BOROUGH OF TENAFLY
SENIOR CENTER
ENERGY ASSESSMENT

for

NEW JERSEY
BOARD OF PUBLIC UTILITIES

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1.0 INTRODUCTION AND BACKGROUND

The Borough of Tenafly Senior Center is a 4,750 square foot single story structure located at 20 South Summit Street. The current building is about 30 years' old, and was assembled from several older, smaller modular buildings relocated to their current site. An addition was also constructed on the northwest corner of the building. The center consists of several offices, a main assembly room, activity room (addition area), kitchen, small library, and adjoining card room. The Senior Center is typically occupied from 8:30 AM to 4:30 PM, Monday through Friday, except holidays. Other hours are available for special events and/or meetings.

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 Borough of Tenafly Senior Center located in Tenafly, NJ. The 4,750 square foot single story structure is about 30 years' old. The center, typically occupied from 8:30 AM to 4:30 PM weekdays, consists of several offices, a main assembly room, activity room, kitchen, small library, and adjoining card room. The following areas were evaluated for energy conservation measures:

- Lighting replacement with occupancy sensors
- Night setback
- Rooftop unit replacement
- Electric domestic hot water heater replacement
- Boiler replacement, including hot water temperature reset
- Window AC units replacement

Various potential Energy Conservation Measures (ECMs) were identified for the above categories. Potential annual savings of $3,000 for the recommended ECMs may be realized with a payback of 5.1 years.

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

ECM-1 Night Setback

Budgetary Cost	Annual Utility Savings					Estimated Maintenance Savings	Total Savings	ROI	Potential Incentive*	Payback (without Incentive)	Payback (with Incentive)
	Electricity		Natural Gas	Water	Total						
$	kW	kWh	Therms	kGals	$	$	$		$	Years	Years
500	0	940	590	0	900	0	900	27.2	NA	0.6	NA

* There is no incentive available through the New Jersey Smart Start Program for this ECM. See section 5.0 for other incentive opportunities.

ECM-3B Replace Rooftop Unit – High Efficiency

Budgetary Cost	Annual Utility Savings					Estimated Maintenance Savings	Total Savings	ROI	Potential Incentive*	Payback (without Incentive)	Payback (with Incentive)
	Electricity		Natural Gas	Water	Total						
$	kW	kWh	Therms	kGals	$	$	$		$	Years	Years
8,200	3.2	1,870	0	0	700	0	700	0.3	500	11.7	11.0

* Incentive shown is per the New Jersey Smart Start Program, Electric Unitary HVAC Application. Also, this measure is potentially eligible for Direct Install funding. See section 5.0 for other incentive opportunities.

ECM-5 Replace Electric Domestic Hot Water Heater

Budgetary Cost	Annual Utility Savings					Estimated Maintenance Savings	Total Savings	ROI	Potential Incentive*	Payback (without Incentive)	Payback (with Incentive)
	Electricity		Natural Gas	Water	Total						
$	kW	kWh	Therms	kGals	$	$	$		$	Years	Years
3,500	2.0	830	(15)	0	500	0	500	0.7	300	7.0	6.4

* Incentive shown is per the New Jersey Smart Start Program, Gas Water Heating Application. See section 5.0 for other incentive opportunities.

ECM-8 Lighting Replacements with Occupancy Sensors

Budgetary Cost	Annual Utility Savings					Estimated Maintenance Savings	Total Savings	ROI	Potential Incentive*	Payback (without Incentive)	Payback (with Incentive)
	Electricity		Natural Gas	Water	Total						
$	kW	kWh	Therms	kGals	$	$	$		$	Years	Years
4,700	1.6	5,000	0	0	900	0	900	2.0	700	5.2	4.4

* Incentive shown is per the New Jersey Smart Start Program, Prescriptive Lighting and Lighting Controls Applications. Also, this measure is potentially eligible for Direct Install funding. See section 5.0 for other incentive opportunities.

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

- ECM-2 Boiler Replacement with Hot Water Temperature Reset
- ECM-4 Replace Window AC Units with Mini Splits

3.0 EXISTING CONDITIONS

3.1 Building - General

The Borough of Tenafly Senior Center is a 4,750 square foot facility, about 30 years' old. The current building is a combination of several smaller modular structures relocated to the current site, and a subsequent addition at the northwest corner. The center is comprised of several offices, a main assembly room, activity room as a result of the addition, kitchen, small library, and card room.

The Senior Center is typically operational 8:30 AM to 4:30 PM, Monday through Friday, except holidays. Flexible hours are available for special events or meetings. The offices are staffed by several employees throughout the day; facility occupancy fluctuates depending on activities.

As previously noted, with exception to the addition, the Senior Center was assembled from several modular structures. Exterior walls are constructed of vinyl siding over 1/2" board insulation, plywood sheathing, 4" wood framing with batt insulation, and finished with gypsum board on the interior. The roof is low pitch and consists of rolled asphalt roofing over felt paper, plywood sheathing, batt insulation, and a drop acoustic tile or gypsum board ceiling. Some areas of the roof are sagging causing water to pool. The roof of the addition area has a higher pitch and was finished with asphalt shingles.

Several types and construction of windows are utilized in the building. Older windows consist of solid aluminum or wood frames and single pane glass. Many of these windows are in poor condition, and some were scheduled for replacement at the time of the audit. Newer windows are constructed of wood frames with vinyl clad exteriors and double pane glass. These windows, installed in most areas of the building, are in good condition. Additionally, there are several skylights located throughout the building that vary in size. Doors at the main entrance are full double pane glass with aluminum frames. Other exterior doors are insulated steel.

3.2 Utility Usage

Utilities include electricity, natural gas, and potable water. Electricity and natural gas are purchased from Public Service Electric & Gas Company (PSE&G). Potable water is provided by United Water New Jersey.

From January 2009 through December 2009, electric usage was approximately 29,140 kWh at a cost of about $6,600. Review of electricity bills during this period showed that the building was charged at the following rates: supply unit cost of $0.130 per kWh; demand unit cost of $15.39 per kW; and a blended unit cost of $0.226 per kWh. Electrical usage was generally higher in the summer months when air conditioning equipment operated. During the same timeframe, the heating equipment, domestic hot water (DHW) heater, and kitchen equipment consumed about 2,620 therms of natural gas. Based on the annual cost of about $3,000, the blended price for natural gas was $1.157 per therm. Natural gas consumption was highest in winter months for heating.

Review of potable water utility bills for the 2008 calendar year determined the facility used a total of about 76,000 gallons of water. At a total cost of about $400, the unit cost for water was about $4.753 per kGal. Utility data can be found in Appendix A.

Electricity and natural gas commodity supply and delivery is presently purchased from PSE&G. 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. According to the U.S. Energy Information Administration, the average commercial unit costs of electricity and natural gas in New Jersey during July 2010 was $0.152 per kWh and $1.09 per therm. Based on the fact that the building is currently paying above the state average for electricity and natural gas, it is recommended that a third party supplier be pursued for both utilities.

3.3 HVAC Systems

Hot water is the primary heating medium utilized in the Senior Center. Heating hot water (HHW) is generated by a Peerless gas-fired, cast-iron, sectional boiler with an input of 320 MBh and output of 256 MBh. The unit was installed in 1980 and is in fair condition. Terminal hydronic heating equipment includes hot water fintube radiators located along the exterior walls of each space. HHW is distributed by three inline circulation pumps; two with 1/8 HP motors, one with a 1/12 HP motor.

Air conditioning for most of the building is performed with (7) wall mounted window AC units. Five units, manufactured by Friedrich, are newer with an output of 23,500 Btuh and energy efficiency ratio (EER) of 8.6. The remaining two units were manufactured by General Electric, have a capacity of about 12,000 Btuh, and serve the offices. HVAC for the activity room in the addition area is provided by a 4 ton Carrier packaged rooftop unit (RTU). The RTU is in poor condition and should be replaced.

Each of the three restrooms is equipped with an inline exhaust fan controlled by the light switch. Above the mechanical closet is an exhaust fan operated by a wall switch, and the kitchen exhaust hood is served by a Flo-Aire up-blast exhaust fan located on the roof.

3.4 Lighting/Electrical Systems

Various lighting fixtures and lamps are utilized throughout the interior spaces. These include T-8 and T-12 fluorescents, screw-type compact fluorescent and incandescent bulbs, 50 watt and 100 watt floodlamps in the kitchen, and 200 watt dimmable spotlights in the assembly room.

Exterior lighting is provided by (2) 100 watt metal halide fixtures located over the doorways. In addition, there are two fixtures equipped with twin 100 watt floodlamps on building corners. All exterior lighting is controlled by photocell.

3.5 Control Systems

Hydronic heating equipment is controlled by three mechanical dial-type thermostats located in the assembly room, small library, and activity room. Building personnel indicated that the building is typically maintained in the upper 60s during the winter. Controls for the air conditioners are integral to the units. The three newer Friedrich AC units in the assembly room were set to 68°F; the two Friedrich units in the library and card room were set at 72°F. The older General Electric AC units in the offices are not equipped with temperature specific controls.

The packaged RTU serving the activity room in the addition area is controlled by a non-programmable digital thermostat. At the time of the audit, this unit was set to maintain 72°F in cooling mode and 68°F in heating mode.

3.6 Plumbing Systems and Kitchen Equipment

The building utilizes two water heaters to generate domestic hot water (DHW). Serving the kitchen and two restrooms is a 40 gallon, 38,000 Btuh Rheem gas-fired unit located in the janitor's closet. The other DHW heater is a 15 gallon, 2,000 watt Rheem electric unit which serves the single restroom and is located in the closet off the small library.

The three restrooms have a single toilet and hand sink. There is a utility sink in the janitor's closet; and the kitchen has a two-bowl stainless steel sink, prep sink, and dishwasher. Other kitchen equipment includes a Cecil-Ware gas griddle, gas range, convection oven, microwave, and a large Sub-Zero refrigerator and freezer unit.

4.0 ENERGY CONSERVATION MEASURES

4.1 ECM-1 Night Setback

Heating equipment for the building is controlled by three mechanical dial-type thermostats typically set to 68°F. The cooling only RTU serving the activity room utilizes a non-programmable digital thermostat set to 72°F. By replacing the older thermostats with new programmable models, all thermostats can be programmed to set back the unoccupied space temperature to save heating and cooling energy. This ECM models the expected savings of adjusting the unoccupied temperature setpoints to 60°F during heating and 80°F during cooling periods. Since most of the building is cooled by non-programmable wall mounted window AC units, temperature setback during cooling can only be applied in the activity room which is served by the RTU. In the calculations for this measure, occupied temperature setpoints were maintained per those in use at the time of the energy audit.

To calculate the benefits of night setback, a block load building model was created to approximate the existing energy load for the building. Since the original building and addition (activity room) areas have differing building envelopes; a block load was created for each space. The block loads, provided in Appendix B, model the maximum overall cooling and heating load for each 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 gains and losses. By entering this calculated maximum load into a spreadsheet containing bin temperature data, the total accumulated year-round cooling and heating energy requirements were determined for each space. The heating and cooling loads for the two areas were then combined and reconciled to building utility data and HVAC equipment energy requirements to confirm the model's accuracy. Bin data for Tenafly, NJ was not available; therefore, data from Newark, NJ was used. The bin temperature spreadsheets are included in Appendix B.

To determine the proposed energy usage in the two areas during temperature setback, a second bin spreadsheet was created for the new accumulated heating and cooling loads for each space. These models were identical to the existing usage spreadsheets except the unoccupied temperatures were adjusted as noted above. The difference in heating therms and cooling kWh between the initial and proposed models is taken as the savings. Following implementation of this measure, the building's annual natural gas and electricity consumption may be reduced by approximately 590 therms and 940 kWh, respectively.

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 8,850 therms, 14,100 kWh, and $7,500.

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

ECM-1 Night Setback

Budgetary Cost	Annual Utility Savings					Estimated Maintenance Savings	Total Savings	ROI	Potential Incentive*	Payback (without Incentive)	Payback (with Incentive)
	Electricity		Natural Gas	Water	Total						
$	kW	kWh	Therms	kGals	$	$	$		$	Years	Years
500	0	940	590	0	900	0	900	27.2	NA	0.6	NA

* There is no incentive available through the New Jersey Smart Start Program for this ECM. See section 5.0 for other incentive opportunities.

This measure is recommended.

4.2 ECM-2 Boiler Replacement with Hot Water Temperature Reset

Heating hot water is provided by a 1980 Peerless gas-fired, cast-iron boiler. The boiler is rated at 320 MBH input, 256 MBH output, with an original efficiency of 80%. Since the boiler is 30 years' old, it is estimated that operational efficiency is approximately 76%. This ECM evaluated replacing the original unit with a high efficiency, condensing boiler with a hot water (HW) temperature reset control system. By installing a HW reset system, heat losses from the building's HHW piping system can be greatly reduced. Additionally, combining the control system with a condensing boiler can improve firing efficiency up to 95%, or higher.

The benefits of applying HW temperature reset were evaluated by generating a spreadsheet that compared the existing piping system losses to those of the proposed system (Appendix C). Using estimated dimensions of the existing HHW hydronic system and bin weather data, with an average HHW temperature of 170°F, the current annual heat loss by the system was found to be about 32,690 MBh. With a HW reset control system in place, the average HHW temperature can be reduced to about 108°F. The resulting annual heat loss from the HHW piping system is reduced to approximately 15,540 MBh.

Piping heat losses calculated for the existing system and with HW reset in place were then applied to the proposed boiler efficiency rates to determine the required therms to overcome the losses. Since the efficiency of the proposed condensing boiler varies based on the return water temperature, the efficiency curve for an Aerco Esteem 399 boiler was used to input the different firing efficiencies with the HW reset system. Averaging the boiler firing efficiencies yielded an annual thermal efficiency of 95%. The difference between the existing and proposed therms required to overcome heat losses result in an annual energy savings of about 180 therms of natural gas.

The proposed ECM also projected savings for boiler replacement. Evaluation of utility bills determined that the boiler consumes about 2,550 therms annually. Applying the 68% boiler efficiency to its annual natural gas usage established a baseline boiler load of approximately 193,950 MBH per year. With the improved efficiency determined in the HW reset calculation, the proposed condensing boiler will require 2,040 therms to meet this load, resulting in a savings of about 510 therms of natural gas per year. As previously stated, the proposed boiler efficiency rating is based on the use of an Aerco Esteem 399 boiler for the calculation. Exact boiler selection and sizing cannot be completed without a more detailed analysis of the building's hydronic heating system and generation of a load profile.

For implementation of this measure, a new gas-fired, condensing, hot water boiler would be installed, along with an integral HW temperature reset control system. New immediate HW supply and return piping must also be installed; valves would be reused where possible. A new exhaust flue system will also be required.

Condensing boilers have an expected life of 24 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 16,560 therms and $19,200.

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

ECM-2 Boiler Replacement with Hot Water Temperature Reset

Budgetary Cost	Annual Utility Savings					Estimated Maintenance Savings	Total Savings	ROI	Potential Incentive*	Payback (without Incentive)	Payback (with Incentive)
	Electricity		Natural Gas	Water	Total						
$	kW	kWh	Therms	kGals	$	$	$		$	Years	Years
12,500	0	0	690	0	800	0	800	0.5	700	15.6	14.8

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

This measure is not recommended.

4.3 ECM-3A Replace Rooftop Unit – Standard Efficiency

Installed in 1990, the cooling only packaged RTU which provides AC to the addition area (activity room) generates cooling at an energy efficiency ratio (EER) of approximately 7.8 (1.54 kW/ton). This unit is also in poor condition and should be replaced in the near future. By replacing this outdated unit with a standard efficiency packaged RTU, it will be possible to achieve an EER of 13.6 (0.88 kW/ton); saving cooling energy.

The savings for this measure were found by utilizing the block load building model for the addition area created for section 4.1 and adjusting the cooling efficiency to reflect the proposed RTU. Comparing the overall energy requirement to cool the space in the existing and proposed models revealed an annual energy reduction of approximately 1,690 kWh, which is attributed to the cooling efficiency improvement.

RTU's have an expected life of 15 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 25,350 kWh, totaling $9,000.

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

ECM-3A Replace Rooftop Unit – Standard Efficiency

Budgetary Cost	Annual Utility Savings					Estimated Maintenance Savings	Total Savings	ROI	Potential Incentive*	Payback (without Incentive)	Payback (with Incentive)
	Electricity		Natural Gas	Water	Total						
$	kW	kWh	Therms	kGals	$	$	$		$	Years	Years
7,700	2.7	1,690	0	0	600	0	600	0.2	NA	12.8	NA

* There is no incentive available through the New Jersey Smart Start Program for this ECM. Also, this measure is potentially eligible for Direct Install funding. See section 5.0 for other incentive opportunities.

This measure is not recommended.

4.4 ECM-3B Replace Rooftop Unit – High Efficiency

As an alternate to replacing the existing RTU with a standard efficiency unit, as discussed in section 4.3, this measure assesses installing a high efficiency cooling only RTU to achieve additional energy savings. With a minimal increase in initial cost, high efficiency units operate with an EER of about 15.0 (0.80 kW/ton), compared to 13.6 for standard efficiency RTUs.

Using the same process as applied in section 4.3, the savings for this measure were calculated based on cooling efficiency improvements of the existing and proposed RTUs. The energy required by each unit to meet the cooling load were compared and the difference revealed an annual electric utility reduction of approximately 1,870 kWh by installing a high efficiency RTU.

While the payback period for this measure does not fall within the normal parameters for recommendation, the current condition of the existing RTU warrants that this measure be recommended for implementation.

RTUs have an expected life of 15 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 28,050 kWh, totaling $10,700.

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

ECM-3B Replace Rooftop Unit – High Efficiency

Budgetary Cost	Annual Utility Savings					Estimated Maintenance Savings	Total Savings	ROI	Potential Incentive*	Payback (without Incentive)	Payback (with Incentive)
	Electricity		Natural Gas	Water	Total						
$	kW	kWh	Therms	kGals	$	$	$		$	Years	Years
8,200	3.2	1,870	0	0	700	0	700	0.3	500	11.7	11.0

* Incentive shown is per the New Jersey Smart Start Program, Electric Unitary HVAC Application. Also, this measure is potentially eligible for Direct Install funding. See section 5.0 for other incentive opportunities.

This measure is recommended.

4.5 ECM-4 Replace Window AC Units with Mini Splits

The original building area utilizes seven window air conditioning units with an average EER of 8.6. This ECM assessed replacing the seven window units with six ductless mini split AC units; two 3 ton units to replace the three window units in the assembly hall and the remaining four on a one for one basis. Mini split units have a higher EER value and can be programmed to operate in conjunction with the occupancy schedule to eliminate unnecessary cooling when the facility is closed.

Using bin weather data for Newark, NJ and the weekly occupancy schedule for the building, the annual operating hours for the existing window AC units was established. Since the existing and proposed AC units are equipped with a thermostat and temperature controls, cycling was taken into account when determining the operating time. EER values were then converted to kWh and applied to the estimated hours of operation to determine the energy consumption for the existing and proposed cooling systems. Replacing the seven window AC units with mini split AC units having an EER of 14.4 will produce an annual savings of approximately 1,960 kWh.

While the payback period for this measure is not within parameters for recommendation, implementation may be warranted due to the age of the equipment.

Ductless mini split AC units have an expected life of 15 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 29,400 kWh and $6,000.

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

ECM-4 Replace Window AC Units with Mini Splits

Budgetary Cost	Annual Utility Savings					Estimated Maintenance Savings	Total Savings	ROI	Potential Incentive*	Payback (without Incentive)	Payback (with Incentive)
	Electricity		Natural Gas	Water	Total						
$	kW	kWh	Therms	kGals	$	$	$		$	Years	Years
36,300	0	1,960	0	0	400	0	400	(0.8)	1,100	>25	>25

* Incentive shown is per the New Jersey Smart Start Program, Electric Unitary HVAC Application. Also, this measure is potentially eligible for Direct Install funding. See section 5.0 for other incentive opportunities.

