Infiltration (occ)	**1,024 cfm**
Overheat Ventilation Factor	**1.00**
Additional ventilation to offset overheat	**0 cfm**
Existing Building Ventilation & Infiltration (unocc)	**1,024 cfm**

Fair Haven
CHA #21968
Building: Borough Hall

ECM-6 Temperature Setback

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.		
						$ -	$ -	$ -	$ -	
Programmable thermostat	2	ea	$ 100	$ 50	$ -	$ 196	$ 121	$ -	$ 317	
Reprogram DDC system		ea	$ -	$ 50	$ -	$ -	$ -	$ -	$ -	per temperature program
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

$ 317	Subtotal
$ 32	10% Contingency
$ 35	Contractor 10% O&P
$ -	0% Engineering
$ 384	**Total**

APPENDIX I

New Jersey Pay For Performance Incentive Program

Fair Haven
CHA #21968
Borough Hall

New Jersey Pay For Performance Incentive Program

Note: The following calculation is based on the New Jersey Pay For Performance Incentive Program per April, 2010. Building must have a minimum average electric demand of 200 kW. This minimum is waived for buildings owned by local governements or non-profit organizations.
The incentive values represented below are applicable through December 31, 2010.

Total Building Area (Square Feet)	4,000
Is this audit funded by the NJ BPU (Y/N)	Yes

Bureau of Public Utilites (BPU)

Incentive #1		
Audit not funded by NJ BPU	$0.10	$/sqft
Audit is funded by NJ BPU	$0.05	$/sqft

	Annual Utilities	
	kWh	Therms
Existing Cost (from utility)	$9,300	$4,500
Existing Usage (from utility)	50,800	3,000
Proposed Savings	15,384	1,169
Existing Total MMBtus	473	
Proposed Savings MMBtus	169	
% Energy Reduction	**35.8%**	
Proposed Annual Savings	$4,576	

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

Incentives $

	Elec	Gas	Total
Incentive #1	$0	$0	$200
Incentive #2	$1,692	$1,286	$2,978
Incentive #3	$1,077	$818	$1,895
Total All Incentives	**$2,769**	**$2,104**	**$5,073**

Total Project Cost	$35,260

		Allowable Incentive
% Incentives #1 of Utility Cost*	**1%**	**$ 200**
% Incentives #2 of Project Cost**	**8%**	**$ 2,978**
% Incentives #3 of Project Cost**	**5%**	**$ 1,895**
Total Eligible Incentives***	**$ 5,073**	
Project Cost w/ Incentives	**$ 30,187**	

Project Payback (years)	
w/o Incentives	**w/ Incentives**
7.7	**6.6**

* Maximum allowable incentive is 50% of annual utility cost if not funded by NJ BPU, and %25 if it is.
** Maximum allowable amount of Incentive #2 is 30% of total project cost.
Maximum allowable amount of Incentive #3 is 20% of total project cost.
*** Maximum allowable amount of Incentive #1 is $50,000 if not funded by NJ BPU, and $25,000 if it is.
Maximum allowable amount of Incentive #2 & #3 is $1 million per gas account and $1 million per electric account

APPENDIX J

Photovoltaic (PV) Rooftop Solar Power Generation

PVWatts *** AC Energy & Cost Savings

Cautions for Interpreting the Results

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

Station Identification	
City:	Newark
State:	New_Jersey
Latitude:	40.70° N
Longitude:	74.17° W
Elevation:	9 m
PV System Specifications	
DC Rating:	10.0 kW
DC to AC Derate Factor:	0.770
AC Rating:	7.7 kW
Array Type:	Fixed Tilt
Array Tilt:	40.7°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	18.3 ¢/kWh

Results

Month	Solar Radiation ($kWh/m^2/day$)	AC Energy (kWh)	Energy Value ($)
1	3.36	828	151.52
2	4.05	894	163.60
3	4.58	1084	198.37
4	4.84	1060	193.98
5	5.30	1168	213.74
6	5.33	1101	201.48
7	5.27	1112	203.50
8	5.25	1101	201.48
9	5.06	1068	195.44
10	4.46	1005	183.91
11	3.15	718	131.39
12	2.87	692	126.64
Year	4.46	11830	2164.89

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

RReDC Return to RReDC home page (*http://rredc.nrel.gov*)

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.

Fair Haven
Borough Hall

Cost of Electricity $0.183 $/kWh

Photovoltaic (PV) Rooftop Solar Power Generation-10 kW System

Budgetary Cost	Annual Utility Savings				Estimated Maintenance Savings	Total Savings	New Jersey Renewable * Energy Incentive	New Jersey Renewable ** SREC	Payback (without incentive)	Payback (with incentive)
$	kW	kWh	therms	$	$	$	$	$	Years	Years
$63,300	**0.0**	**11,830**	**0**	**$2,200**	**0**	**$2,200**	**$7,500**	**$5,800**	**28.8**	**7.0**

Note: Budgetary cost is based on $6,330/kW.
*Incentive based on New Jersey renewable energy program for non-residential applications(PV)= $0.75/W of installed PV system
** Estimated Solar Renewable Energy Certificate Program (SREC) SREC for 15 Years= $487/1000kwh

Estimated Solar Renewable Energy Certificate Program (SREC) payments for 15 Years from RR Renewable Energy Consultants

Year	SREC
1	600
2	600
3	600
4	500
5	500
6	500
7	500
8	500
9	500
10	500
11	400
12	400
13	400
14	400
15	400
AVG	**487**

APPENDIX K

Solar Thermal Domestic Hot Water Plant

Home

What Can I Do?

Electric Choice

Home Energy

FAQs

LEARN
Fact Sheets
Lesson Plans

PLAY
Calculators

NETWORK
Organizations
Businesses
Events Calendar

BROWSE
Resources
Solar
Wind
Biomass
Geothermal
Water

Projects

TX Energy - Past and Present

Financial Help

About Us

About SECO

RARE

Interactive Energy Calculators

RENEWABLE ENERGY
THE INFINITE POWER OF TEXAS

Our calculators help you understand energy production and consumption in a whole new way. Use them to develop a personal profile of your own energy use.

Carbon Pollution Calculator
Electric Power Pollution Calculator
PV System Economics
Solar Water Heating
What's a Watt?

Solar Water Heating Calculator

Water heating is a major energy consumer. Although the energy consumed daily is often less than for air conditioning or heating, it is required year round, making it a good application of solar energy. Use this calculator to explore the energy usage of your water heater, and to estimate whether a solar water heater could save you money.

