BOROUGH OF TENAFLY
DEPARTMENT OF PUBLIC WORKS
MAIN BUILDING
ENERGY ASSESSMENT

for

NEW JERSEY
BOARD OF PUBLIC UTILITIES

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TABLE OF CONTENTS

Page

1.0 INTRODUCTION & BACKGROUND.....1

2.0 EXECUTIVE SUMMARY.....2

3.0 EXISTING CONDITIONS.....5
- 3.1 Building General
- 3.2 Utility Usage
- 3.3 HVAC Systems
- 3.4 Lighting/Electrical Systems
- 3.5 Control Systems
- 3.6 Plumbing Systems

4.0 ENERGY CONSERVATION MEASURES.....8
- 4.1 ECM-1 Night Setback
- 4.2 ECM-2 Replace Furnace and Remote Condensing Unit
- 4.3 ECM-3 Replace Packaged Rooftop Unit
- 4.4 ECM-4 Install Infrared Heaters – Repair Shop
- 4.5 ECM-5 Furnace Replacement – Front Garage
- 4.6 ECM-6 Remove Window AC Unit
- 4.7 ECM-7 Increase Wall Insulation
- 4.8 ECM-8 Replace Overhead Doors and Install Seals
- 4.9 ECM-9 Replace Electric Domestic Hot Water Heaters
- 4.10 ECM-10 Install Low-Flow Urinals
- 4.11 ECM-11 Install Low-Flow Flush Valves on Toilets
- 4.12 ECM-12 Lighting Replacements
- 4.13 ECM-13 Install Occupancy Sensors
- 4.14 ECM-14 Lighting Replacements with Occupancy Sensors

5.0 PROJECT INCENTIVES.....18
- 5.1 Incentives Overview
- 5.2 Building Incentives

6.0 ALTERNATIVE ENERGY EVALUATION.....22
- 6.1 Geothermal
- 6.2 Solar
- 6.3 Wind
- 6.4 Combined Heat and Power Generation (CHP)
- 6.5 Biomass Power Generation
- 6.6 Demand Response Curtailment

7.0 EPA PORTFOLIO MANAGER.....27

8.0 CONCLUSIONS & RECOMMENDATIONS.....28

APPENDICES

A		Utility Usage Analysis
B	ECM-1	Night Setback
C	ECM-2	Replace Furnace and Remote Condensing Unit
D	ECM-3	Replace Packaged Rooftop Unit
E	ECM-4	Install Infrared Heaters – Repair Shop
F	ECM-5	Furnace Replacement – Front Garage
G	ECM-6	Remove Window AC Unit
H	ECM-7	Increase Wall Insulation
I	ECM-8	Replace Overhead Doors and Install Seals
J	ECM-9	Replace Electric Domestic Hot Water Heaters
K	ECM-10	Install Low-Flow Urinals
L	ECM-11	Install Low-Flow Flush Valves on Toilets
M	ECM-12	Lighting Replacements
N	ECM-13	Install Occupancy Sensors
O	ECM-14	Lighting Replacements with Occupancy Sensors
P		New Jersey Pay For Performance Incentive Program
Q		Photovoltaic (PV) Rooftop Solar Power Generation
R		Solar Thermal Domestic Hot Water Plant
S		Wind
T		EPA Portfolio Manager
U		Equipment Inventory

1.0 INTRODUCTION AND BACKGROUND

The Borough of Tenafly's main Department of Public Works (DPW) building is a 7,700 square foot structure located at the DPW complex at 107 Grove Street. Overall, the building is comprised of several offices, two locker/breakrooms, large single bay front garage, repair shop, and a three bay storage garage. The sections housing the office and locker/breakroom areas were originally modular structures built in the 1950s and assembled at the DPW site in the 1970s. The DPW complex operates from 7:00 AM to 3:00 PM, Monday through Friday. Extended hours occur during emergencies and for snow plowing. Over 30 employees are in the complex sporadically, and about three persons are in the offices all day.

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

2.0 EXECUTIVE SUMMARY

This report details the results of the Borough of Tenafly main DPW building in Tenafly, NJ. The 7,700 square foot structure is comprised of several offices, two locker/breakrooms, large single bay front garage, repair shop, and a three bay storage garage. The complex is operational from 7:00 AM to 3:00 PM, Monday through Friday, with extended hours during emergencies and snow plowing. The following areas were evaluated for energy conservation measures:

- Night setback
- Furnace/condensing unit replacement
- Infrared heaters
- Window AC unit removal
- Electric domestic hot water replacement
- Lighting replacement with occupancy sensors
- RTU replacement
- Insulation upgrade
- Overhead door replacement
- Restroom fixture upgrades

Various potential Energy Conservation Measures (ECMs) were identified for the above categories. Potential annual savings of $7,400 for the recommended ECMs may be realized with a payback of 4.8 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
700	0	1,990	640	0	1,000	0	1,000	20.2	NA	0.7	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-2 Replace Furnace and Remote Condensing Unit

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
5,900	0	1,770	260	0	600	0	600	0.8	700	9.8	8.7

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

ECM-4 Install Infrared Heaters – Repair Shop

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
9,800	0	2,150	730	0	1,200	0	1,200	1.1	NA	8.2	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.

ECM-5 Furnace Replacement – Front Garage

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
2,700	0	0	350	0	400	0	400	1.6	300	6.8	6.0

* 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.

ECM-6 Remove Window AC Unit

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
200	1.7	630	0	0	200	0	200	NA	NA	1.0	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.

ECM-9 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
7,100	9.0	3,480	(60)	0	1,700	0	1,700	2.0	600	4.2	3.8

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

ECM-14 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
12,100	3.2	14,870	0	0	2,300	0	2,300	1.9	1,700	5.3	4.5

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

- ECM-3 Replace Packaged Rooftop Unit

3.0 EXISTING CONDITIONS

3.1 Building - General

The Borough of Tenafly main DPW building is a 7,700 square foot structure located at the DPW complex. The building consists of several offices, two locker/breakrooms, single bay front garage, repair shop, and a three bay storage garage. The sections housing the office and locker/breakroom areas were originally modular structures built in the 1950s and assembled at the DPW site in the 1970s. The adjacent garage and repair shop areas appear to be more than 50 years' old.

The Tenafly DPW complex is operational from 7:00 AM to 3:00 PM, Monday through Friday, and as required for emergencies and snow plowing. About three employees are in the office full time, and over 30 employees are on site as required.

As previously noted, the office and locker/breakroom areas of the main DPW building consist of several modular structures. In these areas, the walls are constructed of vinyl siding over 1/2" board insulation, plywood sheathing, 4" wood framing with batt insulation, and finished inside with gypsum board or wood paneling. The pitched roof consists of asphalt shingles over felt paper, plywood sheathing, batt insulation, and a drop ceiling with acoustic tiles. The building rests on concrete blocks; therefore, there is a space of about 24" between the floor and the ground which adds additional heating and cooling loads on the building. The sliding windows have vinyl frames and double pane glass; the doors are insulated steel. Some doors are in very poor condition and in need of replacement.

Exterior walls of the garages and repair shop are constructed of 8" concrete masonry unit (CMU) block with no insulation. Walls visible from the road are finished with vinyl siding, the remaining walls are exposed block. The roofs of the front garage and repair shop are both flat with asphalt, metal decking, steel framing, and batt insulation. The roof of the three bay storage garage is pitched with asphalt shingles over felt paper, plywood sheathing, and batt insulation. There are several windows on the front garage and repair shop; each has a metal frame with single pane glass. Overhead doors on the front garage and repair shop are insulated steel; repair shop door requires new seals. The three overhead doors for the storage garage bays are wood with a row of single pane windows. These three doors are not insulated and also need new seals.

In general the building envelope is in fair to poor condition and in need of continuous maintenance.

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). Electricity for the main DPW building is provided by the primary DPW complex account, natural gas has a dedicated meter for the building. Potable water is provided by United Water New Jersey also on a shared account with the DPW complex.

From January 2009 through December 2009, electric usage for the DPW complex was approximately 132,720 kWh at a cost of about $21,900. Analyzing electricity bills during this period showed that the complex was charged at the following rates: supply unit cost of $0.125 per kWh; demand unit cost of $11.87 per kW; and blended unit cost of $0.165 per kWh. Based on building size and equipment, it is estimated that the main DPW building accounts for about 92,720 kWh of the annual electricity consumption through this meter. During the same timeframe, the building heating equipment consumed about 8,720 therms of natural gas. Based on the annual cost of about $9,600, the blended price for natural

gas was $1.099 per therm. Natural gas consumption is highest in the winter months when the building is in heating mode.

Review of potable water utility bills for the 2008 calendar year determined the DPW complex used a total of about 209,000 gallons of water. At a total cost of about $1,100, the unit cost for water was found to be $5.363 per kGal. However, water usage was not delineated for the DPW building. 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 about equal to the state average for electricity and natural gas, it is recommended that a third party supplier not be pursued at this time.

3.3 HVAC Systems

Heating and air conditioning for the office area is provided by a 1976 Singer gas-fired furnace with a remote condensing unit. Located in the mechanical closet, the unit has an input of 125,000 Btuh and thermal efficiency of 76%. The complementary Rheem remote condensing unit is located outside the building on grade and has a cooling capacity of 4 tons. The large locker/breakroom area is served by a small packaged rooftop unit (RTU) with a heating input/output of 50,000/39,000 Btuh and cooling capacity of 2 tons. A 1984, gas-fired Comfort Maker furnace is located in and serves the front single bay garage. This unit has an input of 100,000 Btuh and output of 76,000 Btuh. Heat for the small breakroom and locker room areas is provided by two wall-mounted, gas-fired adjustable heating units. These two spaces are cooled by two window AC units with capacities of 9,500 Btuh and 8,000 Btuh, respectively. Each restroom has an exhaust fan which is operated with the light switch. HVAC equipment is in fair to poor condition, and the majority of the equipment is in need of replacement in the near future.

The repair shop is equipped with three gas-fired unit heaters suspended from the ceiling; each unit is about 80% efficient and outputs range from 100,000 to 136,000 Btuh. This space is also equipped with several filtering and exhaust devices to maintain air quality. These include two air filtration units mounted high in the repair bay, a smaller air filtration unit mounted over the welding area and vehicle emissions exhaust system. There is also a wall-mounted exhaust fan located towards the ceiling which is used to draw hot air out of the space when it becomes overheated.

Each bay of the storage garage is equipped with a unit heater. The first bay utilizes a Modine gas-fired unit with an input of 150,000 Btuh and output of 120,000 Btuh. Garage bay 2 is equipped with a Reznor unit heater that has an input of 170,000 Btuh and output of 136,000 Btuh. The last bay has a small 5 kW Dayton unit heater. Located between the second and third garage bays is a small parts room which uses an old Tadiran Electronics, 12,000 Btuh window AC unit for cooling. One door to this space was open and another is a screen door; therefore, cooling of the space was not being achieved.

3.4 Lighting/Electrical Systems

Most interior lighting fixtures throughout the building utilize inefficient T-12 fluorescent lamps and magnetic ballasts. There are several incandescent screw-type bulbs used in several restrooms and closets. Additionally, the repair garage is equipped with six 400 watt metal halide fixtures. All interior lighting is switch operated.

Exterior lighting for the building consists of several single and dual bulb fixtures with 50 watt floodlamps. There are also two 400 watt metal halide fixtures on the exterior of the repair shop. All exterior lighting is controlled by a photocell and automatically turns off during the daytime.

3.5 Control Systems

The furnace serving the office area is controlled by an older programmable thermostat. At the time of the audit, this unit was programmed to maintain the temperature at 71°F during cooling and 70°F during heating. Temperature control for the packaged RTU serving the large locker/breakroom area is performed by a mechanical dial-type thermostat, which was set to 64°F for cooling and 68°F for heating. The heating only furnace serving the front garage is also controlled by a mechanical dial-type thermostat set to 65°F. Controls for the two wall-mounted heaters and two window AC units in the small locker room and breakroom areas are integral to the units and have no setback capabilities.

Unit heaters in the repair shop are each controlled by a mechanical thermostat. Building personnel indicated that these thermostats are adjusted for comfort in the winter and are often turned up into the mid-70s to overcome heat loss from opening the overhead door. Gas-fired unit heaters in the first two bays of the storage garage are also controlled by mechanical thermostats; the first bay was set to 75°F and the second was set to 58°F. Controls for the small electric unit heater in the third bay are integral to the unit which was off.

3.6 Plumbing Systems

Domestic hot water (DHW) for fixtures in the office area is generated by a 30 gallon, 4,500 watt Rheem electric water heater. This unit was installed in 2007 and is located in a closet. The office area has three single occupant restrooms; two contain a toilet and hand sink, the third also has a shower. DHW for locker room and breakroom areas is produced by a 40 gallon, 4,500 watt A.O. Smith electric hot water heater. There is a single restroom in the small locker room area and a large multi-stall restroom in the large locker/break room area. The large restroom has three toilets, two urinals, a utility sink and center hand washing station. Flush valves on toilets and urinals are older style and not considered water efficient by today's industry standards.

4.0 ENERGY CONSERVATION MEASURES

4.1 ECM-1 Night Setback

Heating and air conditioning equipment serving the office area is controlled by an old programmable thermostat set to maintain the temperature at 71°F during cooling and 70°F during heating modes. Additionally, temperature control for the packaged RTU serving the large locker/break room is performed by a mechanical dial-type thermostat set to 64°F for cooling and 68°F for heating. 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 in both the office and locker/break room areas. In the calculations for this measure, occupied temperature setpoints were maintained per those in use at the time of the energy audit. In addition to the programmable thermostats, 7-day programmable receptacle timers will be utilized to shut down the two window AC units during unoccupied times.

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 office, locker/break room, shop and garage areas all operate at different temperature setpoints and/or occupancy schedules; 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 four 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 office and locker/break room 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, it is expected the building's annual natural gas and electricity consumption will be reduced by approximately 640 therms and 1,990 kWh, respectively.

Programmable thermostats for night setback have an expected life of 15 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 9,600 therms, 29,850 kWh, and $1,500.

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
700	0	1,990	640	0	1,000	0	1,000	20.2	NA	0.7	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 Replace Furnace and Remote Condensing Unit

The furnace which provides HVAC to the office area was installed in 1976 and has a thermal efficiency of about 76%. In addition, the connected remote condensing unit installed in 1983 provides cooling at an energy efficiency ratio (EER) of approximately 8.0. Both units are at the end of their useful lives and should be considered for replacement. By replacing these units with a condensing furnace and high efficiency remote condenser, it will be possible to achieve a thermal efficiency of 95% and an EER of 14.0; saving both heating and cooling energy.

Utilizing the block load building model for the office area created in section 4.1, the savings for this measure were found by adjusting the heating and cooling efficiencies to reflect those of the proposed equipment, and comparing the overall energy requirements to those in the original model. The resulting annual energy reductions attributed to heating and cooling efficiency improvements were approximately 260 therms and 1,770 kWh.

Condensing gas-fired furnaces and remote condensing units have an expected life of 18 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 4,680 therms, 31,860 kWh, and $10,800.

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

ECM-2 Replace Furnace and Remote Condensing Unit

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
5,900	0	1,770	260	0	600	0	600	0.8	700	9.8	8.7

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

This measure is recommended.

4.3 ECM-3 Replace Packaged Rooftop Unit

The large locker/breakroom area is served by a 1988 packaged RTU with a heating thermal efficiency of 78% and a cooling EER of about 8.0. Additionally, the small locker and breakroom areas utilize two 80% efficient adjustable gas-fired heating units and two window AC units which also have an EER of about 8.0. This measure evaluated the heating and cooling energy reduction of removing all existing HVAC

equipment serving the two locker/breakroom areas, and installing a single, larger high efficiency RTU to heat and cool both areas.

Similarly to the process applied in section 4.2, the savings for this measure were found by utilizing the block load building model for the office/locker room areas created in section 4.1 and adjusting the heating and cooling efficiencies to reflect those of the proposed equipment. Comparing the overall energy requirements to heat and cool the space in the existing and proposed models revealed an annual energy reduction of approximately 30 therms and 1,890 kWh, which are attributed to the heating and cooling efficiency improvements

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

RTUs have an expected life of 15 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 450 therms, 28,350 kWh, and $4,500.

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

ECM-3 Replace Packaged Rooftop Unit

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
9,400	0	1,890	30	0	300	0	300	(0.4)	500	>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.

4.4 ECM-4 Install Infrared Heaters – Repair Shop

The repair shop is heated by three 80% efficient gas-fired unit heaters suspended from the ceiling and blowing horizontally across the space. This ECM evaluated replacement of the unit heaters with infrared gas fired heaters. Infrared heaters distribute heat more effectively than traditional unit heaters, have higher burner efficiencies, and do not require an air circulation fan.

The existing heating load for the repair shop was previously determined in section 4.1 by generating a block load spreadsheet. A key input in this model is the effectiveness factor. This value is representative of the amount of heat generated by the equipment which actually contributes to heating the occupied area of the space. Since unit heaters rely on air movement to distribute heat to the space, their effectiveness is directly related to their orientation, air discharge, and other air movement in the space. Taking these factors into account for the shop area, an effectiveness factor of 85% was estimated. The existing block load model determined that the unit heaters require about 3,670 therms of energy per year to meet the heating load in the repair shop.

The proposed infrared heaters have a burner efficiency of 85% and will transfer heat more effectively via radiation. Radiant heating equipment transfer heat to solid objects and do not rely on air movement, therefore this method of heating has an effectiveness of 100%. Using the block load spreadsheet and

applying efficiency improvements, it was determined that the annual heating gas energy required using infrared heaters is about 2,940 therms, providing a savings of 730 therms when compared to the existing unit heaters. Electrical energy savings will also be realized by eliminating the need to operate the air circulation fans utilized by the existing unit heaters. The electrical energy saving was calculated by applying the annual heating operating hours from the bin data spreadsheet to the power requirement for the existing unit heaters. The total annual electrical savings for this ECM is estimated to be 2,150 kWh.

To calculate the budgetary cost, four high intensity 100 MBh infrared heaters were used as outlined in the cost estimate. The quantity, size, and capacity of the heaters were used for estimating purposes only. Exact selection and sizing cannot be completed without generating a heating load profile for the space.

Infrared heaters have an expected life of 18 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 13,140 therms, 38,700 kWh, and $21,600.

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

ECM-4 Install Infrared Heaters – Repair Shop

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
9,800	0	2,150	730	0	1,200	0	1,200	1.1	NA	8.2	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 recommended.

4.5 ECM-5 Furnace Replacement – Front Garage

A 100,000 Btuh input gas-fired furnace is utilized to heat the front garage. Installed in 1984, the furnace has a thermal efficiency of 76%. This unit is at the end of its useful life and should be considered for replacement. By replacing this outdated unit with a condensing furnace, it will be possible to achieve a thermal efficiency of 95%, therefore reducing the amount of natural gas required to heat the space annually.

To calculate the savings for this measure, the baseline annual heating requirement for the space was established by taking the existing furnace's total input (100,000 Btuh) and applying it to the operating hours required to treat the space. Operating hours were calculated by totaling the hours at which the outside air temperature was below 65°F, according to bin weather data for Newark, NJ, and applying a factor to account for unit cycling. With the estimated runtime and known burner efficiency, it was determined that the existing furnace requires about 1,730 therms of natural gas to meet the baseline heating load of 11,497 MBh per year. The proposed furnace has a burner efficiency of 95%. Using the previously determined baseline heating load and applying efficiency improvement, it was found that the annual heating gas energy required using a condensing furnace can be reduced by about 350 therms.

Condensing furnaces have an expected life of 18 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 6,300 therms, totaling $7,200.

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

ECM-5 Furnace Replacement – Front Garage

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
2,700	0	0	350	0	400	0	400	1.6	300	6.8	6.0

* 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 recommended.

4.6 ECM-6 Remove Window AC Unit

The small parts room located between the second and third garage bays is typically unoccupied and uses an old Tadiran Electronics, 12,000 Btuh window AC unit for cooling. During the time of the audit, one door to this space was open and another is a screen door, resulting in no noticeable cooling effect from the AC unit's operation. This measure calculated the energy savings if this AC unit were to be permanently removed.

Due to the age and condition of the window AC unit, it was estimated that it is currently operating at an EER of 7.0 for an average of 48 hours per week when the outdoor air temperature is above 75°F. Using bin weather data for Newark, NJ this equated to an annual runtime of about 368 hours. With this data, it was determined that the window AC unit unnecessarily consumes approximately 630 kWh annually.