This measure is not recommended.

4.6 ECM-5 Replace Electric Domestic Hot Water Heater

Domestic hot water for the single restroom near the offices is generated by a 15 gallon, 2,000 W electric hot water heater. The restroom has extended periods with little or no use; therefore, a low hot water demand is required. However, the unit must continue to heat the water within the storage tank. Energy required to maintain the hot water temperature setpoint during times of zero demand are known as standby losses. This measure evaluates replacing the existing DHW heater with a tankless, gas-fired, condensing hot water heater to eliminate standby losses.

According to the U.S. Department of Energy, 2.5% of stored capacity is lost every hour during hot water heater standby. This value was applied to the total volume of the existing hot water heater storage tank to determine the annual standby losses. Proposed efficiency was based on the Navien CR180 tankless, condensing hot water heater; it was calculated that 830 kWh would be saved per year. A more detailed hot water demand analysis may be necessary to verify proper sizing. The new water heater will require gas piping, venting, electrical connections, and minor water piping.

Tankless hot water heaters have an expected life of 13 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 10,790 kWh, (260) therms, and $6,500.

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

ECM-5 Replace Electric Domestic Hot Water Heater

Budgetary Cost	Annual Utility Savings					Estimated Maintenance Savings	Total Savings	ROI	Potential Incentive*	Payback (without Incentive)	Payback (with Incentive)
	Electricity		Natural Gas	Water	Total						
$	kW	kWh	Therms	kGals	$	$	$		$	Years	Years
3,500	2.0	830	(15)	0	500	0	500	0.7	300	7.0	6.4

* Incentive shown is per the New Jersey Smart Start Program, Gas Water Heating Application. See section 5.0 for other incentive opportunities.

This measure is recommended.

4.7 ECM-6 Lighting Replacements

A comprehensive fixture survey was conducted of the entire building. Each switch and circuit was identified, and the number of fixtures, locations, and existing wattage established. Inefficient lighting fixtures include those that utilize T-12 fluorescent lamps and incandescent screw type bulbs. Upgrading these lighting fixtures to more efficient technology provides energy savings.

Energy savings for this measure were calculated by applying the existing and proposed fixture wattages to the estimated time of operation. The difference resulted in an annual savings of 3,410 kWh per year. Supporting calculations, including assumptions for lighting hours and annual energy usage for each fixture, are provided in Appendix H.

Retrofitting fixtures that utilize T-12 lamps would require replacement with electronic ballasts and T-8 lamps. Incandescent lamps would be replaced with compact fluorescent spiral light bulbs or flood lamps where applicable.

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 51,150 kWh, totaling $10,500.

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

ECM-6 Lighting Replacements

Budgetary Cost	Annual Utility Savings					Estimated Maintenance Savings	Total Savings	ROI	Potential Incentive*	Payback (without Incentive)	Payback (with Incentive)
	Electricity		Natural Gas	Water	Total						
$	kW	kWh	Therms	kGals	$	$	$		$	Years	Years
4,000	1.6	3,410	0	0	700	0	700	1.8	600	5.7	4.9

* Incentive shown is per the New Jersey Smart Start Program, Prescriptive Lighting Application. Also, this measure is potentially eligible for Direct Install funding. See section 5.0 for other incentive opportunities.

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

4.8 ECM-7 Install Occupancy Sensors

Review of the comprehensive lighting survey determined that lighting in several areas such as the activity room, offices, library and card room are operated continuously throughout the day regardless of occupancy. Therefore, it is proposed that an occupancy sensor be installed in each space to turn off lights when the areas are unoccupied. While also not continuously occupied throughout the day, due to safety concerns, occupancy sensors were not considered in the kitchen, mechanical spaces, and paths of egress.

Using a process similar to that utilized in section 4.7, the energy savings for this measure were calculated by applying the known fixture wattages in the space to the estimated existing and proposed times of operation for each fixture. The difference between the two values resulted in an annual savings of 2,390 kWh per year. Six 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 35,850 kWh and $7,500.

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

ECM-7 Install Occupancy Sensors

Budgetary Cost	Annual Utility Savings					Estimated Maintenance Savings	Total Savings	ROI	Potential Incentive*	Payback (without Incentive)	Payback (with Incentive)
	Electricity		Natural Gas	Water	Total						
$	kW	kWh	Therms	kGals	$	$	$		$	Years	Years
700	0	2,390	0	0	500	0	500	10.4	100	1.4	1.2

* Incentive shown is per the New Jersey Smart Start Program, Lighting Controls Application. Also, this measure is potentially eligible for Direct Install funding. See section 5.0 for other incentive opportunities.

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

4.9 ECM-8 Lighting Replacements with Occupancy Sensors

Due to interactive effects, the energy and cost savings for occupancy sensors and lighting upgrades are not cumulative. This measure is a combination of ECMs-7 and 8 to allow for maximum energy and demand reduction.

The lighting retrofits and controls have an expected lifetime of 15 years, according to the manufacturer, and total energy savings over the life of the project are estimated at 75,000 kWh, totaling $13,500.

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

ECM-8 Lighting Replacements with Occupancy Sensors

Budgetary Cost	Annual Utility Savings					Estimated Maintenance Savings	Total Savings	ROI	Potential Incentive*	Payback (without Incentive)	Payback (with Incentive)
	Electricity		Natural Gas	Water	Total						
$	kW	kWh	Therms	kGals	$	$	$		$	Years	Years
4,700	1.6	5,000	0	0	900	0	900	2.0	700	5.2	4.4

* Incentive shown is per the New Jersey Smart Start Program, Prescriptive Lighting and Lighting Controls Applications. Also, this measure is potentially eligible for Direct Install funding. See section 5.0 for other incentive opportunities.

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 20 0 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.

5.1.5 Direct Install Program

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

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

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

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

5.2 Building Incentives

5.2.1 New Jersey Pay For Performance Program

Under incentive #1 of the New Jersey Pay for Performance Program, the 4,750 square foot building is eligible for about $200 toward development of an Energy Reduction Plan. When calculating the total amount under Incentives #2 and #3, all energy conservation measures are applicable as the amount received is based on building wide energy improvements. Since the overall energy reduction for the building is estimated to exceed the 15% minimum, the building is eligible to receive monies based on Incentives #2 and #3 as discussed above in section 5.1.1. In total, incentives through the NJ P4P program are expected to total about $4,100, reducing the total project payback from 7.8 years to 6.7years. See Appendix K for calculations.

5.2.2 New Jersey Smart Start Program

The Borough of Tenafly senior center is eligible for several incentives available under New Jersey Smart Start Programs. The total amount of a ll qualified incentives is about $3,300 and includes HVAC equipment upgrades, lighting system upgrades and a new gas-fired DHW heater.

5.2.3 Energy Efficient and Conservation Block Grant

The Senior Center is owned by local government which makes it eligible for this incentive. The incentive amount is determined by TRC Solutions and is not calculable at this time. Further information about this incentive, including the application, can be found at:
http://www.njcleanenergy.com/commercial-industrial/programs/energy-efficiency-and-conservation-block-grants

5.2.4 Direct Install Program

The Senior Center is potentially eligible to receive funding from the Direct Install Program. This money will be in conjunction with the Energy Efficiency and Conservation Block Grant. The total implementation cost for all ECMs potentially eligible for Direct Install funding is about $61,700. This program would pay 60%, or about $37,000 of these initial costs. This funding has the potential to significantly affect the payback periods of Energy Conservation Measures. For the Senior Center, the Direct Install Program brings the simple payback from about 15.6 years, to approximately 6.8 years.

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.

The building uses a gas-fired, hot water boiler, packaged rooftop AC unit, and several window AC units to meet the HVAC requirements. With exception to the hydronic heating system, most of the 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 removed or overhauled; and either a low temperature closed loop water source heat pump system or a water to water heat pump system would have to be installed to realize the benefit of the consistent temperature of the ground.

This measure is not recommended because the building's heating and cooling loads do not justify the extent of HVAC system renovation needed for implementation.

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 L.

The State of New Jersey incentives for non-residential PV applications is $0.75/watt up to 30 kW of installed PV array with a maximum system capacity of 50 kW. 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 2010 is expected to be $600/SREC credit. Payments that will be received from the PV producer will change from year to year dependent upon supply and demand. Renewable Energy Consultants is a third party SREC broker that has been approved by the New Jersey Clean Energy Program. As stated above there is no definitive way to calculate an exact price that will be received by the PV producer per SREC over the next 15 years. Renewable Energy Consultants estimated an average of $487/ SERC per year and this number was utilized in the cash flow for this report.

In 2009 the building had a maximum electricity demand of 23.7 kW and a minimum of 6.1 kW. The monthly average over the observed 12 month period was 15.3 kW. The existing load does not justify the use of the maximum incentive cap of 30 kW of installed PV solar array; therefore, an 15 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 L and summarized as follows:

Photovoltaic (PV) Rooftop Solar Power Generation – 15 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
120,000	0	17,745	0	4,000	4,000	11,250	8,600	>25	8.6

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

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 both a gas and an electric water heater and, therefore, this measure would offer natural gas and electrical utility 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 Tenafly 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 M 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	560	50	200	200	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 Tenafly area, the map indicates a mean annual wind speed of 10 miles per hour. For the senior c enter, there are site restrictions such as parking lots, trees and surrounding structures would greatly affect a tower location.

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

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 senior center 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 initial cost and noise issues. 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 Tenafly senior center had a monthly average electricity demand of 15.3 kW and a maximum demand of 23.7 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 States Environmental Protection Agency (EPA) is a federal agency in charge of regulating environment waste and policy in the United States. The EPA has released the EPA Portfolio Manager for public use. The program is designed to allow property owners and managers to share, compare and improve upon their facility's energy consumption. Inputting such parameters as electricity, heating fuel, building characteristics and location into the website based program generates a naturalized energy rating score out of 100. Once an account is registered, monthly utility data can be entered to track the savings progress and retrieve an updated energy rating score on a monthly basis.

The senior center is considered an above average energy consumer per the Portfolio Manager with a Site Energy Usage Index (EUI) of 76 kBTU/ft^2/year. The EUI can be improved by addressing wasted energy from inefficient HVAC equipment, electric water heating, and inefficient lighting systems. By implementing the measures discussed in this report, it is expected that the EUI can be reduced to approximately 42 kBTU/ft^2/year; the national average for this building type is 52 kBTU/ft^2/year. The EPA Portfolio Manager did not generate an energy rating score for this building because the building type (Recreation) is not eligible for an energy star rating.

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

The user name and password for the building's EPA Portfolio Manager Account has been provided to Bob Beutel, Director of Public Works of the Borough of Tenafly.

8.0 CONCLUSIONS & RECOMMENDATIONS

The energy audit conducted by CHA at the Borough of Tenafly Senior Center in Tenafly, New Jersey identified potential ECMs for lighting replacement with occupancy sensors, night setback, rooftop unit replacement, and electric domestic hot water heater replacement. Potential annual savings of $3,000 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					Estimated Maintenance Savings	Total Savings	ROI	Potential Incentive*	Payback (without Incentive)	Payback (with Incentive)
	Electricity		Natural Gas	Water	Total						
$	kW	kWh	Therms	kGals	$	$	$		$	Years	Years
500	0	940	590	0	900	0	900	27.2	NA	0.6	NA

* There is no incentive available through the New Jersey Smart Start Program for this ECM. See section 5.0 for other incentive opportunities.

ECM-3B Replace Rooftop Unit – High Efficiency

Budgetary Cost	Annual Utility Savings					Estimated Maintenance Savings	Total Savings	ROI	Potential Incentive*	Payback (without Incentive)	Payback (with Incentive)
	Electricity		Natural Gas	Water	Total						
$	kW	kWh	Therms	kGals	$	$	$		$	Years	Years
8,200	3.2	1,870	0	0	700	0	700	0.3	500	11.7	11.0

* Incentive shown is per the New Jersey Smart Start Program, Electric Unitary HVAC Application. Also, this measure is potentially eligible for Direct Install funding. See section 5.0 for other incentive opportunities.

ECM-5 Replace Electric Domestic Hot Water Heater

Budgetary Cost	Annual Utility Savings					Estimated Maintenance Savings	Total Savings	ROI	Potential Incentive*	Payback (without Incentive)	Payback (with Incentive)
	Electricity		Natural Gas	Water	Total						
$	kW	kWh	Therms	kGals	$	$	$		$	Years	Years
3,500	2.0	830	(15)	0	500	0	500	0.7	300	7.0	6.4

* Incentive shown is per the New Jersey Smart Start Program, Gas Water Heating Application. See section 5.0 for other incentive opportunities.

ECM-8 Lighting Replacements with Occupancy Sensors

Budgetary Cost	Annual Utility Savings					Estimated Maintenance Savings	Total Savings	ROI	Potential Incentive*	Payback (without Incentive)	Payback (with Incentive)
	Electricity		Natural Gas	Water	Total						
$	kW	kWh	Therms	kGals	$	$	$		$	Years	Years
4,700	1.6	5,000	0	0	900	0	900	2.0	700	5.2	4.4

* Incentive shown is per the New Jersey Smart Start Program, Prescriptive Lighting and Lighting Controls Applications. Also, this measure is potentially eligible for Direct Install funding. See section 5.0 for other incentive opportunities.

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

- ECM-2 Boiler Replacement with Hot Water Temperature Reset
- ECM-4 Replace Window AC Units with Mini Splits

APPENDIX A

Utility Usage Analysis

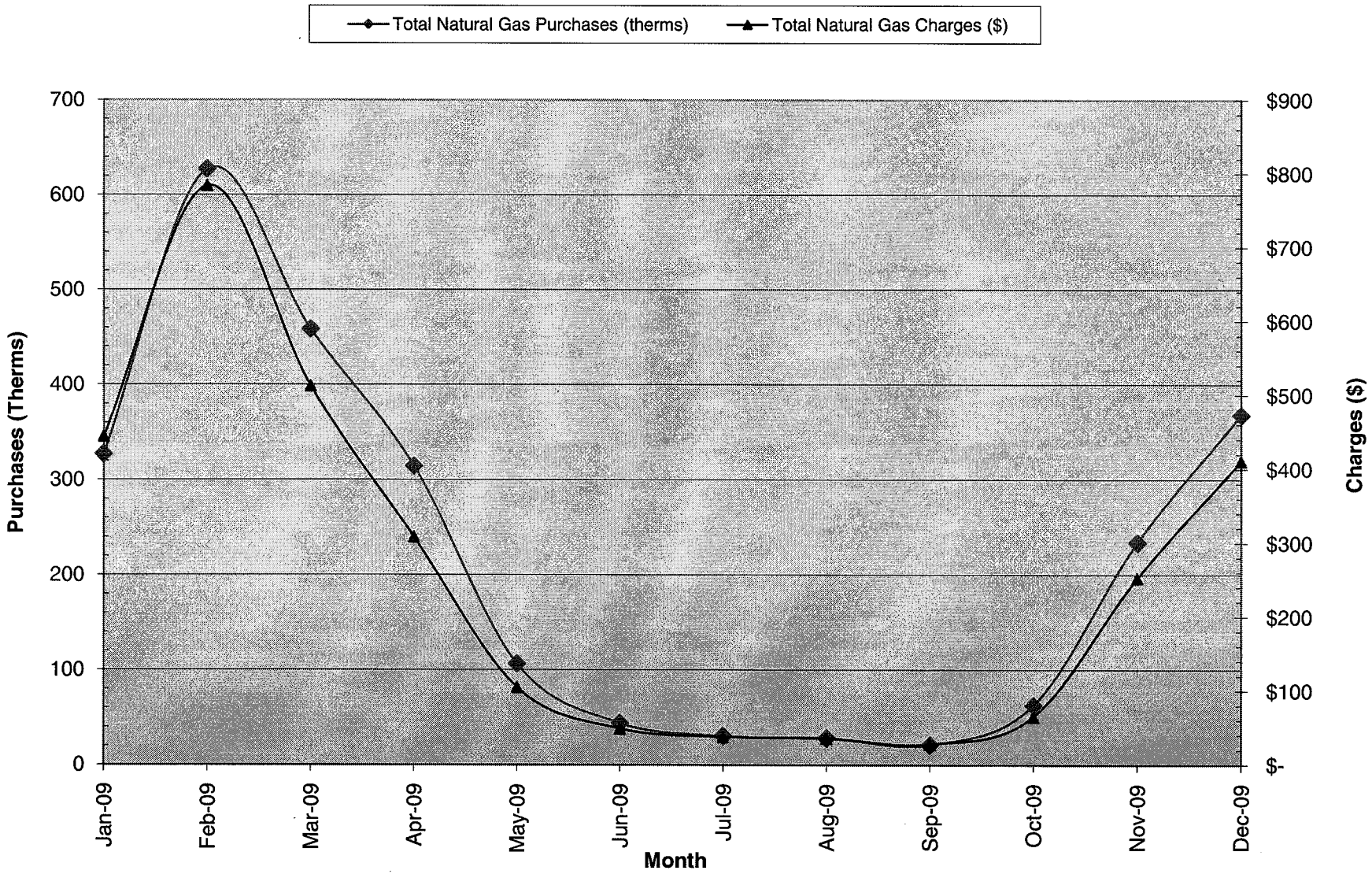
New Jersey BPU Energy Audit Program
CHA Project No.: 21794
Borough of Tenafly
PSE&G - Natural Gas Service

Senior Center
Account No.: **41 471 184 02**
Meter No.: **2122686**

Month	Therms	Charges ($)	($/Therm)
January-09	327	$ 444.18	$ 1.359
February-09	627	$ 783.76	$ 1.250
March-09	458	$ 512.43	$ 1.118
April-09	314	$ 308.50	$ 0.981
May-09	106	$ 104.95	$ 0.987
June-09	44	$ 48.71	$ 1.115
July-09	30	$ 37.75	$ 1.250
August-09	28	$ 35.61	$ 1.267
September-09	21	$ 27.82	$ 1.331
October-09	63	$ 64.92	$ 1.037
November-09	234	$ 252.40	$ 1.080
December-09	368	$ 410.86	$ 1.117