Water Heater Characteristics			
Physical		**Thermal**	
? Diameter (feet)	1.5	? Water Inlet Temperature (Degrees F)	55
? Capacity (gallons)	75	? Ambient Temperature (Degrees F)	70
? Surface Area (calculated - sq ft)	30.27	? Hot Water Temperature (Degrees F)	120
? Effective R-value	NaN	? Hot Water Usage (Gallons per Day)	10
Energy Use			
222.4		? Heat Delivered in Hot Water (BTU/hr)	
0		? Heat loss through insulation (BTU/hr)	

Gas vs. Electric Water Heating		
Gas		**Electric**
0.8	? Overall Efficiency	0.98
0.8	? Conversion Efficiency	0.98
278 BTU/hr	? Power Into Water Heater	226.9 BTU/hr
Cost		
$ 1.51 /Therm	? Utility Rates	$ 0.183 /kWh
$ 36.7727	? Yearly Water Heating Cost	$ 106.530
How Does Solar Compare?		
	? Solar Water Heater Cost: $ 27100	? Percentage Solar: 70
1052.79 years for gas	? Payback Time for Solar System	363.411 years for electric

NJBPU Energy Audits
CHA #21968
Building: Borough of Fair Haven - Borough Hall

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.		
Synergy Solar Thermal System	2	ea			$ 3,600	$ -	$ -	$ 7,848	$ 7,848	
Piping modifications	1	ls	$ 2,000	$ 3,500		$ 1,960	$ 4,235	$ -	$ 6,195	
Electrical modifications	1	ls	$ 1,000	$ 1,000		$ 980	$ 1,210	$ -	$ 2,190	
65 Gallon Storage Tanks	2	ea	$ 200	$ 250		$ 400	$ 500	$ -	$ 900	
10 Gallon Drip Tank	2	ea	$ 100	$ 78		$ 200	$ 156	$ -	$ 356	
						$ -	$ -	$ -	$ -	

$17,489	Subtotal
$ 2,623	15% Contingency
$ 2,623	15% Contractor O&P
$ 4,372	25% Engineering
$27,108	**Total**

Solar Water Heaters

RENEWABLE ENERGY
THE INFINITE POWER
OF TEXAS

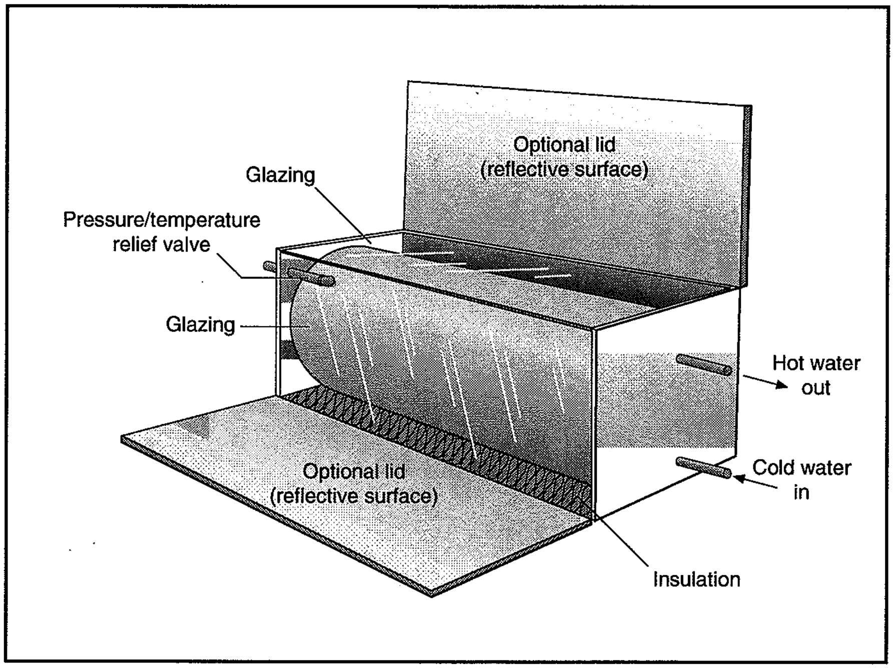
SECO FACT SHEET **NO. 10**

HIGHLIGHTS

- **Solar water heaters can provide half or more of the hot water needs in the average home**
- **Simple or complex, solar water heater systems save money**

SUMMARY

Solar water heaters can be as simple as a garden hose left in the sun or as complex as multiple glass-plated solar collectors filled with propylene glycol. Simple or complex, solar water heaters are an economical option for home and business owners wishing to reduce their water heating costs.



Breadbox or batch heater *Allows cold water to flow in from the bottom and hot water to flow out of the top.*

TYPES OF SYSTEMS

PASSIVE SOLAR SYSTEMS

Generally speaking, a passive solar system requires no moving parts and no external energy source except the sun itself.

Passive water heating systems are not much more complex than a regular garden hose that has been left in the sun. The basic passive water heater consists of one or more 40 gallon water tanks that have been painted black and placed in a well insulated box that has glass or plastic on one side to allow the sun's rays to heat the tanks. This Integral Collector Storage (ICS) system, also known as a "bread box" or batch heater, allows cold water to flow in from the bottom and hot water to flow out of the top. The system operates using only the water pressure from the city or your well. Water from the system is then routed to a standard water heater, where your thermostat determines if the water is already hot enough for use or if additional heat is necessary.

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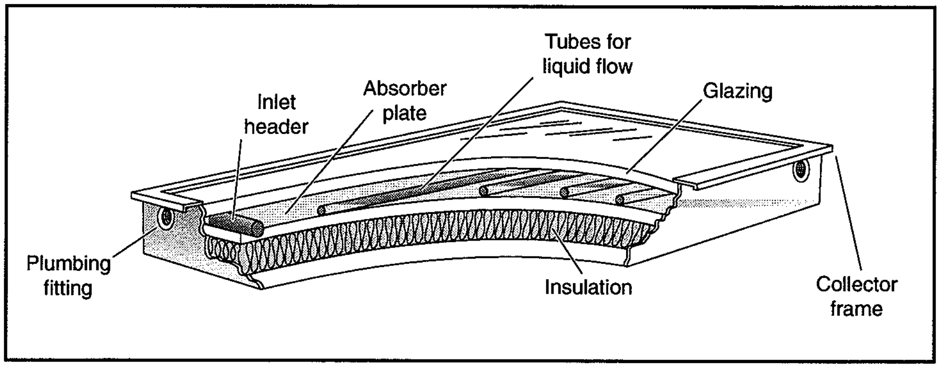


