SADDLE RIVER
DEPARTMENT OF PUBLIC WORKS
ENERGY ASSESSMENT

for

NEW JERSEY
BOARD OF PUBLIC UTILITIES

CHA PROJECT NO. 21351

NOVEMBER 2010

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1.0 INTRODUCTION AND BACKGROUND

The Borough of Saddle River Department of Public Works (DPW) is a 2,048 square foot facility located at 83 East Allendale Road behind the Public Safety complex. The DPW site consists of three structures, including a main office/garage building, two story storage barn, and salt barn. The main building is comprised of a large workshop and vehicle storage area, an office, mechanical room, restroom/locker room, and a loft storage area. There is also a small fuel pumping station on site. The facility operates five days a week for about 7.5 hours per day.

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 Saddle River Department of Public Works (DPW) in the Borough of Saddle River, New Jersey. The 2,048 square foot facility contains the main office/garage building, two story storage barn, and salt barn. The facility operates five days a week for about 7.5 hours per day.
. The following areas were evaluated for energy conservation measures:

- Lighting replacement w/occupancy sensors
- Installation of infrared heater
- Night setback

Various potential Energy Conservation Measures (ECMs) were identified for the above categories. Potential annual savings of $2,600 for the recommended ECMs may be realized with a payback of 3.0 years.

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

ECM-1 Night Setback

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
500	0	0	1,080	1,200	35.0	NA	0.4	NA

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

ECM-2 Install Infrared Heater

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
4,600	0	1,650	630	1,000	2.9	NA	4.6	NA

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

ECM-5 Lighting Replacements with Occupancy Sensors

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
3,400	1.4	2,660	0	400	0.8	800	8.5	6.5

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

3.0 EXISTING CONDITIONS

3.1 Building - General

The Saddle River DPW is a 2,048 square foot facility which consists of a main office/garage building, two story storage barn, and salt barn. The main building was constructed in the early 1990s. The storage barn was built several years later, and the salt barn appeared to be the oldest building; however, facility personnel did not have the construction dates for the storage and salt barns. The main building is comprised of a large workshop, vehicle storage area, and storage loft; and an office area which consists of a single office, utility room, and restroom/locker room. There is also a small fuel pumping station at the facility.

The facility operates five days a week for about 7.5 hours per day, with extended hours as required for snow plowing or other services. The work crew of five is in the facility and field intermittently.

The main building is constructed of 6" wood framing with steel siding on the interior and exterior and 6" batt insulation between the studs. The roof is pitched and consists of asphalt shingles over felt paper, plywood sheathing, batt insulation, and a steel panel ceiling. There are four insulated steel overhead doors on the front of the building along with a single steel man door. The office area has four vinyl double hung windows and the garage area has three aluminum sliding windows. Construction of the storage and salt barns is similar to that of the main building except the buildings are not insulated and the interior side of the walls and roof is open to framing. Building components of all three structures are in good condition.

3.2 Utility Usage

Utilities include electricity, natural gas, and potable water. Electricity is purchased from Orange & Rockland (O&R) and natural gas is purchased from Public Service Electric & Gas Company (PSE&G). Potable water is provided by the municipally owned water department.

In 2009, electric usage was approximately 10,520 kWh at a cost of about $1,700. Analyzing electricity bills during this period showed that the building was charged at the following rates: supply unit cost of $0.157 per kWh; demand unit cost of $1.28 per kW; and a blended unit cost of $0.164 per kWh. Electricity usage was fairly steady throughout the year. During the same timeframe, the building heat and domestic hot water (DHW) produced by natural gas-fired equipment required about 4,330 therms. Based on the annual cost of about $4,900, the blended price for natural gas was $1.142 per therm. Natural gas consumption is highest in the winter months when the building is in heating mode. Utility data can be found in Appendix A.

Electricity and natural gas commodity supply and delivery is presently purchased from O&R and PSE&G, respectively. The delivery component 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 A.

3.3 HVAC Systems

The office area of the main building uses hot water heat generated by a small Crown Arub 42,500 Btuh input, 36,000 Btuh output, gas-fired boiler. Heating hot water (HHW) is distributed to fintube radiators

via a small fractional horsepower in-line circulation pump. Air conditioning for the office is provided by a window AC unit which was not in place at the time of the audit. Additionally, the locker room/restroom utilizes an inline exhaust fan located in the ceiling.

Heat in the garage area is provided by a single Reznor gas-fired unit heater with 200,000 Btuh input and 160,000 Btuh output. This unit is suspended from the ceiling in the rear corner of the space. The garage area is also equipped with two ceiling fans for air circulation. There are no HVAC systems in the storage or salt barns.

3.4 Lighting/Electrical Systems

Lighting in the office area of the main DPW building consists of six 4', two lamp, T-12 fluorescent fixtures with magnetic ballasts. Primary lighting in the garage area is provided by four pendant style fixtures with 400W metal halide lamps. There are also six, two lamp, T-12 fixtures along the back wall; an 8' two lamp, T-12 fixture over the work bench; and six additional two lamp, T-12 fixtures in the storage loft. There is no exterior lighting on the main building.

The storage barn uses two pendant style fixtures with 400W metal halide lamps, along with two 8', two lamp, T-12 fluorescent fixtures for interior lighting. There are also two, 100W metal halide fixtures over the man door, one on the interior and one on the exterior. The exterior fixture is controlled by a combination motion and photovoltaic (PV) sensor.

A single, pole mounted, 250W metal halide lighting fixture is positioned over the pumping station. This fixture is operated by a PV sensor. There is no lighting in the salt barn.

3.5 Control Systems

Heating controls for the office area consists of a single mechanical dial type thermostat located in the single office. This thermostat was set to 68°F. The unit heater in the garage area is also controlled by a mechanical dial thermostat and the space is typically maintained at about 68°F.

3.6 Plumbing Systems

Domestic hot water for the main DPW building is generated by a 40 gallon, State Industries gas-fired water heater with an input of 40,000 Btuh. This unit is located in the utility room and is in good condition. Plumbing fixtures in the locker room/restroom consist of a toilet, urinal, and utility sink. There is also a hose bib on the building exterior. The remaining buildings on the DPW site have no plumbing.

4.0 ENERGY CONSERVATION MEASURES

4.1 ECM-1 Night Setback

The hot water heating system serving the office area is controlled by a mechanical dial type thermostat. Additionally, the unit heater in the main garage area is operated by a similar mechanical thermostat; where both areas are maintained at about 68°F. Installing programmable thermostats to control the hot water heating system and gas-fired unit heater will allow the temperature setpoints to be scheduled according to occupancy for the corresponding areas. Therefore, to conserve heating energy it is proposed that during periods when the building is closed, the heating temperature setpoint be programmed to 60°F in the office area and 55°F in the main garage area.

To calculate the benefits of night setback, block load building models were created to approximate the existing energy load for the office and garage areas. The block loads, provided in Appendix B, model the maximum overall heating load for the space, taking into account various parameters such as roof, wall, and window construction; total envelope surface area; ventilation and infiltration loads; building occupancy; internal heat generation; and other sources of heat gain and loss. By entering this calculated maximum load into a spreadsheet containing bin temperature data, the total accumulated year-round heating energy requirement was determined for each space. Bin data for Saddle River, NJ was not available; therefore, data from nearby Newark, NJ was used. The bin temperature spreadsheets are included in Appendix B.

To determine the proposed energy usage during temperature setback, a second bin spreadsheet was created for the new accumulated heating loads, which was identical to the existing usage spreadsheet except the unoccupied temperature was adjusted as discussed above. The difference in heating therms between the two models is taken as the savings. Following implementation of this measure, it is expected the building's annual natural gas consumption will be reduced by approximately 1,080 therms.

Programmable thermostats have an expected life of 15 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 16,200 therms, totaling $18,000.

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

ECM-1 Night Setback

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
500	0	0	1,080	1,200	35.0	NA	0.4	NA

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

This measure is recommended.

4.2 ECM-2 Install Infrared Heaters

The garage area is heated by a single gas-fired unit heater with a thermal efficiency of 80%. This ECM evaluated replacement of the heater with an infrared gas-fired heater. Infrared heaters distribute heat more

effectively than traditional unit heaters, have equivalent or higher burner efficiencies, and do not require an air circulation fan.

To determine the existing heating loads for the space, a block load spreadsheet for the heated garage area was generated using the same methodology described in section 4.1. Using the block load spreadsheet and thermal efficiency of the unit heater, it was determined that the garage requires 3,140 therms of energy per year to meet the heating load.

The proposed infrared heater has a burner efficiency of 85% and will transfer heat more effectively via radiation. Using the block load spreadsheet and applying efficiency improvements, it was determined that the annual heating gas energy required using an infrared heater can be reduced by 630 therms. Electrical energy savings will also be realized by eliminating the need to operate the air circulation fan on the existing unit heater. The electrical energy saving was calculated by applying the annual heating operating hours from the bin data spreadsheet to the power requirement for the existing unit heater and proposed infrared heater. The total annual electrical savings for this ECM is estimated to be 1,650 kWh.

Modifications to the natural gas piping, exhaust flue stack, and electrical wiring will be necessary. A Reznor VR Series, low intensity infrared heater was used for estimating energy savings and developing budgetary costs. Exact heater selection and sizing will need to be performed if this ECM is pursued.

Infrared heaters have an expected life of 18 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 29,700 kWh and 11,340 therms, totaling $18,000.

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

ECM-2 Install Infrared Heater

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
4,600	0	1,650	630	1,000	2.9	NA	4.6	NA

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

This measure is recommended.

4.3 ECM-3 Lighting Replacements

A comprehensive fixture survey was conducted of the entire facility. Each switch and circuit was identified; as well as the number of fixtures, locations, approximate operating times and existing wattage consumption. The majority of lighting in the facility utilizes inefficient T-12 lamps with magnetic ballasts. Primary lighting fixtures in the garage and barn areas use 400W metal halide lamps. Energy can be saved by upgrading the T-12 fixtures to make use of more efficient T-8 fluorescent lamps and electronic ballasts; and metal halide fixtures can be replaced with high output T-5 fluorescent fixtures.

Energy savings for this measure were calculated by applying the wattages for the existing and proposed lighting fixtures to the estimated time of operation. The difference between the two values resulted in an annual savings of 2,530 kWh per year. Supporting calculations, including all assumptions for lighting hours, and the annual energy usage for each fixture can be found 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 37,950 kWh, totaling $6,000.

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

ECM-3 Lighting Replacements

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
5,600	1.8	2,530	0	400	0.1	900	14.0	11.8

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

This measure is not recommended in lieu of ECM-5.

4.4 ECM-4 Install Occupancy Sensors

While occupancy of the office area in the main building is relatively intermittent throughout the day, lighting fixtures often remain on. Therefore, it is proposed that occupancy sensors be installed in the single office, locker room/restroom and hallway to turn off lights when the spaces are unoccupied. Other areas such as the garage and utility room were not considered for occupancy sensors due to safety concerns or limited hours of lighting operation.

The existing annual fixture operating times were estimated per the building schedule. At 7.5 hours per day, five days per week and 52 weeks per year, this time was found to be 1,950 hours per year. The proposed annual fixture operating times with occupancy sensors installed was determined by estimating the time per day that each space is occupied. For the office, it was predicted the space is actually occupied about one quarter of the workday; the locker room/restroom one third; and the hallway one half. Using a process similar to that applied in section 4.3, the energy savings for this measure were calculated by applying the known fixture wattages in each space to the estimated existing and proposed times of operation for the fixtures. The difference between the two values resulted in an annual savings of 500 kWh per year. Three wall-mounted occupancy sensors and some electrical work are required for this measure.

Occupancy sensors have an expected life of 15 years, according to the manufacturer, and total energy savings over the life of the project are estimated at 7,500 kWh and $1,500.

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

ECM-4 Install Occupancy Sensors

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
400	0	500	0	100	2.8	100	4.0	3.0

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

This measure is not recommended in lieu of ECM-5.

4.5 ECM-5 Lighting Replacements with Occupancy Sensors

Due to interactive effects, the energy and cost savings for lighting upgrades and occupancy sensors are not cumulative. This measure is a combination of ECMs 3 and 4 to allow for more accurate energy and demand reduction. Only lighting upgrades with a payback period less than 15 years were included in the overall recommended measure.

The lighting replacements and occupancy sensors have an expected lifetime of 15 years, according to the manufacturer, and total energy savings over the life of the project are estimated at 39,900 kWh, totaling $6,000.

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

ECM-5 Lighting Replacements with Occupancy Sensors

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
3,400	1.4	2,660	0	400	0.8	800	8.5	6.5

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

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.

Combining incentives #2 and #3 will provide a total of $0.18/ kWh and $1.8/therm not to exceed 50% of total project cost. Additional incentives for #2 and #3 are increased by $0.005/kWh and $0.05/therm for each percentage increase above the 15% minimum target to 20%, calculated with the EPA Portfolio Manager benchmarking tool, not to exceed 50% 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 per building.

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.

5.2 Building Incentives

5.2.1 New Jersey Pay For Performance Program

Under incentive #1 of the New Jersey Pay for Performance Program, the 2,048 square foot building is eligible for about $100 towards 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. Combined, incentives through the NJ P4P program are expected to total about $4,000, reducing the total project payback from 3.3 years to 1.7 years. See Appendix G for calculations.

5.2.2 New Jersey Smart Start Program

The Saddle River DPW building is eligible for several incentives available under New Jersey Smart Start Programs. The total amount of all qualified incentives is about $800 and includes installing high efficiency lighting fixtures and occupancy sensors.