Total	2,620	$ 3,031.89	$ 1.157

Natural Gas Usage - Borough of Tenafly Senior Center



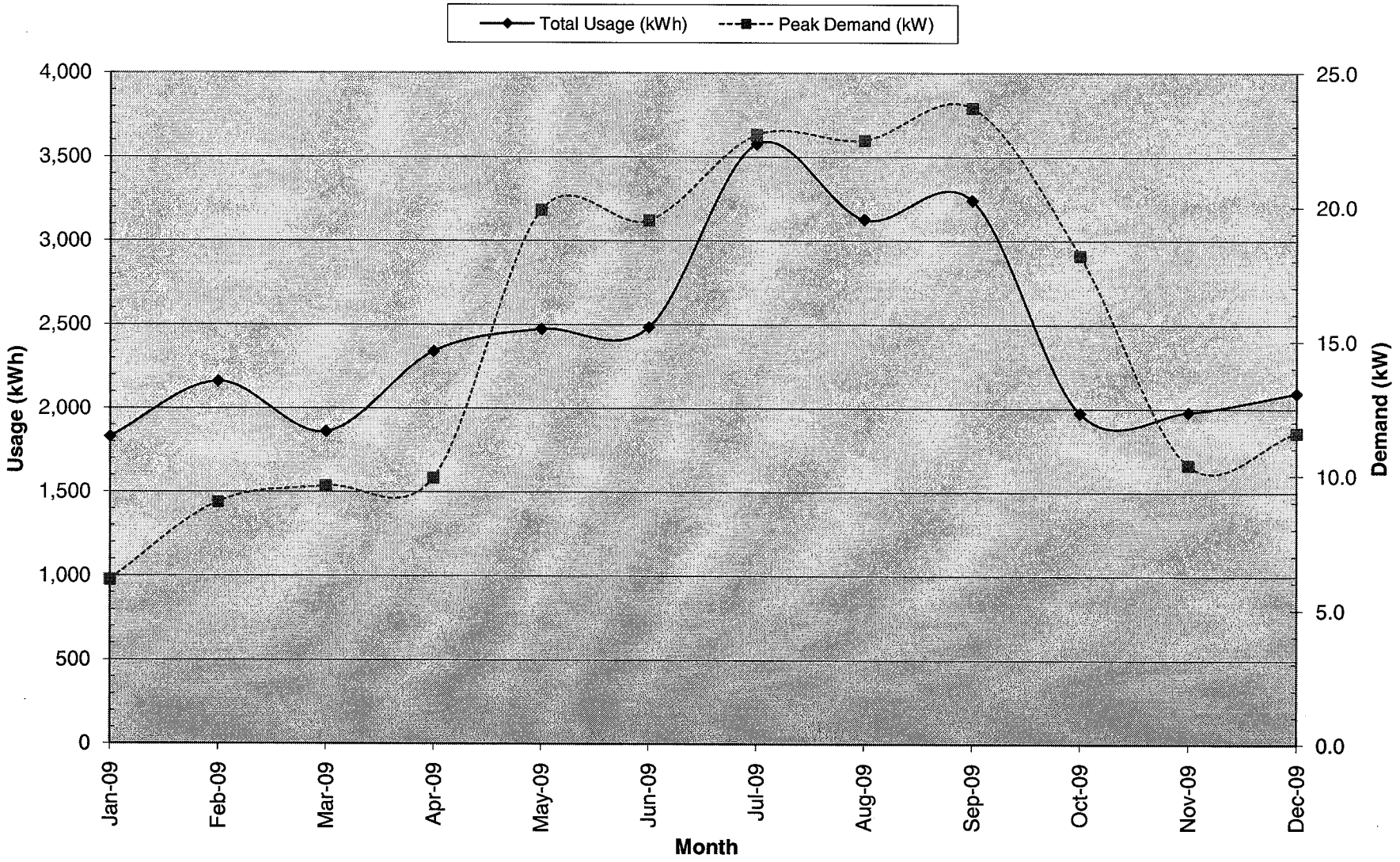
Utility Data - Tenafly.xls
Sr. Ctr-Natural Gas Chart

New Jersey BPU Energy Audit Program
CHA Project No.: 21794
Borough of Tenafly
PSE&G - Electric Service

Senior Center
Account No.: **41 471 184 02**
Meter No.: **62109636**

			Charges			Unit Costs		
Month	Consumption (kWh)	Demand (kW)	Total ($)	Demand ($)	Consumption ($)	Blended Rate ($/kWh)	Consumption ($/kWh)	Demand ($/kW)
January-09	1,830	6.1	$343.34	$131.49	$211.85	$ 0.188	$ 0.116	$ 21.56
February-09	2,160	9.0	$402.64	$144.17	$258.47	$ 0.186	$ 0.120	$ 16.02
March-09	1,860	9.6	$375.98	$146.50	$229.48	$ 0.202	$ 0.123	$ 15.26
April-09	2,340	9.9	$426.88	$147.67	$279.21	$ 0.182	$ 0.119	$ 14.92
May-09	2,472	19.9	$478.83	$186.84	$291.99	$ 0.194	$ 0.118	$ 9.39
June-09	2,484	19.5	$666.36	$337.53	$328.83	$ 0.268	$ 0.132	$ 17.31
July-09	3,576	22.7	$902.79	$385.44	$517.35	$ 0.252	$ 0.145	$ 16.98
August-09	3,126	22.5	$840.29	$383.20	$457.09	$ 0.269	$ 0.146	$ 17.03
September-09	3,240	23.7	$864.51	$397.03	$467.48	$ 0.267	$ 0.144	$ 16.75
October-09	1,974	18.2	$456.65	$204.25	$252.40	$ 0.231	$ 0.128	$ 11.22
November-09	1,980	10.4	$408.36	$174.45	$233.91	$ 0.206	$ 0.118	$ 16.77
December-09	2,094	11.6	$426.30	$179.15	$247.15	$ 0.204	$ 0.118	$ 15.44
Total	29,136	23.7	$6,592.93	$2,817.72	$3,775.21	$ 0.226	$ 0.130	$ 15.39

Electric Usage - Borough of Tenafly Senior Center



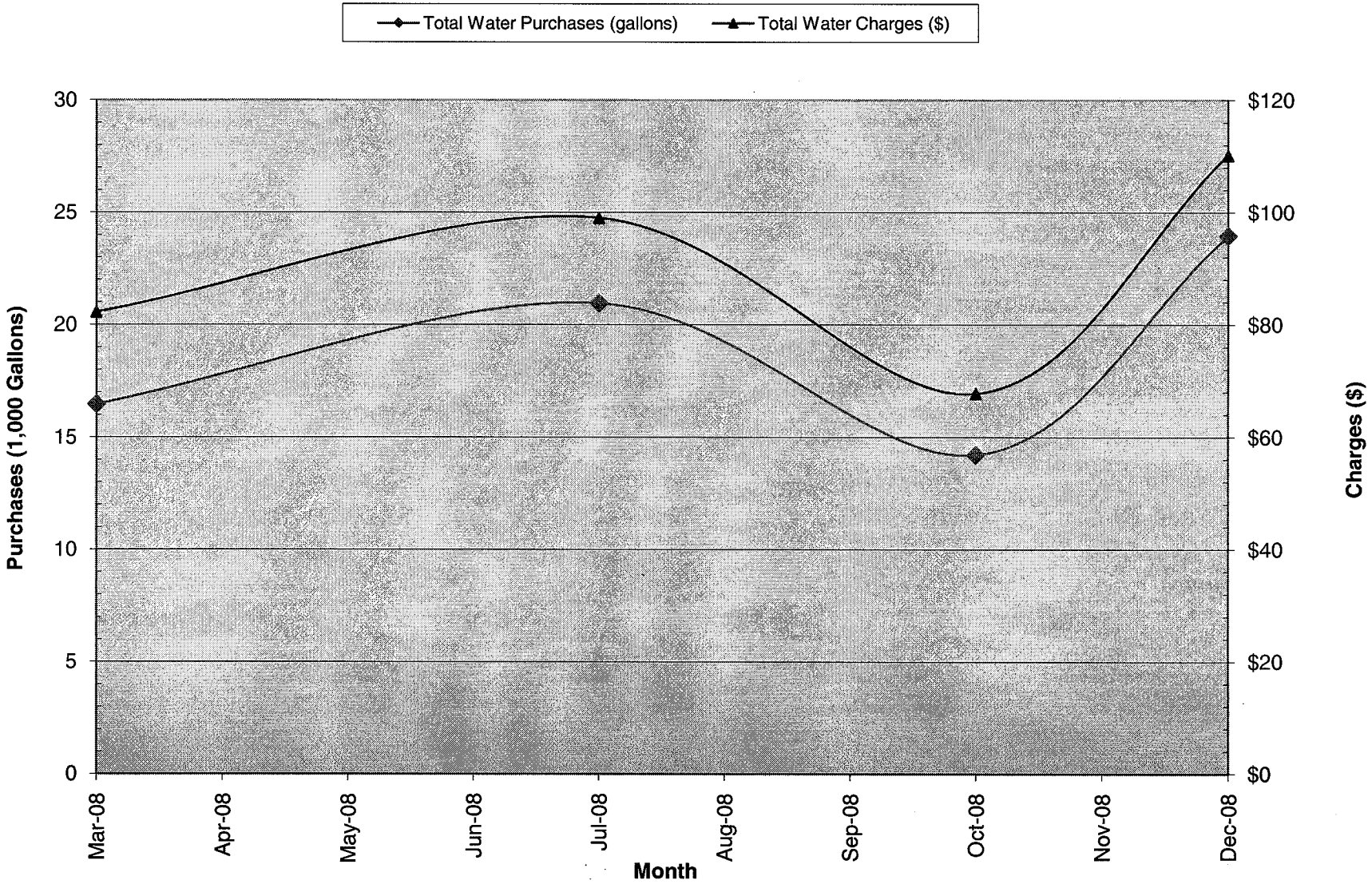
Utility Data - Tenafly.xls
Sr. Ctr-Electricity Chart

New Jersey BPU Energy Audit Program
CHA Project No.: 21794
Borough of Tenafly
United Water New Jersey

Senior Center
Account No.: **10000999469067**
Meter Nos.: **31241010**

Month	Usage (CCF)	Usage (kgals)	Charges ($)	Rate ($/kgal)
March-08	22	16	$82.18	$ 4.994
July-08	28	21	$98.97	$ 4.725
October-08	19	14	$67.74	$ 4.766
December-08	32	24	$110.16	$ 4.602
Total	101	76	$359.05	$ 4.753

Water Usage - Borough of Tenafly - Senior Center



Utility Data - Tenafly.xls
Senior Center - Water Chart

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

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

APPENDIX B

ECM-1 Night Setback

NJBPU - Borough of Tenafly
CHA #21794
Building: Senior Center

ECM-1 Night Setback **Original Bldg**

Building Footprint	3,740	SF	Ex Occupied Clng Temp.	72	°F	Ex Occupied Htg Temp.	68	°F	**Heating Energy Savings** 403 therms
Heating Efficiency	76%		Ex Unoccupied Clng Temp.	72	°F	Ex Unoccupied Htg Temp.	68	°F	**Cooling Energy Savings** 0 kWh
Cooling Efficiency	1.4	kW/ton	Prop Occupied Clng Temp.	72	°F	Prop Occupied Htg Temp.	68	°F	
Building Balance Temp.	60	°F	Prop Unoccupied Clng Temp.	72	°F	Prop Unoccupied Htg Temp.	60	°F	
Internal Gains	31,014	btu/h	Occupied Cooling UA	1,709	btu/hr/°F	Occupied Heating UA	935	btu/hr/°F	
Unoc Internal Gain factor	0.03		Unoccupied Cooling UA	1,048	btu/hr/°F	Unoccupied Heating UA	935	btu/hr/°F	
Ave Occ Internal Gain Factor	0.9		Cooling Occ Enthalpy Setpoint	27.3	Btu/lb				
			Cooling Unocc Enthalpy Setpoint	27.3	Btu/lb				

Note: Temperature setback could not be applied during cooling since this areas is served by window AC units which are not programmable.

					EXISTING LOADS						PROPOSED LOADS									
					Occupied			Unoccupied			Occupied			Unoccupied						
Avg Outdoor Air Temp. Bins °F	Avg Outdoor Air Enthalpy	Existing Equipment Bin Hours	Occupied Equipment Bin Hours	Unoccupied Equipment Bin Hours	Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Unoccupied Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Unoccupied Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Existing Cooling Energy kWh	Proposed Cooling Energy kWh	Existing Heating Energy therms	Proposed Heating Energy therms
A		B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	K	L	M	N
102.5	49.1	0	0	0	-52,126	-75,509	-18,608	-31,963	-75,509	-930	-52,126	-75,509	-18,608	-31,963	-75,509	-930	0	0	0	0
97.5	42.5	3	1	2	-43,580	-52,648	-18,608	-26,723	-52,648	-930	-43,580	-52,648	-18,608	-26,723	-52,648	-930	31	31	0	0
92.5	39.5	34	8	26	-35,035	-42,257	-18,608	-21,483	-42,257	-930	-35,035	-42,257	-18,608	-21,483	-42,257	-930	286	286	0	0
87.5	36.6	131	31	100	-26,490	-32,212	-18,608	-16,244	-32,212	-930	-26,490	-32,212	-18,608	-16,244	-32,212	-930	856	856	0	0
82.5	34	500	119	381	-17,945	-23,207	-18,608	-11,004	-23,207	-930	-17,945	-23,207	-18,608	-11,004	-23,207	-930	2,392	2,392	0	0
77.5	31.6	620	148	472	-9,400	-14,894	-18,608	-5,764	-14,894	-930	-9,400	-14,894	-18,608	-5,764	-14,894	-930	1,929	1,929	0	0
72.5	29.2	664	158	506	-855	-6,581	-18,608	-524	-6,581	-930	-855	-6,581	-18,608	-524	-6,581	-930	955	955	0	0
67.5	27	854	203	651	468	227	-18,608	468	227	-930	468	227	-18,608	0	0	-930	0	0	0	0
62.5	24.5	927	221	706	5,144	2,493	-18,608	5,144	2,493	-930	5,144	2,493	-18,608	0	0	-930	0	0	0	0
57.5	21.4	600	143	457	9,820	4,760	-18,608	9,820	4,760	-930	9,820	4,760	-18,608	2,338	1,133	-930	0	0	0	0
52.5	18.7	610	145	465	14,496	7,026	-18,608	14,496	7,026	-930	14,496	7,026	-18,608	7,014	3,400	-930	0	0	131	64
47.5	16.2	611	145	466	19,172	9,292	-18,608	19,172	9,292	-930	19,172	9,292	-18,608	11,690	5,666	-930	0	0	188	119
42.5	14.4	656	156	500	23,848	11,559	-18,608	23,848	11,559	-930	23,848	11,559	-18,608	16,366	7,933	-930	0	0	261	188
37.5	12.6	1,023	244	779	28,524	13,825	-18,608	28,524	13,825	-930	28,524	13,825	-18,608	21,042	10,199	-930	0	0	501	387
32.5	10.7	734	175	559	33,200	16,092	-18,608	33,200	16,092	-930	33,200	16,092	-18,608	25,719	12,465	-930	0	0	426	345
27.5	8.6	334	80	254	37,876	18,358	-18,608	37,876	18,358	-930	37,876	18,358	-18,608	30,395	14,732	-930	0	0	225	187
22.5	6.8	252	60	192	42,553	20,625	-18,608	42,553	20,625	-930	42,553	20,625	-18,608	35,071	16,998	-930	0	0	192	164
17.5	5.5	125	30	95	47,229	22,891	-18,608	47,229	22,891	-930	47,229	22,891	-18,608	39,747	19,265	-930	0	0	107	93
12.5	4.1	47	11	36	51,905	25,157	-18,608	51,905	25,157	-930	51,905	25,157	-18,608	44,423	21,531	-930	0	0	44	39
7.5	2.6	22	5	17	56,581	27,424	-18,608	56,581	27,424	-930	56,581	27,424	-18,608	49,099	23,798	-930	0	0	23	20
2.5	1	13	3	10	61,257	29,690	-18,608	61,257	29,690	-930	61,257	29,690	-18,608	53,775	26,064	-930	0	0	15	13
-2.5	0	0	0	0	65,933	31,957	-18,608	65,933	31,957	-930	65,933	31,957	-18,608	58,451	28,330	-930	0	0	0	0
-7.5	-1.5	0	0	0	70,609	34,223	-18,608	70,609	34,223	-930	70,609	34,223	-18,608	63,127	30,597	-930	0	0	0	0
TOTALS		8,760	2,086	6,674													6,448	6,448	2,113	1,620

Existing Building Ventilation & Infiltration (Cooling) 770 cfm
Overheat Ventilation Factor 1.00
Original Bldgal ventilation to offset overheat 0 cfm
Existing Building Ventilation & Infiltration (Heating) 420 cfm

NJBPU - Borough of Tenafly
CHA #21794
Building: Senior Center

Reconcile Thermal Model Original Bldg

Building Footprint	3,740 SF	Ex Occupied Clng Temp.	72 °F	Ex Occupied Htg Temp.	68 °F		
Heating Efficiency	76%	Ex Unoccupied Clng Temp.	72 °F	Ex Unoccupied Htg Temp.	68 °F		
Cooling Efficiency	1.40 kW/ton	Occupied Cooling UA	(1,709) btu/hr/°F	Occupied Heating UA	935 btu/hr/°F		
Internal Gains	31,019 btu/h	Unoccupied Cooling UA	(1,048) btu/hr/°F	Unoccupied Heating UA	935 btu/hr/°F		
Unoc Internal Gain factor	0.03	Cooling Occ Enthalpy Setpoint	27.3 Btu/lb				
Ave Occ Internal Gain Factor	0.6	Cooling Unocc Enthalpy Setpoint	27.3 Btu/lb				
Economizer available (Y/N)	No						

					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	-52,126	-75,509	-18,608	-31,963	-75,509	-930	0	0	0	0
97.5	42.5	3	1	2	-43,580	-52,648	-18,608	-26,723	-52,648	-930	0	31	31	0
92.5	39.5	34	8	26	-35,035	-42,257	-18,608	-21,483	-42,257	-930	0	286	286	0
87.5	36.6	131	31	100	-26,490	-32,212	-18,608	-16,244	-32,212	-930	0	856	856	0
82.5	34.0	500	119	381	-17,945	-23,207	-18,608	-11,004	-23,207	-930	0	2,392	2,392	0
77.5	31.6	620	148	472	-9,400	-14,894	-18,608	-5,764	-14,894	-930	0	1,929	1,929	0
72.5	29.2	664	158	506	-855	-6,581	-18,608	-524	-6,581	-930	0	955	955	0
67.5	27.0	854	203	651	468	227	-18,608	468	227	-930	0	0	0	0
62.5	24.5	927	221	706	5,144	2,493	-18,608	5,144	2,493	-930	0	0	0	0
57.5	21.4	600	143	457	9,820	4,760	-18,608	9,820	4,760	-930	0	0	0	0
52.5	18.7	610	145	465	14,496	7,026	-18,608	14,496	7,026	-930	0	0	0	131
47.5	16.2	611	145	466	19,172	9,292	-18,608	19,172	9,292	-930	0	0	0	188
42.5	14.4	656	156	500	23,848	11,559	-18,608	23,848	11,559	-930	0	0	0	261
37.5	12.6	1,023	244	779	28,524	13,825	-18,608	28,524	13,825	-930	0	0	0	501
32.5	10.7	734	175	559	33,200	16,092	-18,608	33,200	16,092	-930	0	0	0	426
27.5	8.6	334	80	254	37,876	18,358	-18,608	37,876	18,358	-930	0	0	0	225
22.5	6.8	252	60	192	42,553	20,625	-18,608	42,553	20,625	-930	0	0	0	192
17.5	5.5	125	30	95	47,229	22,891	-18,608	47,229	22,891	-930	0	0	0	107
12.5	4.1	47	11	36	51,905	25,157	-18,608	51,905	25,157	-930	0	0	0	44
7.5	2.6	22	5	17	56,581	27,424	-18,608	56,581	27,424	-930	0	0	0	23
2.5	1.0	13	3	10	61,257	29,690	-18,608	61,257	29,690	-930	0	0	0	15
-2.5	0.0	0	0	0	65,933	31,957	-18,608	65,933	31,957	-930	0	0	0	0
-7.5	-1.5	0	0	0	70,609	34,223	-18,608	70,609	34,223	-930	0	0	0	0
TOTALS		8,760	2,086	6,674								6,448	6,448	2,113

Existing Building Ventilation & Infiltration (occ) Cooling Only	**770 cfm**
Existing Building Infiltration	**420 cfm**
Overheat Ventilation Factor	**1.00**
Additional ventilation to offset overheat	**0 cfm**
Existing Building Ventilation & Infiltration (unocc) Cooling Only	**770 cfm**
Economizer Ventilation (from AHU's)	**0 cfm**

Energy Use Indices (calculated)

Heating	Base Case
Original	2,113
Addition	441
Total	**2,555**
Target ->	**2,552**
	100.1%

Cooling	Base Case
Original	6,448
Addition	3,632
Total	**10,081**
Target ->	**10,016**
	100.6%

Electrical Requirements for Cooling Equipment

Unit	Area Served	Qty	Clng Hrs	Amps	Volts	Phase	Power Factor	% Runtime	Annual kWh
Window AC	**Varies**	5	1,288	13.1	120	1	0.8	40%	3240
Window AC	**Offices**	2	1,288	8.0	120	1	0.8	40%	791
RTU	**Addition**	1	2,806	24.7	208	3	0.8	30%	5986
Total									**10016**