This measure does not have a life expectancy because it involves decommissioning existing equipment.

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

ECM-6 Remove Window AC Unit

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
200	1.7	630	0	0	200	0	200	NA	NA	1.0	NA

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

This measure is recommended.

4.7 ECM-7 Increase Wall Insulation

Exterior walls of the garages and repair shop are very old and constructed of 8" CMU block with no insulation. Walls visible from the road are finished with vinyl siding, the remaining walls are exposed. These walls have a very low thermal resistance value (R-value) estimated to be 4.8; which results in excessive heat loss. This ECM addressed installation of an Exterior Insulation Finishing System (EIFS) with 3" expanded polystyrene insulation (R-12). An EIFS is applied over the CMU and would require that

the existing vinyl siding be removed where applicable. The increased R-value would reduce heat transfer through the exterior walls resulting in heating energy savings.

To calculate the savings, the heat losses through the exterior walls were found using the existing walls' R-value and bin weather data for Newark, NJ. The values were then totaled to determine the existing annual heat losses. The heat loss values were then determined with a thermal resistance which included the additional R-12 EIFS. The annual energy savings of installing an EIFS to the exterior block walls of the garage and repair shop areas is expected to be about 1,050 therms.

An EIFS requires professional installation. Some preparatory work may be required for the underlying surface. Along with thermal improvements, an EIFS also offers aesthetic enhancement to a building's exterior.

EIFSs have an expected life of 25 years, according to the manufacturer, and total energy savings over the life of the project are estimated at 26,250 therms and $30,000.

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

ECM-7 Increase Wall Insulation

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
42,100	0	0	1,050	0	1,200	0	1,200	(0.3)	NA	>25	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 not recommended.

4.8 ECM-8 Replace Overhead Doors and Install Seals

The four overhead doors serving the back garage area are constructed of uninsulated wood panels with a row of single pane glass windows. Additionally, due to age and use, the seals around each door have visibly deteriorated and are no longer effective at preventing outside air infiltration into the space. While the overhead door serving the repair shop is constructed of insulated steel, its seals are worn from extensive use. This ECM evaluated replacement of the four overhead doors serving the back garage bays with insulated steel panel doors and new seals; and installing just a new seal on the overhead door for the repair shop. The new overhead doors have a higher insulating value and new seals allow less outdoor air to infiltrate the heated space, saving energy.

U-values represent the amount of heat energy that transfers through one square foot of surface area per hour. Therefore, installing a door with a lower U-value would reduce the amount of heat lost through its surface. A portion of the energy savings for this measure was determined by comparing the existing overhead doors' U-value of 0.50 to the U-value of the proposed overhead doors, which is 0.15. Additional savings will be realized from reduction in air infiltration around the doors. These energy savings were calculated by comparing the existing infiltration rate of 0.3 CFM/LF to the proposed infiltration rate of 0.2 CFM/LF, based on the new door seals. It was found that implementation of this measure offers a combined savings of about 310 therms annually.

Insulated steel doors have an expected life of 30 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 9,300 therms and $9,000.

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

ECM-8 Replace Overhead Doors and Install Seals

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
9,600	0	0	310	0	300	0	300	0.1	NA	>25	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 not recommended.

4.9 ECM-9 Replace Electric Domestic Hot Water Heaters

Domestic hot water for the building is generated by a 30 gallon, 4,500 W and a 40 gallon 4,500 W electric hot water heaters. Due to a moderate demand for hot water in the building, there are extended periods of time with little or no use. However, the units must still heat the water within the storage tanks. Energy required maintaining the hot water temperature setpoint during times of zero demand are known as standby losses. This measure evaluated replacing the existing DHW heaters with tankless, gas-fired, condensing hot water heaters 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 tanks to determine the annual standby losses. Proposed efficiency was based on the Navien CR180 tankless, condensing hot water heater; it was calculated that 3,480 kWh would be saved per year for both water heaters combined. 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 45,240 kWh, (780) therms, and $22,100.

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

ECM-9 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
7,100	9.0	3,480	(60)	0	1,700	0	1,700	2.0	600	4.2	3.8

* 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.

4.10 ECM-10 Install Low-Flow Urinals

There are two urinals within the large employee restroom, each is original and has a flush valve that operates at 1.5 gallons per flush (Gpf). Modern urinal and flush valve combinations can reduce water usage to as low as 1/8 gpf (0.125 Gpf). This measure estimated the annual water savings of installing low-flow urinals and flush valves in place of the three existing units.

Following review of the building's occupancy schedule, it was estimated that the two urinals combined are flushed approximately 30 times per day. Applying the number of flushes to the existing and proposed values for Gpf, it was determined that installing new urinals and flush valves can reduce water consumption by about 15.1 kGals per year.

Urinals and flush valves have an expected life of 15 years, according to the manufacturer, and total savings over the life of the project are estimated at 226 kGals, totaling $1,500.

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

ECM-10 Install Low-Flow Urinals

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
1,700	0	0	0	15.1	100	0	100	(0.3)	NA	17.0	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 not recommended.

4.11 ECM-11 Install Low-Flow Flush Valves on Toilets

The large restroom is equipped with three toilets each utilizing flush valves that consume water at a rate of 3.5 Gpf. Replacing the old flush valves on the three toilets with modern units which use 1.28 gpf will conserve domestic water.

Using the same method as in section 4.10, the building's occupancy schedule was used to estimate that all three toilets combined are flushed approximately 15 times per day. Applying the number of flushes to the existing and proposed values for Gpf, it was found that installing new flush valves on the toilets can reduce water consumption by about 12.2 kGals per year.

Flush valves have an expected life of 15 years, according to the manufacturer, and total savings over the life of the project are estimated at 183 kGals, totaling $1,500.

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

ECM-11 Install Low-Flow Flush Valves on Toilets

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
1,300	0	0	0	12.2	100	0	100	(0.3)	NA	13.0	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 not recommended.

4.12 ECM-12 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. Most lighting fixtures use T-12 fluorescent lamps, incandescent screw type bulbs, and 400 watt metal halide high bay fixtures, all of which are considered inefficient by today's standards. 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 9,070 kWh per year. Supporting calculations, including assumptions for lighting hours and annual energy usage for each fixture, are provided in Appendix M.

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 lightbulbs. High bay metal halide fixtures would be removed and replaced with fluorescent circlite style fixtures.

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 136,050 kWh and $24,000.

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

ECM-12 Lighting Replacements

Budgetary Cost	Annual Utility Savings					Estimated Maintenance Savings	Total Savings	ROI	Potential Incentive*	Payback (without Incentive)	Payback (with Incentive)
	Electricity		Natural Gas	Water	Total						
$	kW	kWh	Therms	kGals	$	$	$		$	Years	Years
10,700	3.2	9,070	0	0	1,600	0	1,600	1.2	1,500	6.7	5.8

* 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-14.

4.13 ECM-13 Install Occupancy Sensors

Review of the comprehensive lighting survey determined that lighting in several areas such as the breakroom and locker room areas, offices, and storage garages is 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 other spaces are also not occupied throughout the day, due to safety concerns, occupancy sensors were not considered in the repair shop, mechanical spaces, and paths of egress.

Using a process similar to that utilized in section 4.12, 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 6,330 kWh per year. Six wall-mounted occupancy sensors, four remote 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 94,950 kWh and $15,000.

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

ECM-13 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
1,400	0	6,330	0	0	1,000	0	1,000	10.0	200	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-14.

4.14 ECM-14 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 12 and 13 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 223,050 kWh and $34,500.

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

ECM-14 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
12,100	3.2	14,870	0	0	2,300	0	2,300	1.9	1,700	5.3	4.5

* 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 200 kW/month average minimum has been waived for buildings owned by local governments or municipalities and non-profit organizations. Facilities that meet this criterion must also achieve a minimum performance target of 15% energy reduction by using the EPA Portfolio Manager benchmarking tool before and after implementation of the measure(s). If the participant is a municipal electric company customer, and a customer of a regulated gas New Jersey Utility, only gas measures will be eligible under the Program. American Recovery and Reinvestment Act (ARRA) funding, when available, may allow oil, propane and municipal electric customers to be eligible for the P4P Program. Available incentives are as follows:

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

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

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

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

5.1.2 New Jersey Smart Start Program

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

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

5.1.3 Energy Efficient and Conservation Block Grant

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

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

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

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

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

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

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

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

Funding for this program is dispersed on a first come, first serve basis until all funds are exhausted. The program does not limit the municipality to a minimum or maximum incentive, and the availability of funding cannot be determined prior to application. If the municipality meets all qualifications, the application must be submitted to TRC Energy Solutions for review. TRC will then determine the amount

of the incentive based on projected energy savings of the project. It is important to note that all applications for this incentive must be submitted before implementation of energy conservation measures.

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

5.1.5 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 7,700 square foot building is eligible for about $400 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 $10,400, reducing the total project payback from 11.0 years to 9.8 years. See Appendix P for calculations.

5.2.2 New Jersey Smart Start Program

The Borough of Tenafly main DPW building is eligible for several incentives available under New Jersey Smart Start Programs. The total amount of all qualified incentives is about $3,800 and includes installing new HVAC equipment, a gas-fired tankless DHW heater and upgrades to the lighting systems.

5.2.3 Energy Efficient and Conservation Block Grant

The main DPW building 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 main DPW building 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 $39,900. This program would pay 60%, or about $23,900 of these initial costs. This funding has the potential to significantly affect the payback periods of Energy Conservation Measures. For the main DPW building, the Direct Install Program brings the simple payback from about 11.0 years, to approximately 8.5 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 gas-fired heating equipment, direct expansion cooling and window AC units to meet the HVAC requirements. This existing equipment is not compatible with a geothermal energy source. Therefore, to take advantage of a GHP system, the existing mechanical equipment would have to be completely removed and a low temperature closed loop water source heat pump system would have to be installed to realize the benefit of the consistent temperature of the ground.

This measure is not recommended 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 Q.

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 DPW vehicle storage garage had an estimated maximum electricity demand of about 40 kW. The existing load justifies the use of the maximum incentive cap of 30 kW of installed PV solar array. 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 Q and summarized as follows:

Photovoltaic (PV) Rooftop Solar Power Generation – 30 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
240,000	0	35,490	0	5,900	5,900	22,500	17,300	>25	9.4

*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 electric water heaters and, therefore, this measure would offer 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 R 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	2,190	0	400	400	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 DPW building, 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 S.

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

6.4 Combined Heat and Power Generation (CHP)

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

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

This measure is not recommended.

6.5 Biomass Power Generation

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

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

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

The NJDEP evaluates biomass resources not identified in the RPS.

Examples of eligible facilities for a CORE incentive include:

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

* from NJOCE Website

This measure is not recommended due to initial cost. 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 DPW building had an estimated maximum electricity demand of 40 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 main DPW building is considered a high energy consumer per the Portfolio Manager with a Site Energy Usage Index (EUI) of 172 kBTU/ft^2/year. The EUI can be improved by addressing wasted energy from lack of HVAC controls, electric water heating, inefficient HVAC and lighting systems, etc. By implementing the measures discussed in this report, it is expected that the EUI can be reduced to approximately 122 kBTU/ft^2/year. The EPA Portfolio Manager did not generate an energy rating score for this building because more than 50% of the building type is not eligible for an energy star rating.

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

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's main Department of Public Works building in Tenafly, New Jersey identified potential ECMs for night setback, furnace/condensing unit replacement, infrared heaters, window ac unit removal, electric domestic hot water replacement, and lighting replacement with occupancy sensors. Potential annual savings of $7,400 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
700	0	1,990	640	0	1,000	0	1,000	20.2	NA	0.7	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-2 Replace Furnace and Remote Condensing Unit

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
5,900	0	1,770	260	0	600	0	600	0.8	700	9.8	8.7

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

ECM-4 Install Infrared Heaters – Repair Shop

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
9,800	0	2,150	730	0	1,200	0	1,200	1.1	NA	8.2	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.

ECM-5 Furnace Replacement – Front Garage

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
2,700	0	0	350	0	400	0	400	1.6	300	6.8	6.0

* 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.

ECM-6 Remove Window AC Unit

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
200	1.7	630	0	0	200	0	200	NA	NA	1.0	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-9 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
7,100	9.0	3,480	(60)	0	1,700	0	1,700	2.0	600	4.2	3.8

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

ECM-14 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
12,100	3.2	14,870	0	0	2,300	0	2,300	1.9	1,700	5.3	4.5

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

- ECM-3 Replace Packaged Rooftop Unit

APPENDIX A

Utility Usage Analysis

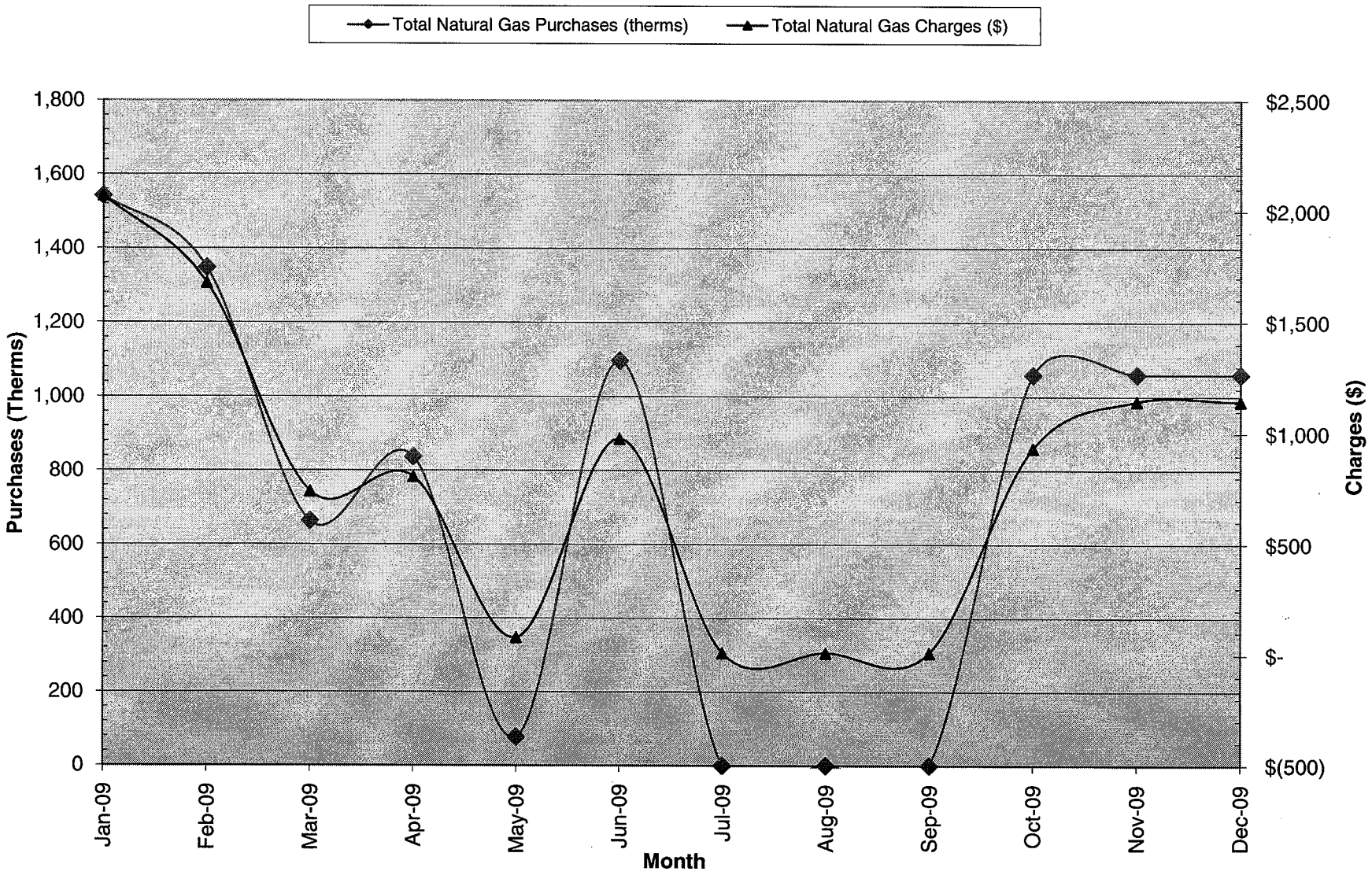
New Jersey BPU Energy Audit Program
CHA Project No.: 21794
Borough of Tenafly
PSE&G - Natural Gas Service

DPW Complex
Account No.: **41 471 136 05**
Meter No.: **2732994**

Month	Therms	Charges ($)	($/Therm)
January-09	1,542	$ 2,069.86	$ 1.343
February-09	1,348	$ 1,677.37	$ 1.245
March-09	663	$ 740.05	$ 1.116
April-09	838	$ 805.46	$ 0.962
May-09	77	$ 78.88	$ 1.023
June-09	1,097	$ 977.13	$ 0.891
July-09	0	$ 10.12	$ -
August-09	0	$ 10.12	$ -
September-09	0	$ 10.12	$ -
October-09	1,058	$ 934.59	$ 0.883
November-09	1,059	$ 1,145.13	$ 1.081
December-09	1,059	$ 1,145.13	$ 1.081

Total	8,740	$ 9,603.96	$ 1.099

Natural Gas Usage - Borough of Tenafly DPW Complex



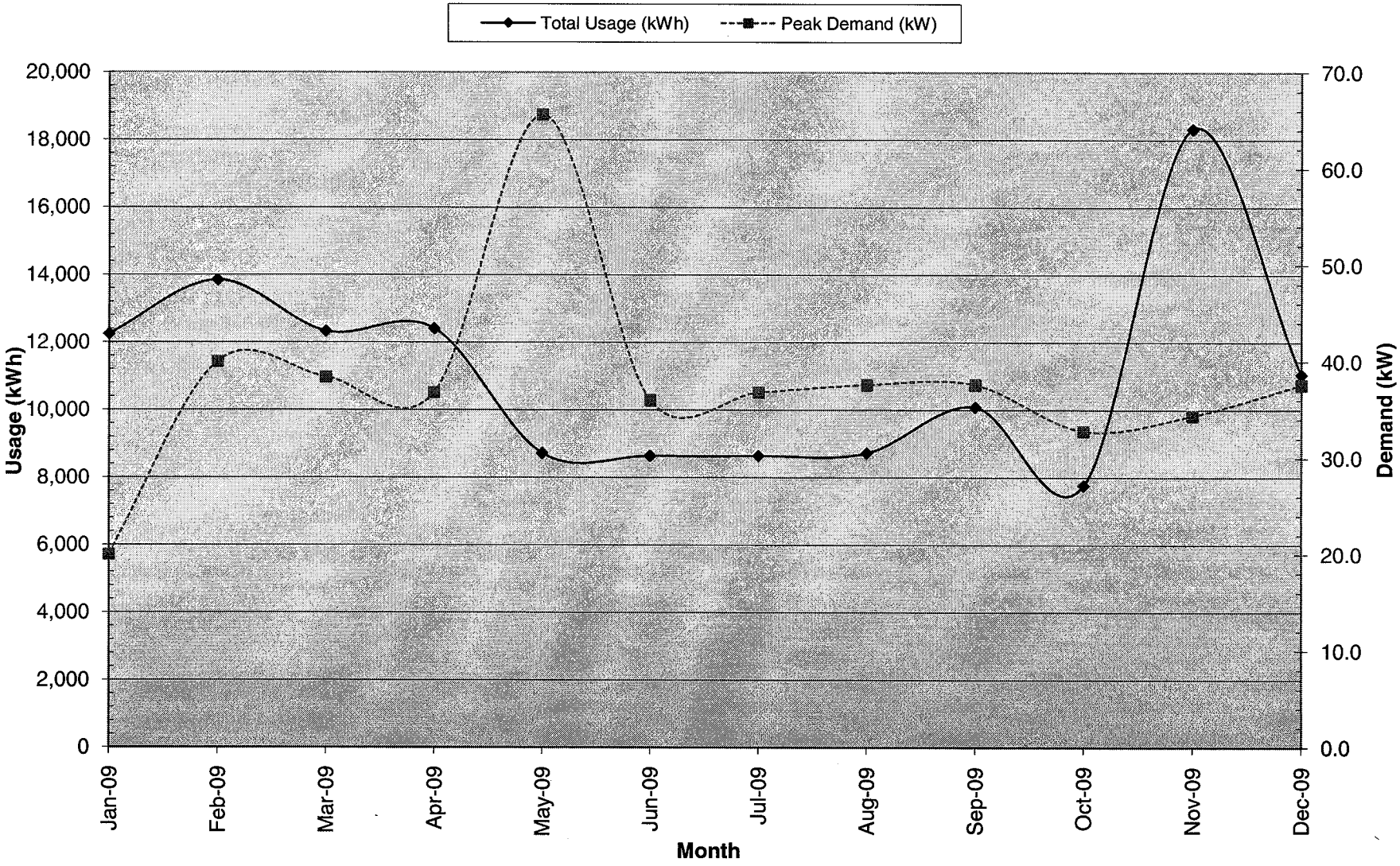
Utility Data - Tenafly.xls
DPW-Natural Gas Chart