Incentives cannot be accepted under multiple NJCEP programs.

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

To meet the heating requirements, the building uses a small gas-fired hot water boiler with fin-tube radiators, and a gas-fired unit heater. This existing equipment is not compatible with a geothermal energy source. Therefore, to take advantage of a GHP system, the existing mechanical equipment would have to be completely removed and a low temperature closed loop water source 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 building's heating load is far too small to justify a renovation of this magnitude.

6.2 Solar

6.2.1 Photovoltaic Rooftop Solar Power Generation

The facility 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 large solar cell array. 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 H.

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

Installation of (PV) arrays in the state New Jersey will allow the owner to participate in the New Jersey solar renewable energy certificates program (SREC). This is a program that has been set up to allow

entities with large amounts of environmentally unfriendly emissions to purchase credits from zero emission (PV) solar-producers. An alternative compliance penalty (ACP) is paid for by the high emission producers and is set each year on a declining scale of 3% per year. One SREC credit is equivalent to 1000 kilowatt hours of PV electrical production; these credits can be traded for period of 15 years from the date of installation. The cost of the ACP penalty for 2009 is $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 2009 is expected to be $600/SREC credit. Payments that will be received from the PV producer will change from year to year dependent upon supply and demand. Renewable Energy Consultants is a third party SREC broker that has been approved by the New Jersey Clean Energy Program. As stated above there is no definitive way to calculate an exact price that will be received by the PV producer per SREC over the next 15 years. Renewable Energy Consultants estimated an average of $487/ SERC per year and this number was utilized in the cash flow for this report.

The building had a maximum electricity demand of 7.0 kW and a minimum of 3.9 kW in 2009. The monthly average over the observed 12 month period was 5.3 kW. The existing load does not justify the use of the maximum incentive cap of 50 kW of installed PV solar array; therefore, a 5 kW system size was selected for the calculations. The system costs for PV installations were derived from the most recent NYSERDA (New York State Energy Research and Development Agency) estimates of total cost of system installation. It should be noted that the cost of installation is currently $8 per watt or $8,000 per kW of installed system. This has increased in the past few years due to the rise in national demand for PV power generator systems. Other cost considerations will also need to be considered. PV panels have an approximate 20 year life span; however, the inverter device that converts DC electricity to AC has a life span of 10 to 12 years and will need to be replaced multiple times during the useful life of the PV system.

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

Photovoltaic (PV) Rooftop Solar Power Generation – 5 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
40,000	0	5,915	0	1,000	1,000	5,000	2,900	>25	9.0

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

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

A standard solar hot water system is typically composed of solar collectors, heat storage vessel, piping, circulators, and controls. 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 a gas-fired water heater and, therefore, this measure would offer natural gas savings.

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, the Borough of Saddle River 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 I and summarized as follows:

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	0	50	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 is, therefore, not eligible for the tax credit incentive.

The most important part of any small wind generation project is the mean annual wind speed at the height of which the turbine will be installed. In the Saddle River area, the map indicates a mean annual wind speed of 10 miles per hour. Additionally, the DPW building has site restrictions such as parking lots, trees and surrounding structures that would greatly affect a tower location.

A wind speed map and aerial site photo are included in Appendix J.

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

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 some or all of the time, with the balance of electric needs satisfied by purchase from the grid.

Any proposed CHP project will need to consider many factors, such as existing system load, use of thermal energy produced, system size, natural gas fuel availability, and proposed plant location. The DPW building has sufficient need for electrical generation and the ability to use most of the thermal byproduct during the winter, thermal usage during the summer months is low. Thermal energy produced by the CHP plant in the warmer months will be wasted. An absorption chiller could be installed to utilize the heat to produce chilled water; however, there is no chilled water distribution system in the building. The most viable selection for a CHP plant at this location would be a reciprocating engine natural gas-fired unit. 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 noise issues. Additionally, purchasing this system and performing modifications to the existing HVAC and electrical systems would greatly outweigh the savings over the life of the equipment.

6.6 Demand Response Curtailment

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

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

A PSE&G pre-approved CSP will require a minimum of 100 kW of load reduction to participate in any curtailment program. The Borough of Saddle River DPW building had a monthly average electricity demand of 5.3 kW and a maximum demand of 7.0 kW in 2009.

This measure is not recommended because the facility does not have adequate load to meet the required minimum load reduction.

7.0 EPA PORTFOLIO MANAGER

The United State 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 DPW facility is considered a high energy consumer per the Portfolio Manager with a Site Energy Usage Index (EUI) of 229 kBTU/ft^2/year. Several factors contribute to the unfavorable EUI, including, wasted energy from unnecessary heating during unoccupied hours and inefficient lighting operation. By implementing the measures discussed in this report, it is expected that the EUI can be reduced to approximately 138 kBTU/ft^2/year. The EPA Portfolio Manager did not generate an energy rating score for this building because the building type (other) is currently not eligible for an energy star rating.

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

The user name and password for the building's EPA Portfolio Manager Account has been provided to Charles Cuccia of the Borough of Saddle River.

8.0 CONCLUSIONS & RECOMMENDATIONS

The energy audit conducted by CHA at the Saddle River DPW, in the Borough of Saddle River, New Jersey identified potential ECMs for lighting replacements with occupancy sensors, night setback, and installation of an infrared heater. Potential annual savings of $2,600 may be realized for the recommended ECMs, with a summary of the costs, savings, and paybacks as follows:

ECM-1 Night Setback

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
500	0	0	1,080	1,200	35.0	NA	0.4	NA

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

ECM-2 Install Infrared Heater

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
4,600	0	1,650	630	1,000	2.9	NA	4.6	NA

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

ECM-5 Lighting Replacements with Occupancy Sensors

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
3,400	1.4	2,660	0	400	0.8	800	8.5	6.5

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

APPENDIX A

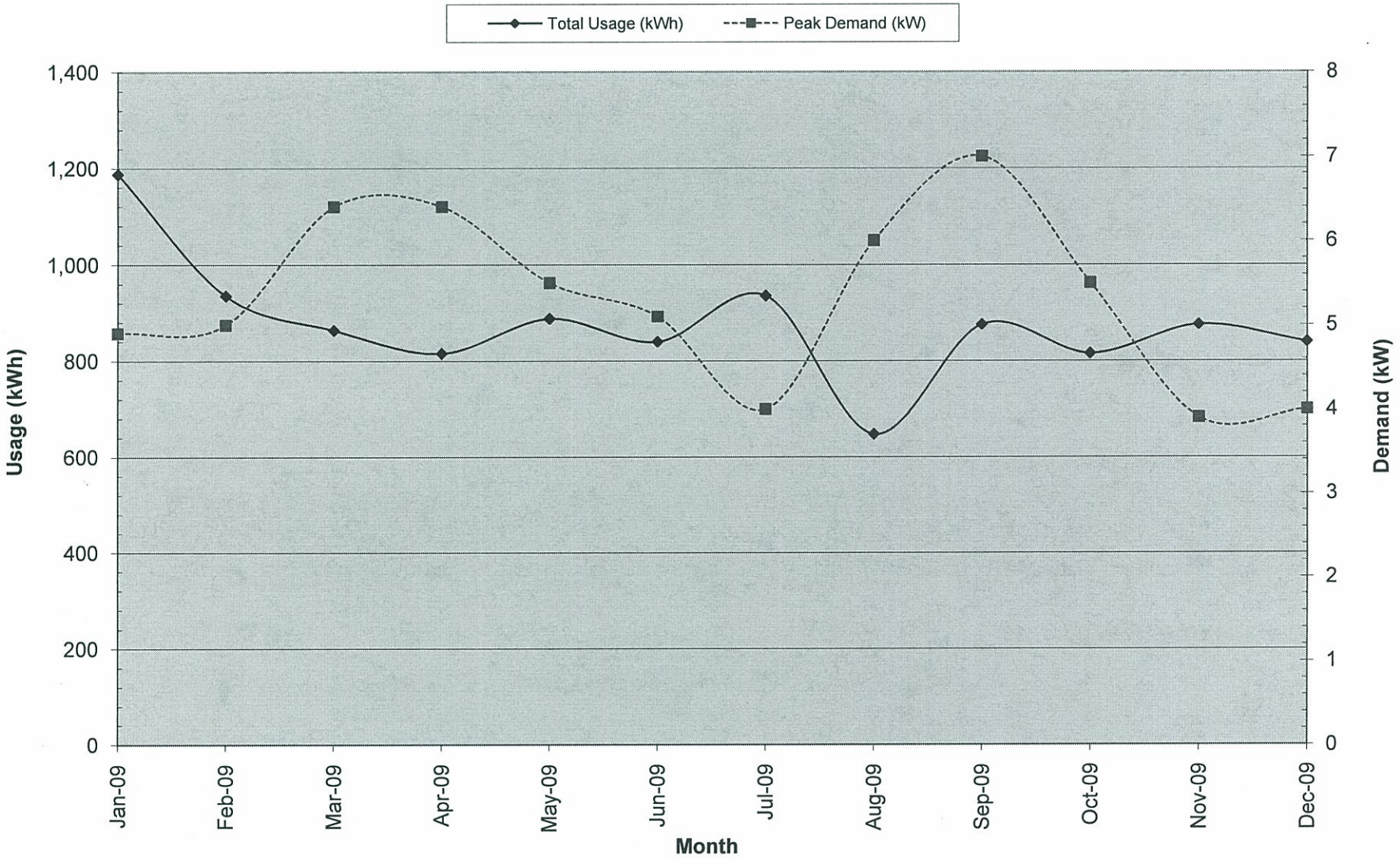
Utility Usage Analysis

New Jersey BPU Energy Audit Program
CHA Project No.: 21351
Borough of Saddle River - Department of Public Works
Orange & Rockland - Electric Service

Address: **85 E Allendale Rd.**
Account No.: **83105-58008**
Meter No.: **-**

			Charges			Unit Costs		
Month	Consumption (kWh)	Demand (kW)	Total ($)	Demand ($)	Consumption ($)	Blended Rate ($/kWh)	Consumption ($/kWh)	Demand ($/kW)
January-09	1,188	4.9	$181.61	$6.61	$175.00	$ 0.153	$ 0.147	$ 1.35
February-09	936	5.0	$116.89	$6.61	$110.28	$ 0.125	$ 0.118	$ 1.32
March-09	864	6.4	$139.99	$13.23	$126.76	$ 0.162	$ 0.147	$ 2.07
April-09	816	6.4	$123.39	$13.23	$110.16	$ 0.151	$ 0.135	$ 2.07
May-09	888	5.5	$139.92	$6.61	$133.31	$ 0.158	$ 0.150	$ 1.20
June-09	840	5.1	$143.65	$0.96	$142.69	$ 0.171	$ 0.170	$ 0.19
July-09	936	4.0	$157.70	$0.00	$157.70	$ 0.168	$ 0.168	$ -
August-09	648	6.0	$173.16	$9.76	$163.40	$ 0.267	$ 0.252	$ 1.63
September-09	876	7.0	$158.28	$19.52	$138.76	$ 0.181	$ 0.158	$ 2.79
October-09	816	5.5	$128.32	$4.79	$123.53	$ 0.157	$ 0.151	$ 0.87
November-09	876	3.9	$129.67	$0.00	$129.67	$ 0.148	$ 0.148	$ -
December-09	840	4.0	$137.95	$0.00	$137.95	$ 0.164	$ 0.164	$ -
Total	10,524	7.0	$1,730.53	$81.32	$1,649.21	$ 0.164	$ 0.157	$ 1.28