HEAT GAIN/LOSS WORKSHEET

Project Name:	NJBPU - Borough of Tenafly	**Project No.:**	CHA #21794		
Location	Tenafly, NJ	**Site Elevation:**	30 Feet	**Specific Volume**	13.50 CF/#
Building Name	Senior Center	**Date:**	07/29/10		
Engineer:	CAA				

Building/Facility Designation Original Bldg (Assembly Rm, Kitchen, Offices, Card Rm, Library)

Outdoor Winter Design DB Temperature	11 *F	**Indoor Winter Design DB Temperature**	68 *F
Outdoor Summer Design DB Temperature	94 *F	**Indoor Summer Design DB Temperature**	72 *F
Outdoor Summer Design WB Temperature	75 *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	U value calculator	14.3	

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	U value calculator	19.5	

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	Average	0.62

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

BUILDING CHARACTERISTICS

Roof Area	3,740 SF		
Occupied Area	3,740 SF	**Return Plenum?**	n

	Gross Wall Length	Average Wall Height	Ceiling Height	Window Area	Door Area	Net Wall Area
North Exposure	48 Ft	10.2 Ft	8.0 Ft	76 SF	21 SF	394 SF
East Exposure	91 Ft	10.0 Ft	8.0 Ft	56 SF	0 SF	854 SF
South Exposure	84 Ft	6.7 Ft	6.7 Ft	84 SF	42 SF	438 SF
West Exposure	91 Ft	5.4 Ft	5.4 Ft	111 SF	21 SF	359 SF

Occupied Forced Ventilation*	350 cfm	#DIV/0!	AC/hr
Unoccupied Forced Ventilation	350 cfm	#DIV/0!	AC/hr

*Cooling Only (50 cfm/Window AC Unit)

HEAT GAIN/LOSS WORKSHEET

Project Name:	NJBPU - Borough of Tenafly	Project No.:	CHA #21794		
Location	Tenafly, NJ	Site Elevation:	30 Feet	Specific Volume	13.50 CF/#
Building Name	Senior Center	Date:	07/29/10		
Engineer:	CAA				

Building/Facility Designation: Original Bldg (Assembly Rm, Kitchen, Offices, Card Rm, Library)

COOLING HEAT GAINS TO THE ROOM - SENSIBLE

SOLAR GAINS

WINDOWS	AREA (SF)	SHGF		Shade Coef	Cooling Load Factor		Solar Heat Gain	
North Exposure	76	38	btu/h/sf	0.8	0.75	Glass Type C	1,733 Btu/hr	
East Exposure	56	216	btu/h/sf	0.8	0.31	Glass Type C	3,000 Btu/hr	
South Exposure	84	109	btu/h/sf	0.8	0.58	Glass Type C	4,248 Btu/hr	
West Exposure	111	216	btu/h/sf	0.8	0.29	Glass Type C	5,562 Btu/hr	
								14,543 Btu/h

CONDUCTION

	NET AREA (SF)	U-VALUE	Cooling Load Temp. Dif.	Return Air Factor	Room Heat Gain	
North Exposure	287	0.07	20 °F	1.0	402 Btu/hr	
East Exposure	672	0.07	39 °F	1.0	1,837 Btu/hr	
South Exposure	437	0.07	27 °F	1.0	827 Btu/hr	
West Exposure	359	0.07	22 °F	1.0	554 Btu/hr	
Roof	3,740	0.05	73 °F	1.0	14,008 Btu/hr	
Fenestration	327	0.62	22 °F		4,460 Btu/hr	
Doors	84	0.14	27 °F		317 Btu/hr	
Ceiling	3,740	0.14	0 °F		0 Btu/hr	
Partition		0.05	0 °F		0 Btu/hr	
Floor	3,740	0.13	0 °F		0 Btu/hr	
						22,406 Btu/h

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

								Room Heat Gain
Lights	1.70	w/sf x	3,740	Occ Area =	6.4	kW x 3.4x	1.0 RAF =	21,700 Btu/h
Plug Load	0.25	w/sf x	3,740	Occ Area =	0.9	kW x 3.4x	1.0 RAF =	3,191 Btu/h
People	25	people x	255	btu/person x	50%	time in space =		3,188 Btu/h
Computer Work Stations			3	Units x	120	W/Unit x 3414 =		1,229 Btu/h
Equipment	0.5	kW x 3.413 =						1,707 Btu/h
Misc.								0 Btu/h
								31,014 Btu/h

VENTILATION AND INFILTRATION

		Infiltration Factor		Perimeter Ratio		Coef	Temp. Diff.	Room Heat Gain	
Walls	1,755 SF	0.15	CFM/SF			1.08	22 °F	6,770 Btu/h	
Doors	84 SF	0.20	CFM/LF	0.95	LF/SF	1.08	22 °F	411 Btu/h	
Windows	327 SF	0.24	CFM/LF	1.24	LF/SF	1.08	22 °F	2,493 Btu/h	
Ventilation	350 cfm					1.08	22 °F	9,000 Btu/h	
									18,675 Btu/h
Infiltration	376 cfm	#DIV/0!	AC/hr						

COOLING HEAT GAINS TO THE RA PLENUM - SENSIBLE

4,950

CONDUCTION

	NET AREA (SF)	U-VALUE	Cooling Load Temp. Dif.	Return Air Factor	Room Heat Gain	
North Exposure	107	0.07	20	1.0	150 Btu/hr	
East Exposure	182	0.07	39	1.0	498 Btu/hr	
South Exposure	1	0.07	27	1.0	2 Btu/hr	
West Exposure	0	0.07	22	1.0	-1 Btu/hr	
Roof	3,740	0.05	73	0.0	0 Btu/hr	
						649 Btu/h

INTERNAL HEAT GAINS

Lights	1.70	w/sf x	3,740	Occ Area =	6.4	kW x3413x	0.00 RAF =
Misc.							

	0 Btu/h
	0 Btu/h
	0 Btu/h

SENSIBLE HEAT GAINS - TEMP. DEPENDENT

Solar	14,543
Conduction to Room	22,406
Conduction to Plenum	649
Ventilaton and Infiltration	18,675
Sub Total	56,274

SENSIBLE HEAT GAINS - TEMP. INDEPENDENT

Internal Gains to Room	31,014
Internal Gains to Plenum	0
Sub Total	31,014

HEAT GAIN/LOSS WORKSHEET

Project Name:	NJBPU - Borough of Tenafly	Project No.:	CHA #21794		
Location	Tenafly, NJ	Site Elevation:	30 Feet	Specific Volume	13.50 CF/#
Building Name	Senior Center	Date:	07/29/10		
Engineer:	CAA				

Building/Facility Designation: Original Bldg (Assembly Rm, Kitchen, Offices, Card Rm, Library)

LATENT COOLING LOADS

Infiltration

		Infiltration Factor	Air Density	Humidity Ratio Dif.	Room Heat Gain
Walls	4,030 SF	0.15 CFM/SF	4,800	0.0043 #/#	12,601 Btu/h
Doors	84 SF	0.20 CFM/LF	4,800	0.0043 #/#	334 Btu/h
Windows	327 SF	0.24 CFM/LF	4,800	0.0043 #/#	2,021 Btu/h
Ventilation	350 cfm		4,800	0.0043 #/#	7,296 Btu/h
People	25 people	0.50 time in space		250 Btu/hr/person	3,125 Btu/h
					25,376 Btu/h

Cooling Load Summary

	Sensible	Latent	Total		
Temperature Dependent Gains	56,274	25,376	81,650		
Temperature Indep. Gains	31,014		31,014	SHR=	0.77
Total	87,288	25,376	112,664		

Building Cooling Load: 9.4 Tons at 398 SF/Ton

Building Air Flow to Condition Space based on a 12°F Temp Rise is: 6,671 CFM (1.78 CFM/sf)

HEATING CALCULATION

CONDUCTION

	NET AREA (SF)	U-VALUE	Heating Load Temp. Dif.		Room Heat Gain
North Exposure	394	0.07	57		1,575 Btu/h
East Exposure	854	0.07	57		3,413 Btu/h
South Exposure	438	0.07	57		1,750 Btu/h
West Exposure	359	0.07	57		1,435 Btu/h
Fenestration	327	0.62	57		11,556 Btu/h
Roof	3,740	0.05	57		10,938 Btu/h
Doors	84	0.14	57		669 Btu/h
Ceiling	3,740	0.14	0		0 Btu/h
Partition	0	0.05	0		0 Btu/h
Floor	3,740	0.13	47	*Building on blocks	21,973 Btu/h

Ventilation and Infiltration

		Infiltration Factor	Coef	Temp. Difference	Air Flow	Room Heat Gain
Walls	2,045 SF	0.15 CFM/SF	1.08	57	307 cfm	18,923 Btu/h
Doors	84 SF	0.20 CFM/LF	1.08	57	16 cfm	987 Btu/h
Windows	327 SF	0.24 CFM/LF	1.08	57	97 cfm	5,981 Btu/h
Ventilation Load	350 cfm		1.08	57	350 cfm	23,319 Btu/h
Total Ventilation & Infiltration Load					770 cfm	49,210 Btu/h

Building Heating Load	102,518	btu/h
		27.4 btu/sf

NJBPU - Borough of Tenafly
CHA #21794
Building: Senior Center
Original Bldg

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	3.0	7.0	2	42.0	40.0
				0.0	0.0
				0.0	0.0
				0.0	0.0
			Sub-total	42.0	40.0
West	3.0	7.0	1	21.0	20.0
				0.0	0.0
			Sub-total	21.0	20.0
			Total	**84.0**	**80.0**

LF/SF
0.95

Walls

	Width (ft)	Height (ft)	Quantity	Area (SF)	Lineal Feet		
North	24.0	10.0	1	240.0	68.0		All wall quantities must remain equal to 1
	13.0	10.0	1	130.0	46.0		
	11.0	11.0	1	121.0	44.0		
				0.0	0.0		
				0.0	0.0	Ave. height	
	48.0			491.0	158.0	10.2	Average height wall automatically linked
East	85.0	10.0	1	850.0	190.0		
	6.0	10.0	1	60.0	32.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0	Ave. height	
	91.0			910.0	222.0	10.0	Average height wall automatically linked
South	24.0	11.0	1	264.0	70.0		
	12.0	10.0	1	120.0	44.0		
	12.0	9.0	1	108.0	42.0		
	36.0	2.0	1	72.0	76.0		
				0.0	0.0	Ave. height	
	84.0			564.0	232.0	6.7	Average height wall automatically linked
West	6.0	10.0	1	60.0	32.0		
	32.0	9.0	1	288.0	82.0		
	9.0	9.0	1	81.0	36.0		
	2.0	10.0	1	20.0	24.0		
	42.0	1.0	1	42.0	86.0	Ave. height	
	91.0			491.0	260.0	5.4	Average height auto linked to block load sheet

Windows

	Width (ft)	Height (ft)	Quantity	Area (SF)	Lineal Feet	
North	2.0	4.0	8	64.0	96.0	
	3.0	2.0	2	12.0	20.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
			Sub-total	76.0	116.0	
East	4.0	3.5	4	56.0	60.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
			Sub-total	56.0	60.0	
South				0.0	0.0	
	3.0	7.0	2	42.0	40.0	
	3.5	1.5	8	42.0	80.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
			Sub-total	84.0	120.0	
West				0.0	0.0	
				0.0	0.0	
	3.0	7.0	3	63.0	60.0	
	4.0	4.0	3	48.0	48.0	
				0.0	0.0	
			Sub-total	111.0	108.0	
						LF/SF
			Total	**327.0**	**404.0**	1.24

NJBPU - Borough of Tenafly
CHA #21794
Building: Senior Center

ECM-1 Night Setback **Addition**

Building Footprint	1,010 SF	Ex Occupied Clng Temp.	72 °F	Ex Occupied Htg Temp.	68 °F	**Heating Energy Savings**	106 therms
Heating Efficiency	76%	Ex Unoccupied Clng Temp.	72 °F	Ex Unoccupied Htg Temp.	60 °F	**Cooling Energy Savings**	836 kWh
Cooling Efficiency	1.54 kW/ton	Prop Occupied Clng Temp.	72 °F	Prop Occupied Htg Temp.	68 °F		
Building Balance Temp.	60 °F	Prop Unoccupied Clng Temp.	80 °F	Prop Unoccupied Htg Temp.	60 °F		
Internal Gains	9,272 btu/h	Occupied Cooling UA	630 btu/hr/°F	Occupied Heating UA	178 btu/hr/°F		
Unoc Internal Gain factor	0.00	Unoccupied Cooling UA	243 btu/hr/°F	Unoccupied Heating UA	178 btu/hr/°F		
Ave Occ Internal Gain Factor	0.0	Cooling Occ Enthalpy Setpoint	27.3 Btu/lb				
		Cooling Unocc Enthalpy Setpoint	27.3 Btu/lb				

					EXISTING LOADS						PROPOSED LOADS									
					Occupied			Unoccupied			Occupied			Unoccupied						
Avg Outdoor Air Temp. Bins °F	Avg Outdoor Air Enthalpy	Existing Equipment Bin Hours	Occupied Equipment Bin Hours	Unoccupied Equipment Bin Hours	Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Unoccupied Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Unoccupied Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Existing Cooling Energy kWh	Proposed Cooling Energy kWh	Existing Heating Energy therms	Proposed Heating Energy therms
A		B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	K	L	M	N
102.5	49.1	0	0	0	-21,223	-43,086	-6,490	-7,413	-43,086	-278	-21,223	-43,086	-6,490	-5,469	-43,086	-278	0	0	0	0
97.5	42.5	3	1	2	-17,744	-30,041	-6,490	-6,198	-30,041	-278	-17,744	-30,041	-6,490	-4,253	-30,041	-278	16	15	0	0
92.5	39.5	34	8	26	-14,264	-24,112	-6,490	-4,983	-24,112	-278	-14,264	-24,112	-6,490	-3,038	-24,112	-278	144	138	0	0
87.5	36.6	131	31	100	-10,785	-18,381	-6,490	-3,767	-18,381	-278	-10,785	-18,381	-6,490	-1,823	-18,381	-278	430	405	0	0
82.5	34	500	119	381	-7,306	-13,242	-6,490	-2,552	-13,242	-278	-7,306	-13,242	-6,490	-608	-13,242	-278	1,199	1,104	0	0
77.5	31.6	620	148	472	-3,827	-8,499	-6,490	-1,337	-8,499	-278	-3,827	-8,499	-6,490	0	0	-278	970	373	0	0
72.5	29.2	664	158	506	-348	-3,755	-6,490	-122	-3,755	-278	-348	-3,755	-6,490	0	0	-278	485	233	0	0
67.5	27	854	203	651	89	75	-6,490	89	75	-278	89	75	-6,490	0	0	-278	175	188	0	0
62.5	24.5	927	221	706	978	827	-6,490	978	827	-278	978	827	-6,490	0	0	-278	133	158	0	0
57.5	21.4	600	143	457	1,867	1,579	-6,490	1,867	1,579	-278	1,867	1,579	-6,490	445	376	-278	56	56	0	0
52.5	18.7	610	145	465	2,756	2,330	-6,490	2,756	2,330	-278	2,756	2,330	-6,490	1,334	1,128	-278	26	26	0	0
47.5	16.2	611	145	466	3,645	3,082	-6,490	3,645	3,082	-278	3,645	3,082	-6,490	2,223	1,879	-278	0	0	40	24
42.5	14.4	656	156	500	4,535	3,834	-6,490	4,535	3,834	-278	4,535	3,834	-6,490	3,112	2,631	-278	0	0	57	40
37.5	12.6	1,023	244	779	5,424	4,585	-6,490	5,424	4,585	-278	5,424	4,585	-6,490	4,001	3,383	-278	0	0	111	84
32.5	10.7	734	175	559	6,313	5,337	-6,490	6,313	5,337	-278	6,313	5,337	-6,490	4,890	4,134	-278	0	0	96	76
27.5	8.6	334	80	254	7,202	6,089	-6,490	7,202	6,089	-278	7,202	6,089	-6,490	5,779	4,886	-278	0	0	51	42
22.5	6.8	252	60	192	8,091	6,840	-6,490	8,091	6,840	-278	8,091	6,840	-6,490	6,669	5,638	-278	0	0	44	37
17.5	5.5	125	30	95	8,980	7,592	-6,490	8,980	7,592	-278	8,980	7,592	-6,490	7,558	6,389	-278	0	0	24	21
12.5	4.1	47	11	36	9,869	8,344	-6,490	9,869	8,344	-278	9,869	8,344	-6,490	8,447	7,141	-278	0	0	10	9
7.5	2.6	22	5	17	10,759	9,095	-6,490	10,759	9,095	-278	10,759	9,095	-6,490	9,336	7,893	-278	0	0	5	5
2.5	1	13	3	10	11,648	9,847	-6,490	11,648	9,847	-278	11,648	9,847	-6,490	10,225	8,644	-278	0	0	3	3
-2.5	0	0	0	0	12,537	10,599	-6,490	12,537	10,599	-278	12,537	10,599	-6,490	11,114	9,396	-278	0	0	0	0
-7.5	-1.5	0	0	0	13,426	11,350	-6,490	13,426	11,350	-278	13,426	11,350	-6,490	12,003	10,148	-278	0	0	0	0
TOTALS		8,760	2,086	6,674													3,632	2,696	441	341

Existing Building Ventilation (Cooling Only) 300 cfm
Overheat Ventilation Factor 1.00
Additional ventilation to offset overheat 0 cfm
Existing Building Infiltration 139 cfm

NJBPU - Borough of Tenafly
CHA #21794
Building: Senior Center

Reconcile Thermal Model Addition

Building Footprint	1,010 SF	Ex Occupied Clng Temp.	72 °F	Ex Occupied Htg Temp.	68 °F
Heating Efficiency	76%	Ex Unoccupied Clng Temp.	72 °F	Ex Unoccupied Htg Temp.	68 °F
Cooling Efficiency	1.54 kW/ton	Occupied Cooling UA	(696) btu/hr/°F	Occupied Heating UA	178 btu/hr/°F
Internal Gains	9,272 btu/h	Unoccupied Cooling UA	(243) btu/hr/°F	Unoccupied Heating UA	178 btu/hr/°F
Unoc Internal Gain factor	0.03	Cooling Occ Enthalpy Setpoint	27.3 Btu/lb		
Ave Occ Internal Gain Factor	0.7	Cooling Unocc Enthalpy Setpoint	27.3 Btu/lb		
Economizer available (Y/N)	No				