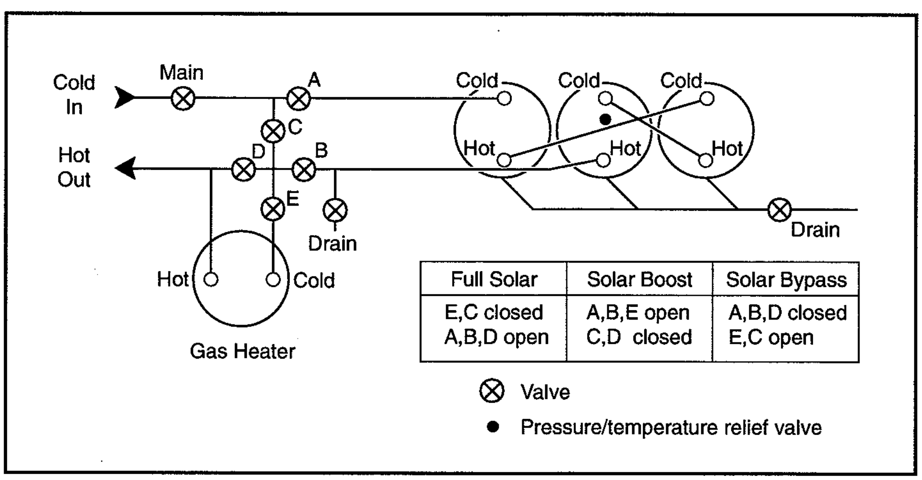
Liquid heating "flat plate" collector *It is a very simple machine.*

ACTIVE SOLAR SYSTEMS: DIRECT AND INDIRECT

Active water heaters are more efficient than their passive brethren, but they also require more equipment in the form of collectors, sensors, circulating pumps and controller mechanisms.

Active systems come in two categories: direct (sometimes known as open loop) and indirect (closed loop). Direct systems heat water in the collectors. Indirect systems do not heat the household water, but instead they employ another fluid such as freon, distilled water or propylene glycol. After the fluid is heated in the collectors, it travels through a heat exchanger, where the heat it contains is transferred to the household water.

While direct systems are more efficient than indirect ones, they require more maintenance and are prone to scaling: a build up of mineral deposits that can close the smaller pipes. In addition, the direct systems must be allowed to drain to prevent damage from freezing or overheating. This drain down design limits installation options and requires additional components.



Full Solar	Solar Boost	Solar Bypass
E,C closed A,B,D open	A,B,E open C,D closed	A,B,D closed E,C open

Full solar, solar boost, and solar bypass systems *Direct systems are more efficient than indirect ones.*

COLLECTOR SYSTEM BASICS

The flat plate solar collector is a very simple machine. An insulated rectangular box, it contains a metal plate (usually copper) that has been painted black, with headers made of 3/4 inch or 1 inch pipe at each end that are connected to small tubes called risers made from 1/4 inch pipe. Supply water flows from the header into the risers where it is heated and then returns to the storage tank. The entire box is covered with tempered glass, which is hail resistant, and then installed at an angle equal to latitude plus 10 degrees.

STORAGE TANKS

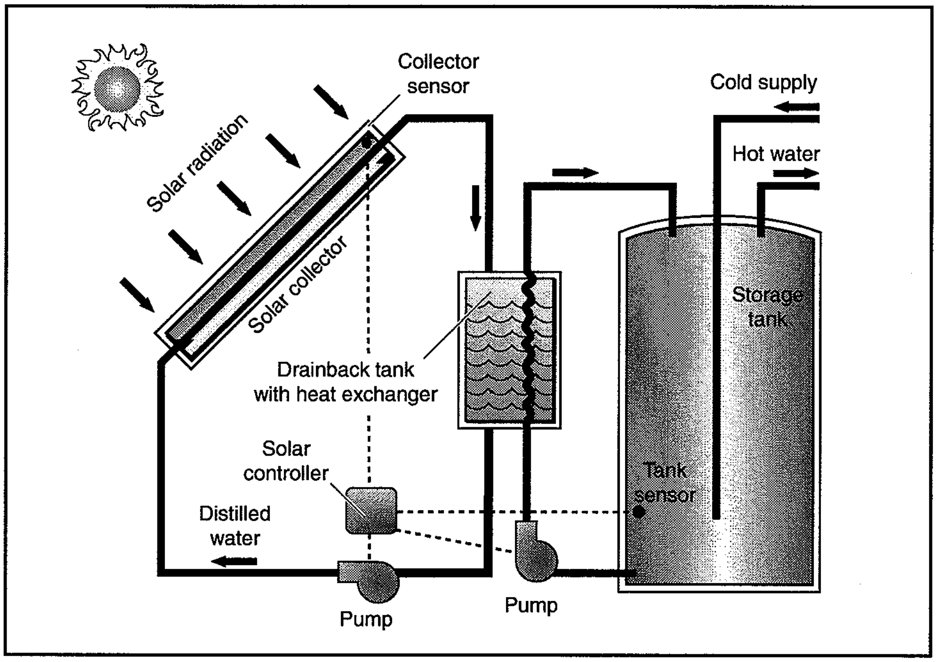
Whether the design used is direct or indirect, a large storage tank will be required. The most commonly used size is 80 gallons. Similar in shape to a water heater, solar water storage tanks must be highly insulated to preserve the heat gained by the collectors. From the storage tank, the water is usually routed to a standard water heater.

Tempering or mixing valves are recommended for residential water heating because solar systems typically heat water to 180 degrees, which can be a safety hazard especially with small children. The tempering valve can be set to 120 degrees and allows cold water to mix with the hot water before it reaches the faucet.

GETTING MORE FROM YOUR SYSTEM

Have you already installed low flow shower heads and aerators on all faucets? This is a cost effective method of not only conserving water but also reducing hot water demand as well.

The time of day when you use water can greatly affect how far you can stretch your solar heated water. For instance after normal morning water usage (when your schedule allows) wait until around noon to do laundry. This allows the solar system to heat up during the morning and to recover again in the afternoon.



Drain back system *The direct systems must be allowed to drain to prevent damage.*

DO IT YOURSELF?

Passive hot water systems, which range in price from $800 to $1,500, are among the easiest ways to incorporate solar design into the home. Because of their simplicity, many homeowners design, build and install passive hot water systems themselves for under $400. If a homeowner doesn't want to embark on a project without help, there are a myriad of instructional videos, blueprints and other materials available to the home handyman.