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

DPW Complex
Account No.: **41 471 136 05**
Meter No.: **728012070**

			Charges			Unit Costs		
Month	Consumption (kWh)	Demand (kW)	Total ($)	Demand ($)	Consumption ($)	Blended Rate ($/kWh)	Consumption ($/kWh)	Demand ($/kW)
January-09	12,240	20.0	$1,646.81	$254.06	$1,392.75	$ 0.135	$ 0.114	$ 12.70
February-09	13,840	40.0	$1,966.20	$333.04	$1,633.16	$ 0.142	$ 0.118	$ 8.33
March-09	12,320	38.4	$1,823.02	$326.81	$1,496.21	$ 0.148	$ 0.121	$ 8.51
April-09	12,400	36.8	$1,781.85	$320.58	$1,461.27	$ 0.144	$ 0.118	$ 8.71
May-09	8,720	65.6	$1,324.53	$305.38	$1,019.15	$ 0.152	$ 0.117	$ 4.66
June-09	8,640	36.0	$1,727.76	$593.47	$1,134.29	$ 0.200	$ 0.131	$ 16.49
July-09	8,640	36.8	$1,862.18	$618.20	$1,243.98	$ 0.216	$ 0.144	$ 16.80
August-09	8,720	37.6	$1,894.56	$627.16	$1,267.40	$ 0.217	$ 0.145	$ 16.68
September-09	10,080	37.6	$2,072.95	$627.76	$1,445.19	$ 0.206	$ 0.143	$ 16.70
October-09	7,760	32.8	$1,316.09	$337.30	$978.79	$ 0.170	$ 0.126	$ 10.28
November-09	18,320	34.4	$2,889.87	$682.05	$2,207.82	$ 0.158	$ 0.121	$ 19.83
December-09	11,040	37.6	$1,642.06	$357.30	$1,284.76	$ 0.149	$ 0.116	$ 9.50
Total	132,720	65.6	$21,947.88	$5,383.11	$16,564.77	$ 0.165	$ 0.125	$ 11.87

Electric Usage - Borough of Tenafly DPW Complex



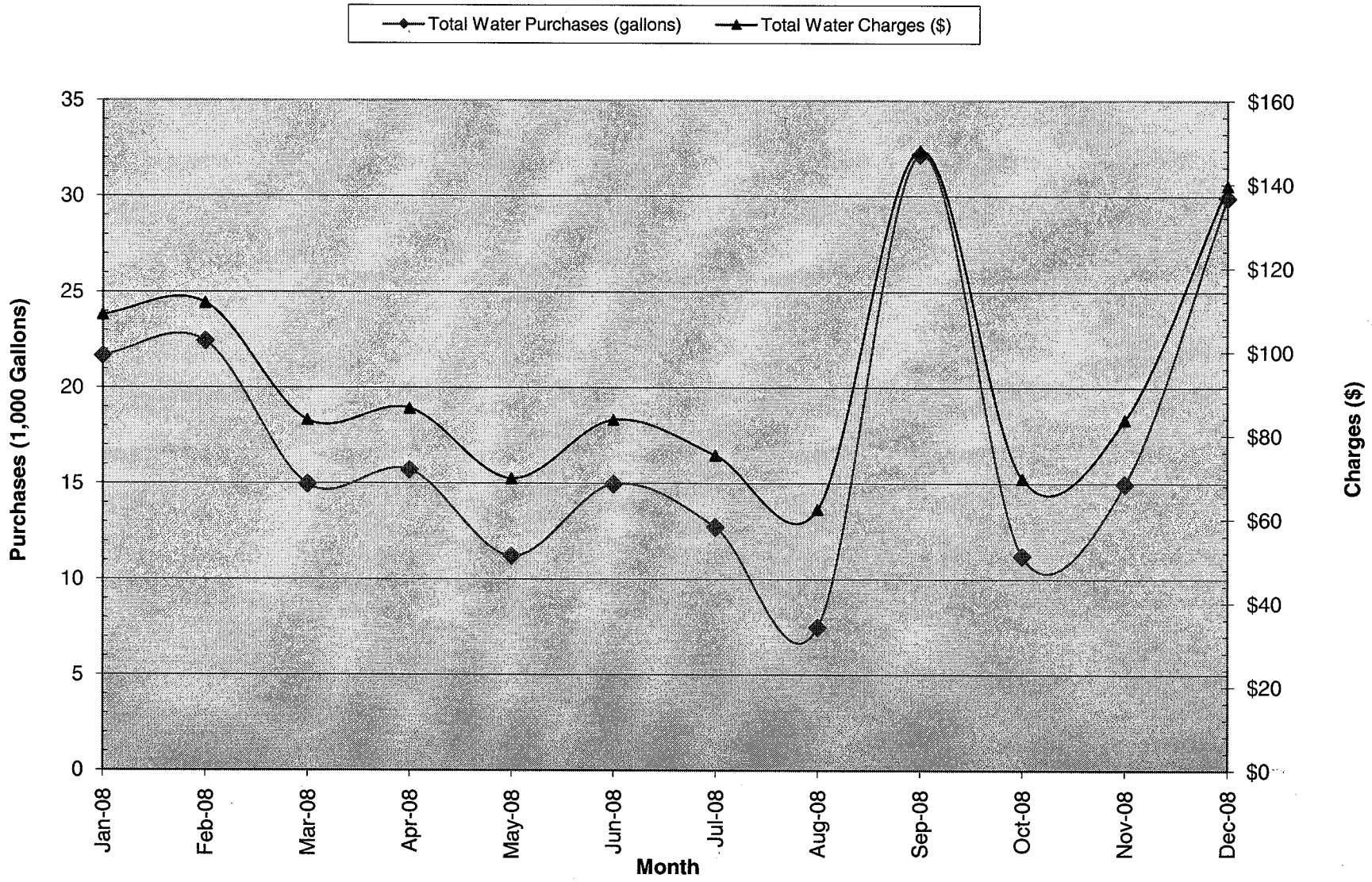
Utility Data - Tenafly.xls
DPW-Electricity Chart

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

DPW Building
Account No.: 102586
Meter Nos.: 88427548, 88224051

Month	Usage (CCF)	Usage (kgals)	Charges ($)	Rate ($/kgal)
January-08	29	22	$108.90	$ 5.020
February-08	30	22	$111.70	$ 4.978
March-08	20	15	$83.72	$ 5.596
April-08	21	16	$86.52	$ 5.508
May-08	15	11	$69.73	$ 6.215
June-08	20	15	$83.72	$ 5.596
July-08	17	13	$75.33	$ 5.924
August-08	10	7	$62.39	$ 8.341
September-08	43	32	148.07	$ 4.604
October-08	15	11	$69.73	$ 6.215
November-08	20	15	$83.72	$ 5.596
December-08	40	30	$139.68	$ 4.668
Total	280	209	$1,123.21	$ 5.363

Water Usage - Borough of Tenafly - DPW Complex



Utility Data - Tenafly.xls
DPW - 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

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

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

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

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

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

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

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

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

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

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

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

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

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

RPL Holdings, Inc
601 Carlson Pkwy
Minnetonka, MN 55305

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

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

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

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

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

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

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: Main DPW Building

ECM-1 Night Setback **Office Area**

Building Footprint	1,720 SF	Ex Occupied Clng Temp.	71 °F	Ex Occupied Htg Temp.	70 °F	**Heating Energy Savings**	332 therms		
Heating Efficiency	80%	Ex Unoccupied Clng Temp.	71 °F	Ex Unoccupied Htg Temp.	70 °F	**Cooling Energy Savings**	358 kWh		
Cooling Efficiency	1.5 kW/ton	Prop Occupied Clng Temp.	71 °F	Prop Occupied Htg Temp.	70 °F				
Building Balance Temp.	60 °F	Prop Unoccupied Clng Temp.	80 °F	Prop Unoccupied Htg Temp.	60 °F				
Internal Gains	10,366 btu/h	Occupied Cooling UA	678 btu/hr/°F	Occupied Heating UA	496 btu/hr/°F				
Unoc Internal Gain factor	0.00	Unoccupied Cooling UA	678 btu/hr/°F	Unoccupied Heating UA	496 btu/hr/°F				
Ave Occ Internal Gain Factor	0.7	Cooling Occ Enthalpy Setpoint	28.8 Btu/lb						
		Cooling Unocc Enthalpy Setpoint	28.8 Btu/lb						

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

					EXISTING LOADS						PROPOSED LOADS									
					Occupied			Unoccupied			Occupied			Unoccupied						
Avg Outdoor Air Temp. Bins °F	Avg Outdoor Air Enthalpy	Existing Equipment Bin Hours	Occupied Equipment Bin Hours	Unoccupied Equipment Bin Hours	Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Unoccupied Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Unoccupied Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Existing Cooling Energy kWh	Proposed Cooling Energy kWh	Existing Heating Energy therms	Proposed Heating Energy therms
A		B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	K	L	M	N
102.5	49.1	0	0	0	-30,820	-29,241	-13,556	-21,188	-29,241	-581	-30,820	-29,241	-13,556	-15,134	-29,241	-581	0	0	0	0
97.5	42.5	3	1	2	-25,928	-19,827	-13,556	-17,825	-19,827	-581	-25,928	-19,827	-13,556	-11,771	-19,827	-581	17	15	0	0
92.5	39.5	34	10	24	-21,036	-15,548	-13,556	-14,462	-15,548	-581	-21,036	-15,548	-13,556	-8,408	-15,548	-581	154	135	0	0
87.5	36.6	131	37	94	-16,144	-11,411	-13,556	-11,098	-11,411	-581	-16,144	-11,411	-13,556	-5,045	-11,411	-581	462	392	0	0
82.5	34	500	143	357	-11,252	-7,703	-13,556	-7,735	-7,703	-581	-11,252	-7,703	-13,556	-1,682	-7,703	-581	1,296	1,025	0	0
77.5	31.6	620	177	443	-6,360	-4,279	-13,556	-4,372	-4,279	-581	-6,360	-4,279	-13,556	0	0	-581	1,047	568	0	0
72.5	29.2	664	190	474	-1,468	-856	-13,556	-1,009	-856	-581	-1,468	-856	-13,556	0	0	-581	522	411	0	0
67.5	27	854	244	610	1,241	856	-13,556	1,241	856	-581	1,241	856	-13,556	0	0	-581	350	394	0	0
62.5	24.5	927	265	662	3,723	2,568	-13,556	3,723	2,568	-581	3,723	2,568	-13,556	0	0	-581	241	289	0	0
57.5	21.4	600	171	429	6,205	4,279	-13,556	6,205	4,279	-581	6,205	4,279	-13,556	1,241	856	-581	66	66	0	0
52.5	18.7	610	174	436	8,687	5,991	-13,556	8,687	5,991	-581	8,687	5,991	-13,556	3,723	2,568	-581	0	0	79	34
47.5	16.2	611	175	436	11,169	7,703	-13,556	11,169	7,703	-581	11,169	7,703	-13,556	6,205	4,279	-581	0	0	111	66
42.5	14.4	656	187	469	13,651	9,414	-13,556	13,651	9,414	-581	13,651	9,414	-13,556	8,687	5,991	-581	0	0	154	105
37.5	12.6	1,023	292	731	16,133	11,126	-13,556	16,133	11,126	-581	16,133	11,126	-13,556	11,169	7,703	-581	0	0	294	217
32.5	10.7	734	210	524	18,615	12,838	-13,556	18,615	12,838	-581	18,615	12,838	-13,556	13,651	9,414	-581	0	0	249	194
27.5	8.6	334	95	239	21,097	14,549	-13,556	21,097	14,549	-581	21,097	14,549	-13,556	16,133	11,126	-581	0	0	131	106
22.5	6.8	252	72	180	23,579	16,261	-13,556	23,579	16,261	-581	23,579	16,261	-13,556	18,615	12,838	-581	0	0	112	93
17.5	5.5	125	36	89	26,061	17,973	-13,556	26,061	17,973	-581	26,061	17,973	-13,556	21,097	14,549	-581	0	0	62	53
12.5	4.1	47	13	34	28,543	19,684	-13,556	28,543	19,684	-581	28,543	19,684	-13,556	23,579	16,261	-581	0	0	26	22
7.5	2.6	22	6	16	31,025	21,396	-13,556	31,025	21,396	-581	31,025	21,396	-13,556	26,061	17,973	-581	0	0	13	12
2.5	1	13	4	9	33,507	23,108	-13,556	33,507	23,108	-581	33,507	23,108	-13,556	28,543	19,684	-581	0	0	9	8
-2.5	0	0	0	0	35,989	24,820	-13,556	35,989	24,820	-581	35,989	24,820	-13,556	31,025	21,396	-581	0	0	0	0
-7.5	-1.5	0	0	0	38,471	26,531	-13,556	38,471	26,531	-581	38,471	26,531	-13,556	33,507	23,108	-581	0	0	0	0
TOTALS		8,760	2,503	6,257													4,153	3,295	1,240	909

Existing Building Ventilation & Infiltration (occ) 317 cfm
Overheat Ventilation Factor 1.00
Additional ventilation to offset overheat 0 cfm
Existing Building Ventilation & Infiltration (unocc) 317 cfm

NJBPU - Borough of Tenafly
CHA #21794
Building: Main DPW Building

ECM-1 Night Setback **Break Room/Locker Room Areas**

Building Footprint	1,130	SF	Ex Occupied Clng Temp.	66	°F	Ex Occupied Htg Temp.	68	°F	**Heating Energy Savings**	308	therms
Heating Efficiency	80%		Ex Unoccupied Clng Temp.	84	°F	Ex Unoccupied Htg Temp.	60	°F	**Cooling Energy Savings**	-1,436	kWh
Cooling Efficiency	1.5	kW/ton	Prop Occupied Clng Temp.	84	°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	10,786	btu/h	Occupied Cooling UA	337	btu/hr/°F	Occupied Heating UA	399	btu/hr/°F			
Unoc Internal Gain factor	0.03		Unoccupied Cooling UA	328	btu/hr/°F	Unoccupied Heating UA	399	btu/hr/°F			
Ave Occ Internal Gain Factor	0.7		Cooling Occ Enthalpy Setpoint	28.6	Btu/lb						
			Cooling Unocc Enthalpy Setpoint	28.6	Btu/lb						

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

					EXISTING LOADS						PROPOSED LOADS									
					Occupied			Unoccupied			Occupied			Unoccupied						
Avg Outdoor Air Temp. Bins °F	Avg Outdoor Air Enthalpy	Existing Equipment Bin Hours	Occupied Equipment Bin Hours	Unoccupied Equipment Bin Hours	Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Unoccupied Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Unoccupied Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Existing Cooling Energy kWh	Proposed Cooling Energy kWh	Existing Heating Energy therms	Proposed Heating Energy therms
A		B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	K	L	M	N
102.5	49.1	0	0	0	-15,294	-46,886	-7,550	-12,626	-46,886	-324	-15,294	-46,886	-7,550	-7,379	-46,886	-324	0	0	0	0
97.5	42.5	3	1	2	-13,307	-31,791	-7,550	-10,987	-31,791	-324	-13,307	-31,791	-7,550	-5,739	-31,791	-324	17	16	0	0
92.5	39.5	34	10	24	-11,321	-24,930	-7,550	-9,347	-24,930	-324	-11,321	-24,930	-7,550	-4,100	-24,930	-324	158	142	0	0
87.5	36.6	131	37	94	-9,335	-18,297	-7,550	-7,707	-18,297	-324	-9,335	-18,297	-7,550	-2,460	-18,297	-324	473	411	0	0
82.5	34	500	143	357	-7,349	-12,350	-7,550	-6,067	-12,350	-324	-7,349	-12,350	-7,550	-820	-12,350	-324	1,323	1,089	0	0
77.5	31.6	620	177	443	-5,363	-6,861	-7,550	-4,427	-6,861	-324	-5,363	-6,861	-7,550	0	0	-324	1,081	456	0	0
72.5	29.2	664	190	474	-3,377	-1,372	-7,550	-2,788	-1,372	-324	-3,377	-1,372	-7,550	0	0	-324	557	311	0	0
67.5	27	854	244	610	-1,390	3,659	-7,550	-1,148	3,659	-324	-1,390	3,659	-7,550	0	0	-324	161	186	0	0
62.5	24.5	927	265	662	1,698	3,019	-7,550	1,698	3,019	-324	1,698	3,019	-7,550	0	0	-324	94	121	0	0
57.5	21.4	600	171	429	3,242	5,764	-7,550	3,242	5,764	-324	3,242	5,764	-7,550	772	1,372	-324	0	0	50	13
52.5	18.7	610	174	436	4,786	8,508	-7,550	4,786	8,508	-324	4,786	8,508	-7,550	2,316	4,117	-324	0	0	83	46
47.5	16.2	611	175	436	6,330	11,253	-7,550	6,330	11,253	-324	6,330	11,253	-7,550	3,860	6,861	-324	0	0	116	79
42.5	14.4	656	187	469	7,874	13,997	-7,550	7,874	13,997	-324	7,874	13,997	-7,550	5,403	9,606	-324	0	0	160	120
37.5	12.6	1,023	292	731	9,418	16,742	-7,550	9,418	16,742	-324	9,418	16,742	-7,550	6,947	12,350	-324	0	0	304	241
32.5	10.7	734	210	524	10,961	19,486	-7,550	10,961	19,486	-324	10,961	19,486	-7,550	8,491	15,095	-324	0	0	257	212
27.5	8.6	334	95	239	12,505	22,231	-7,550	12,505	22,231	-324	12,505	22,231	-7,550	10,035	17,840	-324	0	0	135	115
22.5	6.8	252	72	180	14,049	24,975	-7,550	14,049	24,975	-324	14,049	24,975	-7,550	11,579	20,584	-324	0	0	115	100
17.5	5.5	125	36	89	15,593	27,720	-7,550	15,593	27,720	-324	15,593	27,720	-7,550	13,123	23,329	-324	0	0	64	56
12.5	4.1	47	13	34	17,137	30,465	-7,550	17,137	30,465	-324	17,137	30,465	-7,550	14,667	26,073	-324	0	0	27	24
7.5	2.6	22	6	16	18,681	33,209	-7,550	18,681	33,209	-324	18,681	33,209	-7,550	16,210	28,818	-324	0	0	14	12
2.5	1	13	4	9	20,225	35,954	-7,550	20,225	35,954	-324	20,225	35,954	-7,550	17,754	31,562	-324	0	0	9	8
-2.5	0	0	0	0	21,768	38,698	-7,550	21,768	38,698	-324	21,768	38,698	-7,550	19,298	34,307	-324	0	0	0	0
-7.5	-1.5	0	0	0	23,312	41,443	-7,550	23,312	41,443	-324	23,312	41,443	-7,550	20,842	37,051	-324	0	0	0	0
TOTALS		8,760	2,503	6,257													3,864	2,731	1,333	1,025

Existing Building Ventilation & Infiltration (occ) 508 cfm
Overheat Ventilation Factor 1.00
Additional ventilation to offset overheat 0 cfm
Existing Building Ventilation & Infiltration (unocc) 508 cfm