					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	-21,223	-43,086	-6,490	-7,413	-43,086	-278	0	0	0	0
97.5	42.5	3	1	2	-17,744	-30,041	-6,490	-6,198	-30,041	-278	0	16	16	0
92.5	39.5	34	8	26	-14,264	-24,112	-6,490	-4,983	-24,112	-278	0	144	144	0
87.5	36.6	131	31	100	-10,785	-18,381	-6,490	-3,767	-18,381	-278	0	430	430	0
82.5	34.0	500	119	381	-7,306	-13,242	-6,490	-2,552	-13,242	-278	0	1,199	1,199	0
77.5	31.6	620	148	472	-3,827	-8,499	-6,490	-1,337	-8,499	-278	0	970	970	0
72.5	29.2	664	158	506	-348	-3,755	-6,490	-122	-3,755	-278	0	485	485	0
67.5	27.0	854	203	651	89	75	-6,490	89	75	-278	0	175	175	0
62.5	24.5	927	221	706	978	827	-6,490	978	827	-278	0	133	133	0
57.5	21.4	600	143	457	1,867	1,579	-6,490	1,867	1,579	-278	0	56	56	0
52.5	18.7	610	145	465	2,756	2,330	-6,490	2,756	2,330	-278	0	26	26	0
47.5	16.2	611	145	466	3,645	3,082	-6,490	3,645	3,082	-278	0	0	0	40
42.5	14.4	656	156	500	4,535	3,834	-6,490	4,535	3,834	-278	0	0	0	57
37.5	12.6	1,023	244	779	5,424	4,585	-6,490	5,424	4,585	-278	0	0	0	111
32.5	10.7	734	175	559	6,313	5,337	-6,490	6,313	5,337	-278	0	0	0	96
27.5	8.6	334	80	254	7,202	6,089	-6,490	7,202	6,089	-278	0	0	0	51
22.5	6.8	252	60	192	8,091	6,840	-6,490	8,091	6,840	-278	0	0	0	44
17.5	5.5	125	30	95	8,980	7,592	-6,490	8,980	7,592	-278	0	0	0	24
12.5	4.1	47	11	36	9,869	8,344	-6,490	9,869	8,344	-278	0	0	0	10
7.5	2.6	22	5	17	10,759	9,095	-6,490	10,759	9,095	-278	0	0	0	5
2.5	1.0	13	3	10	11,648	9,847	-6,490	11,648	9,847	-278	0	0	0	3
-2.5	0.0	0	0	0	12,537	10,599	-6,490	12,537	10,599	-278	0	0	0	0
-7.5	-1.5	0	0	0	13,426	11,350	-6,490	13,426	11,350	-278	0	0	0	0
TOTALS		**8,760**	**2,086**	**6,674**								**3,632**	**3,632**	**441**

Existing Building Ventilation (Cooling Only) 300 cfm
Existing Building Infiltration 139 cfm
Overheat Ventilation Factor 1.00
Additional ventilation to offset overheat 0 cfm

Energy Use Indices (calculated)

Heating	Base Case
Original	2,113
Addition	441
Total	**2,555**
Target ->	**2,552**
	100.1%

Cooling	Base Case
Original	6,448
Addition	3,632
Total	**10,081**
Target ->	**10,016**
	100.6%

HEAT GAIN/LOSS WORKSHEET

Project Name:	NJBPU - Borough of Tenafly	**Project No.:**	CHA #21794		
Location	Tenafly, NJ	**Site Elevation:**	30 Feet	**Specific Volume**	13.50 CF/#
Building Name	Senior Center	**Date:**	07/29/10		
Engineer:	CAA				

Building/Facility Designation Addition (Activity Room)

Outdoor Winter Design DB Temperature	11 *F	**Indoor Winter Design DB Temperature**	68 *F
Outdoor Summer Design DB Temperature	94 *F	**Indoor Summer Design DB Temperature**	72 *F
Outdoor Summer Design WB Temperature	75 *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	U value calculator	24.9	

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	U value calculator	33.0	

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 Clad Wood Frame (new)	0.50

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

BUILDING CHARACTERISTICS

Roof Area	1,010 SF		
Occupied Area	1,010 SF	**Return Plenum?**	n

	Gross Wall Length	Average Wall Height	Ceiling Height	Window Area	Door Area	Net Wall Area
North Exposure	24 Ft	13.0 Ft	10.0 Ft	0 SF	0 SF	312 SF
East Exposure	42 Ft	2.0 Ft	10.0 Ft	0 SF	0 SF	84 SF
South Exposure	24 Ft	13.0 Ft	10.0 Ft	84 SF	0 SF	228 SF
West Exposure	42 Ft	11.0 Ft	10.0 Ft	114 SF	0 SF	348 SF

Occupied Forced Ventilation	300 cfm	1.4 AC/hr
Unoccupied Forced Ventilation	300 cfm	1.4 AC/hr

Note: Ventilation rate estimated per existing building conditions and using 2006 International Mechanical Code Requirements.

HEAT GAIN/LOSS WORKSHEET

Project Name:	NJBPU - Borough of Tenafly	Project No.:	CHA #21794		
Location	Tenafly, NJ	Site Elevation:	30 Feet	Specific Volume	13.50 CF/#
Building Name	Senior Center	Date:	07/29/10		
Engineer:	CAA				

Building/Facility Designation: Addition (Activity Room)

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	84	109	btu/h/sf	0.8	0.58	Glass Type C	4,248 Btu/hr
West Exposure	114	216	btu/h/sf	0.8	0.29	Glass Type C	5,713 Btu/hr
							9,961 Btu/h

CONDUCTION

	NET AREA (SF)	U-VALUE	Cooling Load Temp. Dif.	Return Air Factor	Room Heat Gain
North Exposure	240	0.04	20 °F	1.0	193 Btu/hr
East Exposure	41	0.04	39 °F	1.0	64 Btu/hr
South Exposure	156	0.04	27 °F	1.0	169 Btu/hr
West Exposure	306	0.04	22 °F	1.0	270 Btu/hr
Roof	1,010	0.03	73 °F	1.0	2,232 Btu/hr
Fenestration	198	0.50	22 °F		2,178 Btu/hr
Doors	0	0.14	27 °F		0 Btu/hr
Ceiling	1,010	0.14	0 °F		0 Btu/hr
Partition		0.05	0 °F		0 Btu/hr
Floor	1,010	0.04	0 °F		0 Btu/hr
					5,107 Btu/h

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

								Room Heat Gain
Lights	1.70	w/sf x	1,010	Occ Area =	1.7 kW x 3.4x	1.0	RAF =	5,860 Btu/h
Plug Load	0.25	w/sf x	1,010	Occ Area =	0.3 kW x 3.4x	1.0	RAF =	862 Btu/h
People	20	people x	255	btu/person x	50% time in space =			2,550 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
								9,272 Btu/h

VENTILATION AND INFILTRATION

		Infiltration Factor		Perimeter Ratio		Coef	Temp. Diff.	Room Heat Gain
Walls	743 SF	0.10	CFM/SF			1.08	22 °F	1,911 Btu/h
Doors	0 SF	0.20	CFM/LF	0.00	LF/SF	1.08	22 °F	0 Btu/h
Windows	198 SF	0.20	CFM/LF	1.06	LF/SF	1.08	22 °F	1,080 Btu/h
Ventilation	300 cfm					1.08	22 °F	7,714 Btu/h
								10,705 Btu/h
Infiltration	116 cfm	0.5	AC/hr					

COOLING HEAT GAINS TO THE RA PLENUM - SENSIBLE 4,950

CONDUCTION

	NET AREA (SF)	U-VALUE	Cooling Load Temp. Dif.	Return Air Factor	Room Heat Gain
North Exposure	72	0.04	20	1.0	58 Btu/hr
East Exposure	43	0.04	39	1.0	67 Btu/hr
South Exposure	72	0.04	27	1.0	78 Btu/hr
West Exposure	42	0.04	22	1.0	37 Btu/hr
Roof	1,010	0.03	73	0.0	0 Btu/hr
					240 Btu/h

INTERNAL HEAT GAINS

							Room Heat Gain
Lights	1.70	w/sf x	1,010	Occ Area =	1.7 kW x3413x	0.00 RAF =	0 Btu/h
Misc.							0 Btu/h
							0 Btu/h

SENSIBLE HEAT GAINS - TEMP. DEPENDENT	
Solar	9,961
Conduction to Room	5,107
Conduction to Plenum	240
Ventilaton and Infiltration	10,705
Sub Total	26,013

SENSIBLE HEAT GAINS - TEMP. INDEPENDENT	
Internal Gains to Room	9,272
Internal Gains to Plenum	0
Sub Total	9,272

HEAT GAIN/LOSS WORKSHEET

Project Name:	NJBPU - Borough of Tenafly	Project No.:	CHA #21734		
Location	Tenafly, NJ	Site Elevation:	30 Feet	Specific Volume	13.50 CF/#
Building Name	Senior Center	Date:	07/29/10		
Engineer:	CAA				

Building/Facility Designation: Addition (Activity Room)

LATENT COOLING LOADS

Infiltration

		Infiltration Factor	Air Density	Humidity Ratio Dif.	Room Heat Gain	
Walls	1,239 SF	0.10 CFM/SF	4,800	0.0043 #/#	2,583	Btu/h
Doors	0 SF	0.20 CFM/LF	4,800	0.0043 #/#	0	Btu/h
Windows	198 SF	0.20 CFM/LF	4,800	0.0043 #/#	876	Btu/h
Ventilation	300 cfm		4,800	0.0043 #/#	6,254	Btu/h
People	20 people	0.50 time in space		250 Btu/hr/person	2,500	Btu/h
					12,212	Btu/h

Cooling Load Summary

	Sensible	Latent	Total		
Temperature Dependent Gains	26,013	12,212	38,225		
Temperature Indep. Gains	9,272		9,272	SHR=	0.74
Total	35,285	12,212	47,497		

Building Cooling Load: 4.0 Tons at 255 SF/Ton

Building Air Flow to Condition Space based on a 12°F Temp Rise is	2,698 CFM
	2.67 CFM/sf

HEATING CALCULATION

CONDUCTION

	NET AREA (SF)	U-VALUE	Heating Load Temp. Dif.	Room Heat Gain	
North Exposure	312	0.04	57	714	Btu/h
East Exposure	84	0.04	57	192	Btu/h
South Exposure	228	0.04	57	522	Btu/h
West Exposure	348	0.04	57	797	Btu/h
Fenestration	198	0.50	57	5,643	Btu/h
Roof	1,010	0.03	57	1,743	Btu/h
Doors	0	0.14	57	0	Btu/h
Ceiling	1,010	0.14	0	0	Btu/h
Partition	0	0.05	0	0	Btu/h
Floor	1,010	0.04	13	526	Btu/h

Ventilation and Infiltration

		Infiltration Factor	Coef	Temp. Difference	Air Flow	Room Heat Gain	
Walls	972 SF	0.10 CFM/SF	1.08	57	97 cfm	5,996	Btu/h
Doors	0 SF	0.20 CFM/LF	1.08	57	0 cfm	0	Btu/h
Windows	198 SF	0.20 CFM/LF	1.08	57	42 cfm	2,591	Btu/h
Ventilation Load	300 cfm		1.08	57	300 cfm	19,987	Btu/h
Total Ventilation & Infiltration Load					439 cfm	28,574	Btu/h

Building Heating Load	38,711	btu/h
		38.3 btu/sf

NJBPU - Borough of Tenafly
CHA #21794
Building: Senior Center
Addition

Doors

	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
			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	**0.0**	**0.0**

LF/SF
0.00

Walls

	Width (ft)	Height (ft)	Quantity	Area (SF)	Lineal Feet		
North				0.0	0.0		All wall quantities must remain equal to 1
				0.0	0.0		
	24.0	13.0	1	312.0	74.0		
				0.0	0.0		
				0.0	0.0	Ave. height	
	24.0			312.0	74.0	13.0	Average height wall automatically linked
East	42.0	2.0	1	84.0	88.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0	Ave. height	
	42.0			84.0	88.0	2.0	Average height wall automatically linked
South				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
	24.0	13.0	1	312.0	74.0		
				0.0	0.0	Ave. height	
	24.0			312.0	74.0	13.0	Average height wall automatically linked
West				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
	42.0	11.0	1	462.0	106.0		
				0.0	0.0	Ave. height	
	42.0			462.0	106.0	11.0	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	3.0	7.0	4	84.0	80.0
				0.0	0.0
				0.0	0.0
				0.0	0.0
				0.0	0.0
				0.0	0.0
			Sub-total	84.0	80.0
West	3.0	7.0	4	84.0	80.0
	3.0	2.0	5	30.0	50.0
				0.0	0.0
				0.0	0.0
				0.0	0.0
			Sub-total	114.0	130.0
					LF/SF
			Total	**198.0**	**210.0** 1.06

NJBPU - Borough of Tenafly
CHA #21794
Building: Senior Center

ECM-1 Night Setback

Multipliers	
Material:	0.98
Labor:	1.21
Equipment:	1.09

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
						$ -	$ -	$ -	$ -	
Programmable thermostat	3	EA	$ 100	$ 50	$ -	$ 294	$ 182	$ -	$ 476	One programmable thermostat shall replace the two existing theromstats in the activity room. Other thermostats shall be replaced one for one.
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

$ 476	Subtotal
$ -	0% Contingency
$ -	Contractor 0% O&P
$ -	0% Engineering
$ 476	**Total**

APPENDIX C

ECM-2 Boiler Replacement with Hot Water Temperature Reset

NJBPU - Borough of Tenafly
CHA #21794
Building: Senior Center

ECM-2 Boiler Replacement with HW Temperature Reset

Existing Fuel	Nat.Gas
Proposed Fuel	Nat.Gas

Item	Value	Units	Formula/Comments
Baseline Fuel Cost	$ 1.16		
Proposed Fuel Cost	$ 1.16		
Baseline Fuel Use	2,552	Therms	Based on historical utility data
Existing Boiler Plant Efficiency	76%		Estimated or Measured
Baseline Boiler Load	193,952	Mbtu/yr	Baseline Fuel Use x Existing Efficiency x 100 Mbtu/Therms
Baseline Fuel Cost	$ 2,953		
Proposed Boiler Plant Efficiency	95%		New Boiler Efficiency
Proposed Fuel Use	2,039	Therms	Baseline Boiler Load / Proposed Efficiency / 100 Mbtu/Therms
Proposed Fuel Cost	$ 2,359		
Annual Savings	513	Therms	
Annual Savings	**$ 594**	**/yr**	

NJBPU - Borough of Tenafly
CHA #21794
Building: Senior Center

ECM-2 Boiler Replacement with HW Temperature Reset

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

A	B	C	D	E	F	G	H	I	J
					Proposed Usage			Utility Usage	
Amb. Bin Temp °F	Avg. DB Bin Temp °F	Bin Hours	Heating Bin HOURS	Existing Heat Loss In Piping MBH	Avg. HHW Temp @ OA Temp °F	Proposed Heat Loss In Piping MBH	Proposed Boiler Efficiency	Existing Utility Use Therms/Yr	Proposed Utility Use Therms/Yr
100-104	102.0	0	0	0	0	0	0.0%	0	0
95-99	97.0	3	0	0	0	0	0.0%	0	0
90-94	92.0	34	0	0	0	0	0.0%	0	0
85-89	87.0	131	0	0	0	0	0.0%	0	0
80-84	82.0	500	0	0	0	0	0.0%	0	0
75-79	77.0	620	0	0	0	0	0.0%	0	0
70-74	72.0	664	0	0	0	0	0.0%	0	0
65-69	67.0	854	0	0	0	0	0.0%	0	0
60-64	62.0	927	927	5,089	80	2,419	97.0%	52	25
55-59	57.0	600	600	3,294	88	1,566	96.5%	34	16
50-54	52.0	610	610	3,349	95	1,592	96.0%	35	17
45-49	47.0	611	611	3,354	103	1,595	95.5%	35	17
40-44	42.0	656	656	3,601	110	1,712	95.0%	38	18
35-39	37.0	1,023	1,023	5,616	118	2,670	94.5%	59	28
30-34	32.0	734	734	4,030	125	1,916	94.0%	43	20
25-29	27.0	334	334	1,834	133	872	93.5%	20	9
20-24	22.0	252	252	1,383	140	658	93.0%	15	7
15-19	17.0	125	125	686	148	326	92.5%	7	4
10-14	12.0	47	47	258	155	123	92.0%	3	1
5-9	7.0	22	22	121	163	57	91.5%	1	1
0-4	2.0	13	13	71	170	34	91.0%	1	0
-5- -1	-3.0	0	0	0	170	0	91.0%	0	0
-10- -6	-8.0	0	0	0	170	0	91.0%	0	0
Totals		**8,760**	**5,954**	**32,687**		**15,540**		**344**	**163**

Annual Energy Savings	**180**	**Therms/yr**
Annual Cost Savings	**$ 215**	**/yr**

Existing Boiler Efficiency	76%	
Avg. Proposed Boiler Efficiency	95%	

Building HHW Piping System		
Heating On Temperature	65	°F
Total Length of Pipe	450	LF
Existing HHW Setpoint High	180	°F
Existing HHW Setpoint Low	160	°F
Avg HHW Temp	170	°F
Avg Pipe Size	1	Inches
Avg Insul Thickness	1	Inches
Existing Heat Loss	12.2	Btu/Hr/LF
Percent in Uncond. Space	100%	
Existing System Heat Loss	5,490	Btu/Hr
Proposed Min HHW Return*	70	°F
Avg Prop HHW Supply Temp	106	°F
Proposed Heat Loss	5.8	Btu/Hr/LF
Proposed System Heat Loss	2,610	Btu/Hr

*Refer to proposed boiler capabilities

Size (in)	Length (ft)
1	450
1	**Average**

Comments:

A-C	Newark, NJ weather bins
D	Based on building balance points and bin data.
E	Existing heat loss in piping system based on current average HHW temperature.
F	Estimated Average HHW temperature with HW reset based on OA temperature.
G	Proposed heat loss in piping system based on estimated average HW temperature. Return HHW temp min 70 deg F
H	Proposed boiler efficiency based return water temperature and boiler efficiency curve.
I-J	Utility usage to overcome heat loss in HHW piping system based on boiler efficiency.