Electric Usage - Borough of Saddle River - DPW



Utility Data - DPW.xls
Electricity Chart

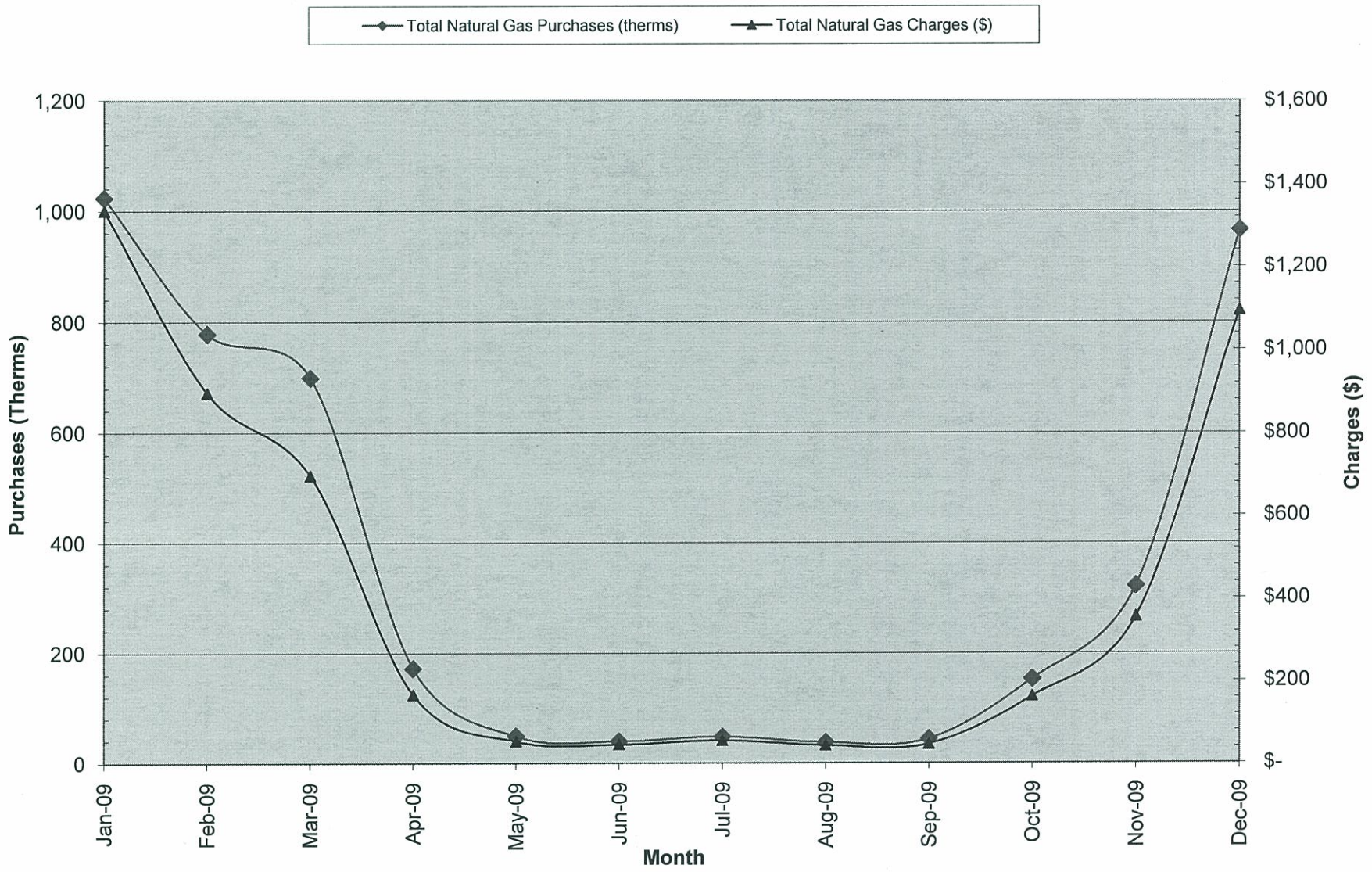
New Jersey BPU Energy Audit Program
CHA Project No.: 21351
Borough of Saddle River - Department of Public Works
PSE&G - Natural Gas Service

Address: **85 E Allendale Rd.**
Account No.: **65 504 685 09**
Meter No.: **3026095**

Month	Therms	Charges ($)	($/Therm)
January-09	1,023.5	$ 1,334.20	$ 1.304
February-09	778.2	$ 896.20	$ 1.152
March-09	699.4	$ 696.69	$ 0.996
April-09	172.2	$ 166.38	$ 0.966
May-09	48.9	$ 53.02	$ 1.084
June-09	39.6	$ 45.35	$ 1.145
July-09	47.9	$ 55.01	$ 1.148
August-09	37.5	$ 43.07	$ 1.149
September-09	43.9	$ 46.27	$ 1.054
October-09	153.1	$ 162.24	$ 1.060
November-09	321.6	$ 354.67	$ 1.103
December-09	966.0	$ 1,094.81	$ 1.133

Total	4,332	$ 4,947.91	$ 1.142

Natural Gas Usage - Borough of Saddle River - DPW



Utility Data - DPW.xls
Natural Gas Chart

ELECTRIC MARKETERS LIST

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Jan 14, 2009

GAS MARKETERS LIST

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

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

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

RPL Holdings, Inc
601 Carlson Pkwy
Minnetonka, MN 55305

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Apr 10, 2009

APPENDIX B

ECM-1 Night Setback

Saddle River, NJ
CHA #21351
Building: Department of Public Works

ECM-1 Night Setback-Garage

Building Footprint	1,664	SF	Ex Occupied Clng Temp.	73	*F	Ex Occupied Htg Temp.	68	*F	**Heating Energy Savings**	1,082	**therms**
Heating Efficiency	80%		Ex Unoccupied Clng Temp.	74	*F	Ex Unoccupied Htg Temp.	68	*F	**Cooling Energy Savings**	#REF!	**kWh**
Cooling Efficiency	0	kW/ton	Prop Occupied Clng Temp.	73	*F	Prop Occupied Htg Temp.	68	*F			
Building Balance Temp.	60	*F	Prop Unoccupied Clng Temp.	74	*F	Prop Unoccupied Htg Temp.	55	*F			
Internal Gains	4,259	btu/h	Occupied Cooling UA	-691	btu/hr/°F	Occupied Heating UA	808	btu/hr/°F			
Unoc Internal Gain factor	0.02		Unoccupied Cooling UA	-607	btu/hr/°F	Unoccupied Heating UA	808	btu/hr/°F			
Ave Occ Internal Gain Factor	0.45		Cooling Occ Enthalpy Setpoint	27.5	Btu/lb						
			Cooling Unocc Enthalpy Setpoint	27.5	Btu/lb						

Heat Distribution Effectiveness 85.0% Heat Distribution Factor per ASHRAE Handbook - Fundamentals for Unit Heaters

					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 Heating Energy therms	Proposed Heating Energy therms
A		B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	M	N
102.5	49.1	0	0	0	-20,392	-102,779	-1,917	-17,299	-51,390	-85	-20,392	-102,779	-1,917	-17,299	-51,390	-85	0	0
97.5	42.5	3	1	2	-16,936	-71,375	-1,917	-14,264	-35,687	-85	-16,936	-71,375	-1,917	-14,264	-35,687	-85	0	0
92.5	39.5	34	8	26	-13,480	-57,100	-1,917	-11,229	-28,550	-85	-13,480	-57,100	-1,917	-11,229	-28,550	-85	0	0
87.5	36.6	131	30	101	-10,023	-43,301	-1,917	-8,194	-21,650	-85	-10,023	-43,301	-1,917	-8,194	-21,650	-85	0	0
82.5	34	500	113	387	-6,567	-30,929	-1,917	-5,159	-15,464	-85	-6,567	-30,929	-1,917	-5,159	-15,464	-85	0	0
77.5	31.6	620	140	480	-3,111	-19,509	-1,917	-2,124	-9,755	-85	-3,111	-19,509	-1,917	-2,124	-9,755	-85	0	0
72.5	29.2	664	150	514	0	0	-1,917	0	0	-85	0	0	-1,917	0	0	-85	0	0
67.5	27	854	193	661	404	571	-1,917	404	285	-85	404	571	-1,917	0	0	-85	0	0
62.5	24.5	927	210	717	4,442	6,281	-1,917	4,442	3,140	-85	4,442	6,281	-1,917	0	0	-85	106	26
57.5	21.4	600	136	464	8,480	11,991	-1,917	8,480	5,995	-85	8,480	11,991	-1,917	0	0	-85	135	36
52.5	18.7	610	138	472	12,518	17,701	-1,917	12,518	8,850	-85	12,518	17,701	-1,917	2,019	1,427	-85	205	81
47.5	16.2	611	138	473	16,556	23,411	-1,917	16,556	11,705	-85	16,556	23,411	-1,917	6,057	4,282	-85	273	149
42.5	14.4	656	148	508	20,594	29,121	-1,917	20,594	14,560	-85	20,594	29,121	-1,917	10,095	7,137	-85	366	232
37.5	12.6	1,023	231	792	24,632	34,831	-1,917	24,632	17,415	-85	24,632	34,831	-1,917	14,133	9,992	-85	684	476
32.5	10.7	734	166	568	28,670	40,541	-1,917	28,670	20,270	-85	28,670	40,541	-1,917	18,171	12,847	-85	572	423
27.5	8.6	334	76	258	32,708	46,251	-1,917	32,708	23,125	-85	32,708	46,251	-1,917	22,209	15,702	-85	297	229
22.5	6.8	252	57	195	36,747	51,961	-1,917	36,747	25,980	-85	36,747	51,961	-1,917	26,248	18,557	-85	252	201
17.5	5.5	125	28	97	40,785	57,671	-1,917	40,785	28,835	-85	40,785	57,671	-1,917	30,286	21,412	-85	139	114
12.5	4.1	47	11	36	44,823	63,381	-1,917	44,823	31,690	-85	44,823	63,381	-1,917	34,324	24,267	-85	57	48
7.5	2.6	22	5	17	48,861	69,091	-1,917	48,861	34,545	-85	48,861	69,091	-1,917	38,362	27,122	-85	29	25
2.5	1	13	3	10	52,899	74,800	-1,917	52,899	37,400	-85	52,899	74,800	-1,917	42,400	29,977	-85	19	16
-2.5	0	0	0	0	56,937	80,510	-1,917	56,937	40,255	-85	56,937	80,510	-1,917	46,438	32,832	-85	0	0
-7.5	-1.5	0	0	0	60,975	86,220	-1,917	60,975	43,110	-85	60,975	86,220	-1,917	50,476	35,687	-85	0	0
TOTALS		**8,760**	**1,981**	**6,779**													**3,137**	**2,056**

Existing Building Ventilation & Infiltration (occ)	**529 cfm**
Overheat Ventilation Factor	**2.00**
Additional ventilation to offset overheat	**529 cfm**
Existing Building Ventilation & Infiltration (unocc)	**529 cfm**

Saddle River, NJ
CHA #21351
Building: Department of Public Works

ECM-1 Night Setback-Office

Building Footprint	384	SF	Ex Occupied Clng Temp.	73	*F	Ex Occupied Htg Temp.	68	*F	**Heating Energy Savings**	**116**	**therms**
Heating Efficiency	80%		Ex Unoccupied Clng Temp.	74	*F	Ex Unoccupied Htg Temp.	68	*F	**Cooling Energy Savings**	**#REF!**	**kWh**
Cooling Efficiency	0	kW/ton	Prop Occupied Clng Temp.	73	*F	Prop Occupied Htg Temp.	68	*F			
Building Balance Temp.	60	*F	Prop Unoccupied Clng Temp.	74	*F	Prop Unoccupied Htg Temp.	60	*F			
Internal Gains	1,245	btu/h	Occupied Cooling UA	-199	btu/hr/°F	Occupied Heating UA	138	btu/hr/°F			
Unoc Internal Gain factor	0.02		Unoccupied Cooling UA	-59	btu/hr/°F	Unoccupied Heating UA	138	btu/hr/°F			
Ave Occ Internal Gain Factor	0.6		Cooling Occ Enthalpy Setpoint	27.5	Btu/lb						
			Cooling Unocc Enthalpy Setpoint	27.5	Btu/lb						

Heat Distribution Effectiveness 0.0% Heat Distribution Factor per ASHRAE Handbook - Fundamentals for Unit Heaters

					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 Heating Energy therms	Proposed Heating Energy therms
A		B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	M	N
102.5	49.1	0	0	0	-5,881	-40,513	-747	-1,667	-11,353	-25	-5,881	-40,513	-747	-1,667	-11,353	-25	0	0
97.5	42.5	3	1	2	-4,884	-28,134	-747	-1,375	-7,884	-25	-4,884	-28,134	-747	-1,375	-7,884	-25	0	0
92.5	39.5	34	8	26	-3,888	-22,507	-747	-1,082	-6,307	-25	-3,888	-22,507	-747	-1,082	-6,307	-25	0	0
87.5	36.6	131	30	101	-2,891	-17,068	-747	-790	-4,783	-25	-2,891	-17,068	-747	-790	-4,783	-25	0	0
82.5	34	500	113	387	-1,894	-12,191	-747	-497	-3,416	-25	-1,894	-12,191	-747	-497	-3,416	-25	0	0
77.5	31.6	620	140	480	-897	-7,690	-747	-205	-2,155	-25	-897	-7,690	-747	-205	-2,155	-25	0	0
72.5	29.2	664	150	514	0	0	-747	0	0	-25	0	0	-747	0	0	-25	0	0
67.5	27	854	193	661	69	225	-747	69	63	-25	69	225	-747	0	0	-25	0	0
62.5	24.5	927	210	717	761	2,476	-747	761	694	-25	761	2,476	-747	0	0	-25	19	6
57.5	21.4	600	136	464	1,453	4,727	-747	1,453	1,325	-25	1,453	4,727	-747	346	315	-25	25	13
52.5	18.7	610	138	472	2,146	6,977	-747	2,146	1,955	-25	2,146	6,977	-747	1,038	946	-25	38	26
47.5	16.2	611	138	473	2,838	9,228	-747	2,838	2,586	-25	2,838	9,228	-747	1,730	1,577	-25	51	39
42.5	14.4	656	148	508	3,530	11,479	-747	3,530	3,217	-25	3,530	11,479	-747	2,422	2,208	-25	69	56
37.5	12.6	1,023	231	792	4,222	13,729	-747	4,222	3,847	-25	4,222	13,729	-747	3,114	2,838	-25	129	108
32.5	10.7	734	166	568	4,914	15,980	-747	4,914	4,478	-25	4,914	15,980	-747	3,807	3,469	-25	108	93
27.5	8.6	334	76	258	5,606	18,231	-747	5,606	5,109	-25	5,606	18,231	-747	4,499	4,100	-25	56	50
22.5	6.8	252	57	195	6,298	20,482	-747	6,298	5,740	-25	6,298	20,482	-747	5,191	4,730	-25	48	43
17.5	5.5	125	28	97	6,990	22,732	-747	6,990	6,370	-25	6,990	22,732	-747	5,883	5,361	-25	26	24
12.5	4.1	47	11	36	7,682	24,983	-747	7,682	7,001	-25	7,682	24,983	-747	6,575	5,992	-25	11	10
7.5	2.6	22	5	17	8,375	27,234	-747	8,375	7,632	-25	8,375	27,234	-747	7,267	6,623	-25	6	5
2.5	1	13	3	10	9,067	29,484	-747	9,067	8,262	-25	9,067	29,484	-747	7,959	7,253	-25	4	3
-2.5	0	0	0	0	9,759	31,735	-747	9,759	8,893	-25	9,759	31,735	-747	8,651	7,884	-25	0	0
-7.5	-1.5	0	0	0	10,451	33,986	-747	10,451	9,524	-25	10,451	33,986	-747	9,343	8,515	-25	0	0
TOTALS		**8,760**	**1,981**	**6,779**													**592**	**476**