Of course, a competent contractor can reduce the hassle factor. If you decide to use a contractor, ask friends for recommendations and be sure to ask potential contractors about their experience with the type of system you want installed. Whether you build it yourself or purchase a passive system, all permits should be purchased and local plumbing codes followed. The installation of an active solar system, which can cost $2,000 to $3,500, is best left to a professional. The best equipment may not operate correctly or may even be ruined by a bad installation.

InfinitePower.org

Financial Acknowledgement This publication was developed as part of the Renewable Energy Demonstration Program and was funded 100% with oil overcharge funds from the Exxon settlement as provided by the Texas State Energy Conservation Office and the U.S. Department of Energy. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

ORGANIZATIONS

American Solar Energy Society
2400 Central Ave., G-1
Boulder, CO 80301
(303) 443-3130
www.ases.org

Energy Center
University of Texas at El Paso
P. O. Box 645
El Paso, Texas 79968
(888) 879-2887
energycenter.utep.edu

Florida Solar Energy Center
1679 Clearlake Road
Cocoa, FL 32922
(407) 638-1000
www.fsec.ucf.edu

Passive Solar Industries Council
1511 K Street, Suite 600
Washington, DC 20005
(202) 628-7400
www.sbicouncil.org

Texas Solar Energy Society
P. O. Box 1447
Austin, TX 78767-1447
(512) 326-3391
e-mail: info@txses.org
www.txses.org

Texas Renewable Energy Industries Association
P. O. Box 16469
Austin, TX 78761
(512) 345-5446
www.treia.org

RESOURCES

TEXAS RENEWABLE ENERGY EDUCATION CAMPAIGN

FREE TEXAS RENEWABLE ENERGY INFORMATION

For more information on how you can put Texas' abundant renewable energy resources to use in your home or business, visit our website at **www.InifinitePower.org** or call us at 1-800-531-5441 ext 31796. Ask about our free lesson plans and videos available to teachers and home schoolers.

ON THE WORLD WIDE WEB:

Renewables, products, sustainable living. A good place to start search. **solstice.crest.org**

El Paso Solar Energy Association. Lots of good information. **www.epsea.org**

Florida Solar Energy Center. Information on solar pool heating and other information. **www.fsec.ucf.edu** You can order a manual called "Solar Water and Pool Heating Design and Installation Manual," for $25. Run by the Florida Solar Energy Center, the site contains a panoply of other documents on renewable energy. **www.fsec.ucf.edu/docsale.htm**

Fun facts on solar water heating, including this one: "Over 1.5 million Americans have invested in solar hot water systems for their homes and businesses, with over 94% of these customers considering the investment a wise decision." **www.seia.org/sf/sfsolth.htm**

City of Austin Green Builder Program's comprehensive guide covering energy, water, building materials, solid waste and other topics. A mammoth resource.
www.greenbuilder.com/sourcebook

Department of Energy offers a wealth of information on solar water heating, including tips on sizing your system, potential cost savings and other helpful info.
www.eren.doe.gov/erec/factsheets/solrwatr.html
www.eren.doe.gov/solarbuildings/hotwater.html

Software to estimate the economic benefits can be found at:
eren.doe.gov/solarbuildings/sbm.html

BOOKS:

The Passive Solar Energy Book. Edward Mazria, Rodale Press, 1979.

Solar Water Heating Systems, Active and Passive. US Department of Energy. (available by calling (800) 523-2929)

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111 EAST 17TH STREET, ROOM 1114
AUSTIN, TEXAS 78774
PH. 800.531.5441 ext 31796
www.InfinitePower.org

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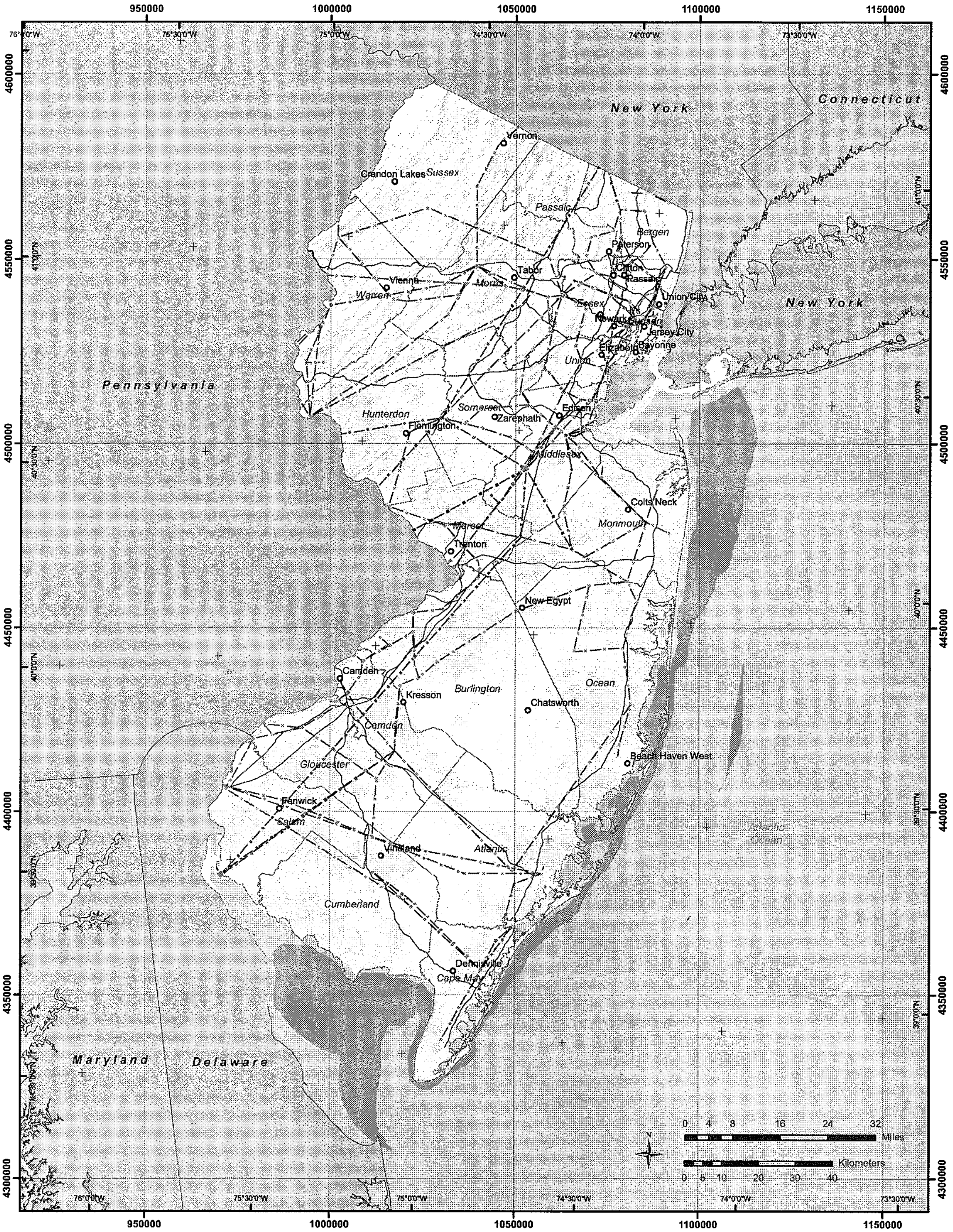
APPENDIX L