NJBPU - Borough of Tenafly
CHA #21794
Building: Senior Center

ECM-2 Boiler Replacement with Hot Water Temperature Reset

Multipliers	
Material:	0.98
Labor:	1.21
Equipment:	1.09

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
						$ -	$ -	$ -	$ -	
Boiler Removal	1	EA		$ 500		$ -	$ 605	$ -	$ 605	Includes flue removal
						$ -	$ -	$ -	$ -	
399 MBH Gas-Fired Condensing HW Boiler*	1	EA	$ 9,000	$ 800		$ 8,820	$ 968	$ -	$ 9,788	Includes freight and startup
Flue Replacement	15	LF	$ 7.5	$ 6.50		$ 110	$ 118	$ -	$ 228	4" PVC Piping
Miscellaneous Electrical	1	LS	$ 200	$ 150		$ 196	$ 182	$ -	$ 378	
Miscellaneous HW and gas Piping	1	LS	$ 200	$ 150		$ 196	$ 182	$ -	$ 378	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

*Pricing based on Aerco Esteem 399 Boiler w/ integral HW reset controller

$	11,376	Subtotal
$	569	5% Contingency
$	597	5% Contractor O&P
$	-	Engineering
$	**12,542**	**Total**

New Jersey Smart Start Incentive Program	QTY	UNIT	$ / UNIT	TOTAL SAVINGS	Cost W/O INCENTIVE	Cost W/ INCENTIVE
					$ -	$ -
NG Boilers ≥ 300 - 1500 MBH	399	MBH	$1.75	$698	$ 9,788	$ 9,090
				$698	$9,788	$9,090

Total ECM Cost w/ Incentives	**$11,844**

APPENDIX D

ECM-3A Replace Rooftop Unit – Standard Efficiency

NJBPU - Borough of Tenafly
CHA #21794
Building: Senior Center

ECM-3A Replace Rooftop Unit - Standard Efficiency

Building Footprint	1,010	SF	Ex Occupied Clng Temp.	72	°F	Ex Occupied Htg Temp.	68	°F	
Heating Efficiency	75%		Ex Unoccupied Clng Temp.	72	°F	Ex Unoccupied Htg Temp.	58	°F	
Building Balance Temp.	60	°F	Occupied Cooling UA	696	btu/hr/°F	Occupied Heating UA	178	btu/hr/°F	
Internal Gains	9,272	btu/h	Unoccupied Cooling UA	249	btu/hr/°F	Unoccupied Heating UA	178	btu/hr/°F	
Unoc Internal Gain factor	0.03		Cooling Occ Enthalpy Setpoint	27.3	Btu/lb				
Ave Occ Internal Gain Factor	0.7		Cooling Unocc Enthalpy Setpoint	27.3	Btu/lb				
Economizer available (Y/N)	Yes								

Existing Cooling Efficiency	1.54	kW/ton	Existing Electric Demand	7.10	kW
Proposed Cooling Efficiency	0.84	kW/ton	Proposed Electric Demand	4.42	kW

Natural Gas Savings	0 therms
Electricity Savings	1,690 kWh
	2.68 kW

					EXISTING LOADS											
					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	Existing Cooling Energy kWh	Proposed Required Cooling Energy kWh	Available Economizer Cooling kWh	Proposed Cooling Energy kWh	Existing Heating Energy therms	Proposed Heating Energy therms
A		B	C	D	E	F	G	H	I	J	K	L	L	L	N	O
102.5	49.1	0	0	0	-21,223	-43,086	-6,490	-7,413	-43,086	-278	0	0	0	0	0	0
97.5	42.5	3	1	2	-17,744	-30,041	-6,490	-6,198	-30,041	-278	16	9	0	9	0	0
92.5	39.5	34	8	26	-14,264	-24,112	-6,490	-4,983	-24,112	-278	144	82	0	82	0	0
87.5	36.6	131	31	100	-10,785	-18,381	-6,490	-3,767	-18,381	-278	430	246	0	246	0	0
82.5	34	500	119	381	-7,306	-13,242	-6,490	-2,552	-13,242	-278	1,199	685	0	685	0	0
77.5	31.6	620	148	472	-3,827	-8,499	-6,490	-1,337	-8,499	-278	970	554	0	554	0	0
72.5	29.2	664	158	506	-348	-3,755	-6,490	-122	-3,755	-278	485	277	0	277	0	0
67.5	27	854	203	651	89	75	-6,490	89	75	-278	175	100	25	74	0	0
62.5	24.5	927	221	706	978	827	-6,490	978	827	-278	133	76	61	15	0	0
57.5	21.4	600	143	457	1,867	1,579	-6,490	1,867	1,579	-278	56	32	83	0	0	0
52.5	18.7	610	145	465	2,756	2,330	-6,490	2,756	2,330	-278	26	15	124	0	0	0
47.5	16.2	611	145	466	3,645	3,082	-6,490	3,645	3,082	-278	0	0	0	0	40	40
42.5	14.4	656	156	500	4,535	3,834	-6,490	4,535	3,834	-278	0	0	0	0	57	57
37.5	12.6	1,023	244	779	5,424	4,585	-6,490	5,424	4,585	-278	0	0	0	0	111	111
32.5	10.7	734	175	559	6,313	5,337	-6,490	6,313	5,337	-278	0	0	0	0	96	96
27.5	8.6	334	80	254	7,202	6,089	-6,490	7,202	6,089	-278	0	0	0	0	51	51
22.5	6.8	252	60	192	8,091	6,840	-6,490	8,091	6,840	-278	0	0	0	0	44	44
17.5	5.5	125	30	95	8,980	7,592	-6,490	8,980	7,592	-278	0	0	0	0	24	24
12.5	4.1	47	11	36	9,869	8,344	-6,490	9,869	8,344	-278	0	0	0	0	10	10
7.5	2.6	22	5	17	10,759	9,095	-6,490	10,759	9,095	-278	0	0	0	0	5	5
2.5	1	13	3	10	11,648	9,847	-6,490	11,648	9,847	-278	0	0	0	0	3	3
-2.5	0	0	0	0	12,537	10,599	-6,490	12,537	10,599	-278	0	0	0	0	0	0
-7.5	-1.5	0	0	0	13,426	11,350	-6,490	13,426	11,350	-278	0	0	0	0	0	0
TOTALS		**8,760**	**2,086**	**6,674**							**3,632**	**2,076**	**294**	**1,942**	**441**	**441**

Existing Building Ventilation	**300 cfm**
Overheat Ventilation Factor	**1.00**
Additional ventilation to offset overheat	**0 cfm**
Existing Building Infiltration	**139 cfm**
Economizer Ventilation	**300 cfm**

NJBPU - Borough of Tenafly
CHA #21794
Building: Senior Center

ECM-3A Replace Rooftop Unit - Standard Efficiency

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.		
						$ -	$ -	$ -	$ -	
RTU Removal	1	EA		$ 600		$ -	$ 726	$ -	$ 726	
						$ -	$ -	$ -	$ -	
RTU 5 Tons (13.0 SEER)*	1	EA	$ 3,700	$ 1,150		$ 3,626	$ 1,392	$ -	$ 5,018	Includes Controls
Miscellaneous Ductwork	1	LS	$ 200	$ 150		$ 196	$ 182	$ -	$ 378	
						$ -	$ -	$ -	$ -	
Miscellaneous Electrical	1	LS	$ 250			$ 245	$ -	$ -	$ 245	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

*RTU pricing based on Carrier model 48TC06 w/ economizer and optional low heat. Existing roof curb to be re-used.

New Jersey Smart Start Incentive Program	QTY	UNIT	$ / UNIT	TOTAL SAVINGS	Cost W/O INCENTIVE	Cost W/ INCENTIVE
Unitary HVAC ≥ 14.0 SEER	5	Ton	$0	$0	$ 5,018	$ 5,018
				$0	$5,018	$5,018

Total ECM Cost w/ Incentives	**$7,703**

$ 6,366	Subtotal
$ 637	10% Contingency
$ 700	10% Contractor O&P
$ -	0% Engineering
$ 7,703	**Total**

APPENDIX E

ECM-3B Replace Rooftop Unit – High Efficiency

NJBPU - Borough of Tenafly
CHA #21794
Building: Senior Center

ECM-3B Replace Rooftop Unit - High Efficiency

Building Footprint	1,010	SF	Ex Occupied Clng Temp.	72	°F	Ex Occupied Htg Temp.	68	°F	
Heating Efficiency	76%		Ex Unoccupied Clng Temp.	72	°F	Ex Unoccupied Htg Temp.	68	°F	
Building Balance Temp.	60	°F	Occupied Cooling UA	696	btu/hr/°F	Occupied Heating UA	178	btu/hr/°F	
Internal Gains	9,272	btu/h	Unoccupied Cooling UA	249	btu/hr/°F	Unoccupied Heating UA	178	btu/hr/°F	
Unoc Internal Gain factor	0.05		Cooling Occ Enthalpy Setpoint	27.3	Btu/lb				
Ave Occ Internal Gain Factor	0.7		Cooling Unocc Enthalpy Setpoint	27.3	Btu/lb				
Economizer available (Y/N)	Yes								

Existing Cooling Efficiency	1.54	kW/ton	Existing Electric Demand	7.10	kW
Proposed Cooling Efficiency	0.90	kW/ton	Proposed Electric Demand	3.95	kW

Natural Gas Savings	0 therms
Electricity Savings	1,867 kWh
	3.15 kW

					EXISTING LOADS											
					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	Existing Cooling Energy kWh	Proposed Required Cooling Energy kWh	Available Economizer Cooling kWh	Proposed Cooling Energy kWh	Existing Heating Energy therms	Proposed Heating Energy therms
A		B	C	D	E	F	G	H	I	J	K	L	L	L	N	O
102.5	49.1	0	0	0	-21,223	-43,086	-6,490	-7,413	-43,086	-278	0	0	0	0	0	0
97.5	42.5	3	1	2	-17,744	-30,041	-6,490	-6,198	-30,041	-278	16	8	0	8	0	0
92.5	39.5	34	8	26	-14,264	-24,112	-6,490	-4,983	-24,112	-278	144	75	0	75	0	0
87.5	36.6	131	31	100	-10,785	-18,381	-6,490	-3,767	-18,381	-278	430	223	0	223	0	0
82.5	34	500	119	381	-7,306	-13,242	-6,490	-2,552	-13,242	-278	1,199	623	0	623	0	0
77.5	31.6	620	148	472	-3,827	-8,499	-6,490	-1,337	-8,499	-278	970	504	0	504	0	0
72.5	29.2	664	158	506	-348	-3,755	-6,490	-122	-3,755	-278	485	252	0	252	0	0
67.5	27	854	203	651	89	75	-6,490	89	75	-278	175	91	23	68	0	0
62.5	24.5	927	221	706	978	827	-6,490	978	827	-278	133	69	56	13	0	0
57.5	21.4	600	143	457	1,867	1,579	-6,490	1,867	1,579	-278	56	29	76	0	0	0
52.5	18.7	610	145	465	2,756	2,330	-6,490	2,756	2,330	-278	26	14	112	0	0	0
47.5	16.2	611	145	466	3,645	3,082	-6,490	3,645	3,082	-278	0	0	0	0	40	40
42.5	14.4	656	156	500	4,535	3,834	-6,490	4,535	3,834	-278	0	0	0	0	57	57
37.5	12.6	1,023	244	779	5,424	4,585	-6,490	5,424	4,585	-278	0	0	0	0	111	111
32.5	10.7	734	175	559	6,313	5,337	-6,490	6,313	5,337	-278	0	0	0	0	96	96
27.5	8.6	334	80	254	7,202	6,089	-6,490	7,202	6,089	-278	0	0	0	0	51	51
22.5	6.8	252	60	192	8,091	6,840	-6,490	8,091	6,840	-278	0	0	0	0	44	44
17.5	5.5	125	30	95	8,980	7,592	-6,490	8,980	7,592	-278	0	0	0	0	24	24
12.5	4.1	47	11	36	9,869	8,344	-6,490	9,869	8,344	-278	0	0	0	0	10	10
7.5	2.6	22	5	17	10,759	9,095	-6,490	10,759	9,095	-278	0	0	0	0	5	5
2.5	1	13	3	10	11,648	9,847	-6,490	11,648	9,847	-278	0	0	0	0	3	3
-2.5	0	0	0	0	12,537	10,599	-6,490	12,537	10,599	-278	0	0	0	0	0	0
-7.5	-1.5	0	0	0	13,426	11,350	-6,490	13,426	11,350	-278	0	0	0	0	0	0
TOTALS		**8,760**	**2,086**	**6,674**							**3,632**	**1,887**	**267**	**1,766**	**441**	**441**

Existing Building Ventilation	**300 cfm**
Overheat Ventilation Factor	**1.00**
Additional ventilation to offset overheat	**0 cfm**
Existing Building Infiltration	**139 cfm**
Economizer Ventilation	**300 cfm**

NJBPU - Borough of Tenafly
CHA #21794
Building: Senior Center

ECM-3B Replace Rooftop Unit - High Efficiency

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.		
						$ -	$ -	$ -	$ -	
RTU Removal	1	EA		$ 600		$ -	$ 726	$ -	$ 726	
						$ -	$ -	$ -	$ -	
RTU 5 Tons High Efficiency (15.2 SEER)*	1	EA	$ 4,150	$ 1,150		$ 4,067	$ 1,392	$ -	$ 5,459	Includes Controls
Miscellaneous Ductwork	1	LS	$ 200	$ 150		$ 196	$ 182	$ -	$ 378	
						$ -	$ -	$ -	$ -	
Miscellaneous Electrical	1	LS	$ 250			$ 245	$ -	$ -	$ 245	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

*RTU pricing based on Carrier model 48HC06 w/ economizer and optional low heat. Existing roof curb to be re-used.

$ 6,807		Subtotal
$ 681	10%	Contingency
$ 749	10%	Contractor O&P
$ -	0%	Engineering
$ 8,236		**Total**

New Jersey Smart Start Incentive Program	QTY	UNIT	$ / UNIT	TOTAL SAVINGS	Cost W/O INCENTIVE	Cost W/ INCENTIVE
Unitary HVAC ≥ 14.0 SEER	5	Ton	$92	$460	$ 5,459	$ 4,999
				$460	$5,459	$4,999

Total ECM Cost w/ Incentives	**$7,776**

APPENDIX F

ECM-4 Replace Window AC Units with Mini Splits

NJBPU - Borough of Tenafly
CHA #21794
Building: Senior Center

ECM-4: Replace Window AC Units with Mini Splits
(utilize remote outdoor condensers)

ASSUMPTIONS			Comments
Electric Cost	$0.226	/ kWh	
Average run hours per Week	60	Hours	Unit is manually turned on (even if after hours)
Space Balance Point	60	F	
Space Temperature Setpoint	72	deg F	setpoint
Avg. BTU / Hr Rating of existing AC unit	20,215	Btu / Hr	(5) 23,500 Btuh units & (2) 12,000 Btuh units
Average EER	8.6		

Item	Value	Units	Comments
Total Number of Units	7		
Existing Annual Electric Usage	4,870	kWh	
Proposed EER	14.4		New ductless mini-splits (per manufacturer)
Proposed Annual Electric Usage	2,908	kWh	Unit will cycle on w/ temp of room. Possible operating time shown below

ANNUAL SAVINGS		
Annual Savings	1,961	kWh
Annual Cost Savings	$443	

OAT - DB Bin Temp F	Annual Hours	Cooling Hrs at Temp Above balance point	Assumed % of time of operation	Assumed hrs of Operation
102.5	0	0	100%	0
97.5	3	1	88%	1
92.5	34	12	76%	9
87.5	131	47	65%	30
82.5	500	179	53%	95
77.5	620	221	41%	91
72.5	664	237	29%	70
67.5	854	0	0%	0
62.5	927	0	0%	0
57.5	600	0	0%	0
52.5	610	0	0%	0
47.5	611	0	0%	0
42.5	656	0	0%	0
37.5	1,023	0	0%	0
32.5	734	0	0%	0
27.5	334	0	0%	0
22.5	252	0	0%	0
17.5	125	0	0%	0
12.5	47	0	0%	0
7.5	22	0	0%	0
2.5	13	0	0%	0
-2.5	0	0	0%	0
-7.5	0	0	0%	0
Total	8,760	697	42%	296

NJBPU - Borough of Tenafly
CHA #21794
Building: Senior Center

ECM-4: Replace Window AC Units with Mini Splits

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.		
						$ -	$ -	$ -	$ -	
Window AC Unit Removal	7	LS		$ 50		$ -	$ 424	$ -	$ 424	
						$ -	$ -	$ -	$ -	
5 Ton Rooftop Condenser	2	EA	$ 3,200	$ 2,000		$ 6,272	$ 4,840	$ -	$ 11,112	
12,000 Btuh Indoor Wall Unit	2	EA	$ 900	$ 800		$ 1,764	$ 1,936	$ -	$ 3,700	Offices
22,200 Btuh Indoor Wall Unit	2	EA	$ 1,100	$ 800		$ 2,156	$ 1,936	$ -	$ 4,092	Card Rm and Libarary
34,600 Btuh Indoor/outdoor Unit	2	EA	$ 3,650	$ 1,000		$ 7,154	$ 2,420	$ -	$ 9,574	Main Assembly Rm
Unit Controllers	4	EA	$ 285			$ 1,117	$ -	$ -	$ 1,117	
Piping Header	1	EA	$ 250			$ 245	$ -	$ -	$ 245	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

Note: Multiple indoor units can be connected to a single outdoor condensing unit.
The above cost estimate is based on four smaller indoor units being being connected to two outdoor units.
The larger indoor unit serving the assembly room is to have its own outdoor condensing unit.

New Jersey Smart Start Incentive	QTY	UNIT	$ / UNIT	TOTAL SAVINGS	Cost W/O INCENTIVE	Cost W/ INCENTIVE
					$ -	$ -
Unitary Split System < 5.4 tons	12	Tons	$92	$1,104	$ 14,812	$ 13,708
					$ -	$ -
				$1,104	$14,812	$13,708

Total ECM Cost w/ Incentives	**$35,212**

$ 30,264	Subtotal
$ 3,026	10% Contingency
$ 3,026	10% Contractor O&P
$ -	0% Engineering
$ 36,316	**Total**

APPENDIX G

ECM-5 Replace Electric Domestic Hot Water Heater

NJBPU - Borough of Tenafly
CHA #21794
Building: Senior Center

ECM-5: Replace Electric DHW Heater

Summary

* Replace Electric DHW Heater w/ Tankless, Condensing, Gas-Fired DHW Heater

Item	Value	Units	Formula/Comments
Occupied days per week	5	days/wk	
Water supply Temperature	50	°F	Termperature of water coming into building
Hot Water Temperature	120	°F	
Hot Water Usage per day	9	gal/day	Calculated from usage below
Annual Hot Water Energy Demand	1,421	MBTU/yr	Energy required to heat annual quantity of hot water to setpoint
Existing Tank Size	15	Gallons	Per manufacturer nameplate
Hot Water Temperature	120	°F	Per building personnel
Average Room Temperature	70	°F	
Standby Losses (% by Volume)	2.5%		(2.5% of stored capacity per hour, per U.S. Department of Energy)
Standby Losses (Heat Loss)	0.2	MBH	
Annual Standby Hot Water Load	1,369	MBTU/yr	
Total Annual Hot Water Demand (w/ standby losses)	2,790	Mbtu/yr	Building demand plus standby losses
Existing Water Heater Efficiency	98%		Per Manufacturer
Total Annual Energy Required	2,847	Mbtu/yr	
Total Annual Electric Required	834	**kWh/yr**	**Electrical Savings**
Average Annual Electric Demand	0.10	kW	
Peak Electric Demand	**2.00**	**kW**	**Per Manufacturer's Nameplate (Demand Savings)**
New Tank Size	0	Gallons	tankless
Hot Water Temperature	120	°F	
Average Room Temperature	70	°F	
Standby Losses (% by Volume)	2.5%		(2.5% of stored capacity per hour, per U.S. Department of Energy)
Standby Losses (Heat Loss)	0.0	MBH	
Annual Standby Hot Water Load	0	MBTU/yr	
Prop Annual Hot Water Demand (w/ standby losses)	1,421	MBTU/yr	
Proposed Avg. Hot water heater efficiency	92%		Based on Navien CR180 instantaneous, condensing DHW Heater
Proposed Total Annual Energy Required	1,550	MBTU/yr	
Proposed Fuel Use	16	Therms/yr	Standby Losses and inefficient DHW heater eliminated
Elec Utility Demand Unit Cost	$15.39	$/kW	
Elec Utility Supply Unit Cost	$0.13	$/kWh	
NG Utility Unit Cost	$1.16	$/Therm	
Existing Operating Cost of DHW	$478	$/yr	
Proposed Operating Cost of DHW	$18	$/yr	
Annual Utility Cost Savings	**$460**	**$/yr**	

Daily Hot Water Demand

FIXTURE	*BASE WATER USE GPM	DURATION OF USE (MIN)	#USES PER DAY MALE	#USES PER DAY FEMALE	FULL TIME OCCUPANTS** MALE	FULL TIME OCCUPANTS** FEMALE	TOTAL GAL/DAY	% HOT WATER	TOTAL HW GAL/DAY
LAVATORY (Low-Flow Lavs use 0.5 GF	2.5	0.25	3	3	5	5	19	50%	9
SHOWER	2.5	5	1	1			0	75%	0
KITCHEN SINK	2.5	0.5	1	1			0	75%	0
MOP SINK	2.5	2	1	1			0	75%	0
Dishwasher (ga	10	1	1	0			0	100%	0
						TOTAL	19		9

*GPM is per standard fixtures, adjust as necessary if actual GPM is known.
**These are the occupanct that use the fixtures. If fixture does not exist change to (0).