NJBPU - Borough of Tenafly
CHA #21794
Building: Main DPW Building

Reconcile Thermal Model **Office Area**

Building Footprint	1,790 SF	Ex Occupied Clng Temp.	71 °F	Ex Occupied Htg Temp.	70 °F		
Heating Efficiency	76%	Ex Unoccupied Clng Temp.	71 °F	Ex Unoccupied Htg Temp.	70 °F		
Cooling Efficiency	1.60 kW/ton	Occupied Cooling UA	(978) btu/hr/°F	Occupied Heating UA	496 btu/hr/°F		
Internal Gains	19,366 btu/h	Unoccupied Cooling UA	(673) btu/hr/°F	Unoccupied Heating UA	496 btu/hr/°F		
Unoc Internal Gain factor	0.03	Cooling Occ Enthalpy Setpoint	28.6 Btu/lb				
Ave Occ Internal Gain Factor	0.7	Cooling Unocc Enthalpy Setpoint	28.6 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	-30,820	-29,241	-13,556	-21,188	-29,241	-581	0	0	0	0
97.5	42.5	3	1	2	-25,928	-19,827	-13,556	-17,825	-19,827	-581	0	17	17	0
92.5	39.5	34	10	24	-21,036	-15,548	-13,556	-14,462	-15,548	-581	0	154	154	0
87.5	36.6	131	37	94	-16,144	-11,411	-13,556	-11,098	-11,411	-581	0	462	462	0
82.5	34.0	500	143	357	-11,252	-7,703	-13,556	-7,735	-7,703	-581	0	1,296	1,296	0
77.5	31.6	620	177	443	-6,360	-4,279	-13,556	-4,372	-4,279	-581	0	1,047	1,047	0
72.5	29.2	664	190	474	-1,468	-856	-13,556	-1,009	-856	-581	0	522	522	0
67.5	27.0	854	244	610	1,241	856	-13,556	1,241	856	-581	0	350	350	0
62.5	24.5	927	265	662	3,723	2,568	-13,556	3,723	2,568	-581	0	241	241	0
57.5	21.4	600	171	429	6,205	4,279	-13,556	6,205	4,279	-581	0	66	66	0
52.5	18.7	610	174	436	8,687	5,991	-13,556	8,687	5,991	-581	0	0	0	83
47.5	16.2	611	175	436	11,169	7,703	-13,556	11,169	7,703	-581	0	0	0	117
42.5	14.4	656	187	469	13,651	9,414	-13,556	13,651	9,414	-581	0	0	0	162
37.5	12.6	1,023	292	731	16,133	11,126	-13,556	16,133	11,126	-581	0	0	0	309
32.5	10.7	734	210	524	18,615	12,838	-13,556	18,615	12,838	-581	0	0	0	262
27.5	8.6	334	95	239	21,097	14,549	-13,556	21,097	14,549	-581	0	0	0	138
22.5	6.8	252	72	180	23,579	16,261	-13,556	23,579	16,261	-581	0	0	0	118
17.5	5.5	125	36	89	26,061	17,973	-13,556	26,061	17,973	-581	0	0	0	65
12.5	4.1	47	13	34	28,543	19,684	-13,556	28,543	19,684	-581	0	0	0	27
7.5	2.6	22	6	16	31,025	21,396	-13,556	31,025	21,396	-581	0	0	0	14
2.5	1.0	13	4	9	33,507	23,108	-13,556	33,507	23,108	-581	0	0	0	9
-2.5	0.0	0	0	0	35,989	24,820	-13,556	35,989	24,820	-581	0	0	0	0
-7.5	-1.5	0	0	0	38,471	26,531	-13,556	38,471	26,531	-581	0	0	0	0
TOTALS		8,760	2,503	6,257								4,153	4,153	1,305

Existing Building Ventilation & Infiltration (occ)	**317**	**cfm**
Overheat Ventilation Factor	**1.00**	
Additional ventilation to offset overheat	**0**	**cfm**
Existing Building Ventilation & Infiltration (unocc)	**317**	**cfm**
Economizer Ventilation (from AHU's)	**0**	**cfm**

Energy Use Indices (calculated)

Heating	Base Case
Office Area	1,305
Lockers/Breaks	1,368
Shop	3,669
Garages	2,557
Total	**8,899**
Target ->	**8,740**
	101.8%

Cooling	Base Case
Office Area	4,153
Lockers/Breaks	3,864
Shop	0
Garages	0
Total	**8,017**
Target ->	**7,961**
	100.7%

Electrical Requirements for Cooling Equipment

Unit	Area Served	Clng Hrs	Amps	Volts	Phase	Power Factor	% Runtime	Annual kWh
Condenser	**Office**	1,952	17.9	208	3	0.8	25%	2515
RTU	**Large Break**	2,806	18.0	208	3	0.8	30%	4362
Window AC	**Small Break**	1,288	5.6	115	1	0.8	75%	498
Window AC	**Small Locker**	1,288	6.6	115	1	0.8	75%	587
Total								**7961**

Building/Facility Designation Office Area

Outdoor Winter Design DB Temperature	11	*F	**Indoor Winter Design DB Temperature**	70	*F
Outdoor Summer Design DB Temperature	94	*F	**Indoor Summer Design DB Temperature**	71	*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	15.9	

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	23.4	

Windows (Select One)

		U Value
	Aluminum Frame, 1/8" SP Glazing	1.05
	Aluminum Frame, 1/4" DP Glazing	0.60
	Aluminum Frame, 3/16" DP Glazing	0.62
	Aluminum Frame, 1/2" DP Glazing	0.50
	Skylights	0.90
X	Vinyl Frame DP Glazing	0.53

	No Storm
Flat Glass	1.06
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	1,730	SF	
Occupied Area	1,730	SF	**Return Plenum?** n

	Gross Wall Length	Average Wall Height	Ceiling Height	Window Area	Door Area	Net Wall Area
North Exposure	48 Ft	14.0 Ft	7.5 Ft	15 SF	0 SF	657 SF
East Exposure	36 Ft	11.5 Ft	7.5 Ft	80 SF	21 SF	313 SF
South Exposure	48 Ft	14.0 Ft	7.5 Ft	0 SF	0 SF	672 SF
West Exposure	36 Ft	11.5 Ft	7.5 Ft	48 SF	21 SF	345 SF

Occupied Forced Ventilation	0	cfm	0.0	AC/hr
Unoccupied Forced Ventilation	0	cfm	0.0	AC/hr

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	Main DPW Building	Date:	07/29/10		
Engineer:	CAA				

Building/Facility Designation: Office Area

COOLING HEAT GAINS TO THE ROOM - SENSIBLE

SOLAR GAINS

WINDOWS	AREA (SF)	SHGF		Shade Coef	Cooling Load Factor		Solar Heat Gain
North Exposure	15	38	btu/h/sf	0.8	0.75	Glass Type C	342 Btu/hr
East Exposure	80	216	btu/h/sf	0.8	0.31	Glass Type C	4,285 Btu/hr
South Exposure	0	109	btu/h/sf	0.8	0.58	Glass Type C	0 Btu/hr
West Exposure	48	216	btu/h/sf	0.8	0.29	Glass Type C	2,405 Btu/hr
							7,033 Btu/h

CONDUCTION

	NET AREA (SF)	U-VALUE	Cooling Load Temp. Dif.	Return Air Factor	Room Heat Gain
North Exposure	345	0.06	20 °F	1.0	433 Btu/hr
East Exposure	169	0.06	39 °F	1.0	413 Btu/hr
South Exposure	360	0.06	27 °F	1.0	610 Btu/hr
West Exposure	201	0.06	22 °F	1.0	277 Btu/hr
Roof	1,730	0.04	73 °F	1.0	5,391 Btu/hr
Fenestration	143	0.53	23 °F		1,743 Btu/hr
Doors	42	0.14	27 °F		156 Btu/hr
Ceiling	1,730	0.14	0 °F		0 Btu/hr
Partition		0.05	0 °F		0 Btu/hr
Floor	1,730	0.13	23 °F		4,974 Btu/hr
					14,000 Btu/h

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

							Room Heat Gain
Lights	1.75 w/sf x	1,730 Occ Area =	3.0 kW x 3.4x	1.0 RAF =			10,333 Btu/h
Plug Load	0.50 w/sf x	1,730 Occ Area =	0.9 kW x 3.4x	1.0 RAF =			2,952 Btu/h
People	3 people x	255 btu/person x	90% time in space =				689 Btu/h
Computer Work Stations		9 Units x	120 W/Unit x	3414 =			3,686 Btu/h
Equipment	0.5 kW x 3,413 =						1,707 Btu/h
Misc.							0 Btu/h
							19,366 Btu/h

VENTILATION AND INFILTRATION

		Infiltration Factor		Perimeter Ratio		Coef	Temp. Diff.	Room Heat Gain
Walls	1,075 SF	0.14	CFM/SF			1.08	23 °F	4,046 Btu/h
Doors	42 SF	0.25	CFM/LF	0.96	LF/SF	1.08	23 °F	269 Btu/h
Windows	143 SF	0.20	CFM/LF	1.01	LF/SF	1.08	23 °F	774 Btu/h
Ventilation	0 cfm					1.08	23 °F	0 Btu/h
								5,089 Btu/h
Infiltration	189 cfm	0.9	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	312	0.06	20	1.0	391 Btu/hr
East Exposure	144	0.06	39	1.0	352 Btu/hr
South Exposure	312	0.06	27	1.0	526 Btu/hr
West Exposure	144	0.06	22	1.0	199 Btu/hr
Roof	1,730	0.04	73	0.0	0 Btu/hr
					1,471 Btu/h

INTERNAL HEAT GAINS

Lights	1.75 w/sf x	1,730 Occ Area =	3.0 kW x3413x	0.00 RAF =	0 Btu/h
Misc.					0 Btu/h
					0 Btu/h

SENSIBLE HEAT GAINS - TEMP. DEPENDENT	
Solar	7,033
Conduction to Room	14,000
Conduction to Plenum	1,471
Ventilaton and Infiltration	5,089
Sub Total	27,592

SENSIBLE HEAT GAINS - TEMP. INDEPENDENT	
Internal Gains to Room	19,366
Internal Gains to Plenum	0
Sub Total	19,366

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	Main DPW Building	Date:	07/29/10		
Engineer:	CAA				

Building/Facility Designation: Office Area

LATENT COOLING LOADS

Infiltration

		Infiltration Factor	Air Density	Humidity Ratio Dif.	Room Heat Gain
Walls	2,642 SF	0.14 CFM/SF	4.800	0.0043 #/#	7,710 Btu/h
Doors	42 SF	0.25 CFM/LF	4.800	0.0043 #/#	208 Btu/h
Windows	143 SF	0.20 CFM/LF	4.800	0.0043 #/#	600 Btu/h
Ventilation	0 cfm		4.800	0.0043 #/#	0 Btu/h
People	3 people	0.90 time in space		250 Btu/hr/person	676 Btu/h
					9,194 Btu/h

Cooling Load Summary

	Sensible	Latent	Total		
Temperature Dependent Gains	27,592	9,194	36,787		
Temperature Indep. Gains	19,366		19,366	SHR=	0.84
Total	46,958	9,194	56,153		

Building Cooling Load: 4.7 Tons at 370 SF/Ton

Building Air Flow to Condition Space based on a 12°F Temp Rise is: 3,502 CFM (2.02 CFM/sf)

HEATING CALCULATION

CONDUCTION

	NET AREA (SF)	U-VALUE	Heating Load Temp. Dif.		Room Heat Gain
North Exposure	657	0.06	59		2,432 Btu/h
East Exposure	313	0.06	59		1,158 Btu/h
South Exposure	672	0.06	59		2,487 Btu/h
West Exposure	345	0.06	59		1,277 Btu/h
Fenestration	143	0.53	59		4,472 Btu/h
Roof	1,730	0.04	59		4,357 Btu/h
Doors	42	0.14	59		346 Btu/h
Ceiling	1,730	0.14	0		0 Btu/h
Partition	0	0.05	0		0 Btu/h
Floor	1,730	0.13	59	*Building on blocks	12,759 Btu/h

Ventilation and Infiltration

		Infiltration Factor	Coef	Temp. Difference	Air Flow	Room Heat Gain
Walls	1,987 SF	0.14 CFM/SF	1.08	59	278 cfm	17,763 Btu/h
Doors	42 SF	0.25 CFM/LF	1.08	59	10 cfm	639 Btu/h
Windows	143 SF	0.20 CFM/LF	1.08	59	29 cfm	1,839 Btu/h
Ventilation Load	0 cfm		1.08	59	0 cfm	0 Btu/h
Total Ventilation & Infiltration Load					317 cfm	20,240 Btu/h

Building Heating Load	49,528	btu/h
		28.6 btu/sf

NJBPU - Borough of Tenafly
CHA #21794
Building: Main DPW Building
Office Area

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	3.0	7.0	1	21.0	20.0
				0.0	0.0
				0.0	0.0
			Sub-total	21.0	20.0
South				0.0	0.0
				0.0	0.0
				0.0	0.0
				0.0	0.0
			Sub-total	0.0	0.0
West	3.0	7.0	1	21.0	20.0
				0.0	0.0
			Sub-total	21.0	20.0
			Total	**42.0**	**40.0**

LF/SF
0.95

Walls

	Width (ft)	Height (ft)	Quantity	Area (SF)	Lineal Feet		
North	48.0	14.0	1	672.0	124.0		**All wall quantities must remain equal to 1**
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0	Ave. height	
	48.0			672.0	124.0	14.0	Average height wall automatically linked
East	36.0	11.5	1	414.0	95.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0	Ave. height	
	36.0			414.0	95.0	11.5	Average height wall automatically linked
South	48.0	14.0	1	672.0	124.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0	Ave. height	
	48.0			672.0	124.0	14.0	Average height wall automatically linked
West	36.0	11.5	1	414.0	95.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0	Ave. height	
	36.0			414.0	95.0	11.5	Average height auto linked to block load sheet

Windows

	Width (ft)	Height (ft)	Quantity	Area (SF)	Lineal Feet	
North	5.0	3.0	1	15.0	16.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
			Sub-total	15.0	16.0	
East	4.0	4.0	5	80.0	80.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
			Sub-total	80.0	80.0	
South				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	
West	4.0	4.0	3	48.0	48.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
			Sub-total	48.0	48.0	
						LF/SF
			Total	**143.0**	**144.0**	1.01

NJBPU - Borough of Tenafly
CHA #21794
Building: Main DPW Building

Reconcile Thermal Model **Break Room / Locker Room Areas**

Building Footprint	1,130 SF	Ex Occupied Clng Temp.	64 °F	Ex Occupied Htg Temp.	68 °F		
Heating Efficiency	78%	Ex Unoccupied Clng Temp.	64 °F	Ex Unoccupied Htg Temp.	68 °F		
Cooling Efficiency	1.50 kW/ton	Occupied Cooling UA	(397) btu/hr/°F	Occupied Heating UA	309 btu/hr/°F		
Internal Gains	10,786 btu/h	Unoccupied Cooling UA	(328) btu/hr/°F	Unoccupied Heating UA	309 btu/hr/°F		
Unoc Internal Gain factor	0.03	Cooling Occ Enthalpy Setpoint	28.6 Btu/lb				
Ave Occ Internal Gain Factor	0.7	Cooling Unocc Enthalpy Setpoint	28.6 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	-15,294	-46,886	-7,550	-12,626	-46,886	-324	0	0	0	0
97.5	42.5	3	1	2	-13,307	-31,791	-7,550	-10,987	-31,791	-324	0	17	17	0
92.5	39.5	34	10	24	-11,321	-24,930	-7,550	-9,347	-24,930	-324	0	158	158	0
87.5	36.6	131	37	94	-9,335	-18,297	-7,550	-7,707	-18,297	-324	0	473	473	0
82.5	34.0	500	143	357	-7,349	-12,350	-7,550	-6,067	-12,350	-324	0	1,323	1,323	0
77.5	31.6	620	177	443	-5,363	-6,861	-7,550	-4,427	-6,861	-324	0	1,081	1,081	0
72.5	29.2	664	190	474	-3,377	-1,372	-7,550	-2,788	-1,372	-324	0	557	557	0
67.5	27.0	854	244	610	-1,390	3,659	-7,550	-1,148	3,659	-324	0	161	161	0
62.5	24.5	927	265	662	1,698	3,019	-7,550	1,698	3,019	-324	0	94	94	0
57.5	21.4	600	171	429	3,242	5,764	-7,550	3,242	5,764	-324	0	0	0	51
52.5	18.7	610	174	436	4,786	8,508	-7,550	4,786	8,508	-324	0	0	0	85
47.5	16.2	611	175	436	6,330	11,253	-7,550	6,330	11,253	-324	0	0	0	119
42.5	14.4	656	187	469	7,874	13,997	-7,550	7,874	13,997	-324	0	0	0	164
37.5	12.6	1,023	292	731	9,418	16,742	-7,550	9,418	16,742	-324	0	0	0	312
32.5	10.7	734	210	524	10,961	19,486	-7,550	10,961	19,486	-324	0	0	0	264
27.5	8.6	334	95	239	12,505	22,231	-7,550	12,505	22,231	-324	0	0	0	139
22.5	6.8	252	72	180	14,049	24,975	-7,550	14,049	24,975	-324	0	0	0	118
17.5	5.5	125	36	89	15,593	27,720	-7,550	15,593	27,720	-324	0	0	0	66
12.5	4.1	47	13	34	17,137	30,465	-7,550	17,137	30,465	-324	0	0	0	27
7.5	2.6	22	6	16	18,681	33,209	-7,550	18,681	33,209	-324	0	0	0	14
2.5	1.0	13	4	9	20,225	35,954	-7,550	20,225	35,954	-324	0	0	0	9
-2.5	0.0	0	0	0	21,768	38,698	-7,550	21,768	38,698	-324	0	0	0	0
-7.5	-1.5	0	0	0	23,312	41,443	-7,550	23,312	41,443	-324	0	0	0	0
TOTALS		8,760	2,503	6,257								3,864	3,864	1,368

Existing Building Ventilation & Infiltration (occ)	**508 cfm**
Overheat Ventilation Factor	**1.00**
Additional ventilation to offset overheat	**0 cfm**
Existing Building Ventilation & Infiltration (unocc)	**508 cfm**
Economizer Ventilation (from AHU's)	**0 cfm**

Energy Use Indices (calculated)

Heating	Base Case
Office Area	1,305
Lockers/Breaks	1,368
Shop	3,669
Garages	2,557
Total	**8,899**
Target ->	**8,740**
	101.8%

Cooling	Base Case
Office Area	4,153
Lockers/Breaks	3,864
Shop	0
Garages	0
Total	**8,017**
Target ->	**7,961**
	100.7%

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	Main DPW Building	**Date:**	07/29/10		
Engineer:	CAA				

Building/Facility Designation Break Room/Locker Room Areas

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**	64 °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	15.9	

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	16.5	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	23.4	

Windows (Select One)		U Value
	Aluminum Frame, 1/8" SP Glazing	1.05
	Aluminum Frame, 1/4" DP Glazing	0.60
	Aluminum Frame, 3/16" DP Glazing	0.62
	Aluminum Frame, 1/2" DP Glazing	0.50
	Skylights	0.90
X	Vinyl Frame DP Glazing	0.53

	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	1,130 SF		
Occupied Area	1,130 SF	**Return Plenum?**	n

	Gross Wall Length	Average Wall Height	Ceiling Height	Window Area	Door Area	Net Wall Area
North Exposure	52 Ft	12.0 Ft	7.5 Ft	5 SF	21 SF	599 SF
East Exposure	20 Ft	14.0 Ft	7.5 Ft	18 SF	21 SF	241 SF
South Exposure	14 Ft	12.0 Ft	7.5 Ft	20 SF	18 SF	131 SF
West Exposure	44 Ft	10.0 Ft	7.5 Ft	0 SF	0 SF	440 SF

Occupied Forced Ventilation	300 cfm	#DIV/0!	AC/hr
Unoccupied Forced Ventilation	300 cfm	#DIV/0!	AC/hr

Ventilation rates estimated per building space and 2006 International Mechanical Code

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	Main DPW Building	Date:	07/29/10		
Engineer:	CAA				

Building/Facility Designation: Break Room/Locker Room Areas

COOLING HEAT GAINS TO THE ROOM - SENSIBLE

SOLAR GAINS

WINDOWS	AREA (SF)	SHGF		Shade Coef	Cooling Load Factor		Solar Heat Gain
North Exposure	6	38	btu/h/sf	0.8	0.75	Glass Type C	103 Btu/hr
East Exposure	18	216	btu/h/sf	0.8	0.31	Glass Type C	964 Btu/hr
South Exposure	20	109	btu/h/sf	0.8	0.58	Glass Type C	1,012 Btu/hr
West Exposure	0	216	btu/h/sf	0.8	0.29	Glass Type C	0 Btu/hr
							2,078 Btu/h

CONDUCTION

	NET AREA (SF)	U-VALUE	Cooling Load Temp. Dif.	Return Air Factor	Room Heat Gain
North Exposure	365	0.06	20 °F	1.0	457 Btu/hr
East Exposure	111	0.06	39 °F	1.0	272 Btu/hr
South Exposure	68	0.06	27 °F	1.0	114 Btu/hr
West Exposure	330	0.06	22 °F	1.0	455 Btu/hr
Roof	1,130	0.04	73 °F	1.0	3,521 Btu/hr
Fenestration	43	0.53	30 °F		676 Btu/hr
Doors	60	0.14	27 °F		224 Btu/hr
Ceiling	1,130	0.14	0 °F		0 Btu/hr
Partition		0.05	0 °F		0 Btu/hr
Floor	1,130	0.13	23 °F		3,249 Btu/hr
					8,969 Btu/h