Existing Building Ventilation & Infiltration (occ) **417 cfm**
Overheat Ventilation Factor **1.00**
Additional ventilation to offset overheat **0 cfm**
Existing Building Ventilation & Infiltration (unocc) **117 cfm**

Saddle River, NJ
CHA #21351
Building: Department of Public Works **Main Building Garage Area**

Reconcile Thermal Model

Building Footprint	1,664	SF	Ex Occupied Clng Temp.	73	*F	Ex Occupied Htg Temp.	68 *F
Heating Efficiency	80%		Ex Unoccupied Clng Temp.	73	*F	Ex Unoccupied Htg Temp.	68 *F
Cooling Efficiency	0.00	kW/ton	Occupied Cooling UA	(691)	btu/hr/*F	Occupied Heating UA	808 btu/hr/*F
Internal Gains	4,259	btu/h	Unoccupied Cooling UA	(607)	btu/hr/*F	Unoccupied Heating UA	808 btu/hr/*F
Unoc Internal Gain factor	0.02		Cooling Occ Enthalpy Setpoint	27.5	Btu/lb		
Ave Occ Internal Gain Factor	0.5		Cooling Unocc Enthalpy Setpoint	27.5	Btu/lb		
Economizer available (Y/N)	No						
Heat Distribution Effectiveness	85.0%	Heat Distribution Factor per ASHRAE Handbook - Fundamentals for Unit Heaters					

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	-20,392	-102,779	-1,917	-17,906	-51,390	-85	0	0	0	0
97.5	42.5	3	1	2	-16,936	-71,375	-1,917	-14,871	-35,687	-85	0	0	0	0
92.5	39.5	34	8	26	-13,480	-57,100	-1,917	-11,836	-28,550	-85	0	0	0	0
87.5	36.6	131	30	101	-10,023	-43,301	-1,917	-8,801	-21,650	-85	0	0	0	0
82.5	34.0	500	113	387	-6,567	-30,929	-1,917	-5,766	-15,464	-85	0	0	0	0
77.5	31.6	620	140	480	-3,111	-19,509	-1,917	-2,731	-9,755	-85	0	0	0	0
72.5	29.2	664	150	514	0	0	-1,917	0	0	-85	0	0	0	0
67.5	27.0	854	193	661	404	571	-1,917	404	285	-85	0	0	0	0
62.5	24.5	927	210	717	4,442	6,281	-1,917	4,442	3,140	-85	0	0	0	106
57.5	21.4	600	136	464	8,480	11,991	-1,917	8,480	5,995	-85	0	0	0	135
52.5	18.7	610	138	472	12,518	17,701	-1,917	12,518	8,850	-85	0	0	0	205
47.5	16.2	611	138	473	16,556	23,411	-1,917	16,556	11,705	-85	0	0	0	273
42.5	14.4	656	148	508	20,594	29,121	-1,917	20,594	14,560	-85	0	0	0	366
37.5	12.6	1,023	231	792	24,632	34,831	-1,917	24,632	17,415	-85	0	0	0	684
32.5	10.7	734	166	568	28,670	40,541	-1,917	28,670	20,270	-85	0	0	0	572
27.5	8.6	334	76	258	32,708	46,251	-1,917	32,708	23,125	-85	0	0	0	297
22.5	6.8	252	57	195	36,747	51,961	-1,917	36,747	25,980	-85	0	0	0	252
17.5	5.5	125	28	97	40,785	57,671	-1,917	40,785	28,835	-85	0	0	0	139
12.5	4.1	47	11	36	44,823	63,381	-1,917	44,823	31,690	-85	0	0	0	57
7.5	2.6	22	5	17	48,861	69,091	-1,917	48,861	34,545	-85	0	0	0	29
2.5	1.0	13	3	10	52,899	74,800	-1,917	52,899	37,400	-85	0	0	0	19
-2.5	0.0	0	0	0	56,937	80,510	-1,917	56,937	40,255	-85	0	0	0	0
-7.5	-1.5	0	0	0	60,975	86,220	-1,917	60,975	43,110	-85	0	0	0	0
TOTALS		**8,760**	**1,981**	**6,779**								**0**	**0**	**3,137**

Existing Building Ventilation & Infiltration (occ)	**529**	**cfm**
Overheat Ventilation Factor	**2.00**	**Due to frequent opening of four overhead doors**
Additional ventilation to offset overheat	**529**	**cfm**
Existing Building Ventilation & Infiltration (unocc)	**529**	**cfm**
Economizer Ventilation (from AHU's)	**0**	**cfm**

Energy Use Indices (calculated)

Heating	Base Case
Garage	3,137
Office	592
Total	**3,729**
Target ->	**3,800**
	98.1%

	Base Case
Cooling	**0**
Target ->	**300**
	0.0%

HEAT GAIN/LOSS WORKSHEET

Project Name:	Saddle River, NJ	Project No.:	CHA #21351		
Location		Site Elevation:	460 Feet	Specific Volume	13.50 CF/#
Building Name	Department of Public Works	Date:	05/05/10		
Engineer:	CAA				

Building/Facility Designation Main Building Garage Area

Outdoor Winter Design DB Temperature	14 *F	Indoor Winter Design DB Temperature	68 *F
Outdoor Summer Design DB Temperature	91 *F	Indoor Summer Design DB Temperature	73 *F
Outdoor Summer Design WB Temperature	73 *F	Indoor Summer Design WB Temperature	60 *F
Outdoor Summer Humidity Ratio	0.0121 ##	Indoor Air (70*F) Humidity Ratio	0.0078 ##

ENVELOPE DESCRIPTIONS (Descriptions are from Interior to Exterior)

Walls (Select One - Type X)

		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	Steel Siding, 6" Insulation, Steel Siding	20.7	

Roofs (Select One)

		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	Steel Deck, 6" insulation, Attic space, Plywood Sheathing, Felt & Shingles	23.0	

Windows (Select One)

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

	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	2,048 SF		
Occupied Area	1,664 SF	Return Plenum?	n

	Gross Wall Length	Average Wall Height	Ceiling Height	Window Area	Door Area	Net Wall Area
North Exposure	64 Ft	13.0 Ft	13.0 Ft	0 SF	488 SF	344 SF
East Exposure	32 Ft	6.0 Ft	6.0 Ft	0 SF	0 SF	192 SF
South Exposure	64 Ft	13.0 Ft	13.0 Ft	30 SF	0 SF	802 SF
West Exposure	32 Ft	15.0 Ft	13.0 Ft	0 SF	0 SF	480 SF

Forced Ventilation 0 cfm

HEAT GAIN/LOSS WORKSHEET

Project Name:	Saddle River, NJ	Project No.:	CHA #21351		
Location		Site Elevation:	460 Feet	Specific Volume	13.50 CF/#
Building Name	Department of Public Works	Date:	05/05/10		
Engineer:	CAA				

Building/Facility Designation: Main Building Garage Area

COOLING HEAT GAINS TO THE ROOM - SENSIBLE

SOLAR GAINS

WINDOWS	AREA (SF)	SHGF	Shade Coef	Cooling Load Factor		Solar Heat Gain
North Exposure	0	38 btu/h/sf	0.8	0.75	Glass Type C	0 Btu/hr
East Exposure	0	216 btu/h/sf	0.8	0.31	Glass Type C	0 Btu/hr
South Exposure	30	109 btu/h/sf	0.8	0.58	Glass Type C	1,517 Btu/hr
West Exposure	0	216 btu/h/sf	0.8	0.29	Glass Type C	0 Btu/hr
						1,517 Btu/h

CONDUCTION

	NET AREA (SF)	U-VALUE	Cooling Load Temp. Dif.	Return Air Factor	Room Heat Gain
North Exposure	344	0.05	20 *F	1.0	332 Btu/hr
East Exposure	192	0.05	39 *F	1.0	362 Btu/hr
South Exposure	802	0.05	27 *F	1.0	1,046 Btu/hr
West Exposure	416	0.05	22 *F	1.0	442 Btu/hr
Roof	2,048	0.04	73 *F	1.0	6,500 Btu/hr
Fenestration	30	0.62	18 *F		335 Btu/hr
Doors	488	0.14	27 *F		1,840 Btu/hr
Ceiling	2,048	0.14	0 *F		0 Btu/hr
Partition		0.05	0 *F		0 Btu/hr
Floor	1,664	0.04	0 *F		0 Btu/hr
					10,858 Btu/h

INTERNAL HEAT GAINS

								Room Heat Gain
Lights	0.75 w/sf x	1,664 Occ Area =	1.2 kW x 3.4x	1.0 RAF =	4,259 Btu/h
Plug Load	0.00 w/sf x	1,664 Occ Area =	0.0 kW x 3.4x	1.0 RAF =	0 Btu/h
People	0 people x	255 btu/person x	50% time in space =		0 Btu/h
Computer Work Stations		0 Units x	120 W/Unit x	3414 =	0 Btu/h
Equipment	0.0 kW x 3.413 =				0 Btu/h
Misc.					0 Btu/h
					4,259 Btu/h

VENTILATION AND INFILTRATION

		Infiltration Factor	Perimeter Ratio	Coef	Temp. Diff.	Room Heat Gain
Walls	1,754 SF	0.25 CFM/SF		1.08	18 *F	9,226 Btu/h
Doors	488 SF	0.35 CFM/LF	0.36 LF/SF	1.08	18 *F	1,296 Btu/h
Windows	30 SF	0.30 CFM/LF	1.40 LF/SF	1.08	18 *F	265 Btu/h
Ventilation	0 cfm			1.08	18 *F	0 Btu/h
						10,787 Btu/h

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	0	0.05	20	1.0	0 Btu/hr
East Exposure	0	0.05	39	1.0	0 Btu/hr
South Exposure	0	0.05	27	1.0	0 Btu/hr
West Exposure	64	0.05	22	1.0	68 Btu/hr
Roof	2,048	0.04	73	0.0	0 Btu/hr
					68 Btu/h

INTERNAL HEAT GAINS

Lights	0.75 w/sf x	1,664 Occ Area =	1.2 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	1,517	Internal Gains to Room	4,259
Conduction to Room	10,858	Internal Gains to Plenum	0
Conduction to Plenum	68		
Ventilaton and Infiltration	10,787		
Sub Total	23,230	Sub Total	4,259

HEAT GAIN/LOSS WORKSHEET

Project Name:	Saddle River, NJ	**Project No.:**	CHA #21351		
Location		**Site Elevation:**	460 Feet	**Specific Volume**	13.50 CF/#
Building Name	Department of Public Works	**Date:**	05/05/10		
Engineer:	CAA				

Building/Facility Designation Main Building Garage Area

LATENT COOLING LOADS

Infiltration

		Infiltration Factor	Air Density	Humidity Ratio Dif.	Room Heat Gain
Walls	2,112 SF	0.25 CFM/SF	4,800	0.0043 #/#	11,007 Btu/h
Doors	488 SF	0.35 CFM/LF	4,800	0.0043 #/#	1,284 Btu/h
Windows	30 SF	0.30 CFM/LF	4,800	0.0043 #/#	263 Btu/h
Ventilation	0 cfm		4,800	0.0043 #/#	0 Btu/h
People	0 people	0.50 time in space		250 Btu/hr/person	0 Btu/h
					12,553 Btu/h

Cooling Load Summary

	Sensible	Latent	Total	
Temperature Dependent Gains	23,230	12,553	35,783	
Temperature Indep. Gains	4,259		4,259	SHR= 0.69
Total	27,489	12,553	40,042	

Building Cooling Load 3.3 Tons at 499 SF/Ton

Building Air Flow to Condition Space based on a 12*F Temp Rise is **2,111 CFM** / **1.27 CFM/sf**

HEATING CALCULATION

CONDUCTION

	NET AREA (SF)	U-VALUE	Heating Load Temp. Dif.	Room Heat Gain
North Exposure	344	0.05	54	897 Btu/h
East Exposure	192	0.05	54	501 Btu/h
South Exposure	802	0.05	54	2,092 Btu/h
West Exposure	480	0.05	54	1,252 Btu/h
Fenestration	30	0.62	54	1,004 Btu/h
Roof	2,048	0.04	54	4,808 Btu/h
Doors	488	0.14	54	3,680 Btu/h
Ceiling	2,048	0.06	54	7,078 Btu/h
Partition	0	0.05	0	0 Btu/h
Floor	1,664	0.67	20	22,298 Btu/h

Ventilation and Infiltration

		Infiltration Factor	Coef	Temp. Difference	Air Flow	Room Heat Gain
Walls	1,818 SF	0.25 CFM/SF	1.08	54	455 cfm	26,562 Btu/h
Doors	488 SF	0.35 CFM/LF	1.08	54	62 cfm	3,600 Btu/h
Windows	30 SF	0.30 CFM/LF	1.08	54	13 cfm	736 Btu/h
Ventilation Load	0 cfm		1.08	54	0 cfm	0 Btu/h
Total Ventilation & Infiltration Load					529 cfm	30,898 Btu/h