Wind



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
- 100 kV-161 kV
- 230 kV-287 kV
- 345 kV
- 500 kV
- 735 kV +
- Step-Up
- 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 M

EPA Portfolio Manager

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Borough Hall

Building ID: 2413044
For 12-month Period Ending: October 31, 2009[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: October 14, 2010

Facility
Borough Hall
748 River Road
Fair Haven, NJ 07704

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 1967
Gross Floor Area (ft^2): 4,040

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

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	176,890
Natural Gas (kBtu)[4]	281,795
Total Energy (kBtu)	458,685
Energy Intensity[5]	
Site (kBtu/ft^2/yr)	114
Source (kBtu/ft^2/yr)	219
Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	42
Electric Distribution Utility	
FirstEnergy - Jersey Central Power & Lt Co	
National Average Comparison	
National Average Site EUI	77
National Average Source EUI	182
% Difference from National Average Source EUI	21%
Building Type	Office

Stamp of Certifying Professional

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

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

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

Certifying Professional
N/A

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

ENERGY STAR® Data Checklist for Commercial Buildings

In order for a building to qualify for the ENERGY STAR, a Professional Engineer (PE) or a Registered Architect (RA) 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 or RA 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	Borough Hall	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	Office	Is this an accurate description of the space in question?		☐
Location	748 River Road, Fair Haven, NJ 07704	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		☐

Borough Hall (Office)

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☑
Gross Floor Area	4,040 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.		☐
Weekly operating hours	60 Hours	Is this the total number of hours per week that the Office 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	15	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. The normal worker density ranges between 0.3 and 5.3 workers per 1000 square feet (92.8 square meters)		☐
Number of PCs	15	Is this the number of personal computers in the Office?		☐
Percent Cooled	50% or more	Is this the percentage of the total floor space within the facility that is served by mechanical cooling equipment?		☐
Percent Heated	50% or more	Is this the percentage of the total floor space within the facility that is served by mechanical heating equipment?		☐

ENERGY STAR® Data Checklist
for Commercial Buildings

Energy Consumption

Power Generation Plant or Distribution Utility: FirstEnergy - Jersey Central Power & Lt Co

Fuel Type: Electricity		
Meter: Electricity (kWh (thousand Watt-hours)) **Space(s):** Entire Facility **Generation Method:** Grid Purchase		
Start Date	**End Date**	**Energy Use (kWh (thousand Watt-hours))**
09/19/2009	10/16/2009	3,719.00
08/18/2009	09/18/2009	6,112.00
07/17/2009	08/17/2009	6,412.00
06/17/2009	07/16/2009	5,057.00
05/16/2009	06/16/2009	4,398.00
04/17/2009	05/15/2009	3,758.00
03/18/2009	04/16/2009	3,474.00
02/13/2009	03/17/2009	3,533.00
01/15/2009	02/12/2009	3,827.00
12/16/2008	01/14/2009	3,917.00
11/14/2008	12/15/2008	4,254.00
Electricity Consumption (kWh (thousand Watt-hours))		**48,461.00**
Electricity Consumption (kBtu (thousand Btu))		**165,348.93**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		**165,348.93**
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)**
09/23/2009	10/22/2009	70.02
08/21/2009	09/22/2009	7.32
07/23/2009	08/20/2009	4.18
07/01/2009	07/22/2009	4.19
06/02/2009	06/30/2009	5.23
04/30/2009	06/01/2009	12.60
03/28/2009	04/29/2009	195.47
02/28/2009	03/27/2009	397.47
01/30/2009	02/27/2009	453.24
12/29/2008	01/29/2009	806.96
11/25/2008	12/28/2008	565.54

Natural Gas Consumption (therms)	**2,522.22**
Natural Gas Consumption (kBtu (thousand Btu))	**252,222.00**
Total Natural Gas Consumption (kBtu (thousand Btu))	**252,222.00**
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 PE or RA 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
Borough Hall
748 River Road
Fair Haven, NJ 07704

Facility Owner
N/A

Primary Contact for this Facility
N/A

General Information

Borough Hall	
Gross Floor Area Excluding Parking: (ft²)	4,040
Year Built	1967
For 12-month Evaluation Period Ending Date:	October 31, 2009

Facility Space Use Summary

Borough Hall	
Space Type	Office
Gross Floor Area(ft2)	4,040
Weekly operating hours	60
Workers on Main Shift	15
Number of PCs	15
Percent Cooled	50% or more
Percent Heated	50% or more

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	Current (Ending Date 10/31/2009)	Baseline (Ending Date 09/30/2009)	Rating of 75	Target	National Average
Energy Performance Rating	N/A	N/A	75	N/A	N/A
Energy Intensity					
Site (kBtu/ft2)	114	118	67	N/A	77
Source (kBtu/ft2)	219	226	129	N/A	182
Energy Cost					
$/year	$ 13,657.69	$ 13,702.52	$ 8,023.32	N/A	$ 9,262.31
$/ft2/year	$ 3.38	$ 3.39	$ 1.99	N/A	$ 2.29
Greenhouse Gas Emissions					
$MtCO_2e$/year	42	43	25	N/A	28
$kgCO_2e$/ft2/year	10	11	6	N/A	7