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

							Room Heat Gain
Lights	1.75 w/sf x	1,130 Occ Area =	2.0 kW x 3.4x	1.0 RAF =	6,749 Btu/h
Plug Load	0.25 w/sf x	1,130 Occ Area =	0.3 kW x 3.4x	1.0 RAF =	964 Btu/h
People	15 people x	255 btu/person x	25% time in space =		956 Btu/h
Computer Work Stations		1 Units x	120 W/Unit x 3414 =		410 Btu/h
Equipment	0.5 kW x 3.413 =				1,707 Btu/h
Misc.					0 Btu/h
					10,786 Btu/h

VENTILATION AND INFILTRATION

		Infiltration Factor		Perimeter Ratio		Coef	Temp. Diff.	Room Heat Gain
Walls	873 SF	0.13	CFM/SF			1.08	30 °F	3,980 Btu/h
Doors	60 SF	0.25	CFM/LF	0.99	LF/SF	1.08	30 °F	517 Btu/h
Windows	43 SF	0.20	CFM/LF	1.20	LF/SF	1.08	30 °F	358 Btu/h
Ventilation	300 cfm					1.08	30 °F	10,520 Btu/h
								15,374 Btu/h

Infiltration: 138 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	234	0.06	20	1.0	294 Btu/hr
East Exposure	130	0.06	39	1.0	318 Btu/hr
South Exposure	63	0.06	27	1.0	107 Btu/hr
West Exposure	110	0.06	22	1.0	152 Btu/hr
Roof	1,130	0.04	73	0.0	0 Btu/hr
					870 Btu/h

INTERNAL HEAT GAINS

Lights	1.75 w/sf x	1,130 Occ Area =	2.0 kW x3413x	0.00 RAF =	0 Btu/h
Misc.					0 Btu/h
					0 Btu/h

SENSIBLE HEAT GAINS - TEMP. DEPENDENT		SENSIBLE HEAT GAINS - TEMP. INDEPENDENT	
Solar	2,078	Internal Gains to Room	10,786
Conduction to Room	8,969	Internal Gains to Plenum	0
Conduction to Plenum	870		
Ventilaton and Infiltration	15,374		
Sub Total	27,291	Sub Total	10,786

HEAT GAIN/LOSS WORKSHEET

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

Building/Facility Designation Break Room/Locker Room Areas

LATENT COOLING LOADS

Infiltration

		Infiltration Factor	Air Density	Humidity Ratio Dif.	Room Heat Gain
Walls	1,667 SF	0.13 CFM/SF	4,800	0.0043 #/#	4,517 Btu/h
Doors	60 SF	0.25 CFM/LF	4,800	0.0043 #/#	307 Btu/h
Windows	43 SF	0.20 CFM/LF	4,800	0.0043 #/#	213 Btu/h
Ventilation	300 cfm		4,800	0.0043 #/#	6,254 Btu/h
People	15 people	0.25 time in space		250 Btu/hr/person	938 Btu/h
					12,229 Btu/h

Cooling Load Summary

	Sensible	Latent	Total		
Temperature Dependent Gains	27,291	12,229	39,520		
Temperature Indep. Gains	10,786		10,786	SHR=	0.76
Total	38,077	12,229	50,306		

Building Cooling Load 4.2 Tons at 270 SF/Ton

Building Air Flow to Condition Space based on a 12°F Temp Rise is **2,865 CFM** / **2.54 CFM/sf**

HEATING CALCULATION

CONDUCTION

	NET AREA (SF)	U-VALUE	Heating Load Temp. Dif.		Room Heat Gain
North Exposure	599	0.06	57		2,140 Btu/h
East Exposure	241	0.06	57		862 Btu/h
South Exposure	131	0.06	57		467 Btu/h
West Exposure	440	0.06	57		1,573 Btu/h
Fenestration	43	0.53	57		1,284 Btu/h
Roof	1,130	0.04	57		2,749 Btu/h
Doors	60	0.14	57		474 Btu/h
Ceiling	1,130	0.14	0		0 Btu/h
Partition	0	0.05	0		0 Btu/h
Floor	1,130	0.13	57	*Building on blocks	8,051 Btu/h

Ventilation and Infiltration

		Infiltration Factor	Coef	Temp. Difference	Air Flow	Room Heat Gain
Walls	1,410 SF	0.13 CFM/SF	1.08	57	183 cfm	11,308 Btu/h
Doors	60 SF	0.25 CFM/LF	1.08	57	15 cfm	910 Btu/h
Windows	43 SF	0.20 CFM/LF	1.08	57	10 cfm	629 Btu/h
Ventilation Load	300 cfm		1.08	57	300 cfm	19,987 Btu/h
Total Ventilation & Infiltration Load					508 cfm	32,834 Btu/h

Building Heating Load	**50,434**	**btu/h**
		44.6 btu/sf

NJBPU - Borough of Tenafly
CHA #21794
Building: Main DPW Building
Break Room / Locker Room Areas

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	3.0	7.0	1	21.0	20.0	
				0.0	0.0	
				0.0	0.0	
			Sub-total	21.0	20.0	
South	2.5	7.0	1	17.5	19.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
			Sub-total	17.5	19.0	
West				0.0	0.0	
				0.0	0.0	
			Sub-total	0.0	0.0	
			Total	**59.5**	**59.0**	LF/SF 0.99

Walls

	Width (ft)	Height (ft)	Quantity	Area (SF)	Lineal Feet		
North	52.0	12.0	1	624.0	128.0		All wall quantities must remain equal to 1
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0	Ave. height	
	52.0			624.0	128.0	12.0	Average height wall automatically linked
East	20.0	14.0	1	280.0	68.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0	Ave. height	
	20.0			280.0	68.0	14.0	Average height wall automatically linked
South	14.0	12.0	1	168.0	52.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0	Ave. height	
	14.0			168.0	52.0	12.0	Average height wall automatically linked
West	44.0	10.0	1	440.0	108.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0	Ave. height	
	44.0			440.0	108.0	10.0	Average height auto linked to block load sheet

Windows

	Width (ft)	Height (ft)	Quantity	Area (SF)	Lineal Feet
North	3.0	1.5	1	4.5	9.0
				0.0	0.0
				0.0	0.0
				0.0	0.0
				0.0	0.0
				0.0	0.0
			Sub-total	4.5	9.0
East	3.0	3.0	2	18.0	24.0
				0.0	0.0
				0.0	0.0
				0.0	0.0
				0.0	0.0
				0.0	0.0
			Sub-total	18.0	24.0
South	5.0	4.0	1	20.0	18.0
				0.0	0.0
				0.0	0.0
				0.0	0.0
				0.0	0.0
				0.0	0.0
			Sub-total	20.0	18.0
West				0.0	0.0
				0.0	0.0
				0.0	0.0
				0.0	0.0
				0.0	0.0
			Sub-total	0.0	0.0
			Total	**42.5**	**51.0**

LF/SF
1.20

NJBPU - Borough of Tenafly
CHA #21794
Building: Main DPW Building

Reconcile Thermal Model **Repair Shop**

Building Footprint	1,800	SF	Ex Occupied Clng Temp.	75	°F	Ex Occupied Htg Temp.	68 °F
Heating Efficiency	80%		Ex Unoccupied Clng Temp.	75	°F	Ex Unoccupied Htg Temp.	68 °F
Cooling Efficiency	1.00	kW/ton	Occupied Cooling UA	(2,084)	btu/hr/°F	Occupied Heating UA	1,114 btu/hr/°F
Internal Gains	21,472	btu/h	Unoccupied Cooling UA	(1,952)	btu/hr/°F	Unoccupied Heating UA	1,114 btu/hr/°F
Unoc Internal Gain factor	0.03		Cooling Occ Enthalpy Setpoint	27.5	Btu/lb		
Ave Occ Internal Gain Factor	0.7		Cooling Unocc Enthalpy Setpoint	27.5	Btu/lb		
Economizer available (Y/N)	No						

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

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

					EXISTING LOADS									
					Occupied			Unoccupied						
Avg Outdoor Air Temp. Bins °F	Avg Outdoor Air Enthalpy	Total Bin Hours	Occupied Equipment Bin Hours	Unoccupied Equipment Bin Hours	Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Unoccupied Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Available Economizer Cooling kWh	Necessary Cooling Energy kWh	Existing Cooling Energy kWh	Existing Heating Energy therms
A		B	C	D	E	F	G	H	I	J	K	L	M	M
102.5	49.1	0	0	0	-57,320	-101,761	-14,961	-53,688	-67,841	-641	0	0	0	0
97.5	42.5	3	1	2	-46,898	-70,667	-14,961	-43,927	-47,112	-641	0	39	39	0
92.5	39.5	34	10	24	-36,476	-56,534	-14,961	-34,165	-37,689	-641	0	351	351	0
87.5	36.6	131	37	94	-26,054	-42,872	-14,961	-24,404	-28,581	-641	0	1,020	1,020	0
82.5	34.0	500	143	357	-15,633	-30,623	-14,961	-14,642	-20,415	-641	0	2,557	2,557	0
77.5	31.6	620	177	443	-5,211	-19,316	-14,961	-4,881	-12,877	-641	0	1,656	1,656	0
72.5	29.2	664	190	474	0	0	-14,961	0	0	-641	0	383	383	0
67.5	27.0	854	244	610	557	565	-14,961	557	377	-641	0	422	422	0
62.5	24.5	927	265	662	6,124	6,219	-14,961	6,124	4,146	-641	0	97	97	0
57.5	21.4	600	171	429	11,692	11,872	-14,961	11,692	7,915	-641	0	0	0	141
52.5	18.7	610	174	436	17,259	17,526	-14,961	17,259	11,684	-641	0	0	0	232
47.5	16.2	611	175	436	22,827	23,179	-14,961	22,827	15,453	-641	0	0	0	321
42.5	14.4	656	187	469	28,395	28,832	-14,961	28,395	19,222	-641	0	0	0	440
37.5	12.6	1,023	292	731	33,962	34,486	-14,961	33,962	22,990	-641	0	0	0	835
32.5	10.7	734	210	524	39,530	40,139	-14,961	39,530	26,759	-641	0	0	0	706
27.5	8.6	334	95	239	45,097	45,792	-14,961	45,097	30,528	-641	0	0	0	370
22.5	6.8	252	72	180	50,665	51,446	-14,961	50,665	34,297	-641	0	0	0	315
17.5	5.5	125	36	89	56,233	57,099	-14,961	56,233	38,066	-641	0	0	0	175
12.5	4.1	47	13	34	61,800	62,753	-14,961	61,800	41,835	-641	0	0	0	72
7.5	2.6	22	6	16	67,368	68,406	-14,961	67,368	45,604	-641	0	0	0	37
2.5	1.0	13	4	9	72,935	74,059	-14,961	72,935	49,373	-641	0	0	0	24
-2.5	0.0	0	0	0	78,503	79,713	-14,961	78,503	53,142	-641	0	0	0	0
-7.5	-1.5	0	0	0	84,070	85,366	-14,961	84,070	56,911	-641	0	0	0	0
TOTALS		8,760	2,503	6,257								8,691	8,691	3,669

Existing Building Ventilation & Infiltration (occ)	**698**	**cfm**
Overheat Ventilation Factor	1.50	**Due to opening overhead doors**
Additional ventilation to offset overheat	**349**	**cfm**
Existing Building Ventilation & Infiltration (unocc)	**698**	**cfm**
Economizer Ventilation (from AHU's)	0	**cfm**

Energy Use Indices (calculated)

Heating	Base Case
Office Area	1,305
Lockers/Breaks	1,368
Shop	3,669
Garages	2,557
Total	**8,899**
Target ->	**8,740**
	101.8%

Cooling	Base Case
Office Area	4,153
Lockers/Breaks	3,864
Shop	0
Garages	0
Total	**8,017**
Target ->	**7,961**
	100.7%

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	Main DPW Building	**Date:**	07/29/10		
Engineer:	CAA				

Building/Facility Designation Repair Shop

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**	75 *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	4.8	

Roofs (Select One)

		R Value	Roof Type
	Tectum Deck, 3.3" Insul., BU Roof	13.0	1
	Steel Deck, 6" 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	20.0	

Windows (Select One)

		U Value
x	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
	Vinyl Frame DP Glazing	0.53

	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	1,800 SF		
Occupied Area	1,800 SF	**Return Plenum?**	n

	Gross Wall Length	Average Wall Height	Ceiling Height	Window Area	Door Area	Net Wall Area
North Exposure	30 Ft	18.0 Ft	18.0 Ft	0 SF	338 SF	202 SF
East Exposure	60 Ft	11.3 Ft	18.0 Ft	30 SF	0 SF	645 SF
South Exposure	30 Ft	18.0 Ft	18.0 Ft	0 SF	21 SF	519 SF
West Exposure	60 Ft	13.8 Ft	18.0 Ft	18 SF	21 SF	791 SF

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

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	Main DPW Building	Date:	07/29/10		
Engineer:	CAA				

Building/Facility Designation: Repair Shop

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	30	216	btu/h/sf	0.8	0.31	Glass Type C	1,607 Btu/hr	
South Exposure	0	109	btu/h/sf	0.8	0.58	Glass Type C	0 Btu/hr	
West Exposure	16	216	btu/h/sf	0.8	0.29	Glass Type C	902 Btu/hr	
								2,509 Btu/h

CONDUCTION

	NET AREA (SF)	U-VALUE	Cooling Load Temp. Dif.	Return Air Factor	Room Heat Gain	
North Exposure	202	0.21	20 °F	1.0	846 Btu/hr	
East Exposure	1,050	0.21	39 °F	1.0	8,571 Btu/hr	
South Exposure	519	0.21	27 °F	1.0	2,933 Btu/hr	
West Exposure	1,041	0.21	22 °F	1.0	4,794 Btu/hr	
Roof	1,800	0.05	73 °F	1.0	6,571 Btu/hr	
Fenestration	48	1.05	19 °F		958 Btu/hr	
Doors	380	0.14	27 °F		1,433 Btu/hr	
Ceiling	1,800	0.14	0 °F		0 Btu/hr	
Partition		0.05	0 °F		0 Btu/hr	
Floor	1,800	0.04	23 °F		1,656 Btu/hr	
						27,761 Btu/h

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

								Room Heat Gain
Lights	1.50	w/sf x	1,800	Occ Area =	2.7 kW x 3.4x	1.0	RAF =	9,215 Btu/h
Plug Load	0.25	w/sf x	1,800	Occ Area =	0.5 kW x 3.4x	1.0	RAF =	1,536 Btu/h
People	2	people x	255	btu/person x	75% time in space =			383 Btu/h
Computer Work Stations			0	Units x	120 W/Unit x 3414 =			0 Btu/h
Equipment	3.0	kW x 3.413 =						10,239 Btu/h
Misc.								0 Btu/h
								21,372 Btu/h

VENTILATION AND INFILTRATION

		Infiltration Factor		Perimeter Ratio		Coef	Temp. Diff.	Room Heat Gain	
Walls	2,812 SF	0.15	CFM/SF			1.08	19 °F	9,367	Btu/h
Doors	380 SF	0.30	CFM/LF	0.31	LF/SF	1.08	19 °F	786	Btu/h
Windows	48 SF	0.30	CFM/LF	1.04	LF/SF	1.08	19 °F	333	Btu/h
Ventilation	0 cfm					1.08	19 °F	0	Btu/h
									10,487 Btu/h
Infiltration	472 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	0	0.21	20	1.0	0 Btu/hr	
East Exposure	675	0.21	39	1.0	5,510 Btu/hr	
South Exposure	0	0.21	27	1.0	0 Btu/hr	
West Exposure	830	0.21	22	1.0	3,822 Btu/hr	
Roof	1,800	0.05	73	0.0	0 Btu/hr	
						9,332 Btu/h

INTERNAL HEAT GAINS

Lights	1.50	w/sf x	1,800	Occ Area =	2.7 kW x3413x	0.00	RAF =	0 Btu/h
Misc.								0 Btu/h
								0 Btu/h

SENSIBLE HEAT GAINS - TEMP. DEPENDENT		SENSIBLE HEAT GAINS - TEMP. INDEPENDENT	
Solar	2,509	Internal Gains to Room	21,372
Conduction to Room	27,761	Internal Gains to Plenum	0
Conduction to Plenum	9,332		
Ventilaton and Infiltration	10,487		
Sub Total	50,089	Sub Total	21,372

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	Main DPW Building	Date:	07/29/10		
Engineer:	CAA				

Building/Facility Designation: Repair Shop

LATENT COOLING LOADS

Infiltration

		Infiltration Factor	Air Density	Humidity Ratio Dif.	Room Heat Gain
Walls	3,305 SF	0.15 CFM/SF	4,800	0.0043 #/#	10,334 Btu/h
Doors	380 SF	0.30 CFM/LF	4,800	0.0043 #/#	738 Btu/h
Windows	48 SF	0.30 CFM/LF	4,800	0.0043 #/#	313 Btu/h
Ventilation	0 cfm		4,800	0.0043 #/#	0 Btu/h
People	2 people	0.75 time in space		250 Btu/hr/person	375 Btu/h
					11,760 Btu/h

Cooling Load Summary

	Sensible	Latent	Total	
Temperature Dependent Gains	50,089	11,760	61,849	
Temperature Indep. Gains	21,372		21,372	SHR= 0.86
Total	71,462	11,760	83,222	

Building Cooling Load: 6.9 Tons at 260 SF/Ton

Building Air Flow to Condition Space based on a 12°F Temp Rise is: 4,784 CFM (2.66 CFM/sf)

HEATING CALCULATION

CONDUCTION

	NET AREA (SF)	U-VALUE	Heating Load Temp. Dif.	Room Heat Gain
North Exposure	202	0.21	57	2,410 Btu/h
East Exposure	1,725	0.21	57	20,581 Btu/h
South Exposure	519	0.21	57	6,192 Btu/h
West Exposure	1,871	0.21	57	22,323 Btu/h
Fenestration	48	1.05	57	2,873 Btu/h
Roof	1,800	0.05	57	5,131 Btu/h
Doors	380	0.14	57	3,025 Btu/h
Ceiling	1,800	0.14	0	0 Btu/h
Partition	0	0.05	0	0 Btu/h
Floor	1,800	0.04	13	936 Btu/h

Ventilation and Infiltration

		Infiltration Factor	Coef	Temp. Difference	Air Flow	Room Heat Gain
Walls	4,317 SF	0.15 CFM/SF	1.08	57	648 cfm	39,947 Btu/h
Doors	380 SF	0.30 CFM/LF	1.08	57	35 cfm	2,184 Btu/h
Windows	48 SF	0.30 CFM/LF	1.08	57	15 cfm	925 Btu/h
Ventilation Load	0 cfm		1.08	57	0 cfm	0 Btu/h
Total Ventilation & Infiltration Load					698 cfm	43,056 Btu/h

Building Heating Load: 106,526 btu/h (59.2 btu/sf)

NJBPU - Borough of Tenafly
CHA #21794
Building: Main DPW Building
Repair Shop

	Width (ft)	Height (ft)	Quantity	Area (SF)	Lineal Feet	
North	26.0	13.0	1	338.0	78.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
			Sub-total	338.0	78.0	
East				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
			Sub-total	0.0	0.0	
South	3.0	7.0	1	21.0	20.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
			Sub-total	21.0	20.0	
West	3.0	7.0	1	21.0	20.0	
				0.0	0.0	
			Sub-total	21.0	20.0	
			Total	**380.0**	**118.0**	LF/SF 0.31

Walls

	Width (ft)	Height (ft)	Quantity	Area (SF)	Lineal Feet		
North	30.0	18.0	1	540.0	96.0		**All wall quantities must remain equal to 1**
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0	Ave. height	
	30.0			540.0	96.0	18.0	Average height wall automatically linked
East	45.0	9.0	1	405.0	108.0		
	15.0	18.0	1	270.0	66.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0	Ave. height	
	60.0			675.0	174.0	11.3	Average height wall automatically linked
South	30.0	18.0	1	540.0	96.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0	Ave. height	
	30.0			540.0	96.0	18.0	Average height wall automatically linked
West	35.0	18.0	1	630.0	106.0		
	25.0	8.0	1	200.0	66.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0	Ave. height	
	60.0			830.0	172.0	13.8	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	6.0	3.0	1	18.0	18.0	
	3.0	4.0	1	12.0	14.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
			Sub-total	30.0	32.0	
South				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	
West	6.0	3.0	1	18.0	18.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
			Sub-total	18.0	18.0	
						LF/SF
			Total	**48.0**	**50.0**	1.04