Building Heating Load **74,510** **btu/h**

44.8 btu/sf

Saddle River, NJ
CHA #21351
Building: Department of Public Works **Main Building Garage Area**

Doors

	Width (ft)	Height (ft)	Quantity	Area (SF)	Lineal Feet
North				0.0	0.0
	10.0	10.0	2	200.0	80.0
	12.0	12.0	2	288.0	96.0
				0.0	0.0
				0.0	0.0
				0.0	0.0
			Sub-total	488.0	176.0
East				0.0	0.0
				0.0	0.0
				0.0	0.0
			Sub-total	0.0	0.0
South				0.0	0.0
				0.0	0.0
				0.0	0.0
				0.0	0.0
			Sub-total	0.0	0.0
West				0.0	0.0
				0.0	0.0
			Sub-total	0.0	0.0
			Total	**488.0**	**176.0**

LF/SF
0.36

Walls

	Width (ft)	Height (ft)	Quantity	Area (SF)	Lineal Feet		
North	64.0	13.0	1	832.0	154.0		All wall quantities must remain equal to 1
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0	Ave. height	
	64.0			832.0	154.0	13.0	Average height wall automatically linked to
East	32.0	6.0	1	192.0	76.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0	Ave. height	
	32.0			192.0	76.0	6.0	Average height wall automatically linked to
South	64.0	13.0	1	832.0	154.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0	Ave. height	
	64.0			832.0	154.0	13.0	Average height wall automatically linked to
West	32.0	15.0	1	480.0	94.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0	Ave. height	
	32.0			480.0	94.0	15.0	Average height auto linked to block load sheet

Windows

	Width (ft)	Height (ft)	Quantity	Area (SF)	Lineal Feet	
North				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
			Sub-total	0.0	0.0	
East				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
			Sub-total	0.0	0.0	
South	5.0	2.0	3	30.0	42.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
			Sub-total	30.0	42.0	
West				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
			Sub-total	0.0	0.0	
			Total	**30.0**	**42.0**	LF/SF 1.40

Saddle River, NJ
CHA #21351
Building: Department of Public Works **Main Building Office Area**

Reconcile Thermal Model

Building Footprint	384	SF	Ex Occupied Clng Temp.	73	*F	Ex Occupied Htg Temp.	68 *F
Heating Efficiency	80.0%		Ex Unoccupied Clng Temp.	73	*F	Ex Unoccupied Htg Temp.	68 *F
Cooling Efficiency	0.00	kW/ton	Occupied Cooling UA	(199)	btu/hr/*F	Occupied Heating UA	138 btu/hr/*F
Internal Gains	1,245	btu/h	Unoccupied Cooling UA	(59)	btu/hr/*F	Unoccupied Heating UA	138 btu/hr/*F
Unoc Internal Gain factor	0.02		Cooling Occ Enthalpy Setpoint	27.5	Btu/lb		
Ave Occ Internal Gain Factor	0.6		Cooling Unocc Enthalpy Setpoint	27.5	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	-5,881	-40,513	-747	-1,726	-11,353	-25	0	0	0	0
97.5	42.5	3	1	2	-4,884	-28,134	-747	-1,433	-7,884	-25	0	0	0	0
92.5	39.5	34	8	26	-3,888	-22,507	-747	-1,141	-6,307	-25	0	0	0	0
87.5	36.6	131	30	101	-2,891	-17,068	-747	-848	-4,783	-25	0	0	0	0
82.5	34.0	500	113	387	-1,894	-12,191	-747	-556	-3,416	-25	0	0	0	0
77.5	31.6	620	140	480	-897	-7,690	-747	-263	-2,155	-25	0	0	0	0
72.5	29.2	664	150	514	0	0	-747	0	0	-25	0	0	0	0
67.5	27.0	854	193	661	69	225	-747	69	63	-25	0	0	0	0
62.5	24.5	927	210	717	761	2,476	-747	761	694	-25	0	0	0	19
57.5	21.4	600	136	464	1,453	4,727	-747	1,453	1,325	-25	0	0	0	25
52.5	18.7	610	138	472	2,146	6,977	-747	2,146	1,955	-25	0	0	0	38
47.5	16.2	611	138	473	2,838	9,228	-747	2,838	2,586	-25	0	0	0	51
42.5	14.4	656	148	508	3,530	11,479	-747	3,530	3,217	-25	0	0	0	69
37.5	12.6	1,023	231	792	4,222	13,729	-747	4,222	3,847	-25	0	0	0	129
32.5	10.7	734	166	568	4,914	15,980	-747	4,914	4,478	-25	0	0	0	108
27.5	8.6	334	76	258	5,606	18,231	-747	5,606	5,109	-25	0	0	0	56
22.5	6.8	252	57	195	6,298	20,482	-747	6,298	5,740	-25	0	0	0	48
17.5	5.5	125	28	97	6,990	22,732	-747	6,990	6,370	-25	0	0	0	26
12.5	4.1	47	11	36	7,682	24,983	-747	7,682	7,001	-25	0	0	0	11
7.5	2.6	22	5	17	8,375	27,234	-747	8,375	7,632	-25	0	0	0	6
2.5	1.0	13	3	10	9,067	29,484	-747	9,067	8,262	-25	0	0	0	4
-2.5	0.0	0	0	0	9,759	31,735	-747	9,759	8,893	-25	0	0	0	0
-7.5	-1.5	0	0	0	10,451	33,986	-747	10,451	9,524	-25	0	0	0	0
TOTALS		**8,760**	**1,981**	**6,779**								**0**	**0**	**592**

Existing Building Ventilation & Infiltration (occ)	**417**	**cfm**
Overheat Ventilation Factor	**1.00**	
Additional ventilation to offset overheat	**0**	**cfm**
Existing Building Ventilation & Infiltration (unocc)	**117**	**cfm**
Economizer Ventilation (from AHU's)	**300**	**cfm**

Energy Use Indices (calculated)

Heating	Base Case
Garage	3,137
Office	592
Total	**3,729**
Target ->	**3,800**
	98.1%

	Base Case
Cooling	**0**
Target ->	**300**
	0.0%

HEAT GAIN/LOSS WORKSHEET

Project Name:	Saddle River, NJ	**Project No.:**	CHA #21351		
Location		**Site Elevation:**	460 Feet	**Specific Volume**	13.50 CF/#
Building Name	Department of Public Works	**Date:**	05/05/10		
Engineer:	CAA				

Building/Facility Designation Main Building Office Area

Outdoor Winter Design DB Temperature	14 *F	**Indoor Winter Design DB Temperature**	68 *F
Outdoor Summer Design DB Temperature	91 *F	**Indoor Summer Design DB Temperature**	73 *F
Outdoor Summer Design WB Temperature	73 *F	**Indoor Summer Design WB Temperature**	60 *F
Outdoor Summer Humidity Ratio	0.0121 ##	**Indoor Air (70*F) Humidity Ratio**	0.0078 ##

ENVELOPE DESCRIPTIONS (Descriptions are from Interior to Exterior)

Walls (Select One - Type X)

		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	Steel Siding, 6" Insulation, Steel Siding	20.0	

Roofs (Select One)

		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	Steel Deck, 6" insulation, Attic space, Plywood Sheathing, Felt & Shingles	23.0	

Windows (Select One)

		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
	Aluminum Frame, 1/2" DP Glazing	0.50
	Skylights	0.90
X	Vinyl Frame, DP Glazing	0.45

	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 0 SF
Occupied Area 384 SF

Ceiling is to Garage area, roof accounted for in garage

Return Plenum? n

	Gross Wall Length	Average Wall Height	Ceiling Height	Window Area	Door Area	Net Wall Area
North Exposure	12 Ft	9.0 Ft	8.0 Ft	0 SF	21 SF	87 SF
East Exposure	25 Ft	9.0 Ft	8.0 Ft	36 SF	0 SF	189 SF
South Exposure	12 Ft	9.0 Ft	8.0 Ft	12 SF	0 SF	96 SF
West Exposure	0 Ft	0.0 Ft	0.0 Ft	0 SF	0 SF	0 SF

Forced Ventilation 300 cfm

Due to continuously running locker room exhaust fan and boiler combustion air intake to utility room.

HEAT GAIN/LOSS WORKSHEET

Project Name:	Saddle River, NJ	Project No.:	CHA #21351		
Location		Site Elevation:	460 Feet	Specific Volume	13.50 CF/#
Building Name	Department of Public Works	Date:	05/05/10		
Engineer:	CAA				

Building/Facility Designation: Main Building Office Area

COOLING HEAT GAINS TO THE ROOM - SENSIBLE

SOLAR GAINS

WINDOWS	AREA (SF)	SHGF	Shade Coef	Cooling Load Factor		Solar Heat Gain
North Exposure	0	38 btu/h/sf	0.8	0.75	Glass Type C	0 Btu/hr
East Exposure	36	216 btu/h/sf	0.8	0.31	Glass Type C	1,928 Btu/hr
South Exposure	12	109 btu/h/sf	0.8	0.58	Glass Type C	607 Btu/hr
West Exposure	0	216 btu/h/sf	0.8	0.29	Glass Type C	0 Btu/hr
						2,535 Btu/h

CONDUCTION

	NET AREA (SF)	U-VALUE	Cooling Load Temp. Dif.	Return Air Factor	Room Heat Gain
North Exposure	75	0.05	20 *F	1.0	75 Btu/hr
East Exposure	164	0.05	39 *F	1.0	320 Btu/hr
South Exposure	84	0.05	27 *F	1.0	113 Btu/hr
West Exposure	0	0.05	22 *F	1.0	0 Btu/hr
Roof	0	0.04	73 *F	1.0	0 Btu/hr
Fenestration	48	0.45	18 *F		389 Btu/hr
Doors	21	0.14	27 *F		79 Btu/hr
Ceiling	384	0.14	0 *F		0 Btu/hr
Partition		0.05	0 *F		0 Btu/hr
Floor	384	0.04	0 *F		0 Btu/hr
					976 Btu/h

INTERNAL HEAT GAINS

							Room Heat Gain
Lights	0.90 w/sf x	384 Occ Area =	0.3 kW x 3.4x	1.0 RAF =			1,180 Btu/h
Plug Load	0.05 w/sf x	384 Occ Area =	0.0 kW x 3.4x	1.0 RAF =			66 Btu/h
People	0 people x	255 btu/person x	50% time in space =				0 Btu/h
Computer Work Stations		0 Units x	120 W/Unit x	3414 =			0 Btu/h
Equipment	0.0 kW x 3.413 =						0 Btu/h
Misc.							0 Btu/h
							1,245 Btu/h

VENTILATION AND INFILTRATION

		Infiltration Factor	Perimeter Ratio	Coef	Temp. Diff.	Room Heat Gain
Walls	323 SF	0.25 CFM/SF		1.08	18 *F	1,699 Btu/h
Doors	21 SF	0.35 CFM/LF	0.95 LF/SF	1.08	18 *F	147 Btu/h
Windows	48 SF	0.30 CFM/LF	1.17 LF/SF	1.08	18 *F	353 Btu/h
Ventilation	300 cfm			1.08	18 *F	6,312 Btu/h
						8,511 Btu/h

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	12	0.05	20	1.0	12 Btu/hr
East Exposure	25	0.05	39	1.0	49 Btu/hr
South Exposure	12	0.05	27	1.0	16 Btu/hr
West Exposure	0	0.05	22	1.0	0 Btu/hr
Roof	0	0.04	73	0.0	0 Btu/hr
					77 Btu/h

INTERNAL HEAT GAINS

					Room Heat Gain
Lights	0.90 w/sf x	384 Occ Area =	0.3 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	2,535	Internal Gains to Room	1,245
Conduction to Room	976	Internal Gains to Plenum	0
Conduction to Plenum	77		
Ventilaton and Infiltration	8,511		
Sub Total	12,100	Sub Total	1,245

HEAT GAIN/LOSS WORKSHEET

Project Name:	Saddle River, NJ	Project No.:	CHA #21351		
Location		Site Elevation:	460 Feet	Specific Volume	13.50 CF/#
Building Name	Department of Public Works	Date:	05/05/10		
Engineer:	CAA				

Building/Facility Designation: Main Building Office Area

LATENT COOLING LOADS

Infiltration

			Infiltration Factor		Air Density	Humidity Ratio Dif.		Room Heat Gain	
Walls	49	SF	0.25	CFM/SF	4,800	0.0043	##	255	Btu/h
Doors	21	SF	0.35	CFM/LF	4,800	0.0043	##	146	Btu/h
Windows	48	SF	0.30	CFM/LF	4,800	0.0043	##	350	Btu/h
Ventilation	300	cfm			4,800	0.0043	##	6,254	Btu/h
People	0	people	0.50	time in space		250	Btu/hr/person	0	Btu/h
									7,005 Btu/h

Cooling Load Summary

	Sensible	Latent	Total		
Temperature Dependent Gains	12,100	7,005	19,105		
Temperature Indep. Gains	1,245		1,245	SHR=	0.66
Total	13,345	7,005	20,350		

Building Cooling Load: 1.7 Tons at 226 SF/Ton

Building Air Flow to Condition Space based on a 12*F Temp Rise is: 1,022 CFM (2.66 CFM/sf)