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

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

APPENDIX N

Block Load and Reconcile Thermal

Fair Haven
CHA #21968
Building: Borough Hall

Reconcile Thermal Model

Building Footprint	7,284 SF	Ex Occupied Clng Temp.	74 °F	Ex Occupied Htg Temp.	68 °F		
Heating Efficiency	79%	Ex Unoccupied Clng Temp.	74 °F	Ex Unoccupied Htg Temp.	68 °F		
Cooling Efficiency	1.20 kW/ton	Occupied Cooling UA	(2,713) btu/hr/°F	Occupied Heating UA	1,039 btu/hr/°F		
Internal Gains	45,612 btu/h	Unoccupied Cooling UA	(1,724) btu/hr/°F	Unoccupied Heating UA	1,039 btu/hr/°F		
Unoc Internal Gain factor	0.06	Cooling Occ Enthalpy Setpoint	27 Btu/lb				
Ave Occ Internal Gain Factor	0.7	Cooling Unocc Enthalpy Setpoint	27 Btu/lb				
Economizer available (Y/N)	No						

Heating and cooling energy are unrelated in this model. If the building being analyzed is not cooled, disregard cooling energy calculations

					EXISTING LOADS									
					Occupied			Unoccupied						
Avg Outdoor Air Temp. Bins °F	Avg Outdoor Air Enthalpy	Total Bin Hours	Occupied Equipment Bin Hours	Unoccupied Equipment Bin Hours	Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Unoccupied Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Available Economizer Cooling kWh	Necessary Cooling Energy kWh	Existing Cooling Energy kWh	Existing Heating Energy therms
A		B	C	D	E	F	G	H	I	J	K	L	M	M
102.5	49.1	0	0	0	-77,330	-101,788	-31,928	-49,138	-101,788	-2,737	0	0	0	0
97.5	42.5	3	1	2	-63,764	-71,390	-31,928	-40,518	-71,390	-2,737	0	38	38	0
92.5	39.5	34	8	26	-50,197	-57,573	-31,928	-31,897	-57,573	-2,737	0	352	352	0
87.5	36.6	131	31	100	-36,630	-44,216	-31,928	-23,276	-44,216	-2,737	0	1,053	1,053	0
82.5	34.0	500	119	381	-23,063	-32,241	-31,928	-14,655	-32,241	-2,737	0	2,929	2,929	0
77.5	31.6	620	148	472	-9,497	-21,187	-31,928	-6,035	-21,187	-2,737	0	2,339	2,339	0
72.5	29.2	664	158	506	0	0	-31,928	0	0	-2,737	0	643	643	0
67.5	27.0	854	203	651	520	553	-31,928	520	553	-2,737	0	736	736	0
62.5	24.5	927	221	706	5,716	6,080	-31,928	5,716	6,080	-2,737	0	444	444	0
57.5	21.4	600	143	457	10,912	11,607	-31,928	10,912	11,607	-2,737	0	134	134	0
52.5	18.7	610	145	465	16,108	17,134	-31,928	16,108	17,134	-2,737	0	0	0	182
47.5	16.2	611	145	466	21,305	22,661	-31,928	21,305	22,661	-2,737	0	0	0	265
42.5	14.4	656	156	500	26,501	28,188	-31,928	26,501	28,188	-2,737	0	0	0	374
37.5	12.6	1,023	244	779	31,697	33,715	-31,928	31,697	33,715	-2,737	0	0	0	722
32.5	10.7	734	175	559	36,893	39,241	-31,928	36,893	39,241	-2,737	0	0	0	617
27.5	8.6	334	80	254	42,089	44,768	-31,928	42,089	44,768	-2,737	0	0	0	326
22.5	6.8	252	60	192	47,286	50,295	-31,928	47,286	50,295	-2,737	0	0	0	280
17.5	5.5	125	30	95	52,482	55,822	-31,928	52,482	55,822	-2,737	0	0	0	156
12.5	4.1	47	11	36	57,678	61,349	-31,928	57,678	61,349	-2,737	0	0	0	65
7.5	2.6	22	5	17	62,874	66,876	-31,928	62,874	66,876	-2,737	0	0	0	33
2.5	1.0	13	3	10	68,071	72,403	-31,928	68,071	72,403	-2,737	0	0	0	22
-2.5	0.0	0	0	0	73,267	77,930	-31,928	73,267	77,930	-2,737	0	0	0	0
-7.5	-1.5	0	0	0	78,463	83,457	-31,928	78,463	83,457	-2,737	0	0	0	0
TOTALS		8,760	2,086	6,674								8,669	8,669	3,042

Existing Building Ventilation & Infiltration (occ)	**1,024 cfm**
Overheat Ventilation Factor	**1.00**
Additional ventilation to offset overheat	**0 cfm**
Existing Building Ventilation & Infiltration (unocc)	**1,024 cfm**
Economizer Ventilation (from AHU's)	**0 cfm**

Energy Use Indices (calculated)

	Base Case
Heating	3,042
Target ->	2,900
	104.9%

	Base Case
Cooling	8,669
Target ->	8,384
	103.4%

Electrical Requirements for Cooling Equipment

Unit	Area Served	Clng Hrs	Amps	Volts	Phase	Power Factor	% Runtime	Annual kWh
Condenser 1	Lennox AHU	1,952	21.2	208	3	0.8	25%	3127
Condenser 2	Lennox AHU	1,952	19.4	208	3	0.8	25%	2862
Condenser 3	York AHU	1,952	20.3	208	3	0.8	20%	2395
Total								8,384

HEAT GAIN/LOSS WORKSHEET

Project Name:	Fair Haven	**Project No.:**	CHA #21968		
Location	748 River Road Fair Haven NJ, 07704	**Site Elevation:**	460 Feet	**Specific Volume**	14.00 CF/#
Building Name	Borough Hall	**Date:**			
Engineer:	Jacob Hansen / Patrick Shane				

Building/Facility Designation

Outdoor Winter Design DB Temperature	10 °F	**Indoor Winter Design DB Temperature**	68 °F
Outdoor Summer Design DB Temperature	93 °F	**Indoor Summer Design DB Temperature**	74 °F
Outdoor Summer Design WB Temperature	74 °F	**Indoor Summer Design WB Temperature**	60 °F
Outdoor Summer Humidity Ratio	0.0121 #/#	**Indoor Air (70°F) Humidity Ratio**	0.0079 #/#

ENVELOPE DESCRIPTIONS (Descriptions are from Interior to Exterior)

Walls (Select One - Type X)