NJBPU - Borough of Tenafly
CHA #21794
Building: Senior Center

ECM-5: Replace Electric DHW 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.		
						$ -	$ -	$ -	$ -	
Electric DHW Heater Removal	1	LS		$ 50		$ -	$ 61	$ -	$ 61	
						$ -	$ -	$ -	$ -	
Instantaneous Gas-Fired DHW Heater	1	EA	$ 1,200	$ 280		$ 1,176	$ 339	$ -	$ 1,515	
Miscellaneous Electrical	1	LS	$ 50	$ 100		$ 49	$ 121	$ -	$ 170	
Venting	10	LF	$ 5.50	$ 6.70		$ 54	$ 81	$ -	$ 135	PVC piping
Miscellaneous Piping and Valves	1	LS	$ 300	$ 500		$ 294	$ 605	$ -	$ 899	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

$ 2,779		Subtotal
$ 417	15%	Contingency
$ 320	10%	Contractor O&P
$ -	0%	Engineering
$ 3,516		**Total**

New Jersey Smart Start Incentive Program	QTY	UNIT	$ / UNIT	TOTAL SAVINGS	Cost W/O INCENTIVE	Cost W/ INCENTIVE
Tankless Water Heater	1	EA	$300	$300	$ 1,515	$ 1,215
				$300	$1,515	$1,215

Total ECM Cost w/ Incentives	**$3,216**

APPENDIX H

ECM-6 Lighting Replacements

New Jersey BPU Energy Audit Program
CHA #21794
Borough of Tenafly - Senior Citizen Center
ECM-6 Lighting Replacements

Cost of Electricity: $0.130 $/kWh
$15.39 $/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
33	Vestibule	8	13 W CF 1	CFQ13/1-L	15	0.1	SW	2080	250	8	13 W CF 1	CFQ13/1-L	15	0.1	SW	2,080	250	-	0.0	$ -	$ -	$0		
35	Main Assembly Hall	19	T 32 R F 3 (ELE)	F43ILL/2	90	1.7	SW	1300	2,223	19	T 32 R F 3 (ELE)	F43ILL/2	90	1.7	SW	1,300	2,223	-	0.0	$ -	$ -	$0		
229	Main Assembly Hall (Stage Lighting)	3	WP200 I 1	I200/1	200	0.6	Dimmer SW	260	156	3	WP200 I 1	I200/1	200	0.6	Dimmer SW	260	156	-	0.0	$ -	$ -	$0		
137	Kitchen	7	SP 50 I	I50/1	50	0.4	SW	2080	728	7	CF 26	CFQ26/1-L	27	0.2	SW	2,080	393	335	0.2	$ 73.27	$ 94.50	$49	1.3	0.6
78	Kitchen	2	EP I 100	I100/1	100	0.2	SW	2080	416	2	CF 26	CFQ26/1-L	27	0.1	SW	2,080	112	304	0.1	$ 66.44	$ 32.40	$14	0.5	0.3
11	Activity Room	12	S 34 P F 2 (MAG)	F42EE	72	0.9	SW	2080	1,797	12	C 28 P F 2	F42SSILL	48	0.6	SW	2,080	1,198	599	0.3	$ 131.06	$ 1,275.00	$180	9.7	8.4
71	Restroom #1	1	I 60	I60/1	60	0.1	SW	780	47	1	CF 26	CFQ26/1-L	27	0.0	SW	780	21	26	0.0	$ 9.44	$ 6.75	$0	0.7	0.7
71	Restroom #2	1	I 60	I60/1	60	0.1	SW	780	47	1	CF 26	CFQ26/1-L	27	0.0	SW	780	21	26	0.0	$ 9.44	$ 6.75	$0	0.7	0.7
71	Janitor's Closet	1	I 60	I60/1	60	0.1	SW	260	16	1	CF 26	CFQ26/1-L	27	0.0	SW	260	7	9	0.0	$ 7.21	$ 6.75	$0	0.9	0.9
137	Hallway	2	SP 50 I	I50/1	50	0.1	SW	1040	104	2	CF 26	CFQ26/1-L	27	0.1	SW	1,040	56	48	0.0	$ 14.71	$ 27.00	$14	1.8	0.9
6	Front Office	2	T 34 R F 4 (MAG)	F44EE	144	0.3	SW	2080	599	2	T 28 R F 4	F44SSILL	96	0.2	SW	2,080	399	200	0.1	$ 43.69	$ 262.50	$30	6.0	5.3
11	Side Office	2	S 34 P F 2 (MAG)	F42EE	72	0.1	SW	2080	300	2	C 28 P F 2	F42SSILL	48	0.1	SW	2,080	200	100	0.0	$ 21.84	$ 212.50	$30	9.7	8.4
6	Director's Office	4	T 34 R F 4 (MAG)	F44EE	144	0.6	SW	2080	1,198	4	T 28 R F 4	F44SSILL	96	0.4	SW	2,080	799	399	0.2	$ 87.38	$ 525.00	$60	6.0	5.3
71	Restroom #3	1	I 60	I60/1	60	0.1	SW	780	47	1	CF 26	CFQ26/1-L	27	0.0	SW	780	21	26	0.0	$ 9.44	$ 6.75	$0	0.7	0.7
11	Library	8	S 34 P F 2 (MAG)	F42EE	72	0.6	SW	2080	1,198	8	C 28 P F 2	F42SSILL	48	0.4	SW	2,080	799	399	0.2	$ 87.38	$ 850.00	$120	9.7	8.4
11	Card Room	6	S 34 P F 2 (MAG)	F42EE	72	0.4	SW	2080	899	6	C 28 P F 2	F42SSILL	48	0.3	SW	2,080	599	300	0.1	$ 65.53	$ 637.50	$90	9.7	8.4
78	Exterior Flood Lights	2	EP I 100	I100/1	100	0.2	Photocell	4380	876	2	CF 26	CFQ26/1-L	27	0.1	Photocell	4,380	237	639	0.1	$ 110.10	$ 32.40	$14	0.3	0.2
142	Exterior Entry Lights	2	MH 100	MH100/1	128	0.3	Photocell	4380	1,121	2	MH 100	MH100/1	128	0.3	Photocell	4,380	1,121	-	0.0	$ -	$ -	$0		
	Total	**83**				**6.7**			**12,020**	**83**				**1,033**	**5.1**			**8,612**	**3,408**	**1.6**	**$737**	**$3,976**	**$601**		
																		Demand Savings		**1.6**	**$294**			
																		kWh Savings		**3,408**	**$443**			
																		Total savings			**$737**		**5.4**	**4.6**

APPENDIX I

ECM-7 Install Occupancy Sensors

New Jersey BPU Energy Audit Program
CHA #21794
Borough of Tenafly - Senior Citizen Center
ECM-7 Install Occupancy Sensors

Cost of Electricity: **$0.130 $/kWh**
$15.39 $/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
33	Vestibule	8	13 W CF 1	CFQ13/1-L	15	0.1	SW	2080	249.6	8	13 W CF 1	CFQ13/1-L	15	0.1	None	2080	249.6	0.0	0.0	$0.00	$0.00	$0.00		
35	Main Assembly Hall	19	T 32 R F 3 (ELE)	F43ILL/2	90	1.7	SW	1300	2,223.0	19	T 32 R F 3 (ELE)	F43ILL/2	90	1.7	None	1300	2,223.0	0.0	0.0	$0.00	$0.00	$0.00		
229	Main Assembly Hall (Stage Lighting)	3	WP200 I 1	I200/1	200	0.6	Dimmer SW	260	156.0	3	WP200 I 1	I200/1	200	0.6	None	260	156.0	0.0	0.0	$0.00	$0.00	$0.00		
137	Kitchen	7	SP 50 I	I50/1	50	0.4	SW	2080	728.0	7	SP 50 I	I50/1	50	0.4	None	2080	728.0	0.0	0.0	$0.00	$0.00	$0.00		
78	Kitchen	2	EP I 100	I100/1	100	0.2	SW	2080	416.0	2	EP I 100	I100/1	100	0.2	None	2080	416.0	0.0	0.0	$0.00	$0.00	$0.00		
11	Activity Room	12	S 34 P F 2 (MAG)	F42EE	72	0.9	SW	2080	1,797.1	12	S 34 P F 2 (MAG)	F42EE	72	0.9	OCC	1560	1,347.8	449.3	0.0	$58.41	$118.75	$20.00	2.0	1.7
71	Restroom #1	1	I 60	I60/1	60	0.1	SW	780	46.8	1	I 60	I60/1	60	0.1	None	780	46.8	0.0	0.0	$0.00	$0.00	$0.00		
71	Restroom #2	1	I 60	I60/1	60	0.1	SW	780	46.8	1	I 60	I60/1	60	0.1	None	780	46.8	0.0	0.0	$0.00	$0.00	$0.00		
71	Janitor's Closet	1	I 60	I60/1	60	0.1	SW	260	15.6	1	I 60	I60/1	60	0.1	None	260	15.6	0.0	0.0	$0.00	$0.00	$0.00		
137	Hallway	2	SP 50 I	I50/1	50	0.1	SW	1040	104.0	2	SP 50 I	I50/1	50	0.1	None	1040	104.0	0.0	0.0	$0.00	$0.00	$0.00		
6	Front Office	2	T 34 R F 4 (MAG)	F44EE	144	0.3	SW	2080	599.0	2	T 34 R F 4 (MAG)	F44EE	144	0.3	OCC	1200	345.6	253.4	0.0	$32.95	$118.75	$20.00	3.6	3.0
11	Side Office	2	S 34 P F 2 (MAG)	F42EE	72	0.1	SW	2080	299.5	2	S 34 P F 2 (MAG)	F42EE	72	0.1	OCC	1200	172.8	126.7	0.0	$16.47	$118.75	$20.00	7.2	6.0
6	Director's Office	4	T 34 R F 4 (MAG)	F44EE	144	0.6	SW	2080	1,198.1	4	T 34 R F 4 (MAG)	F44EE	144	0.6	OCC	1200	691.2	506.9	0.0	$65.89	$118.75	$20.00	1.8	1.5
71	Restroom #3	1	I 60	I60/1	60	0.1	SW	780	46.8	1	I 60	I60/1	60	0.1	SW	780	46.8	0.0	0.0	$0.00	$0.00	$0.00		
11	Library	8	S 34 P F 2 (MAG)	F42EE	72	0.6	SW	2080	1,198.1	8	S 34 P F 2 (MAG)	F42EE	72	0.6	OCC	1040	599.0	599.0	0.0	$77.88	$118.75	$20.00	1.5	1.3
11	Card Room	6	S 34 P F 2 (MAG)	F42EE	72	0.4	SW	2080	898.6	6	S 34 P F 2 (MAG)	F42EE	72	0.4	OCC	1040	449.3	449.3	0.0	$58.41	$118.75	$20.00	2.0	1.7
78	Exterior Flood Lights	2	EP I 100	I100/1	100	0.2	Photocell	4380	876.0	2	EP I 100	I100/1	100	0.2	None	4380	876.0	0.0	0.0	$0.00	$0.00	$0.00		
142	Exterior Entry Lights	2	MH 100	MH100/1	128	0.3	Photocell	4380	1,121.3	2	MH 100	MH100/1	128	0.3	None	4380	1,121.3	0.0	0.0	$0.00	$0.00	$0.00		
	Total	**83**				**6.7**			**12,020**	**83**				**7**			**9,636**	**2,385**	**0**	**$ 310**	**$ 713**	**$ 120**		
																		Demand Savings		**0.0**	**$0**			
																		kWh Savings		**2,385**	**$310**			
																		Total Savings			**$310**		**2.3**	**1.9**

APPENDIX J

ECM-8 Lighting Replacements with Occupancy Sensors

New Jersey BPU Energy Audit Program

CHA #21794

Borough of Tenafly - Senior Citizen Center

ECM-8 Lighting Replacements with Occupancy Sensors

Cost of Electricity: **$0.130 $/kWh**

$15.39 $/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
33	Vestibule	8	13 W CF 1	CFQ13/1-L	15	0.1	SW	2080	250	8	13 W CF 1	CFQ13/1-L	15	0.1	None	2,080	250	-	0.0	$ -	$ -	$ -		
35	Main Assembly Hall	19	T 32 R F 3 (ELE)	F43ILL/2	90	1.7	SW	1300	2,223	19	T 32 R F 3 (ELE)	F43ILL/2	90	1.7	None	1,300	2,223	-	0.0	$ -	$ -	$ -		
229	Main Assembly Hall (Stage Lighting)	3	WP200 I 1	i200/1	200	0.6	Dimmer SW	260	156	3	WP200 I 1	i200/1	200	0.6	None	260	156	-	0.0	$ -	$ -	$ -		
137	Kitchen	7	SP 50 I	I50/1	50	0.4	SW	2080	728	7	CF 26	CFQ26/1-L	27	0.2	None	2,080	393	335	0.2	$ 73.27	$ 94.50	$ 49	1.3	0.6
78	Kitchen	2	EP I 100	I100/1	100	0.2	SW	2080	416	2	CF 26	CFQ26/1-L	27	0.1	None	2,080	112	304	0.1	$ 66.44	$ 32.40	$ 14	0.5	0.3
11	Activity Room	12	S 34 P F 2 (MAG)	F42EE	72	0.9	SW	2080	1,797	12	C 28 P F 2	F42SSILL	48	0.6	OCC	1,560	899	899	0.3	$ 170.00	$ 1,393.75	$ 200	8.2	7.0
71	Restroom #1	1	I 60	I60/1	60	0.1	SW	780	47	1	CF 26	CFQ26/1-L	27	0.0	None	780	21	26	0.0	$ 9.44	$ 6.75	$ -	0.7	0.7
71	Restroom #2	1	I 60	I60/1	60	0.1	SW	780	47	1	CF 26	CFQ26/1-L	27	0.0	None	780	21	26	0.0	$ 9.44	$ 6.75	$ -	0.7	0.7
71	Janitor's Closet	1	I 60	I60/1	60	0.1	SW	260	16	1	CF 26	CFQ26/1-L	27	0.0	None	260	7	9	0.0	$ 7.21	$ 6.75	$ -	0.9	0.9
137	Hallway	2	SP 50 I	I50/1	50	0.1	SW	1040	104	2	CF 26	CFQ26/1-L	27	0.1	None	1,040	56	48	0.0	$ 14.71	$ 27.00	$ 14	1.8	0.9
6	Front Office	2	T 34 R F 4 (MAG)	F44EE	144	0.3	SW	2080	599	2	T 28 R F 4	F44SSILL	96	0.2	OCC	1,200	230	369	0.1	$ 65.65	$ 381.25	$ 50	5.8	5.0
11	Side Office	2	S 34 P F 2 (MAG)	F42EE	72	0.1	SW	2080	300	2	C 28 P F 2	F42SSILL	48	0.1	OCC	1,200	115	184	0.0	$ 32.83	$ 331.25	$ 50	10.1	8.6
6	Director's Office	4	T 34 R F 4 (MAG)	F44EE	144	0.6	SW	2080	1,198	4	T 28 R F 4	F44SSILL	96	0.4	OCC	1,200	461	737	0.2	$ 131.30	$ 643.75	$ 80	4.9	4.3
71	Restroom #3	1	I 60	I60/1	60	0.1	SW	780	47	1	CF 26	CFQ26/1-L	27	0.0	SW	780	21	26	0.0	$ 9.44	$ 6.75	$ -	0.7	0.7
11	Library	8	S 34 P F 2 (MAG)	F42EE	72	0.6	SW	2080	1,198	8	C 28 P F 2	F42SSILL	48	0.4	OCC	1,040	399	799	0.2	$ 139.29	$ 968.75	$ 140	7.0	5.9
11	Card Room	6	S 34 P F 2 (MAG)	F42EE	72	0.4	SW	2080	899	6	C 28 P F 2	F42SSILL	48	0.3	OCC	1,040	300	599	0.1	$ 104.47	$ 756.25	$ 110	7.2	6.2
78	Exterior Flood Lights	2	EP I 100	I100/1	100	0.2	Photocell	4380	876	2	CF 26	CFQ26/1-L	27	0.1	None	4,380	237	639	0.1	$ 110.10	$ 32.40	$ 14	0.3	0.2
142	Exterior Entry Lights	2	MH 100	MH100/1	128	0.3	Photocell	4380	1,121	2	MH 100	MH100/1	128	0.3	None	4,380	1,121	-	0.0	$ -	$ -	$ -		
	Total	**83**				**6.7**			**12,020**	**83**				**5.1**			**7,022**		**1.6**	**$ 944**	**$ 4,688**	**$ 721**		
																		Demand Savings		**1.6**	**$294**			
																		kWh Savings		**4,998**	**$650**			
																		Total Savings		-	**$944**		**5.0**	**4.2**

APPENDIX K

New Jersey Pay For Performance Incentive Program

NJBPU - Borough of Tenafly
CHA #21794
Building: Senior Center

New Jersey Pay For Performance Incentive Program

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

Total Building Area (Square Feet)	4,750
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)	$6,590	$3,030
Existing Usage (from utility)	29,136	2,620
Proposed Savings	8,640	1,270
Existing Total MMBtus	361	
Proposed Savings MMBtus	156.488	
% Energy Reduction	**43.3%**	
Proposed Annual Savings	$3,800	

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

Note: Only ECMs with a positive ROI were included in the energy and cost totals for this calculation.

	Incentives $		
	Elec	Gas	Total
Incentive #1	$0	$0	$238
Incentive #2	$950	$1,397	$2,347
Incentive #3	$605	$889	$1,494
Total All Incentives	**$1,555**	**$2,286**	**$4,079**

Total Project Cost	$29,500

		Allowable Incentive
% Incentives #1 of Utility Cost*	2.5%	$238
% Incentives #2 of Project Cost**	8.0%	$2,347
% Incentives #3 of Project Cost**	5.1%	$1,494
Total Eligible Incentives***	**$4,079**	
Project Cost w/ Incentives	$25,421	

Project Payback (years)	
w/o Incentives	w/ Incentives
7.8	6.7

* 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 L

Photovoltaic (PV) Rooftop Solar Power Generation

Borough of Tenafly
Senior Center

Cost of Electricity	$0.226	$/kWh
System Capacity	15.0	kW

Photovoltaic (PV) Rooftop Solar Power Generation

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
$120,000	**0.0**	**17,745**	**0**	**$4,000**	**0**	**$4,000**	**$11,250**	**$8,600**	**30.0**	**8.6**

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

*Incentive based on New Jersey renewable energy program for non-residential applications(PV)= $0.75/W of installed PV system

** Estimated Solar Renewable Energy Certificate Program (SREC) SREC for 15 Years= $487/1000kwh

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

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

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:	15.0 kW
DC to AC Derate Factor:	0.770
AC Rating:	11.5 kW
Array Type:	Fixed Tilt
Array Tilt:	40.7°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	22.6 ¢/kWh

Results			
Month	Solar Radiation (kWh/m^2/day)	AC Energy (kWh)	Energy Value ($)
1	3.36	1242	280.69
2	4.05	1341	303.07
3	4.58	1627	367.70
4	4.84	1590	359.34
5	5.30	1751	395.73
6	5.33	1652	373.35
7	5.27	1668	376.97
8	5.25	1651	373.13
9	5.06	1601	361.83
10	4.46	1508	340.81
11	3.15	1076	243.18
12	2.87	1038	234.59
Year	4.46	17745	4010.37

Output Hourly Performance Data * Output Results as Text

About the Hourly Performance Data Saving Text from a Browser

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

Please send questions and comments regarding PVWATTS to Webmaster

Disclaimer and copyright notice

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

Cautions for Interpreting the Results

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

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

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

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

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

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

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

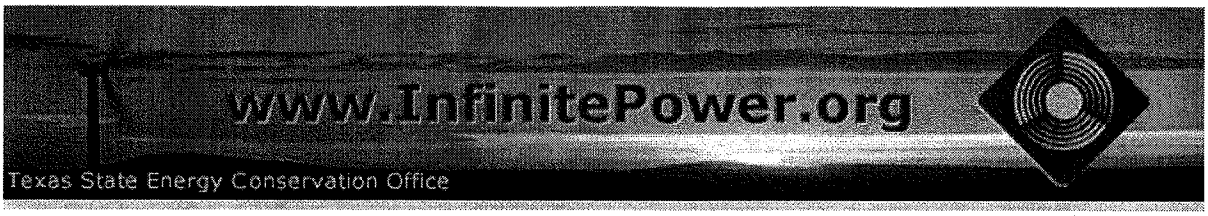
Besides the cost savings shown in the table, other benefits of PV systems include greater energy independence and a reduction in fossil fuel usage and air pollution. For commercial customers, additional cost savings may come from reducing demand charges. Homeowners can often include the cost of the PV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

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

Return to RREDC Home Page (*http://rredc.nrel.gov/*)

APPENDIX M

Solar Thermal Domestic Hot Water Plant



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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.