NJBPU - Borough of Tenafly
CHA #21794
Building: Main DPW Building

Reconcile Thermal Model **Garage Areas**

Building Footprint	2,650 SF	Ex Occupied Clng Temp.	76 °F	Ex Occupied Htg Temp.	65 °F	Average Existing Setpoint	
Heating Efficiency	80%	Ex Unoccupied Clng Temp.	78 °F	Ex Unoccupied Htg Temp.	65 °F	Average Existing Setpoint	
Cooling Efficiency	1.50 kW/ton	Occupied Cooling UA	(2,118) btu/hr/°F	Occupied Heating UA	1,019 btu/hr/°F		
Internal Gains	16,545 btu/h	Unoccupied Cooling UA	(1,590) btu/hr/°F	Unoccupied Heating UA	1,019 btu/hr/°F		
Unoc Internal Gain factor	0.03	Cooling Occ. Enthalpy Setpoint	27.6 Btu/lb				
Ave Occ Internal Gain Factor	0.7	Heating Unocc Enthalpy Setpoint	23.8 Btu/lb				
Economizer available (Y/N)	No						

Heat Distribution Effectiveness 90.0% Heat Distribution Factor per ASHRAE Handbook - Fundamentals for Unit Heaters

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

					EXISTING LOADS									
					Occupied			Unoccupied						
Avg Outdoor Air Temp. Bins °F	Avg Outdoor Air Enthalpy	Total Bin Hours	Occupied Equipment Bin Hours	Unoccupied Equipment Bin Hours	Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Unoccupied Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Available Economizer Cooling kWh	Necessary Cooling Energy kWh	Existing Cooling Energy kWh	Existing Heating Energy therms
A		B	C	D	E	F	G	H	I	J	K	L	M	M
102.5	49.1	0	0	0	-58,257	-67,515	-11,581	-52,218	-54,012	-496	0	0	0	0
97.5	42.5	3	1	2	-47,665	-46,885	-11,581	-42,724	-37,508	-496	0	33	33	0
92.5	39.5	34	10	24	-37,073	-37,508	-11,581	-33,230	-30,006	-496	0	299	299	0
87.5	36.6	131	37	94	-26,481	-28,444	-11,581	-23,736	-22,755	-496	0	861	861	0
82.5	34.0	500	143	357	-15,888	-20,317	-11,581	-14,241	-16,253	-496	0	2,237	2,237	0
77.5	31.6	620	177	443	-5,296	-12,815	-11,581	-4,747	-10,252	-496	0	1,516	1,516	0
72.5	29.2	664	190	474	0	0	-11,581	0	0	-496	0	304	304	0
67.5	27.0	854	244	610	0	0	-11,581	0	0	-496	0	391	391	0
62.5	24.5	927	265	662	2,547	1,875	-11,581	2,547	1,500	-496	0	237	237	0
57.5	21.4	600	171	429	7,641	5,626	-11,581	7,641	4,501	-496	0	0	0	73
52.5	18.7	610	174	436	12,734	9,377	-11,581	12,734	7,502	-496	0	0	0	145
47.5	16.2	611	175	436	17,828	13,128	-11,581	17,828	10,502	-496	0	0	0	216
42.5	14.4	656	187	469	22,922	16,879	-11,581	22,922	13,503	-496	0	0	0	307
37.5	12.6	1,023	292	731	28,016	20,629	-11,581	28,016	16,504	-496	0	0	0	597
32.5	10.7	734	210	524	33,110	24,380	-11,581	33,110	19,504	-496	0	0	0	513
27.5	8.6	334	95	239	38,203	28,131	-11,581	38,203	22,505	-496	0	0	0	272
22.5	6.8	252	72	180	43,297	31,882	-11,581	43,297	25,505	-496	0	0	0	234
17.5	5.5	125	36	89	48,391	35,633	-11,581	48,391	28,506	-496	0	0	0	131
12.5	4.1	47	13	34	53,485	39,383	-11,581	53,485	31,507	-496	0	0	0	55
7.5	2.6	22	6	16	58,578	43,134	-11,581	58,578	34,507	-496	0	0	0	28
2.5	1.0	13	4	9	63,672	46,885	-11,581	63,672	37,508	-496	0	0	0	18
-2.5	0.0	0	0	0	68,766	50,636	-11,581	68,766	40,509	-496	0	0	0	0
-7.5	-1.5	0	0	0	73,860	54,387	-11,581	73,860	43,509	-496	0	0	0	0
TOTALS		8,760	2,503	6,257								5,878	5,878	2,590
												Electric Heat Equivalent		32
												Total Required Therms		2,557

Existing Building Ventilation & Infiltration (occ)	556 cfm	
Overheat Ventilation Factor	1.25	**Due to opening overhead doors**
Additional ventilation to offset overheat	139 cfm	
Existing Building Ventilation & Infiltration (unocc)	556 cfm	
Economizer Ventilation (from AHU's)	0 cfm	

Energy Use Indices (calculated)

Heating	Base Case
Office Area	1,305
Lockers/Breaks	1,368
Shop	3,669
Garages	2,557
Total	**8,899**
Target ->	**8,740**
	101.8%

Cooling	Base Case
Office Area	4,153
Lockers/Breaks	3,864
Shop	0
Garages	0
Total	**8,017**
Target ->	**7,961**
	100.7%

Electrical Requirements for Heating Equipment

Unit	Area Served	Htg Hrs	kW	% Runtime	Annual kWh	Equiv Therms
Unit Heater	**End Bay**	4,427	5	50%	11,068	32
Total					**11,068**	**32**

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	Main DPW Building	**Date:**	07/29/10		
Engineer:	CAA				

Building/Facility Designation Garage Areas

Outdoor Winter Design DB Temperature	11 °F		**Indoor Winter Design DB Temperature**	65 °F	
Outdoor Summer Design DB Temperature	94 °F		**Indoor Summer Design DB Temperature**	75 °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	4.8	

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	20.0	

Windows (Select One)

		U Value
x	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
	Vinyl Frame DP Glazing	0.53

	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	3,160 SF			
Occupied Area	2,850 SF	**Return Plenum?**	n	

	Gross Wall Length	Average Wall Height	Ceiling Height	Window Area	Door Area	Net Wall Area
North Exposure	66 Ft	12.0 Ft	12.0 Ft	0 SF	501 SF	291 SF
East Exposure	30 Ft	15.0 Ft	15.0 Ft	0 SF	240 SF	210 SF
South Exposure	100 Ft	12.0 Ft	12.0 Ft	83 SF	0 SF	1,118 SF
West Exposure	55 Ft	9.0 Ft	9.0 Ft	0 SF	0 SF	495 SF

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

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	Main DPW Building	Date:	07/29/10		
Engineer:	CAA				

Building/Facility Designation: Garage Areas

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	83	109	btu/h/sf	0.8	0.58	Glass Type C	4,173 Btu/hr
West Exposure	0	216	btu/h/sf	0.8	0.29	Glass Type C	0 Btu/hr
							4,173 Btu/h

CONDUCTION

	NET AREA (SF)	U-VALUE	Cooling Load Temp. Dif.	Return Air Factor	Room Heat Gain
North Exposure	291	0.21	20 °F	1.0	1,218 Btu/hr
East Exposure	210	0.21	39 °F	1.0	1,714 Btu/hr
South Exposure	1,118	0.21	27 °F	1.0	6,316 Btu/hr
West Exposure	495	0.21	22 °F	1.0	2,279 Btu/hr
Roof	3,160	0.05	73 °F	1.0	11,535 Btu/hr
Fenestration	83	1.05	19 °F		1,646 Btu/hr
Doors	741	0.14	27 °F		2,794 Btu/hr
Ceiling	2,850	0.14	0 °F		0 Btu/hr
Partition		0.05	0 °F		0 Btu/hr
Floor	2,850	0.04	23 °F		2,622 Btu/hr
					30,125 Btu/h

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

								Room Heat Gain
Lights	1.25	w/sf x	2,850	Occ Area =	3.6 kW x 3.4x		1.0 RAF =	12,159 Btu/h
Plug Load	0.10	w/sf x	2,850	Occ Area =	0.3 kW x 3.4x		1.0 RAF =	973 Btu/h
People	0	people x	255	btu/person x	50%	time in space =		0 Btu/h
Computer Work Stations			0	Units x	120	W/Unit x 3414 =		0 Btu/h
Equipment	1.0	kW x 3.413 =						3,413 Btu/h
Misc.								0 Btu/h
								16,545 Btu/h

VENTILATION AND INFILTRATION

		Infiltration Factor		Perimeter Ratio		Coef	Temp. Diff.	Room Heat Gain
Walls	2,114 SF	0.15	CFM/SF			1.08	19 °F	7,041 Btu/h
Doors	741 SF	0.30	CFM/LF	0.35	LF/SF	1.08	19 °F	1,732 Btu/h
Windows	83 SF	0.30	CFM/LF	0.76	LF/SF	1.08	19 °F	420 Btu/h
Ventilation	0 cfm					1.08	19 °F	0 Btu/h
								9,192 Btu/h

Infiltration: 414 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	0	0.21	20	1.0	0 Btu/hr
East Exposure	450	0.21	39	1.0	3,673 Btu/hr
South Exposure	0	0.21	27	1.0	0 Btu/hr
West Exposure	495	0.21	22	1.0	2,279 Btu/hr
Roof	3,160	0.05	73	0.0	0 Btu/hr
					5,953 Btu/h

INTERNAL HEAT GAINS

							Room Heat Gain
Lights	1.25	w/sf x	2,850	Occ Area =	3.6 kW x3413x	0.00 RAF =	0 Btu/h
Misc.							0 Btu/h
							0 Btu/h

SENSIBLE HEAT GAINS - TEMP. DEPENDENT		SENSIBLE HEAT GAINS - TEMP. INDEPENDENT	
Solar	4,173	Internal Gains to Room	16,545
Conduction to Room	30,125	Internal Gains to Plenum	0
Conduction to Plenum	5,953		
Ventilaton and Infiltration	9,192		
Sub Total	49,443	Sub Total	16,545

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	Main DPW Building	Date:	07/29/10		
Engineer:	CAA				

Building/Facility Designation: Garage Areas

LATENT COOLING LOADS

Infiltration

		Infiltration Factor	Air Density	Humidity Ratio Dif.	Room Heat Gain
Walls	4,105 SF	0.15 CFM/SF	4,800	0.0043 #/#	12,836 Btu/h
Doors	741 SF	0.30 CFM/LF	4,800	0.0043 #/#	1,626 Btu/h
Windows	83 SF	0.30 CFM/LF	4,800	0.0043 #/#	394 Btu/h
Ventilation	0 cfm		4,800	0.0043 #/#	0 Btu/h
People	0 people	0.50 time in space		250 Btu/hr/person	0 Btu/h
					14,856 Btu/h

Cooling Load Summary

	Sensible	Latent	Total	
Temperature Dependent Gains	49,443	14,856	64,299	
Temperature Indep. Gains	16,545		16,545	SHR= 0.82
Total	65,987	14,856	80,843	

Building Cooling Load: 6.7 Tons at 423 SF/Ton

Building Air Flow to Condition Space based on a 12°F Temp Rise is: 4,623 CFM; 1.62 CFM/sf

HEATING CALCULATION

CONDUCTION

	NET AREA (SF)	U-VALUE	Heating Load Temp. Dif.	Room Heat Gain
North Exposure	291	0.21	54	3,289 Btu/h
East Exposure	660	0.21	54	7,460 Btu/h
South Exposure	1,118	0.21	54	12,631 Btu/h
West Exposure	990	0.21	54	11,190 Btu/h
Fenestration	83	1.05	54	4,678 Btu/h
Roof	3,160	0.05	54	8,533 Btu/h
Doors	741	0.14	54	5,589 Btu/h
Ceiling	2,850	0.14	0	0 Btu/h
Partition	0	0.05	0	0 Btu/h
Floor	3,160	0.04	13	1,643 Btu/h

Ventilation and Infiltration

		Infiltration Factor	Coef	Temp. Difference	Air Flow	Room Heat Gain
Walls	3,059 SF	0.15 CFM/SF	1.08	54	459 cfm	26,812 Btu/h
Doors	741 SF	0.30 CFM/LF	1.08	54	78 cfm	4,559 Btu/h
Windows	83 SF	0.30 CFM/LF	1.08	54	19 cfm	1,105 Btu/h
Ventilation Load	0 cfm		1.08	54	0 cfm	0 Btu/h
Total Ventilation & Infiltration Load					556 cfm	32,475 Btu/h

Building Heating Load	87,488	btu/h
		30.7 btu/sf

NJBPU - Borough of Tenafly
CHA #21794
Building: Main DPW Building
Garage Areas

Doors

	Width (ft)	Height (ft)	Quantity	Area (SF)	Lineal Feet
North	12.0	10.0	4	480.0	176.0
	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
			Sub-total	501.0	196.0
East	20.0	12.0	1	240.0	64.0
				0.0	0.0
				0.0	0.0
			Sub-total	240.0	64.0
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	**741.0**	**260.0**

LF/SF
0.35

Walls

	Width (ft)	Height (ft)	Quantity	Area (SF)	Lineal Feet		
North	66.0	12.0	1	792.0	156.0		**All wall quantities must remain equal to 1**
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0	Ave. height	
	66.0			792.0	156.0	12.0	Average height wall automatically linked
East	30.0	15.0	1	450.0	90.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0	Ave. height	
	30.0			450.0	90.0	15.0	Average height wall automatically linked
South	40.0	12.0	1	480.0	104.0		
	60.0	12.0	1	720.0	144.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0	Ave. height	
	100.0			1200.0	248.0	12.0	Average height wall automatically linked
West	30.0	4.0	1	120.0	68.0		
	25.0	15.0	1	375.0	80.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0	Ave. height	
	55.0			495.0	148.0	9.0	Average height auto linked to block load sheet

Windows

	Width (ft)	Height (ft)	Quantity	Area (SF)	Lineal Feet	
North				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
			Sub-total	0.0	0.0	
East				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
			Sub-total	0.0	0.0	
South	5.0	5.5	3	82.5	63.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
			Sub-total	82.5	63.0	
West				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
			Sub-total	0.0	0.0	
			Total	**82.5**	**63.0**	LF/SF 0.76

NJBPU - Borough of Tenafly
CHA #21794
Building: Main DPW Building

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	2	EA	$ 100	$ 150	$ -	$ 196	$ 363	$ -	$ 559	Furnace & RTU
7 Day Programmable Timer	2	EA	$ 30	$ 20	$ -	$ 59	$ 48	$ -	$ 107	Window AC units
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

$ 666	Subtotal
$ 67	10% Contingency
$ -	Contractor 0% O&P
$ -	0% Engineering
$ 733	**Total**

APPENDIX C

ECM-2 Replace Furnace and Remote Condensing Unit

NJBPU - Borough of Tenafly
CHA #21794
Building: Main DPW Building

ECM-2 Replace Furnace and Remote Condensing Unit
Replace existing gas-fired furnace with high-efficiency condensing furnace and outdoor condensing unit

Building Footprint	1,730	SF	Ex Occupied Clng Temp.	71	°F	Ex Occupied Htg Temp.	70	°F	**Heating Energy Savings**	25%	therms
Building Balance Temp.	60	°F	Ex Unoccupied Clng Temp.	71	°F	Ex Unoccupied Htg Temp.	70	°F	**Cooling Energy Savings**	1,772	kWh
Internal Gains	19,366	btu/h	Prop Occupied Clng Temp.	71	°F	Prop Occupied Htg Temp.	70	°F			
Unoc Internal Gain factor	0.03		Prop Unoccupied Clng Temp.	71	°F	Prop Unoccupied Htg Temp.	70	°F			
Ave Occ Internal Gain Factor	0.7		Occupied Cooling UA	978	btu/hr/°F	Occupied Heating UA	498	btu/hr/°F			
			Unoccupied Cooling UA	978	btu/hr/°F	Unoccupied Heating UA	498	btu/hr/°F			
Existing Heating Efficiency	78%		Cooling Occ Enthalpy Setpoint	28.6	Btu/lb						
Existing Cooling Efficiency	1.0	kW/ton	Cooling Unocc Enthalpy Setpoint	28.6	Btu/lb						
Proposed Heating Efficiency	95%										
Proposed Cooling Efficiency	0.86	kW/ton									

					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	-30,820	-29,241	-13,556	-21,188	-29,241	-581	-30,820	-29,241	-13,556	-21,188	-29,241	-581	0	0	0	0
97.5	42.5	3	1	2	-25,928	-19,827	-13,556	-17,825	-19,827	-581	-25,928	-19,827	-13,556	-17,825	-19,827	-581	17	10	0	0
92.5	39.5	34	10	24	-21,036	-15,548	-13,556	-14,462	-15,548	-581	-21,036	-15,548	-13,556	-14,462	-15,548	-581	154	88	0	0
87.5	36.6	131	37	94	-16,144	-11,411	-13,556	-11,098	-11,411	-581	-16,144	-11,411	-13,556	-11,098	-11,411	-581	462	265	0	0
82.5	34	500	143	357	-11,252	-7,703	-13,556	-7,735	-7,703	-581	-11,252	-7,703	-13,556	-7,735	-7,703	-581	1,296	743	0	0
77.5	31.6	620	177	443	-6,360	-4,279	-13,556	-4,372	-4,279	-581	-6,360	-4,279	-13,556	-4,372	-4,279	-581	1,047	600	0	0
72.5	29.2	664	190	474	-1,468	-856	-13,556	-1,009	-856	-581	-1,468	-856	-13,556	-1,009	-856	-581	522	299	0	0
67.5	27	854	244	610	1,241	856	-13,556	1,241	856	-581	1,241	856	-13,556	1,241	856	-581	350	200	0	0
62.5	24.5	927	265	662	3,723	2,568	-13,556	3,723	2,568	-581	3,723	2,568	-13,556	3,723	2,568	-581	241	138	0	0
57.5	21.4	600	171	429	6,205	4,279	-13,556	6,205	4,279	-581	6,205	4,279	-13,556	6,205	4,279	-581	66	38	0	0
52.5	18.7	610	174	436	8,687	5,991	-13,556	8,687	5,991	-581	8,687	5,991	-13,556	8,687	5,991	-581	0	0	83	67
47.5	16.2	611	175	436	11,169	7,703	-13,556	11,169	7,703	-581	11,169	7,703	-13,556	11,169	7,703	-581	0	0	117	94
42.5	14.4	656	187	469	13,651	9,414	-13,556	13,651	9,414	-581	13,651	9,414	-13,556	13,651	9,414	-581	0	0	162	130
37.5	12.6	1,023	292	731	16,133	11,126	-13,556	16,133	11,126	-581	16,133	11,126	-13,556	16,133	11,126	-581	0	0	309	247
32.5	10.7	734	210	524	18,615	12,838	-13,556	18,615	12,838	-581	18,615	12,838	-13,556	18,615	12,838	-581	0	0	262	210
27.5	8.6	334	95	239	21,097	14,549	-13,556	21,097	14,549	-581	21,097	14,549	-13,556	21,097	14,549	-581	0	0	138	110
22.5	6.8	252	72	180	23,579	16,261	-13,556	23,579	16,261	-581	23,579	16,261	-13,556	23,579	16,261	-581	0	0	118	94
17.5	5.5	125	36	89	26,061	17,973	-13,556	26,061	17,973	-581	26,061	17,973	-13,556	26,061	17,973	-581	0	0	65	52
12.5	4.1	47	13	34	28,543	19,684	-13,556	28,543	19,684	-581	28,543	19,684	-13,556	28,543	19,684	-581	0	0	27	22
7.5	2.6	22	6	16	31,025	21,396	-13,556	31,025	21,396	-581	31,025	21,396	-13,556	31,025	21,396	-581	0	0	14	11
2.5	1	13	4	9	33,507	23,108	-13,556	33,507	23,108	-581	33,507	23,108	-13,556	33,507	23,108	-581	0	0	9	7
-2.5	0	0	0	0	35,989	24,820	-13,556	35,989	24,820	-581	35,989	24,820	-13,556	35,989	24,820	-581	0	0	0	0
-7.5	-1.5	0	0	0	38,471	26,531	-13,556	38,471	26,531	-581	38,471	26,531	-13,556	38,471	26,531	-581	0	0	0	0
TOTALS		8,760	2,503	6,257													4,153	2,381	1,305	1,044

Existing Building Ventilation & Infiltration (occ)	**317**	**cfm**
Overheat Ventilation Factor	1.00	
Additional ventilation to offset overheat	**0**	**cfm**
Existing Building Ventilation & Infiltration (unocc)	**317**	**cfm**

NJBPU - Borough of Tenafly
CHA #21794
Building: Main DPW Building

ECM-2 Replace Furnace and Remote Condensing Unit

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.		
						$ -	$ -	$ -	$ -	
Furnace Removal	1	EA		$ 240		$ -	$ 290	$ -	$ 290	
Condensing Unit Removal	1	EA		$ 300		$ -	$ 363	$ -	$ 363	
						$ -	$ -	$ -	$ -	
125 MBH High Efficiency Condensing Furnace	1	EA	$ 900	$ 700		$ 882	$ 847	$ -	$ 1,729	Includes Controls
4 Ton High Efficiency Outdoor Condensing Unit	1	EA	$ 1,700	$ 830		$ 1,666	$ 1,004	$ -	$ 2,670	
						$ -	$ -	$ -	$ -	
Miscellaneous Electrical and Ductwork	1	LS	$ 300			$ 294	$ -	$ -	$ 294	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

$ 5,347	Subtotal
$ 267	5% Contingency
$ 281	5% Contractor O&P
$ -	0% Engineering
$ 5,895	**Total**

New Jersey Smart Start Incentive Program	QTY	UNIT	$ / UNIT	TOTAL SAVINGS	Cost W/O INCENTIVE	Cost W/ INCENTIVE
Gas-Fired Furnace	1	EA	$300	$300	$ 1,729	$ 1,429
Split system <5.4 tons	4	Tons	$92	$368	$ 2,670	$ 2,302
				$668	$4,399	$3,731

Total ECM Cost w/ Incentives	**$5,227**

APPENDIX D

ECM-3 Replace Packaged Rooftop Unit

NJBPU - Borough of Tenafly
CHA #21794
Building: Main DPW Building

ECM-3 Replace Packaged Rooftop Unit
Replace existing packaged RTU with more efficient unit. Extend new unit to serve small breakroom and locker room.