HEATING CALCULATION

CONDUCTION

	NET AREA (SF)	U-VALUE	Heating Load Temp. Dif.	Room Heat Gain	
North Exposure	87	0.05	54	235	Btu/h
East Exposure	189	0.05	54	510	Btu/h
South Exposure	96	0.05	54	259	Btu/h
West Exposure	0	0.05	54	0	Btu/h
Fenestration	48	0.45	54	1,166	Btu/h
Roof	0	0.04	54	0	Btu/h
Doors	21	0.14	54	158	Btu/h
Ceiling	384	0.05	0	0	Btu/h
Partition	0	0.05	0	0	Btu/h
Floor	384	0.67	20	5,146	Btu/h

Ventilation and Infiltration

			Infiltration Factor		Coef	Temp. Difference	Air Flow	Room Heat Gain	
Walls	372	SF	0.25	CFM/SF	1.08	54	93 cfm	5,435	Btu/h
Doors	21	SF	0.35	CFM/LF	1.08	54	7 cfm	409	Btu/h
Windows	48	SF	0.30	CFM/LF	1.08	54	17 cfm	982	Btu/h
Ventilation Load	300	cfm			1.08	54	300 cfm	18,935	Btu/h
Total Ventilation & Infiltration Load							417 cfm	25,761	Btu/h

Building Heating Load	33,236	btu/h
		86.6 btu/sf

Saddle River, NJ
CHA #21351
Building: Department of Public Works **Main Building Office Area**

Doors

	Width (ft)	Height (ft)	Quantity	Area (SF)	Lineal Feet
North	3.0	7.0	1	21.0	20.0
				0.0	0.0
				0.0	0.0
				0.0	0.0
				0.0	0.0
				0.0	0.0
			Sub-total	21.0	20.0
East				0.0	0.0
				0.0	0.0
				0.0	0.0
			Sub-total	0.0	0.0
South				0.0	0.0
				0.0	0.0
				0.0	0.0
				0.0	0.0
			Sub-total	0.0	0.0
West				0.0	0.0
				0.0	0.0
			Sub-total	0.0	0.0
			Total	**21.0**	**20.0**

LF/SF
0.95

Walls

	Width (ft)	Height (ft)	Quantity	Area (SF)	Lineal Feet		
North	12.0	9.0	1	108.0	42.0		All wall quantities must remain equal to 1
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0	Ave. height	
	12.0			108.0	42.0	9.0	Average height wall automatically linked to
East	25.0	9.0	1	225.0	68.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0	Ave. height	
	25.0			225.0	68.0	9.0	Average height wall automatically linked to
South	12.0	9.0	1	108.0	42.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0	Ave. height	
	12.0			108.0	42.0	9.0	Average height wall automatically linked to
West				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0	Ave. height	
	0.0			0.0	0.0	0.0	Average height auto linked to block load sheet

Windows

	Width (ft)	Height (ft)	Quantity	Area (SF)	Lineal Feet	
North				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
			Sub-total	0.0	0.0	
East	3.0	4.0	3	36.0	42.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
			Sub-total	36.0	42.0	
South	3.0	4.0	1	12.0	14.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
			Sub-total	12.0	14.0	
West				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
			Sub-total	0.0	0.0	
						LF/SF
			Total	**48.0**	**56.0**	1.17

Saddle River, NJ
CHA #21351
Building: Department of Public Works

ECM-2 Install Infrared Heater

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.		
						$ -	$ -	$ -	$ -	
Unit Heater Removal	1	EA		$ 450		$ -	$ 545	$ -	$ 545	Cap HHW piping in place.
40' NG Infrared Tube Heater 175 MBH	1	EA	$ 1,850	$ 400		$ 1,813	$ 484	$ -	$ 2,297	Includes Controls
Gas Piping, Valves, etc.	1	EA	$ 150	$ 100		$ 147	$ 121	$ -	$ 268	Connect to existing gas piping
4" Class B Vent Piping	10	LF	$ 6.70	$ 10		$ 66	$ 121	$ -	$ 187	Connect to existing roof stack
Miscellaneous electrical	1	LS	$ 100	$ 100		$ 98	$ 121	$ -	$ 219	
						$ -	$ -	$ -	$ -	

Note: Unit selections and budgetary pricing are per Reznor VR series infrared tube heaters.

$3,515	Subtotal
$703	20% Contingency
$422	10% Contractor O&P
$0	0% Engineering
$4,640	**Total**

APPENDIX C

ECM-2 Install Infrared Heaters

Saddle River, NJ
CHA #21351
Building: Department of Public Works

ECM-2 Install Infrared Heater

Building Footprint	1,664	SF	Ex Occupied Htg Temp.	68	*F
Natural Gas Heat Content	100,000	Btu/Therm	Ex Unoccupied Htg Temp.	68	*F
Building Balance Temp.	60	*F	Occupied Heating UA	808	btu/hr/°F
Internal Gains	4,259	btu/h	Unoccupied Heating UA	808	btu/hr/°F
Unocc Internal Gain factor	0.02				
Ave Occ Internal Gain Factor	0.45				

Heating Energy Savings	**627 Therms/yr**
Electric Energy Savings	**1,650 kWh/yr**

Existing Burner Efficiency	80.0%	Existing thermal efficiency (Boiler)
Existing Heat Distribution Effectiveness	85.0%	Heat Distribution Factor per ASHRAE Handbook - Fundamentals for Unit Heaters
Proposed Burner Efficiency	85.0%	Based on Reznor Infrared Tube Heaters
Proposed Heat Distribution Effectiveness	100%	Heat Distribution Factor per ASHRAE Handbook - Fundamentals for Infrared Heaters

					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 Heating Energy Therms	Proposed Heating Energy Therms
A		B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	M	N
102.5	49	0	0	0	0	0	-1,917	0	0	-85	0	0	-1,917	0	0	-85	0	0
97.5	43	3	1	2	0	0	-1,917	0	0	-85	0	0	-1,917	0	0	-85	0	0
92.5	40	34	8	26	0	0	-1,917	0	0	-85	0	0	-1,917	0	0	-85	0	0
87.5	37	131	30	101	0	0	-1,917	0	0	-85	0	0	-1,917	0	0	-85	0	0
82.5	34	500	113	387	0	0	-1,917	0	0	-85	0	0	-1,917	0	0	-85	0	0
77.5	32	620	140	480	0	0	-1,917	0	0	-85	0	0	-1,917	0	0	-85	0	0
72.5	29	664	150	514	0	0	-1,917	0	0	-85	0	0	-1,917	0	0	-85	0	0
67.5	27	854	193	661	404	571	-1,917	404	285	-85	404	571	-1,917	404	285	-85	0	0
62.5	25	927	210	717	4,442	6,281	-1,917	4,442	3,140	-85	4,442	6,281	-1,917	4,442	3,140	-85	106	85
57.5	21	600	136	464	8,480	11,991	-1,917	8,480	5,995	-85	8,480	11,991	-1,917	8,480	5,995	-85	135	108
52.5	19	610	138	472	12,518	17,701	-1,917	12,518	8,850	-85	12,518	17,701	-1,917	12,518	8,850	-85	205	164
47.5	16	611	138	473	16,556	23,411	-1,917	16,556	11,705	-85	16,556	23,411	-1,917	16,556	11,705	-85	273	219
42.5	14	656	148	508	20,594	29,121	-1,917	20,594	14,560	-85	20,594	29,121	-1,917	20,594	14,560	-85	366	293
37.5	13	1,023	231	792	24,632	34,831	-1,917	24,632	17,415	-85	24,632	34,831	-1,917	24,632	17,415	-85	684	547
32.5	11	734	166	568	28,670	40,541	-1,917	28,670	20,270	-85	28,670	40,541	-1,917	28,670	20,270	-85	572	458
27.5	9	334	76	258	32,708	46,251	-1,917	32,708	23,125	-85	32,708	46,251	-1,917	32,708	23,125	-85	297	238
22.5	7	252	57	195	36,747	51,961	-1,917	36,747	25,980	-85	36,747	51,961	-1,917	36,747	25,980	-85	252	202
17.5	6	125	28	97	40,785	57,671	-1,917	40,785	28,835	-85	40,785	57,671	-1,917	40,785	28,835	-85	139	111
12.5	4	47	11	36	44,823	63,381	-1,917	44,823	31,690	-85	44,823	63,381	-1,917	44,823	31,690	-85	57	46
7.5	3	22	5	17	48,861	69,091	-1,917	48,861	34,545	-85	48,861	69,091	-1,917	48,861	34,545	-85	29	23
2.5	1	13	3	10	52,899	74,800	-1,917	52,899	37,400	-85	52,899	74,800	-1,917	52,899	37,400	-85	19	15
-2.5	0	0	0	0	56,937	80,510	-1,917	56,937	40,255	-85	56,937	80,510	-1,917	56,937	40,255	-85	0	0
-7.5	-2	0	0	0	60,975	86,220	-1,917	60,975	43,110	-85	60,975	86,220	-1,917	60,975	43,110	-85	0	0
TOTALS		**8,760**	**1,981**	**6,779**													**3,137**	**2,510**

Existing Building Ventilation & Infiltration (occ)	**529 cfm**	
Overheat Ventilation Factor	**2.00**	Due to opening garage doors
Additional ventilation to offset overheat	**529 cfm**	
Existing Building Ventilation & Infiltration (unocc)	**529 cfm**	

Electrical Requirements for Heating Equipment

Existing Equipment

Unit	Htng Hrs	Amps	Volts	Phase	Power Factor	Annual kWh
UH-1	2,161	9.5	115	1	0.8	1889
Total						**1,889**

Proposed Equipment

Unit	Htng Hrs	Amps	Volts	Phase	Power Factor	Annual kWh
175 MB Infrared	2,161	1.2	115	1	0.8	239
Total						**239**

*Electrical data based on Reznor VR Series Infrared Heaters

Avg. OA Temp °F	Heating Hrs	Assumed % Time of Operation	hrs of Operation
102.5	0	0%	0
97.5	0	0%	0
92.5	0	0%	0
87.5	0	0%	0
82.5	0	0%	0
77.5	0	0%	0
72.5	0	0%	0
67.5	0	0%	0
62.5	927	8%	71
57.5	600	15%	92
52.5	610	23%	141
47.5	611	31%	188
42.5	656	38%	252
37.5	1023	46%	472
32.5	734	54%	395
27.5	334	62%	206
22.5	252	69%	174
17.5	125	77%	96
12.5	47	85%	40
7.5	22	92%	20
2.5	13	100%	13
-2.5	0	100%	0
-7.5	0	100%	0
	5,954	36%	2161

Saddle River, NJ
CHA #21351
Building: Department of Public Works

ECM-2 Install Infrared Heater

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.		
						$ -	$ -	$ -	$ -	
Unit Heater Removal	1	EA		$ 450		$ -	$ 545	$ -	$ 545	Cap HHW piping in place.
40' NG Infrared Tube Heater 175 MBH	1	EA	$ 1,850	$ 400		$ 1,813	$ 484	$ -	$ 2,297	Includes Controls
Gas Piping, Valves, etc.	1	EA	$ 150	$ 100		$ 147	$ 121	$ -	$ 268	Connect to existing gas piping
4" Class B Vent Piping	10	LF	$ 6.70	$ 10		$ 66	$ 121	$ -	$ 187	Connect to existing roof stack
Miscellaneous electrical	1	LS	$ 100	$ 100		$ 98	$ 121	$ -	$ 219	
						$ -	$ -	$ -	$ -	

Note: Unit selections and budgetary pricing are per Reznor VR series infrared tube heaters.