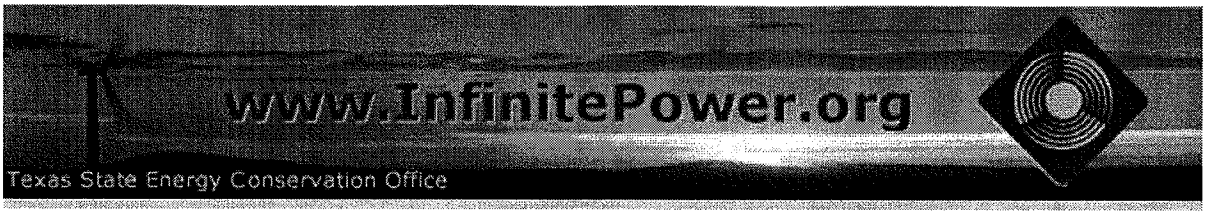
Carbon Pollution Calculator
Electric Power Pollution Calculator
PV System Economics
Solar Water Heating
What's a Watt?

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)	68
? 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		
$ 1.157 /Therm	? Utility Rates	$ 0.226 /kWh
$ 60.6700	? Yearly Water Heating Cost	$ 288.359
How Does Solar Compare?		
? Solar Water Heater Cost: $ 13550		? Percentage Solar: 70
319.056 years for gas	? Payback Time for Solar System	68.3131 years for electric



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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	? Water Inlet Temperature (Degrees F)	50
? Capacity (gallons)	15	? Ambient Temperature (Degrees F)	68
? Surface Area (calculated - sq ft)	9.592	? Hot Water Temperature (Degrees F)	120
? Effective R-value	NaN	? Hot Water Usage (Gallons per Day)	9
Energy Use			
215.5		? 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
269.4 BTU/hr	? Power Into Water Heater	219.9 BTU/hr
Cost		
$ 1.157 /Therm	? Utility Rates	$ 0.226 /kWh
$ 27.3045	? Yearly Water Heating Cost	$ 127.502
How Does Solar Compare?		
? Solar Water Heater Cost: $ 13550		? Percentage Solar: 70
708.934 years for gas	? Payback Time for Solar System	151.817 years for electric

NJBPU Energy Audits
CHA #21794
Borough of Tenafly - Senior Center

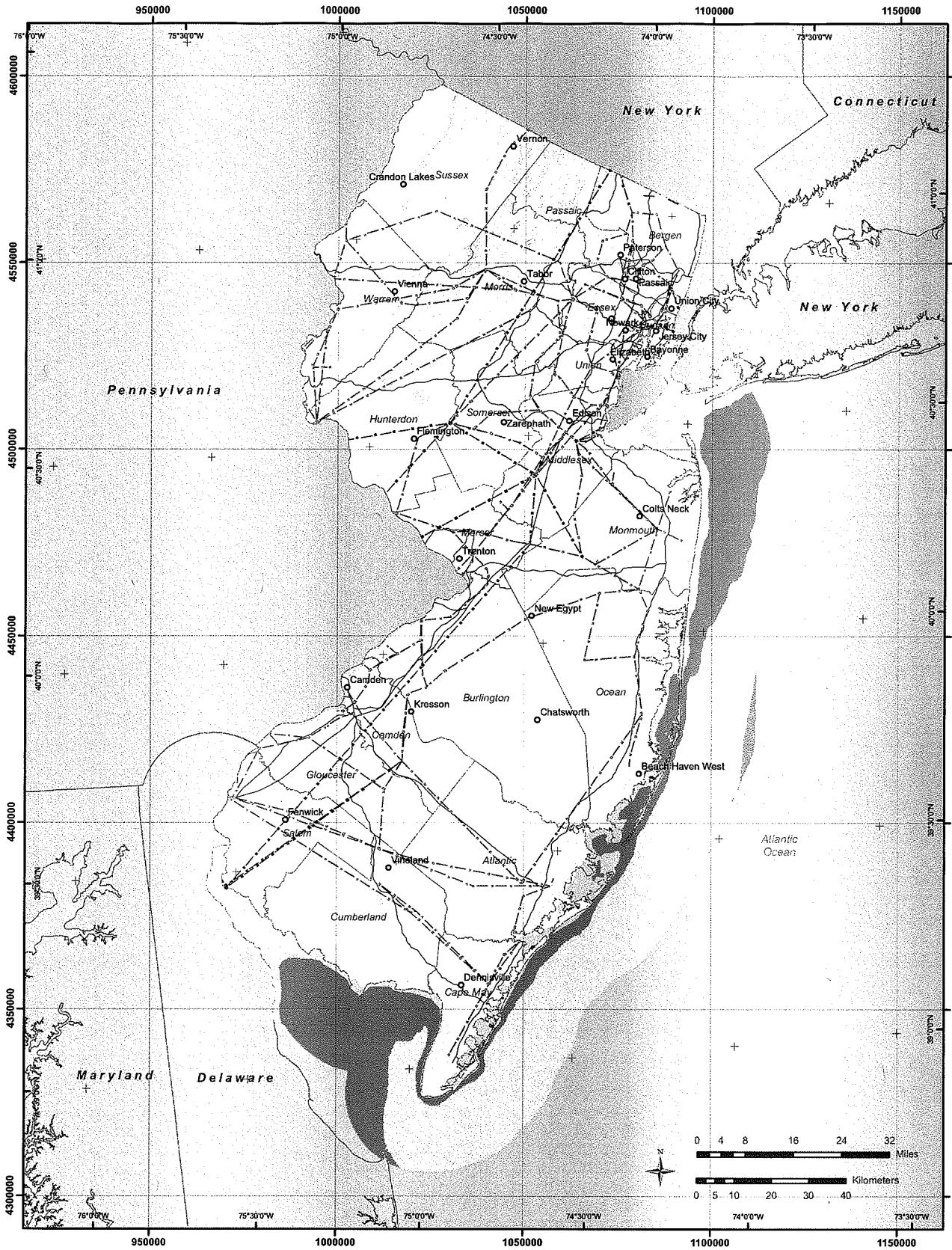
Multipliers	
Material:	0.98
Labor:	1.21
Equipment:	1.09

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 N

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	13.4 - 14.5	6.0 - 6.5
10.1 - 11.2	4.5 - 5.0	14.5 - 15.7	6.5 - 7.0
11.2 - 12.3	5.0 - 5.5	15.7 - 16.8	7.0 - 7.5
12.3 - 13.4	5.5 - 6.0	16.8 - 17.9	7.5 - 8.0
		17.9 - 19.0	8.0 - 8.5
		> 19.0	> 8.5

AWS Truewind

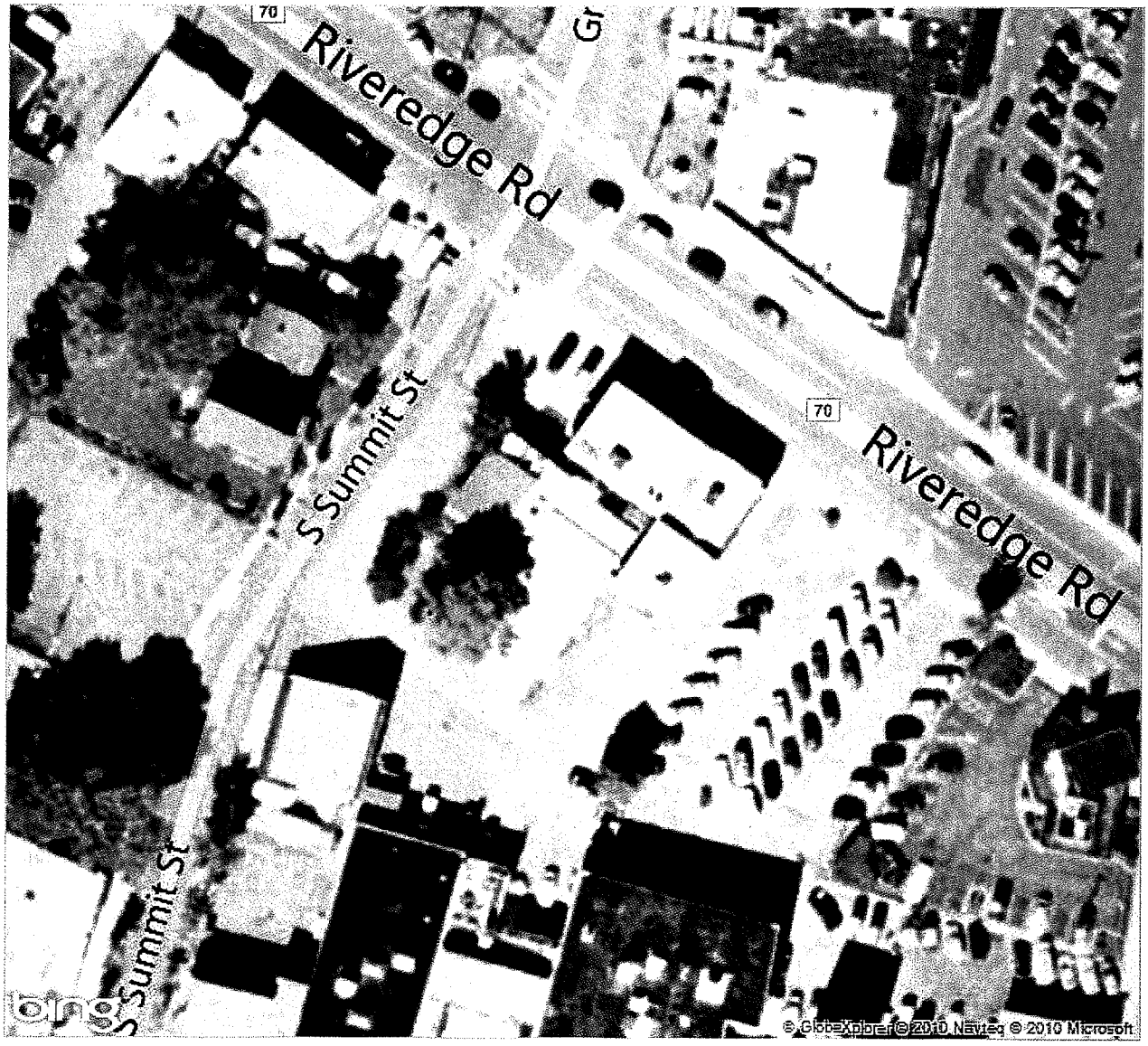
Projection: Tranverse Mercator, UTM Zone 17 WGS84
Spatial Resolution of Wind Resource Data: 200m
This map was created by AWS Truewind using the MesoMap system and historical weather data. Although it is believed to represent an accurate overall picture of the wind energy resource, estimates at any location should be confirmed by measurement.
The transmission line information was obtained by AWS Truewind from the Global Energy Decisions Velocity Suite. AWS does not warrant the accuracy of the transmission line information.

AWS Truewind, LCC

Print

Bing Maps

20 South Summit Street
Tenafly, NJ



APPENDIX O

EPA Portfolio Manager

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Senior Center

Building ID: 2413351
For 12-month Period Ending: December 31, 2009[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: August 19, 2010

Facility
Senior Center
20 South Summit Street
Tenafly, NJ 07670

Facility Owner
Tenafly Department of Public Works
107 Grove Street
Tenafly, NJ 07670

Primary Contact for this Facility
Robert Beutel
107 Grove Street
Tenafly, NJ 07670

Year Built: 1980
Gross Floor Area (ft²): 4,750

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

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	99,412
Natural Gas (kBtu)[4]	262,000
Total Energy (kBtu)	361,412

Energy Intensity[5]

Site (kBtu/ft²/yr)	76
Source (kBtu/ft²/yr)	128

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	29

Electric Distribution Utility
Public Service Elec & Gas Co

National Average Comparison

National Average Site EUI	52
National Average Source EUI	102
% Difference from National Average Source EUI	25%
Building Type	Social/Meeting

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

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

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☑
Building Name	Senior Center	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	Social/Meeting	Is this an accurate description of the space in question?		☐
Location	20 South Summit Street, Tenafly, NJ 07670	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		☐
Senior Center (Other)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	☑
Gross Floor Area	4,750 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	3(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	3(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: Public Service Elec & Gas Co

Fuel Type: Electricity

Meter: PSE&G 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	2,094.00
11/01/2009	11/30/2009	1,980.00
10/01/2009	10/31/2009	1,974.00
09/01/2009	09/30/2009	3,240.00
08/01/2009	08/31/2009	3,126.00
07/01/2009	07/31/2009	3,576.00
06/01/2009	06/30/2009	2,484.00
05/01/2009	05/31/2009	2,472.00
04/01/2009	04/30/2009	2,340.00
03/01/2009	03/31/2009	1,860.00
02/01/2009	02/28/2009	2,160.00
01/01/2009	01/31/2009	1,830.00
PSE&G Electric Consumption (kWh (thousand Watt-hours))		**29,136.00**
PSE&G Electric Consumption (kBtu (thousand Btu))		**99,412.03**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		**99,412.03**
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	368.00
11/01/2009	11/30/2009	234.00
10/01/2009	10/31/2009	63.00
09/01/2009	09/30/2009	21.00
08/01/2009	08/31/2009	28.00
07/01/2009	07/31/2009	30.00
06/01/2009	06/30/2009	44.00
05/01/2009	05/31/2009	106.00
04/01/2009	04/30/2009	314.00
03/01/2009	03/31/2009	458.00

02/01/2009	02/28/2009	627.00
01/01/2009	01/31/2009	327.00
PSE&G Natural Gas Consumption (therms)		**2,620.00**
PSE&G Natural Gas Consumption (kBtu (thousand Btu))		**262,000.00**
Total Natural Gas Consumption (kBtu (thousand Btu))		**262,000.00**
Is this the total Natural Gas consumption at this building including all Natural Gas meters?		☐

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

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

Certifying Professional

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

Name: _____ Date: _____

Signature: _____

Signature is required when applying for the ENERGY STAR.

FOR YOUR RECORDS ONLY. DO NOT SUBMIT TO EPA.

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

Facility
Senior Center
20 South Summit Street
Tenafly, NJ 07670

Facility Owner
Tenafly Department of Public Works
107 Grove Street
Tenafly, NJ 07670

Primary Contact for this Facility
Robert Beutel
107 Grove Street
Tenafly, NJ 07670

General Information

Senior Center	
Gross Floor Area Excluding Parking: (ft²)	4,750
Year Built	1980
For 12-month Evaluation Period Ending Date:	December 31, 2009

Facility Space Use Summary

Senior Center	
Space Type	Other - Social/Meeting
Gross Floor Area(ft²)	4,750
Number of PCs°	3
Weekly operating hours°	40
Workers on Main Shift°	3

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)	76	76	0	N/A	52
Source (kBtu/ft²)	128	128	0	N/A	102
Energy Cost					
$/year	N/A	N/A	N/A	N/A	N/A
$/ft²/year	N/A	N/A	N/A	N/A	N/A
Greenhouse Gas Emissions					
$MtCO_2e$/year	29	29	0	N/A	20
$kgCO_2e/ft^2$/year	6	6	0	N/A	4

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

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

APPENDIX P

Equipment Inventory

New Jersey BPU Energy Audit Program
CHA #21794
Borough of Tenafly - Senior Center

Description	QTY	Manufacturer Name	Model No.	Serial No.	Equipment Type / Utility	Capacity/Size/Efficiency	Location	Areas Served	Date Installed	Remaining Useful Life (years)	Other Info.
Hot Water Boiler	1	Peerless	82-535-H	6050761	Heating / Natural Gas	320,000 Btuh input 256,000 Btuh output	Mech Closet	All	1980	5	Cast-iron sectional; Fair condition
Hot Water Pump	1	Bell & Gossett	-	-	Pump / Electric	1/12 HP; 1725 RPM	Mech Closet	-	-	-	Fair Condition
Hot Water Pump	2	Taco	0010-F3	194-1376	Pump / Electric	1/8 HP; 3250 RPM	Mech Closet	-	-	-	Fair Condition
Wall AC Unit	5	Friedrich	CP24N30	Varies	Cooling / Electric	23,500 Btuh; 8.6 EER	Varies	Varies	2007	7	Excellent condition
Wall AC Unit	2	General Electric	-	-	Cooling / Electric	12,000 Btuh	Offices	Offices	-	-	Fair Condition
Domestic Hot Water Heater	1	Rheem	22V40F1	RHLN090741016	Hot water / Natural Gas	38,000 Btuh; 40 gals	Janitor Closet	Restrooms/Kitchen	2007	11	Excellent condition
Domestic Hot Water Heater	1	Rheem	81VP15S	1100305382	Hot water / Electric	2,000 watts; 15 gals	Closet	Restroom	2000	4	Good condition
Exhaust Fan	3	-	-	-	Exhaust / Electric	-	Restrooms	Restrooms	-	-	All switch operated
Exhaust Fan	1	-	-	-	Exhaust / Electric	-	Mech Closet	Mech Closet	-	-	Switch operated
Exhaust Fan	1	Flo-Aire	BDU 414	-	Exhaust / Electric	-	Roof	Kitchen Hood	-	-	Good condition
Packaged Rooftop Unit	1	Carrier	50DJ006520 Series GA	2490G78786	HVAC / Electric	5 tons cooling	Roof	Activity Room	1990	-5	Poor condition

New Jersey BPU Energy Audit Program
CHA #21794
Borough of Tenafly - Senior Citizen Center
Existing Lighting

Cost of Electricity: **$0.130 $/kWh**
$15.39 $/kW

		EXISTING CONDITIONS									
	Area Description	**No. of Fixtures**	**Standard Fixture Code**	**NYSERDA Fixture Code**	**Watts per Fixture**	**kW/Space**	**Exist Control**	**Annual Hours**	**Retrofit Control**	**Annual kWh**	
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	Retrofit control device	(kW/space) * (Annual Hours)	Notes
33	Vestibule	8	13 W CF 1	CFQ13/1-L	15	0.1	SW	2080	None	250	
35	Main Assembly Hall	19	T 32 R F 3 (ELE)	F43ILL/2	90	1.7	SW	1300	None	2,223	
229	Main Assembly Hall (Stage Lighting)	3	WP200 I 1	i200/1	200	0.6	Dimmer SW	260	None	156	
137	Kitchen	7	SP 50 I	I50/1	50	0.4	SW	2080	None	728	
78	Kitchen	2	EP I 100	I100/1	100	0.2	SW	2080	None	416	
11	Activity Room	12	S 34 P F 2 (MAG)	F42EE	72	0.9	SW	2080	OCC	1,797	
71	Restroom #1	1	I 60	I60/1	60	0.1	SW	780	None	47	Exhaust fan connected to light switch
71	Restroom #2	1	I 60	I60/1	60	0.1	SW	780	None	47	Exhaust fan connected to light switch
71	Janitor's Closet	1	I 60	I60/1	60	0.1	SW	260	None	16	
137	Hallway	2	SP 50 I	I50/1	50	0.1	SW	1040	None	104	
6	Front Office	2	T 34 R F 4 (MAG)	F44EE	144	0.3	SW	2080	OCC	599	
11	Side Office	2	S 34 P F 2 (MAG)	F42EE	72	0.1	SW	2080	OCC	300	
6	Director's Office	4	T 34 R F 4 (MAG)	F44EE	144	0.6	SW	2080	OCC	1,198	
71	Restroom #3	1	I 60	I60/1	60	0.1	SW	780	SW	47	Exhaust fan connected to light switch
11	Library	8	S 34 P F 2 (MAG)	F42EE	72	0.6	SW	2080	OCC	1,198	
11	Card Room	6	S 34 P F 2 (MAG)	F42EE	72	0.4	SW	2080	OCC	899	
78	Exterior Flood Lights	2	EP I 100	I100/1	100	0.2	Photocell	4380	None	876	
142	Exterior Entry Lights	2	MH 100	MH100/1	128	0.3	Photocell	4380	None	1,121	
	Total	**83**				**6.7**				**12,020**	