Building Footprint	1,130 SF	Ex Occupied Clng Temp.	64 °F	Ex Occupied Htg Temp.	68 °F	**Heating Energy Savings**	34 therms
Building Balance Temp.	60 °F	Ex Unoccupied Clng Temp.	64 °F	Ex Unoccupied Htg Temp.	68 °F	**Cooling Energy Savings**	1,888 kWh
Internal Gains	10,786 btu/h	Occupied Cooling UA	397 btu/hr/°F	Occupied Heating UA	309 btu/hr/°F		
Unoc Internal Gain factor	0.03	Unoccupied Cooling UA	328 btu/hr/°F	Unoccupied Heating UA	309 btu/hr/°F		
Ave Occ Internal Gain Factor	0.7	Cooling Occ Enthalpy Setpoint	28.6 Btu/lb				
Economizer available (Y/N)	Yes	Cooling Unocc Enthalpy Setpoint	28.6 Btu/lb				
Existing Heating Efficiency	76%						
Existing Cooling Efficiency	1.6 kW/ton						
Proposed Heating Efficiency	80%						
Proposed Cooling Efficiency	0.80 kW/ton						

					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 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	M	N
102.5	49.1	0	0	0	-15,294	-46,886	-7,550	-12,626	-46,886	-324	0	0	0		0	0	0
97.5	42.5	3	1	2	-13,307	-31,791	-7,550	-10,987	-31,791	-324	17	9	0		9	0	0
92.5	39.5	34	10	24	-11,321	-24,930	-7,550	-9,347	-24,930	-324	158	84	0		84	0	0
87.5	36.6	131	37	94	-9,335	-18,297	-7,550	-7,707	-18,297	-324	473	252	0		252	0	0
82.5	34	500	143	357	-7,349	-12,350	-7,550	-6,067	-12,350	-324	1,323	706	0		706	0	0
77.5	31.6	620	177	443	-5,363	-6,861	-7,550	-4,427	-6,861	-324	1,081	576	0		576	0	0
72.5	29.2	664	190	474	-3,377	-1,372	-7,550	-2,788	-1,372	-324	557	297	0		297	0	0
67.5	27	854	244	610	-1,390	3,659	-7,550	-1,148	3,659	-324	161	86	35		51	0	0
62.5	24.5	927	265	662	1,698	3,019	-7,550	1,698	3,019	-324	94	50	98		0	0	0
57.5	21.4	600	171	429	3,242	5,764	-7,550	3,242	5,764	-324	0	0	0		0	51	50
52.5	18.7	610	174	436	4,786	8,508	-7,550	4,786	8,508	-324	0	0	0		0	85	83
47.5	16.2	611	175	436	6,330	11,253	-7,550	6,330	11,253	-324	0	0	0		0	119	116
42.5	14.4	656	187	469	7,874	13,997	-7,550	7,874	13,997	-324	0	0	0		0	164	160
37.5	12.6	1,023	292	731	9,418	16,742	-7,550	9,418	16,742	-324	0	0	0		0	312	304
32.5	10.7	734	210	524	10,961	19,486	-7,550	10,961	19,486	-324	0	0	0		0	264	257
27.5	8.6	334	95	239	12,505	22,231	-7,550	12,505	22,231	-324	0	0	0		0	139	135
22.5	6.8	252	72	180	14,049	24,975	-7,550	14,049	24,975	-324	0	0	0		0	118	115
17.5	5.5	125	36	89	15,593	27,720	-7,550	15,593	27,720	-324	0	0	0		0	66	64
12.5	4.1	47	13	34	17,137	30,465	-7,550	17,137	30,465	-324	0	0	0		0	27	27
7.5	2.6	22	6	16	18,681	33,209	-7,550	18,681	33,209	-324	0	0	0		0	14	14
2.5	1	13	4	9	20,225	35,954	-7,550	20,225	35,954	-324	0	0	0		0	9	9
-2.5	0	0	0	0	21,768	38,698	-7,550	21,768	38,698	-324	0	0	0		0	0	0
-7.5	-1.5	0	0	0	23,312	41,443	-7,550	23,312	41,443	-324	0	0	0		0	0	0
TOTALS		**8,760**	**2,503**	**6,257**							**3,864**	**2,061**	**133**		**1,976**	**1,368**	**1,333**

Existing Building Ventilation & Infiltration (occ)	**508 cfm**
Overheat Ventilation Factor	**1.00**
Additional ventilation to offset overheat	**0 cfm**
Existing Building Ventilation & Infiltration (unocc)	**508 cfm**
Economizer Ventilation	**300 cfm**

NJBPU - Borough of Tenafly
CHA #21794
Building: Main DPW Building

ECM-3 Replace Packaged Rooftop Unit

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	
Gas-Fired Space Heater Removal	2	EA		$ 75		$ -	$ 182	$ -	$ 182	
Window AC Unit Removal	2	EA		$ 50		$ -	$ 121	$ -	$ 121	
						$ -	$ -	$ -	$ -	
5 Ton cooling /100 MBH heating RTU (15.2 SEER)*	1	EA	$ 4,500	$ 1,150		$ 4,410	$ 1,392	$ -	$ 5,802	Includes Controls
Additional Ductwork and Diffusers	1	LS	$ 500	$ 500		$ 490	$ 605	$ -	$ 1,095	For small break room
Roof Curb Adapter	1	EA	$ 225	$ 125		$ 221	$ 151	$ -	$ 372	
Miscellaneous Electrical	1	LS	$ 250			$ 245	$ -	$ -	$ 245	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

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

$	8,542	Subtotal
$	427	5% Contingency
$	448	5% Contractor O&P
$	-	0% Engineering
$	**9,417**	**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	$ 5,802	$ 5,342
				$460	$5,802	$5,342

Total ECM Cost w/ Incentives	**$8,957**

APPENDIX E

ECM-4 Install Infrared Heaters – Repair Shop

NJBPU - Borough of Tenafly
CHA #21794
Building: Main DPW Building

ECM-4: Install Infrared Heaters - Repair Shop

Building Footprint	1,800	SF	Ex Occupied Htg Temp.	68	*F
Natural Gas Heat Content	100,000	Btu/Therm	Ex Unoccupied Htg Temp.	68	*F
Building Balance Temp.	60	*F	Occupied Heating UA	1,114	btu/hr/*F
Internal Gains	21,372	btu/h	Unoccupied Heating UA	1,114	btu/hr/*F
Unocc Internal Gain factor	0.03				
Ave Occ Internal Gain Factor	0.7				

Heating Energy Savings	**734 Therms/yr**
Electric Energy Savings	**2,154 kWh/yr**

Existing Burner Efficiency	80.0%	Existing heating equipment burner efficiency
Existing Heat Distribution Effectiveness	85.0%	Heat Distribution Factor per ASHRAE Handbook - Fundamentals for Unit Heaters
Proposed Burner Efficiency	85.0%	Based on Reznor Infrared Tube Heaters
Proposed Heat Distribution Effectiveness	100%	Heat Distribution Factor per ASHRAE Handbook - Fundamentals for Infrared Heaters

				EXISTING LOADS						PROPOSED LOADS							
				Occupied			Unoccupied			Occupied			Unoccupied				
Avg Outdoor Air Temp. Bins °F	Avg Outdoor Air Enthalpy	Existing Equipment Bin Hours	Occupied Equipment Bin Hours	Unoccupied Equipment Bin Hours	Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Unoccupied Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Unoccupied Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Existing Heating Energy Therms	Proposed Heating Energy Therms
A		B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	M	N
102.5	49.1	0	0	0	0	0	-14,961	0	0	-641	0	0	-14,961	0	0	-641	0	0
97.5	42.5	3	1	2	0	0	-14,961	0	0	-641	0	0	-14,961	0	0	-641	0	0
92.5	39.5	34	10	24	0	0	-14,961	0	0	-641	0	0	-14,961	0	0	-641	0	0
87.5	36.6	131	37	94	0	0	-14,961	0	0	-641	0	0	-14,961	0	0	-641	0	0
82.5	34.0	500	143	357	0	0	-14,961	0	0	-641	0	0	-14,961	0	0	-641	0	0
77.5	31.6	620	177	443	0	0	-14,961	0	0	-641	0	0	-14,961	0	0	-641	0	0
72.5	29.2	664	190	474	0	0	-14,961	0	0	-641	0	0	-14,961	0	0	-641	0	0
67.5	27.0	854	244	610	557	565	-14,961	557	377	-641	557	565	-14,961	557	377	-641	0	0
62.5	24.5	927	265	662	6,124	6,219	-14,961	6,124	4,146	-641	6,124	6,219	-14,961	6,124	4,146	-641	0	0
57.5	21.4	600	171	429	11,692	11,872	-14,961	11,692	7,915	-641	11,692	11,872	-14,961	11,692	7,915	-641	141	113
52.5	18.7	610	174	436	17,259	17,526	-14,961	17,259	11,684	-641	17,259	17,526	-14,961	17,259	11,684	-641	232	186
47.5	16.2	611	175	436	22,827	23,179	-14,961	22,827	15,453	-641	22,827	23,179	-14,961	22,827	15,453	-641	321	257
42.5	14.4	656	187	469	28,395	28,832	-14,961	28,395	19,222	-641	28,395	28,832	-14,961	28,395	19,222	-641	440	352
37.5	12.6	1,023	292	731	33,962	34,486	-14,961	33,962	22,990	-641	33,962	34,486	-14,961	33,962	22,990	-641	835	668
32.5	10.7	734	210	524	39,530	40,139	-14,961	39,530	26,759	-641	39,530	40,139	-14,961	39,530	26,759	-641	706	565
27.5	8.6	334	95	239	45,097	45,792	-14,961	45,097	30,528	-641	45,097	45,792	-14,961	45,097	30,528	-641	370	296
22.5	6.8	252	72	180	50,665	51,446	-14,961	50,665	34,297	-641	50,665	51,446	-14,961	50,665	34,297	-641	315	252
17.5	5.5	125	36	89	56,233	57,099	-14,961	56,233	38,066	-641	56,233	57,099	-14,961	56,233	38,066	-641	175	140
12.5	4.1	47	13	34	61,800	62,753	-14,961	61,800	41,835	-641	61,800	62,753	-14,961	61,800	41,835	-641	72	58
7.5	2.6	22	6	16	67,368	68,406	-14,961	67,368	45,604	-641	67,368	68,406	-14,961	67,368	45,604	-641	37	30
2.5	1.0	13	4	9	72,935	74,059	-14,961	72,935	49,373	-641	72,935	74,059	-14,961	72,935	49,373	-641	24	19
-2.5	0.0	0	0	0	78,503	79,713	-14,961	78,503	53,142	-641	78,503	79,713	-14,961	78,503	53,142	-641	0	0
-7.5	-1.5	0	0	0	84,070	85,366	-14,961	84,070	56,911	-641	84,070	85,366	-14,961	84,070	56,911	-641	0	0
TOTALS		**8,760**	**2,503**	**6,257**													**3,669**	**2,935**

Existing Building Ventilation & Infiltration (occ)	**698**	**cfm**
Overheat Ventilation Factor	**1.50**	
Additional ventilation to offset overheat	**349**	**cfm**
Existing Building Ventilation & Infiltration (unocc)	**698**	**cfm**

Electrical Requirements for Heating Equipment

Existing Equipment

Unit	Htng Hrs	Amps	Volts	Phase	Power Factor	Annual kWh
UH-1	2,090	4.3	115	1	0.8	827
UH-2	2,090	4.3	115	1	0.8	827
UH-3	2,090	2.6	115	1	0.8	500
Total						**2154**

Proposed Equipment

Unit	Htng Hrs	Amps	Volts	Phase	Power Factor	Annual kWh
Infrared Htr	2,090	0	115	1	0.8	0
Infrared Htr	2,090	0	115	1	0.8	0
Infrared Htr	2,090	0	115	1	0.8	0
Infrared Htr	2,090	0	115	1	0.8	0
Total						**0**

*Electrical data based on Reznor VR Series Infrared Heaters

Avg. OA Temp °F	Heating Hrs	Assumed % Time of Operation	hrs of Operation
102.5	0	0%	0
97.5	0	0%	0
92.5	0	0%	0
87.5	0	0%	0
82.5	0	0%	0
77.5	0	0%	0
72.5	0	0%	0
67.5	0	0%	0
62.5	0	8%	0
57.5	600	15%	92
52.5	610	23%	141
47.5	611	31%	188
42.5	656	38%	252
37.5	1023	46%	472
32.5	734	54%	395
27.5	334	62%	206
22.5	252	69%	174
17.5	125	77%	96
12.5	47	85%	40
7.5	22	92%	20
2.5	13	100%	13
-2.5	0	100%	0
-7.5	0	100%	0
	5,027	42%	2090

NJBPU - Borough of Tenafly
CHA #21794
Building: Main DPW Building

ECM-4: Install Infrared Heaters - Repair Shop

Multipliers	
Material:	0.98
Labor:	1.21
Equipment:	1.09

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
						$ -	$ -	$ -	$ -	
Unit Heater Removal	3	EA		$ 450		$ -	$ 1,634	$ -	$ 1,634	
						$ -	$ -	$ -	$ -	
High Intensity Infrared Heater 100 MBH	4	EA	$ 680	$ 325		$ 2,666	$ 1,573	$ -	$ 4,239	Includes Controls
Miscellaneous Gas Piping, Valves, etc.	4	EA	$ 200	$ 250		$ 784	$ 1,210	$ -	$ 1,994	
Miscellaneous electrical	1	LS	$ 250			$ 245	$ -	$ -	$ 245	
						$ -	$ -	$ -	$ -	

Note: Unit selections and budgetary pricing are per Reznor high-intensity infrared heaters.

$8,111	Subtotal
$811	10% Contingency
$892	10% Contractor O&P
$0	0% Engineering
$9,814	**Total**

APPENDIX F

ECM-5 Furnace Replacement – Front Garage

NJBPU - Borough of Tenafly
CHA #21794
Building: Main DPW Building

ECM-5 Furnace Replacement - Front Garage

Existing Fuel	Nat.Gas
Proposed Fuel	Nat.Gas

Item	Value	Units	Formula/Comments
Baseline Fuel Cost	$ 1.10		
Proposed Fuel Cost	$ 1.10		
Temperature Setpoint	65	°F	Per thermostat setpoint
Total Heating Equipment Input	100,000	Btuh	Per existing equipment
Annual Hours of Operation	1,732	hrs/year	Calculated Below
Baseline Fuel Use	1,732	Therms	Based on historical utility data
Existing Furnace Efficiency	76%		Estimated or Measured
Existing Heat Distribution Effectiveness	90%		
Baseline Heating Load	118,497	Mbtu/yr	Baseline Fuel Use x Existing Efficiency x Effectiveness x 100 Mbtu/Therms
Baseline Fuel Cost	$ 1,904		
Proposed Furnace Efficiency	95%		New Condensing Furnace Efficiency
Proposed Heat Distribution Effectiveness	90%		
Proposed Fuel Use	1,386	Therms	Baseline Heating Load / Proposed Efficiency / Effectiveness / 100 Mbtu/Therms
Proposed Fuel Cost	$ 1,523		
Annual Savings	346	Therms	
Annual Savings	$ 381	/yr	

OAT - DB Bin Temp F	Annual Hours	Heating Hours		Hours of Operation
102.5	0	0	0%	0
97.5	3	0	0%	0
92.5	34	0	0%	0
87.5	131	0	0%	0
82.5	500	0	0%	0
77.5	620	0	0%	0
72.5	664	0	0%	0
67.5	854	0	0%	0
62.5	927	927	3%	32
57.5	600	600	10%	62
52.5	610	610	17%	105
47.5	611	611	24%	147
42.5	656	656	31%	204
37.5	1,023	1,023	38%	388
32.5	734	734	45%	329
27.5	334	334	52%	173
22.5	252	252	59%	148
17.5	125	125	66%	82
12.5	47	47	72%	34
7.5	22	22	79%	17
2.5	13	13	86%	11
-2.5	0	0	93%	0
-7.5	0	0	100%	0
Total	8,760	5,954	29%	1732

NJBPU - Borough of Tenafly
CHA #21794
Building: Main DPW Building

ECM-5 Furnace Replacement - Front Garage

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.		
						$ -	$ -	$ -	$ -	
Furnace Removal	1	EA		$ 240		$ -	$ 290	$ -	$ 290	
						$ -	$ -	$ -	$ -	
100 MBH High Efficiency Condensing Furnace	1	EA	$ 900	$ 700		$ 882	$ 847	$ -	$ 1,729	Includes Controls
						$ -	$ -	$ -	$ -	
Miscellaneous Electrical and Ductwork	1	LS	$ 300			$ 294	$ -	$ -	$ 294	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

$ 2,313	Subtotal	
$ 231	10%	Contingency
$ 127	5%	Contractor O&P
$ -	0%	Engineering
$ 2,672	**Total**	

New Jersey Smart Start Incentive Program	QTY	UNIT	$ / UNIT	TOTAL SAVINGS	Cost W/O INCENTIVE	Cost W/ INCENTIVE
Gas-Fired Furnace	1	EA	$300	$300	$ 1,729	$ 1,429
				$300	$1,729	$1,429

Total ECM Cost w/ Incentives	**$2,372**

APPENDIX G

ECM-6 Remove Window AC Unit

NJBPU - Borough of Tenafly
CHA #21794
Building: Main DPW Building

ECM-6: Remove Window AC Unit - Parts Room
AC Unit in parts room operates with doors open and no occupants. Unit can be removed to reduce overall energy consumption.