$3,515	Subtotal
$703	20% Contingency
$422	10% Contractor O&P
$0	0% Engineering
$4,640	**Total**

APPENDIX D

ECM-3 Lighting Replacements

Energy Audit of Saddle River - DPW
CHA Project No. 21351
ECM-3 Lighting Replacements

Cost of Electricity: **$0.157 $/kWh**
$1.28 $/kW

		EXISTING CONDITIONS								RETROFIT CONDITIONS								COST & SAVINGS ANALYSIS						
	Area Description	**No. of Fixtures**	**Standard Fixture Code**	**NYSERDA Fixture Code**	**Watts per Fixture**	**kW/Space**	**Exist Control**	**Annual Hours**	**Annual kWh**	**Number of Fixtures**	**Standard Fixture Code**	**Fixture Code**	**Watts per Fixture**	**kW/Space**	**Retrofit Control**	**Annual Hours**	**Annual kWh**	**Annual kWh Saved**	**Annual kW Saved**	**Annual $ Saved**	**Retrofit Cost**	**NJ Lighting Incentive**	**Simple Payback With Out Incentive**	**Simple Payback**
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	No. of fixtures before the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated daily hours for the usage group	(kW/space) * (Annual Hours)	No. of fixtures after the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Number of Fixtures)	Retrofit control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	(Original Annual kWh) - (Retrofit Annual kWh)	(Original Annual kW) - (Retrofit Annual kW)	(kWh Saved) * ($/kWh)	Cost for renovations to lighting system	Prescriptive Lighting Measures	Length of time for renovations cost to be recovered	Length of time for renovations cost to be recovered
2	Office	2	T 34 W F 2 (MAG) RL/RB	F42ES	80	0.2	SW	1950	312	2	0	F42LL	60	0.1	SW	1,950	234	78	0.0	$ 12.86	$ 300.00	$30	23.3	21.0
2	Utility Room	1	T 34 W F 2 (MAG) RL/RB	F42ES	80	0.1	SW	520	42	1	0	F42LL	60	0.1	SW	520	31	10	0.0	$ 1.94	$ 150.00	$15	77.3	69.6
2	Locker Room/Restroom	1	T 34 W F 2 (MAG) RL/RB	F42ES	80	0.1	SW	1950	156	1	0	F42LL	60	0.1	SW	1,950	117	39	0.0	$ 6.43	$ 150.00	$15	23.3	21.0
2	Hallway	2	T 34 W F 2 (MAG) RL/RB	F42ES	80	0.2	SW	1950	312	2	0	F42LL	60	0.1	SW	1,950	234	78	0.0	$ 12.86	$ 300.00	$30	23.3	21.0
146	Main Building Garage	4	High Bay MH 400	MH400/1	458	1.8	SW	1950	3,572	4	P 54 C F 4	F44GHL	234	0.9	SW	1,950	1,625	1,747	0.9	$ 288.07	$ 1,560.00	$400	5.4	4.0
2	Main Building Garage (Back Wall)	6	T 34 W F 2 (MAG) RL/RB	F42ES	80	0.5	SW	780	374	6	0	F42LL	60	0.4	SW	780	281	94	0.1	$ 16.54	$ 900.00	$90	54.4	49.0
2	Main Building Garage (Loft)	6	T 34 W F 2 (MAG) RL/RB	F42ES	80	0.5	SW	520	250	6	0	F42LL	60	0.4	SW	520	187	62	0.1	$ 11.64	$ 900.00	$90	77.3	69.6
191	Main Building Garage (Workbench)	1	S 60 C F 2 (ELE) 8'	F82EE	123	0.1	SW	1300	160	1	0	F82ILL-R	98	0.1	SW	1,300	127	33	0.0	$ 5.49	$ 174.00	$15	31.7	29.0
146	Storage Barn	2	High Bay MH 400	MH400/1	458	0.9	SW	780	714	2	P 54 C F 4	F44GHL	234	0.5	SW	780	365	349	0.4	$ 61.74	$ 780.00	$200	12.6	9.4
191	Storage Barn	2	S 60 C F 2 (ELE) 8'	F82EE	123	0.2	SW	780	192	2	0	F82ILL-R	98	0.2	SW	780	153	39	0.1	$ 6.89	$ 348.00	$30	50.5	46.1
	Total	**27**				**4.6**			**6,084**	**27**			**1,024**	**2.8**			**3,555**	**2,530**	**1.8**	**$424**	**$5,562**	**$915**		
																	Demand Savings			**1.8**	**$27**			
																	kWh Savings			**2,530**	**$397**			
																	Total savings				**$424**		**13.1**	**10.9**

APPENDIX E

ECM-4 Install Occupancy Sensors

Energy Audit of Saddle River - DPW
CHA Project No. 21351
ECM-4 Install Occupancy Sensors

Cost of Electricity: **$0.157 $/kWh**
$1.28 $/kW

		EXISTING CONDITIONS								RETROFIT CONDITIONS								COST & SAVINGS ANALYSIS						
	Area Description	No. of Fixtures	Standard Fixture Code	NYSERDA Fixture Code	Watts per Fixture	kW/Space	Exist Control	Annual Hours	Annual kWh	Number of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Retrofit Control	Annual Hours	Annual kWh	Annual kWh Saved	Annual kW Saved	Annual $ Saved	Retrofit Cost	NJ Lighting Incentive	Simple Payback With Out Incentive	Simple Payback
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	No. of fixtures before the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	No. of fixtures after the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Number of Fixtures)	Retrofit control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	(Original Annual kWh) - (Retrofit Annual kWh)	(Original Annual kW) - (Retrofit Annual kW)	(kW Saved) * ($/kWh)	Cost for renovations to lighting system		Length of time for renovations cost to be recovered	Length of time for renovations cost to be recovered
2	Office	2	T 34 W F 2 (MAG) RL/RB	F42ES	80	0.2	SW	1950	312	2	T 34 W F 2 (MAG) RL/RB	F42ES	80	0.2	OCC	488	78.0	234.0	0.0	$36.74	$118.75	$20.00	3.2	2.7
2	Utility Room	1	T 34 W F 2 (MAG) RL/RB	F42ES	80	0.1	SW	520	42	1	T 34 W F 2 (MAG) RL/RB	F42ES	80	0.1	None	520	41.6	0.0	0.0	$0.00	$0.00	$0.00		
2	Locker Room/Restroom	1	T 34 W F 2 (MAG) RL/RB	F42ES	80	0.1	SW	1950	156	1	T 34 W F 2 (MAG) RL/RB	F42ES	80	0.1	OCC	585	46.8	109.2	0.0	$17.14	$118.75	$20.00	6.9	5.8
2	Hallway	2	T 34 W F 2 (MAG) RL/RB	F42ES	80	0.2	SW	1950	312	2	T 34 W F 2 (MAG) RL/RB	F42ES	80	0.2	OCC	975	156.0	156.0	0.0	$24.49	$118.75	$20.00	4.8	4.0
146	Main Building Garage	4	High Bay MH 400	MH400/1	458	1.8	SW	1950	3,572	4	High Bay MH 400	MH400/1	458	1.8	None	1950	3,572.4	0.0	0.0	$0.00	$0.00	$0.00		
2	Main Building Garage (Back Wall)	6	T 34 W F 2 (MAG) RL/RB	F42ES	80	0.5	SW	780	374	6	T 34 W F 2 (MAG) RL/RB	F42ES	80	0.5	None	780	374.4	0.0	0.0	$0.00	$0.00	$0.00		
2	Main Building Garage (Loft)	6	T 34 W F 2 (MAG) RL/RB	F42ES	80	0.5	SW	520	250	6	T 34 W F 2 (MAG) RL/RB	F42ES	80	0.5	None	520	249.6	0.0	0.0	$0.00	$0.00	$0.00		
191	Main Building Garage (Workbench)	1	S 60 C F 2 (ELE) 8'	F82EE	123	0.1	SW	1300	160	1	S 60 C F 2 (ELE) 8'	F82EE	123	0.1	None	1300	159.9	0.0	0.0	$0.00	$0.00	$0.00		
146	Storage Barn	2	High Bay MH 400	MH400/1	458	0.9	SW	780	714	2	High Bay MH 400	MH400/1	458	0.9	None	780	714.5	0.0	0.0	$0.00	$0.00	$0.00		
191	Storage Barn	2	S 60 C F 2 (ELE) 8'	F82EE	123	0.2	SW	780	192	2	S 60 C F 2 (ELE) 8'	F82EE	123	0.2	None	780	191.9	0.0	0.0	$0.00	$0.00	$0.00		
	Total	27				4.6			6,084	27				5			5,585	499	0	78	$356	60		
																	Demand Savings			0.0	$0			
																	kWh Savings			499	$78			
																	Total Savings				$78		4.5	3.8

APPENDIX F

ECM-5 Lighting Replacements with Occupancy Sensors

Energy Audit of Saddle River - DPW
CHA Project No. 21351
ECM-5 Lighting Replacements with Occupancy Sensors

Cost of Electricity: $0.157 $/kWh
$1.28 $/kW

		EXISTING CONDITIONS								RETROFIT CONDITIONS								COST & SAVINGS ANALYSIS						
	Area Description	No. of Fixtures	Standard Fixture Code	NYSERDA Fixture Code	Watts per Fixture	kW/Space	Exist Control	Annual Hours	Annual kWh	Number of Fixtures	Standard Fixture Code	Fixture Code	Watts per Fixture	kW/Space	Retrofit Control	Annual Hours	Annual kWh	Annual kWh Saved	Annual kW Saved	Annual $ Saved	Retrofit Cost	NJ Lighting Incentive	Simple Payback With Out Incentive	Simple Payback
Field Code	Unique description of the location - Room number/Room name: Floor number (if applicable)	No. of fixtures before the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Fixt No.)	Pre-inst. control device	Estimated daily hours for the usage group	(kW/space) * (Annual Hours)	No. of fixtures after the retrofit	"Lighting Fixture Code" Example 2T 40 R F(U) = 2'x2' Troff 40 w Recess. Floor 2 lamps U shape	Code from Table of Standard Fixture Wattages	Value from Table of Standard Fixture Wattages	(Watts/Fixt) * (Number of Fixtures)	Retrofit control device	Estimated annual hours for the usage group	(kW/space) * (Annual Hours)	(Original Annual kWh) - (Retrofit Annual kWh)	(Original Annual kW) - (Retrofit Annual kW)	(kWh Saved) * ($/kWh)	Cost for renovations to lighting system	Prescriptive Lighting Measures	Length of time for renovations cost to be recovered	Length of time for renovations cost to be recovered
2	Office	2	T 34 W F 2 (MAG) RL/RB	F42ES	80	0.2	SW	1950	312	2	0	F42LL	60	0.1	OCC	520	62	250	0.0	$ 39.80	$ 418.75	$ 80	10.5	**8.5**
2	Utility Room	1	T 34 W F 2 (MAG) RL/RB	F42ES	80	0.1	SW	520	42	1	0	F42LL	60	0.1	None	520	31	10	0.0	$ 1.94	$ 150.00	$ 15	77.3	69.6
2	Locker Room/Restroom	1	T 34 W F 2 (MAG) RL/RB	F42ES	80	0.1	SW	1950	156	1	0	F42LL	60	0.1	OCC	585	35	121	0.0	$ 19.29	$ 268.75	$ 35	13.9	**12.1**
2	Hallway	2	T 34 W F 2 (MAG) RL/RB	F42ES	80	0.2	SW	1950	312	2	0	F42LL	60	0.1	OCC	975	117	195	0.0	$ 31.23	$ 418.75	$ 50	13.4	**11.8**
146	Main Building Garage	4	High Bay MH 400	MH400/1	458	1.8	SW	1950	3,572	4	P 54 C F 4	F44GHL	234	0.9	None	1,950	1,825	1,747	0.9	$ 288.07	$ 1,560.00	$ 400	5.4	**4.0**
2	Main Building Garage (Back Wall)	6	T 34 W F 2 (MAG) RL/RB	F42ES	80	0.5	SW	780	374	6	0	F42LL	60	0.4	None	780	281	94	0.1	$ 16.54	$ 900.00	$ 90	54.4	49.0
2	Main Building Garage (Loft)	6	T 34 W F 2 (MAG) RL/RB	F42ES	80	0.5	SW	520	250	6	0	F42LL	60	0.4	None	520	187	62	0.1	$ 11.64	$ 900.00	$ 90	77.3	69.6
191	Main Building Garage (Workbench)	1	S 60 C F 2 (ELE) 8'	F82EE	123	0.1	SW	1300	160	1	0	F82ILL-R	98	0.1	None	1,300	127	33	0.0	$ 5.49	$ 174.00	$ 15	31.7	29.0
146	Storage Barn	2	High Bay MH 400	MH400/1	458	0.9	SW	780	714	2	P 54 C F 4	F44GHL	234	0.5	None	780	365	349	0.4	$ 61.74	$ 780.00	$ 200	12.6	**9.4**
191	Storage Barn	2	S 60 C F 2 (ELE) 8'	F82EE	123	0.2	SW	780	192	2	0	F82ILL-R	98	0.2	None	780	153	39	0.05	$ 6.89	$ 348.00	$ 30	50.5	46.1
	Total	**27**				**4.6**			**6,084**	**27**				**2.8**			**3,184**		**1.8**	**483**	**5,918**	**1,005**		
																All Lighting Measures	Demand Savings			1.8	$27			
																	kWh Savings			2,900	$455			
																	Total Savings				$483		12.3	10.2
																Lighting Measures w/ <15 yr Payback					**$3,446**	**$765**		
																	Demand Savings			**1.4**	**$22**			
																	kWh Savings			**2,662**	**$418**			
																	Total Savings				**$440**		**7.8**	**6.1**

APPENDIX G

New Jersey Pay For Performance Incentive Program

Saddle River, NJ
CHA #21351
Building: Department of Public Works

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)	2,048
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)	$1,730	$4,950
Existing Usage (from utility)	10,520	4,330
Proposed Savings	4,310	1,710
Existing Total MMBtus	469	
Proposed Savings MMBtus	186	
% Energy Reduction	**39.6%**	
Proposed Annual Savings	$2,600	

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

	Incentives $		
	Elec	Gas	Total
Incentive #1	$0	$0	$102
Incentive #2	$474	$1,881	$2,355
Incentive #3	$302	$1,197	$1,499
Total All Incentives	**$776**	**$3,078**	**$3,956**

Total Project Cost	$8,500

		Allowable Incentive
% Incentives #1 of Utility Cost*	1.5%	$102
% Incentives #2 of Project Cost**	27.7%	$2,355
% Incentives #3 of Project Cost**	17.6%	$1,499
Total Eligible Incentives***	**$3,956**	
Project Cost w/ Incentives	$4,544	

Project Payback (years)	
w/o Incentives	w/ Incentives
3.3	1.7

* 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 H

Photovoltaic (PV) Rooftop Solar Power Generation

Borough of Saddle River
Department of Public Works

Cost of Electricity $0.164 $/kWh

Photovoltaic (PV) Rooftop Solar Power Generation-5kW 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
$40,000	**0.0**	**5,915**	**0**	**$1,000**	**0**	**$1,000**	**$5,000**	**$2,900**	**40.0**	**9.0**

Note: Budgetary cost is based on $8,000/kW.