Select	Description	R Value	Wall Type
	Steel Siding, 4" Insulation, Steel Siding	15.2	1
	Plaster or Gypsum, frame construction, 5" Insulation, 1" stucco	18.2	1
	4" WH CMU, 1" Insulation, Finished Exterior	5.2	2
	Plaster or Gypsum, frame construction, 3" Insulation, 8" LW CMU	7.8	5
	4" Face Brick, 2" Concrete, 1" Insulation, Exterior Finish	5.1	12
	4" Face Brick, 4" Concrete, 1" Insulation, Exterior Finish	4.0	11
	Interior Finish, 2" Insulation, 8" CMU, 4" Face Brick	10.9	16
	Finished Surface, 8" LW CMU (filled), Air Space, 4" Face Brick	11.1	16
	Stucco or Gypsum, 2.5" Insul, Face Brick	14.3	10
	4" Block, 1" insulation, 8" Block	19.9	16
X	U value calculator	6.9	

Roofs (Select One)

Select	Description	R Value	Roof Type
	Tectum Deck, 3.3" Insul., BU Roof	13.0	1
	Steel Deck, 5" Insul., BU Roof	18.2	1
	Attic Roof with 6" Insul.	25.0	4
	4" HW Concrete Deck, BU Roof	2.7	2
	Ceiling, 3" Insulation, 4" Concrete Deck, BU Roof	14.9	4
	Ceiling, 4" Concrete Deck, 3" Insulation, BU Roof	18.5	13
	Ceiling, 4" Concrete Deck, 6" Insulation, BU Roof	21.7	14
	Ceiling, Wood Deck, 6" Insulation, Felt & Membrane	22.7	10
	Wood Deck, 6" insulation, Felt & Membrane	18.0	
x	U value calculator	21.4	

Windows (Select One)

Select	Description	U Value
	Aluminum Frame, 1/8" SP Glazing	1.05
	Aluminum Frame, 1/4" DP Glazing	0.60
	Aluminum Frame, 3/16" DP Glazing	0.62
X	Aluminum Frame, 1/2" DP Glazing	0.50
	Skylights	0.90
	Other	0.50

	No Storm
Flat Glass	1.05
Flat Glass (e=.6)	1.00
Flat Glass (e=0.4)	0.90
Flat Glass (e=0.2)	0.77
Double Glaze (3/16 in air)	0.63
Double Glaze (1/4 in air)	0.60
Double Glaze (1/2 in air)	0.53
Double Glaze (e=.6)	0.50
Double Glaze (e=0.4)	0.42
Double Glaze (e=0.2)	0.35
Triple Glaze (1/4 in air)	0.42
Triple Glaze (1/2 in air)	0.35

BUILDING CHARACTERISTICS

Roof Area 3,642 SF
Occupied Area 7,284 SF

Return Plenum? n

	Gross Wall Length	Average Wall Height	Ceiling Height	Window Area	Door Area	Net Wall Area
North Exposure	66 Ft	18.5 Ft	16.0 Ft	51 SF	42 SF	1,128 SF
East Exposure	57 Ft	18.5 Ft	16.0 Ft	96 SF	25 SF	934 SF
South Exposure	66 Ft	18.5 Ft	16.0 Ft	64 SF	42 SF	1,115 SF
West Exposure	57 Ft	18.5 Ft	16.0 Ft	177 SF	0 SF	878 SF

Occupied Forced Ventilation	300 cfm	0.2 AC/hr
Unoccupied Forced Ventilation	300 cfm	0.2 AC/hr

HEAT GAIN/LOSS WORKSHEET

Project Name:	Fair Haven	Project No.:	CHA #21968		
Location	748 River Road Fair Haven NJ, 07704	Site Elevation:	460 Feet	Specific Volume	14.00 CF/#
Building Name	Borough Hall	Date:			
Engineer:	Jacob Hansen / Patrick Shane				

Building/Facility Designation

COOLING HEAT GAINS TO THE ROOM - SENSIBLE

SOLAR GAINS

WINDOWS	AREA (SF)	SHGF	Shade Coef	Cooling Load Factor		Solar Heat Gain	
North Exposure	51	38 btu/h/sf	0.8	0.75	Glass Type C	1,163 Btu/hr	
East Exposure	96	216 btu/h/sf	0.8	0.31	Glass Type C	5,147 Btu/hr	
South Exposure	64	109 btu/h/sf	0.8	0.58	Glass Type C	3,237 Btu/hr	
West Exposure	177	216 btu/h/sf	0.8	0.29	Glass Type C	8,852 Btu/hr	
							18,399 Btu/h

CONDUCTION

	NET AREA (SF)	U-VALUE	Cooling Load Temp. Dif.	Return Air Factor	Room Heat Gain	
North Exposure	963	0.14	20 °F	1.0	2,779 Btu/hr	
East Exposure	791	0.14	39 °F	1.0	4,454 Btu/hr	
South Exposure	950	0.14	27 °F	1.0	3,701 Btu/hr	
West Exposure	735	0.14	22 °F	1.0	2,334 Btu/hr	
Roof	3,642	0.05	73 °F	1.0	12,412 Btu/hr	
Fenestration	388	0.50	19 °F		3,606 Btu/hr	
Doors	109	0.14	27 °F		409 Btu/hr	
Ceiling	7,284	0.14	0 °F		0 Btu/hr	
Partition		0.05	0 °F		0 Btu/hr	
Floor	7,284	0.04	0 °F		0 Btu/hr	
						29,696 Btu/h

INTERNAL HEAT GAINS (all loads below are based on Occupied Periods)

						Room Heat Gain	
Lights	1.25 w/sf x	7,284 Occ Area =		9.1 kW x 3.4x	1.0 RAF =	31,075 Btu/h	
Plug Load	0.10 w/sf x	7,284 Occ Area =		0.7 kW x 3.4x	1.0 RAF =	2,486 Btu/h	
People	20 people x	255 btu/person x	75%	time in space =		3,825 Btu/h	
Computer Work Stations		13 Units x	120	W/Unit x	3414 =	5,324 Btu/h	
Equipment	0.9 kW x 3.413 =					2,901 Btu/h	
Misc.						0 Btu/h	
							45,612 Btu/h

VENTILATION AND INFILTRATION

		Infiltration Factor	Perimeter Ratio	Coef	Temp. Diff.	Room Heat Gain	
Walls	3,440 SF	0.15 CFM/SF		1.04	19 °F	10,819 Btu/h	
Doors	109 SF	0.22 CFM/LF	0.93 LF/SF	1.04	19 °F	466 Btu/h	
Windows	388 SF	0.22 CFM/LF	1.09 LF/SF	1.04	19 °F	1,952 Btu/h	
Ventilation	300 cfm			1.04	19 °F	6,290 Btu/h	
							19,527 Btu/h