*Incentive based on New Jersey renewable energy program for non-residential applications(PV)= $1.00/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**

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:	5.0 kW
DC to AC Derate Factor:	0.770
AC Rating:	3.8 kW
Array Type:	Fixed Tilt
Array Tilt:	40.7°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	16.4 ¢/kWh

Results			
Month	Solar Radiation (kWh/m²/day)	AC Energy (kWh)	Energy Value ($)
1	3.36	414	67.90
2	4.05	447	73.31
3	4.58	542	88.89
4	4.84	530	86.92
5	5.30	584	95.78
6	5.33	551	90.36
7	5.27	556	91.18
8	5.25	550	90.20
9	5.06	534	87.58
10	4.46	503	82.49
11	3.15	359	58.88
12	2.87	346	56.74
Year	4.46	5915	970.06

Output Hourly Performance Data

About the Hourly Performance Data

Output Results as Text

Saving Text from a Browser

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

Please send questions and comments regarding PVWATTS to Webmaster

Disclaimer and copyright notice

Cautions for Interpreting the Results

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

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

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

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

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

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

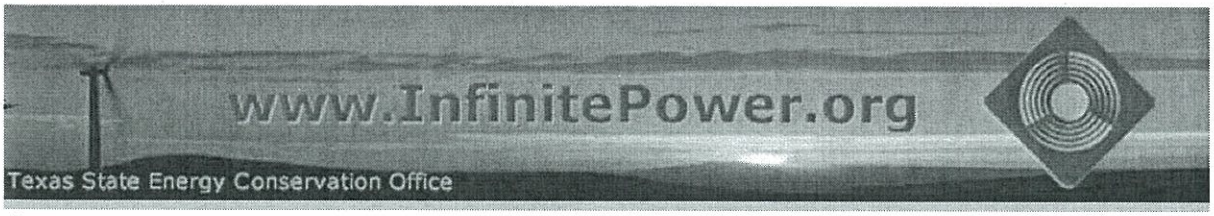
If net-metering isn't available and the PV system sends surplus electricity to the utility grid, the utility generally buys the electricity from the owner at a lower price than the owner pays the utility for electricity. In this case, the cost savings shown in the table should be reduced.

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

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

APPENDIX I

Solar Thermal Domestic Hot Water Plant



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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)	50
? Capacity (gallons)	40	? Ambient Temperature (Degrees F)	70
? Surface Area (calculated - sq ft)	17.79	? Hot Water Temperature (Degrees F)	120
? Effective R-value	NaN	? Hot Water Usage (Gallons per Day)	20
Energy Use			
478.9		? 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
598.6 BTU/hr	? Power Into Water Heater	488.7 BTU/hr
Cost		
$ 1.142 /Therm	? Utility Rates	$ 0.164 /kWh
$ 59.8834	? Yearly Water Heating Cost	$ 205.623
How Does Solar Compare?		
? Solar Water Heater Cost: $ 27100		? Percentage Solar: 70
646.493 years for gas	? Payback Time for Solar System	188.277 years for electric

NJBPU Energy Audits
CHA #21351
Borough of Saddle River - DPW

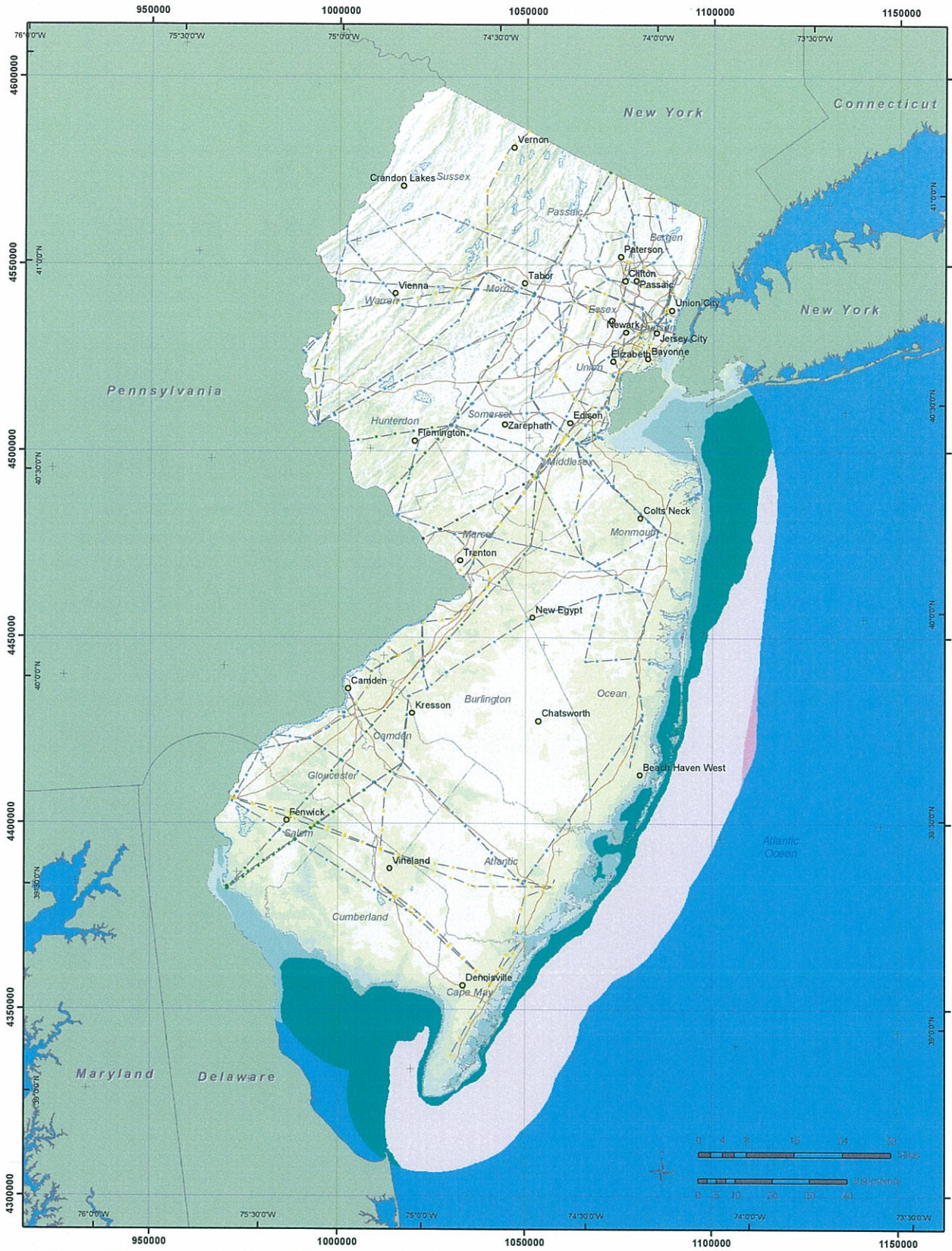
Multipliers	
Material:	0.98
Labor:	1.21
Equipment:	1.09

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 GallonStorage 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**

APPENDIX J

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

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

AWS Truewind

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

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

Bing Maps

83 E Allendale Rd, Saddle River, NJ 07458-3058

My Notes

APPENDIX K

EPA Portfolio Manager

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Department of Public Works

Building ID: 2306443
For 12-month Period Ending: December 31, 2009[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: May 10, 2010

Facility
Department of Public Works
83 East Allendale Road
Saddle River, NJ 07458

Facility Owner
Borough of Saddle River
100 East Allendale Road
Saddle River, NJ 07458

Primary Contact for this Facility
Charles Cuccia
100 East Allendale Road
Saddle River, NJ 07458

Year Built: 1992
Gross Floor Area (ft²): 2,048

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

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	35,908
Natural Gas (kBtu)[4]	433,180
Total Energy (kBtu)	469,088
Energy Intensity[5]	
Site (kBtu/ft²/yr)	229
Source (kBtu/ft²/yr)	280
Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	27
Electric Distribution Utility	
Rockland Electric Co	
National Average Comparison	
National Average Site EUI	104
National Average Source EUI	213
% Difference from National Average Source EUI	32%
Building Type	Other

Stamp of Certifying Professional

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

Certifying Professional
N/A

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

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

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

ENERGY STAR® Data Checklist for Commercial Buildings

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

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

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☑
Building Name	Department of Public Works	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	Other	Is this an accurate description of the space in question?		☐
Location	83 East Allendale Road , Saddle River, NJ 07458	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		☐

DPW (Other)

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☑
Gross Floor Area	2,048 Sq. Ft.	Does this square footage include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, atria, vent shafts, etc. Also note that existing atriums should only include the base floor area that it occupies. Interstitial (plenum) space between floors should not be included in the total. Finally gross floor area is not the same as leasable space. Leasable space is a subset of gross floor area.		☐
Number of PCs	1(Optional)	Is this the number of personal computers in the space?		☐
Weekly operating hours	40Hours(Optional)	Is this the total number of hours per week that the space is 75% occupied? This number should exclude hours when the facility is occupied only by maintenance, security, or other support personnel. For facilities with a schedule that varies during the year, "operating hours/week" refers to the total weekly hours for the schedule most often followed.		☐
Workers on Main Shift	5(Optional)	Is this the number of employees present during the main shift? Note this is not the total number of employees or visitors who are in a building during an entire 24 hour period. For example, if there are two daily 8 hour shifts of 100 workers each, the Workers on Main Shift value is 100.		☐

ENERGY STAR® Data Checklist for Commercial Buildings

Energy Consumption

Power Generation Plant or Distribution Utility: Rockland Electric Co

Fuel Type: Electricity

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

Start Date	End Date	Energy Use (kWh (thousand Watt-hours))
12/01/2009	12/31/2009	840.00
11/01/2009	11/30/2009	876.00
10/01/2009	10/31/2009	816.00
09/01/2009	09/30/2009	876.00
08/01/2009	08/31/2009	648.00
07/01/2009	07/31/2009	936.00
06/01/2009	06/30/2009	840.00
05/01/2009	05/31/2009	888.00
04/01/2009	04/30/2009	816.00
03/01/2009	03/31/2009	864.00
02/01/2009	02/28/2009	936.00
01/01/2009	01/31/2009	1,188.00
Orange & Rockland Electric Consumption (kWh (thousand Watt-hours))		**10,524.00**
Orange & Rockland Electric Consumption (kBtu (thousand Btu))		**35,907.89**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		**35,907.89**
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?		☐

Fuel Type: Natural Gas

Meter: PSE&G Natural Gas (therms)
Space(s): Entire Facility

Start Date	End Date	Energy Use (therms)
12/01/2009	12/31/2009	966.00
11/01/2009	11/30/2009	321.60
10/01/2009	10/31/2009	153.10
09/01/2009	09/30/2009	43.90
08/01/2009	08/31/2009	37.50
07/01/2009	07/31/2009	47.90
06/01/2009	06/30/2009	39.60
05/01/2009	05/31/2009	48.90
04/01/2009	04/30/2009	172.20
03/01/2009	03/31/2009	699.40

02/01/2009	02/28/2009	778.20
01/01/2009	01/31/2009	1,023.50
PSE&G Natural Gas Consumption (therms)		**4,331.80**
PSE&G Natural Gas Consumption (kBtu (thousand Btu))		**433,180.00**
Total Natural Gas Consumption (kBtu (thousand Btu))		**433,180.00**
Is this the total Natural Gas consumption at this building including all Natural Gas meters?		☐

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

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

Certifying Professional

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

Name: _____ Date: _____

Signature: _____

Signature is required when applying for the ENERGY STAR.

FOR YOUR RECORDS ONLY. DO NOT SUBMIT TO EPA.

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

Facility
Department of Public Works
83 East Allendale Road
Saddle River, NJ 07458

Facility Owner
Borough of Saddle River
100 East Allendale Road
Saddle River, NJ 07458

Primary Contact for this Facility
Charles Cuccia
100 East Allendale Road
Saddle River, NJ 07458

General Information

Department of Public Works	
Gross Floor Area Excluding Parking: (ft²)	2,048
Year Built	1992
For 12-month Evaluation Period Ending Date:	December 31, 2009

Facility Space Use Summary

DPW	
Space Type	Other - Other
Gross Floor Area(ft²)	2,048
Number of PCs°	1
Weekly operating hours°	40
Workers on Main Shift°	5

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 12/31/2009)	**Baseline** (Ending Date 12/31/2009)	**Rating of 75**	**Target**	**National Average**
Energy Performance Rating	N/A	N/A	75	N/A	N/A
Energy Intensity					
Site (kBtu/ft²)	229	229	0	N/A	104
Source (kBtu/ft²)	280	280	0	N/A	213
Energy Cost					
$/year	$ 6,668.44	$ 6,668.44	N/A	N/A	$ 3,027.80
$/ft²/year	$ 3.26	$ 3.26	N/A	N/A	$ 1.48
Greenhouse Gas Emissions					
$MtCO_2e$/year	27	27	0	N/A	12
$kgCO_2e/ft^2$/year	13	13	0	N/A	6

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

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

New Jersey BPU Energy Audit Program
CHA #21351
Borough of Saddle River - DPW

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	Crown Aruba	XE2 Series 1087	418700689	Heating / Natural Gas	42.5 MBH input, 36.0 MBH output	Utility Room	Office / Locker room / Utility Room	1991	6	
Unit Heater	1	Reznor	B-200	-	Heating / Natural Gas	200 MBH input, 160 MBH output	Main Garage	Main Garage	1991	0	
Domestic HW Heater	1	State Industries	SR8 40 NADSO	C95396922	DHW / Natural Gas	40 Gal / 40,000 Btuh	Utility Room	Locker Room / Utility Room	1991	0	