Infiltration 631 cfm 0.5 AC/hr

COOLING HEAT GAINS TO THE RA PLENUM - SENSIBLE

4,950

CONDUCTION

	NET AREA (SF)	U-VALUE	Cooling Load Temp. Dif.	Return Air Factor	Room Heat Gain	
North Exposure	165	0.14	20	1.0	476 Btu/hr	
East Exposure	143	0.14	39	1.0	802 Btu/hr	
South Exposure	165	0.14	27	1.0	643 Btu/hr	
West Exposure	143	0.14	22	1.0	452 Btu/hr	
Roof	3,642	0.05	73	0.0	0 Btu/hr	
						2,373 Btu/h

INTERNAL HEAT GAINS

Lights	1.25 w/sf x	7,284 Occ Area =	9.1 kW x3413x	0.00 RAF =	0 Btu/h	
Misc.					0 Btu/h	
						0 Btu/h

SENSIBLE HEAT GAINS - TEMP. DEPENDENT		SENSIBLE HEAT GAINS - TEMP. INDEPENDENT	
Solar	18,399	Internal Gains to Room	45,612
Conduction to Room	29,696	Internal Gains to Plenum	0
Conduction to Plenum	2,373		
Ventilaton and Infiltration	19,527		
Sub Total	69,995	Sub Total	45,612

HEAT GAIN/LOSS WORKSHEET

Project Name:	Fair Haven	**Project No.:**	CHA #21968		
Location	748 River Road Fair Haven NJ, 07704	**Site Elevation:**	460 Feet	**Specific Volume**	14.00 CF/#
Building Name	Borough Hall	**Date:**			
Engineer:	Jacob Hansen / Patrick Shane				

Building/Facility Designation

LATENT COOLING LOADS

Infiltration

		Infiltration Factor	Air Density	Humidity Ratio Dif.	Room Heat Gain
Walls	4,257 SF	0.15 CFM/SF	4,629	0.0042 #/#	12,540 Btu/h
Doors	109 SF	0.22 CFM/LF	4,629	0.0042 #/#	436 Btu/h
Windows	388 SF	0.22 CFM/LF	4,629	0.0042 #/#	1,828 Btu/h
Ventilation	300 cfm		4,629	0.0042 #/#	5,892 Btu/h
People	20 people	0.75 time in space		250 Btu/hr/person	3,750 Btu/h
					24,446 Btu/h

Cooling Load Summary

	Sensible	Latent	Total		
Temperature Dependent Gains	69,995	24,446	94,441		
Temperature Indep. Gains	45,612		45,612	SHR=	0.83
Total	115,607	24,446	140,053		

Building Cooling Load 11.7 Tons at 624 SF/Ton

Building Air Flow to Condition Space based on a 12°F Temp Rise is **9,040 CFM** **1.24 CFM/sf**

HEATING CALCULATION

CONDUCTION

	NET AREA (SF)	U-VALUE	Heating Load Temp. Dif.	Room Heat Gain
North Exposure	1,128	0.14	58	9,473 Btu/h
East Exposure	934	0.14	58	7,843 Btu/h
South Exposure	1,115	0.14	58	9,364 Btu/h
West Exposure	878	0.14	58	7,372 Btu/h
Fenestration	388	0.50	58	11,283 Btu/h
Roof	3,642	0.05	58	9,896 Btu/h
Doors	109	0.14	58	882 Btu/h
Ceiling	7,284	0.14	0	0 Btu/h
Partition	0	0.05	0	0 Btu/h
Floor	3,642	0.04	30	4,370 Btu/h

Ventilation and Infiltration

		Infiltration Factor	Coef	Temp. Difference	Air Flow	Room Heat Gain
Walls	4,055 SF	0.15 CFM/SF	1.04	58	608 cfm	36,949 Btu/h
Doors	109 SF	0.22 CFM/LF	1.04	58	22 cfm	1,350 Btu/h
Windows	388 SF	0.22 CFM/LF	1.04	58	93 cfm	5,654 Btu/h
Ventilation Load	300 cfm		1.04	58	300 cfm	19,683 Btu/h
Total Ventilation & Infiltration Load					1,024 cfm	63,636 Btu/h

Building Heating Load 124,120 btu/h

17.0 btu/sf

APPENDIX O

Equipment Inventory

Description	QTY	Manufacturer Name	Model No.	Serial No.	Equipment Type / Utility	Capacity/Size	Location	Areas Served	Date Installed	Remaining Useful Life (years)	Other Info.
Boiler	1	Weil-McLain	PFG-6-PIN	N/A	Heating & Cooling / Natural Gas & Electric	305 MBH input, 215 MBH output	Boiler Room	Entire Building		16	Good Condition
HW Pump	1	Bell & Gossett	-	-	Heating / Electric	1/8 HP	Boiler Room	Entire Building	-	-	Good Condition
HW Pump	1	Bell & Gossett	-	-	Heating / Electric	1/8 HP	Boiler Room	Entire Building	-	-	Good Condition
HW Pump	1	Bell & Gossett	-	-	Heating / Electric	1/8 HP	Boiler Room	Entire Building	-	-	Good Condition
Heat Pump AHU #1	1	Lennox	G/HC060SB	EEFS1224105	HVAC / HW & Electric	60,000 Btuh	Boiler Room	2nd Floor	-	16	Good Condition
Heat Pump AHU #2	1	Lennox	G/HC048SB	EEFS120048	HVAC / HW & Electric	48,000 Btuh	Boiler Room	1st Floor	-	16	Good Condition
Heat Pump AHU #3	1	Lennox	CB30M-65-4P	5808D30708	HVAC / HW & Electric	30,000 Btuh	Boiler Room	2nd Floor	-	16	Fair Condition
York Furnace	1	York	515B120CVHFS	EEFS1224105	HVAC / HW & Electric	-	Boiler Room	Library		10	Fair Condition
Condenser #1	1	Lennox	HS29-060-134	5807643110	Cooling / Electric	5.0 tons; 17.3 Amps	Outside	Heat Pump AHU	-	10	Fair Condition
Condenser #2	1	Lennox	HS29-060-134		Cooling / Electric	5.0 tons; 17.3 Amps	Outside	Heat Pump AHU	-	10	Fair Condition
Condenser #3	1	Lennox	HS29-513-14	5895E-63900	Cooling / Electric	5.0 tons; 15.9 Amps	Outside	Heat Pump AHU	-	10	Fair Condition
Domestic HW Heater	1	A.O. Smith			DHW / Natural Gas	75 Gal / 75,500 Btuh	Boiler Room	Entire Building	-	10	Fair Condition