ASSUMPTIONS			Comments
Electric Unit Cost	$0.165	/ kWh	
Electric Demand Cost	$11.870	/ kW	
Cooling Months	4	months	
Average run hours per Week	48	Hours	Unit is manually turned on/off
Space Balance Point	70	F	
Space Temperature Setpoint	75	deg F	setpoint
Avg. BTU / Hr Rating of existing AC unit	12,000	Btu / Hr	
Average EER	7.0		Unit appears more than 10 years old, EER was 8 when new

Item	Value	Units	Comments
Total Number of Units	1		
Existing Annual Electric Usage	631	kWh	

ANNUAL SAVINGS		
Annual Electric Unit Savings	631	kWh
Summer Electric Demand Savings	1.7	kW
Annual Cost Savings	$185	

OAT - DB Bin Temp F	Annual Hours	Cooling Hrs at Temp Above balance point
102.5	0	0
97.5	3	1
92.5	34	10
87.5	131	37
82.5	500	143
77.5	620	177
72.5	664	0
67.5	854	0
62.5	927	0
57.5	600	0
52.5	610	0
47.5	611	0
42.5	656	0
37.5	1,023	0
32.5	734	0
27.5	334	0
22.5	252	0
17.5	125	0
12.5	47	0
7.5	22	0
2.5	13	0
-2.5	0	0
-7.5	0	0

Total	8,760	368

NJBPU - Borough of Tenafly
CHA #21794
Building: Main DPW Building

ECM-6: Remove Window AC Unit - Parts Room

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	1	LS		$ 50		$ -	$ 61	$ -	$ 61	
Wall Patching	1	LS	$ 50	$ 75		$ 49	$ 91	$ -	$ 140	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

$ 200	Subtotal
$ -	0% Contingency
$ -	0% Contractor O&P
$ -	0% Engineering
$ 200	**Total**

APPENDIX H

ECM-7 Increase Wall Insulation

NJBPU - Borough of Tenafly
CHA #21794
Building: Main DPW Building

ECM-7 Increase Wall Insulation **Shop Area**

Total Existing Wall Area	2,157	sf
Existing U-value	0.21	Btu/hr/(sf*F)
Existing R-value	4.8	
Proposed U-value	0.06	Btu/hr/(sf*F)
Proposed R-value	16.8	With 3" EIFS Wall System
Heating Efficiency	80%	
Cooling Efficiency	0.00	kW/ton

Existing Cooling

Max. North Wall Cooling Load	846	Btu/hr
Max. East Wall Cooling Load	8,571	Btu/hr
Max. South Wall Cooling Load	2,933	Btu/hr
Max. West Wall Cooling Load	4,096	Btu/hr

Existing Heating

Existing Heating Load Temp Diff.	57	F
Existing Max. Wall Heating Load	51,509	Btu/hr
Heating On Point	60	F

Proposed Cooling

Max. North Wall Cooling Load	240	Btu/hr
Max. East Wall Cooling Load	2,436	Btu/hr
Max. South Wall Cooling Load	834	Btu/hr
Max. West Wall Cooling Load	1,164	Btu/hr

Proposed Heating

Proposed Max. Heating Load	14,647	Btu/hr

Occupied Cooling Setpoint	75	F
Unoccupied Cooling Setpoint	78	F

Occupied Heating Setpoint	68	F
Unoccupied Heating Setpoint	68	F

Existing Cooling Total	-	kWh/yr
Proposed Cooling Total	-	kWh/yr
Savings	-	kWh/yr

Existing Heating Total	62,469,926	Btu/yr
Proposed Heating Total	17,764,885	Btu/yr
Savings	44,705,040	Btu/yr
Input	559	therms

				Occupied				Unoccupied							
Avg Outdoor Air Temp. Bins °F	Existing Equipment Bin Hours	Occupied Equipment Bin Hours	Unoccupied Equipment Bin Hours	Existing Heat Gain	Proposed Heat Gain	Existing Heat Loss	Proposed Heat Loss	Existing Heat Gain	Proposed Heat Gain	Existing Heat Loss	Proposed Heat Loss	Existing Cooling Load	Existing Heating Load	Proposed Cooling Load	Proposed Heating Load
				(Btu/hr)	(Btu/hr)	(Btu/hr)	(Btu/hr)	(Btu/hr)	(Btu/hr)	(Btu/hr)	(Btu/hr)	(kWh/yr)	(Btu/yr)	(kWh/yr)	(Btu/yr)
97.5	3	1	2	17,144	4,875	-	-	17,144	4,875	-	-	-	-	-	-
92.5	34	10	24	13,334	3,792	-	-	13,334	3,792	-	-	-	-	-	-
87.5	131	37	94	9,524	2,708	-	-	9,524	2,708	-	-	-	-	-	-
82.5	500	143	357	5,715	1,625	-	-	5,715	1,625	-	-	-	-	-	-
77.5	620	177	443	1,905	542	-	-	1,905	542	-	-	-	-	-	-
72.5	664	190	474	-	-	-	-	-	-	-	-	-	-	-	-
67.5	854	244	610	-	-	-	-	-	-	-	-	-	-	-	-
62.5	927	265	662	-	-	-	-	-	-	-	-	-	-	-	-
57.5	600	171	429	-	-	4,741	1,348	-	-	4,741	1,348	-	2,844,396	-	808,875
52.5	610	174	436	-	-	6,998	1,990	-	-	6,998	1,990	-	4,268,851	-	1,213,954
47.5	611	175	436	-	-	9,256	2,632	-	-	9,256	2,632	-	5,655,155	-	1,608,185
42.5	656	187	469	-	-	11,513	3,274	-	-	11,513	3,274	-	7,552,548	-	2,147,756
37.5	1,023	292	731	-	-	13,770	3,916	-	-	13,770	3,916	-	14,087,208	-	4,006,050
32.5	734	210	524	-	-	16,028	4,558	-	-	16,028	4,558	-	11,764,511	-	3,345,533
27.5	334	95	239	-	-	18,285	5,200	-	-	18,285	5,200	-	6,107,324	-	1,736,770
22.5	252	72	180	-	-	20,543	5,842	-	-	20,543	5,842	-	5,176,800	-	1,472,153
17.5	125	36	89	-	-	22,800	6,484	-	-	22,800	6,484	-	2,850,039	-	810,480
12.5	47	13	34	-	-	25,058	7,126	-	-	25,058	7,126	-	1,177,715	-	334,913
7.5	22	6	16	-	-	27,315	7,768	-	-	27,315	7,768	-	600,935	-	170,891
2.5	13	4	9	-	-	29,573	8,410	-	-	29,573	8,410	-	384,445	-	109,327
-2.5	0	0	0	-	-	31,830	9,052	-	-	31,830	9,052	-	-	-	-
-7.5	0	0	0	-	-	34,088	9,694	-	-	34,088	9,694	-	-	-	-
TOTALS	**8,760**	**2,503**	**6,257**									**-**	**62,469,926**	**-**	**17,764,885**

NJBPU - Borough of Tenafly
CHA #21794
Building: Main DPW Building

ECM-7 Increase Wall Insulation

Garage Areas

Total Existing Wall Area	2,114	sf
Existing U-value	0.21	Btu/hr/(sf*F)
Existing R-value	4.8	
Proposed U-value	0.06	Btu/hr/(sf*F)
Proposed R-value	16.8	With 3" EIFS Wall System
Heating Efficiency	80%	
Cooling Efficiency	0.00	kW/ton

Existing Cooling

Max. North Wall Cooling Load	1,218	Btu/hr
Max. East Wall Cooling Load	1,714	Btu/hr
Max. South Wall Cooling Load	3,016	Btu/hr
Max. West Wall Cooling Load	2,473	Btu/hr

Existing Heating

Existing Heating Load Temp Diff.	54	F
Existing Max. Wall Heating Load	34,570	Btu/hr
Heating On Point	60	F

Proposed Cooling

Max. North Wall Cooling Load	346	Btu/hr
Max. East Wall Cooling Load	488	Btu/hr
Max. South Wall Cooling Load	1,790	Btu/hr
Max. West Wall Cooling Load	846	Btu/hr

Proposed Heating

Proposed Max. Heating Load	9,831	Btu/hr

Occupied Cooling Setpoint	75	F
Unoccupied Cooling Setpoint	78	F

Occupied Heating Setpoint	65	F
Unoccupied Heating Setpoint	65	F

Existing Cooling Total	-	kWh/yr
Proposed Cooling Total	-	kWh/yr
Savings	-	kWh/yr

Existing Heating Total	54,538,475	Btu/yr
Proposed Heating Total	15,509,379	Btu/yr
Savings	39,029,096	Btu/yr
Input	488	therms

				Occupied				Unoccupied							
Avg Outdoor Air Temp. Bins °F	Existing Equipment Bin Hours	Occupied Equipment Bin Hours	Unoccupied Equipment Bin Hours	Existing Heat Gain	Proposed Heat Gain	Existing Heat Loss	Proposed Heat Loss	Existing Heat Gain	Proposed Heat Gain	Existing Heat Loss	Proposed Heat Loss	Existing Cooling Load	Existing Heating Load	Proposed Cooling Load	Proposed Heating Load
				(Btu/hr)	(Btu/hr)	(Btu/hr)	(Btu/hr)	(Btu/hr)	(Btu/hr)	(Btu/hr)	(Btu/hr)	(kWh/yr)	(Btu/yr)	(kWh/yr)	(Btu/yr)
97.5	3	1	2	11,527	3,278	-	-	11,527	3,278	-	-	-	-	-	-
92.5	34	10	24	8,966	2,550	-	-	8,966	2,550	-	-	-	-	-	-
87.5	131	37	94	6,404	1,821	-	-	6,404	1,821	-	-	-	-	-	-
82.5	500	143	357	3,842	1,093	-	-	3,842	1,093	-	-	-	-	-	-
77.5	620	177	443	1,281	364	-	-	1,281	364	-	-	-	-	-	-
72.5	664	190	474	-	-	-	-	-	-	-	-	-	-	-	-
67.5	854	244	610	-	-	-	-	-	-	-	-	-	-	-	-
62.5	927	265	662	-	-	-	-	-	-	-	-	-	-	-	-
57.5	600	171	429	-	-	3,318	944	-	-	3,318	944	-	1,990,738	-	566,116
52.5	610	174	436	-	-	5,530	1,573	-	-	5,530	1,573	-	3,373,195	-	959,252
47.5	611	175	436	-	-	7,742	2,202	-	-	7,742	2,202	-	4,730,214	-	1,345,155
42.5	656	187	469	-	-	9,954	2,831	-	-	9,954	2,831	-	6,529,620	-	1,856,861
37.5	1,023	292	731	-	-	12,166	3,460	-	-	12,166	3,460	-	12,445,429	-	3,539,169
32.5	734	210	524	-	-	14,378	4,089	-	-	14,378	4,089	-	10,553,122	-	3,001,044
27.5	334	95	239	-	-	16,589	4,718	-	-	16,589	4,718	-	5,540,887	-	1,575,690
22.5	252	72	180	-	-	18,801	5,347	-	-	18,801	5,347	-	4,737,956	-	1,347,356
17.5	125	36	89	-	-	21,013	5,976	-	-	21,013	5,976	-	2,626,668	-	746,959
12.5	47	13	34	-	-	23,225	6,605	-	-	23,225	6,605	-	1,091,588	-	310,420
7.5	22	6	16	-	-	25,437	7,234	-	-	25,437	7,234	-	559,619	-	159,142
2.5	13	4	9	-	-	27,649	7,863	-	-	27,649	7,863	-	359,439	-	102,215
-2.5	0	0	0	-	-	29,861	8,492	-	-	29,861	8,492	-	-	-	-
-7.5	0	0	0	-	-	32,073	9,121	-	-	32,073	9,121	-	-	-	-
TOTALS	**8,760**	**2,503**	**6,257**									-	**54,538,475**	-	**15,509,379**

NJBPU - Borough of Tenafly
CHA #21794
Building: Main DPW Building

ECM-7 Increase Wall Insulation

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.		
						$ -	$ -	$ -	$ -	
Remove Vinyl Siding (Shop)	1,215	SQFT		$ 0.52		$ -	$ 764	$ -	$ 764	Only 2 Sides of Bldg
Remove Vinyl Siding (Garages)	1,050	SQFT		$ 0.52		$ -	$ 661	$ -	$ 661	Only on Front Garage
						$ -	$ -	$ -	$ -	
EIFS Wall System (3" EPS)	2,157	SQFT	$ 3.02	$ 3.69	$ 0.35	$ 6,384	$ 9,631	$ 823	$ 16,838	Shop Area
EIFS Wall System (3" EPS)	2,114	SQFT	$ 3.02	$ 3.69	$ 0.35	$ 6,255	$ 9,437	$ 806	$ 16,498	Garage Areas
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

Exterior Insulation Finishing System (EIFS)
Expanded Polystyrene (EPS)

$	34,761	Subtotal
$	3,476	10% Contingency
$	3,824	10% Contractor O&P
$	-	Engineering
$	**42,060**	**Total**

APPENDIX I

ECM-8 Replace Overhead Doors and Install Seals

NJBPU - Borough of Tenafly
CHA #21794
Building: Main DPW Building

ECM-8 Replace Overhead Doors and Install Seals **Repair Shop and Garage Areas**

Description Doors can lead to increased energy consumption due to infiltration/exfiltration and heat gain/loss. Replacing older doors with poor insulation and seals with insulated doors and new seals can decrease energy usage.
This measures evaluates installing new door seals on the Repair Shop overhead door and replacing the 4 wooden overhead doors on the rear garage area with new insulated doors.

Given

Occupied Cooling Hours per Week	0	Hours	
Occupied Heating Hours per Week	48	Hours	
Heating Energy Cost	$1.10	$/therm	
Cooling Cost	$0.165	$/kWh	
Occupied Cooling Setpoint Temperature	75.0	Degrees F	(Assumption)
Occupied Cooling Avg Space Air Enthalpy	25.5	btu/# air	(Assumption)
Occupied Heatng Setpoint Temperature	65.0	Degrees F Occupied	Average per T-stats
Unoccupied Heating Setpoint Temperature	65.0	Degrees F Unoccupied	Average per T-stats
Door Area (to be replaced)	480	sq.ft.	(From door survey)
Door Perimeter (To be replaced & have seals installed)	254	ft	(From door survey)
Proposed U factor	0.15	Btu/(h*sqft*degf)	(From door vendor)
Proposed Air Infiltration	0.20	cfm/ft	(From door vendor)
Cooling Conversion	12,000	Btu/ton	
Heating Btu Conversion	1,000,000	Btu/MMBtu	

Assumptions

Existing U factor	0.50	Btu/(h*sqft*degf)	(From ASHRAE Fundamentals)
Existing Air Infiltration	0.30	cfm/ft	(From ASHRAE Fundamentals)
Heating System Efficiency	80%		
Cooling System Efficiency	1.50	kW/ton	

Formula

Cooling Energy Conduction = (Existing U x Area x (OA Temp - RA Temp) x Op Hours)

Heating Energy Conduction = (Existing U x Area x (RA Temp - OA Temp) x Op Hours)
Cooling Energy Infiltration = (4.5 x Leakage x Perimeter x (OA Enthalpy - RA Enthalpy) x Op Hours)
Heating Energy Infiltration = 1.08 x Leakage x Perimeter x (RA temp - OA temp) x Op Hours)
Load = (Conduction) + (Infiltration)
Cooling Energy = (Cooling Load) / (12,000 Btu/Ton) x (kw/Ton)
Heating Energy = (Heating Load) / (1,000,000 Btu/MMBtu) / (Boiler Efficiency)
Energy Cost = (Energy) x (Cost/Unit)

Existing

Operation	OA Enthalpy	OA Temp	Total Hours	Cooling Occupied Hours	Heating Occupied Hours	Heating Unoccupied Hours	Cooling Occupied Conduction	Heating Occupied Conduction	Heating Unoccupied Conduction	Cooling Occupied Infiltration	Heating Occupied Infiltration	Heating Unoccupied Infiltration
Cooling	38.3	92.5	37	0.0	0.0	0.0	0	0	0	0	0	0
Cooling	36.6	87.5	131	0.0	0.0	0.0	0	0	0	0	0	0
Cooling	33.5	82.5	500	0.0	0.0	0.0	0	0	0	0	0	0
Cooling	31.6	77.5	620	0.0	0.0	0.0	0	0	0	0	0	0
Heating	30.3	72.5	664	0.0	0.0	0.0	0	0	0	0	0	0
Heating	27.9	67.5	854	0.0	0.0	0.0	0	0	0	0	0	0
Heating	24.6	62.5	927	0.0	264.9	662.1	0	158,914	397,286	0	54,492	136,229
Heating	21.6	57.5	600	0.0	171.4	428.6	0	308,571	771,429	0	105,809	264,523
Heating	18.7	52.5	610	0.0	174.3	435.7	0	522,857	1,307,143	0	179,288	448,219
Heating	16.2	47.5	611	0.0	174.6	436.4	0	733,200	1,833,000	0	251,414	628,536
Heating	14.3	42.5	656	0.0	187.4	468.6	0	1,012,114	2,530,286	0	347,054	867,635
Heating	12.4	37.5	1,023	0.0	292.3	730.7	0	1,929,086	4,822,714	0	661,483	1,653,709
Heating	10.4	32.5	734	0.0	209.7	524.3	0	1,635,771	4,089,429	0	560,906	1,402,265
Heating	8.7	27.5	334	0.0	95.4	238.6	0	858,857	2,147,143	0	294,502	736,255
Heating	7	22.5	252	0.0	72.0	180.0	0	734,400	1,836,000	0	251,826	629,564
Heating	5.4	17.5	125	0.0	35.7	89.3	0	407,143	1,017,857	0	139,609	349,023
Heating	3.9	12.5	47	0.0	13.4	33.6	0	169,200	423,000	0	58,019	145,047
Heating	2.5	7.5	22	0.0	6.3	15.7	0	86,743	216,857	0	29,744	74,360
Heating	1.2	2.5	13	0.0	3.7	9.3	0	55,714	139,286	0	19,104	47,761
Heating	-0.2	-2.5	0	0.0	0.0	0.0	0	0	0	0	0	0
Heating	-1.4	-7.5	0	0.0	0.0	0.0	0	0	0	0	0	0
Subtotal =			8,760	0	1,701	4,253	0	8,612,571	21,531,429 btu	0	2,953,251	7,383,127 btu

	Conduction Infiltration		
Cooling Load =	(0) + (0) =		0 btu
	Cooling Load		
Cooling Energy =	(0)/(12000) * (1.50) =		0 kWh
	Cooling Energy Cooling Cost		
Cooling Energy Cost =	(0.00) x ($0.165) =		$ -
	Conduction Infiltration		
Heating Load =	(30144000) + (10336378) =		40,480,378 btu
	Heating Load Heat Content		
Heating Energy =	(40480378)/(80%)/(100000) =		506 therms
	Heating Energy Heating Cost		
Heating Energy Cost =	(506.00) x ($1.099) =		$ 556

Operation	OA Enthalphy	OA Temp	Total Hours	Cooling Occupied Hours	Heating Occupied Hours	Heating Unoccupied Hours	Cooling Occupied Conduction	Heating Occupied Conduction	Heating Unoccupied Conduction	Cooling Occupied Infiltration	Heating Occupied Infiltration	Heating Unoccupied Infiltration
Cooling	38.3	92.5	37	0.0	0.0	0.0	0	0	0	0	0	0
Cooling	36.6	87.5	131	0.0	0.0	0.0	0	0	0	0	0	0
Cooling	33.5	82.5	500	0.0	0.0	0.0	0	0	0	0	0	0
Cooling	31.6	77.5	620	0.0	0.0	0.0	0	0	0	0	0	0
Heating	30.3	72.5	664	0.0	0.0	0.0	0	0	0	0	0	0
Heating	27.9	67.5	854	0.0	0.0	0.0	0	0	0	0	0	0
Heating	24.6	62.5	927	0.0	264.9	662.1	0	47,674	119,186	0	36,328	90,820
Heating	21.6	57.5	600	0.0	171.4	428.6	0	92,571	231,429	0	70,539	176,349
Heating	18.7	52.5	610	0.0	174.3	435.7	0	156,857	392,143	0	119,525	298,813
Heating	16.2	47.5	611	0.0	174.6	436.4	0	219,960	549,900	0	167,610	419,024
Heating	14.3	42.5	656	0.0	187.4	468.6	0	303,634	759,086	0	231,369	578,423
Heating	12.4	37.5	1,023	0.0	292.3	730.7	0	578,726	1,446,814	0	440,989	1,102,472
Heating	10.4	32.5	734	0.0	209.7	524.3	0	490,731	1,226,829	0	373,937	934,843
Heating	8.7	27.5	334	0.0	95.4	238.6	0	257,657	644,143	0	196,335	490,837
Heating	7	22.5	252	0.0	72.0	180.0	0	220,320	550,800	0	167,884	419,710
Heating	5.4	17.5	125	0.0	35.7	89.3	0	122,143	305,357	0	93,073	232,682
Heating	3.9	12.5	47	0.0	13.4	33.6	0	50,760	126,900	0	38,679	96,698
Heating	2.5	7.5	22	0.0	6.3	15.7	0	26,023	65,057	0	19,829	49,574
Heating	1.2	2.5	13	0.0	3.7	9.3	0	16,714	41,786	0	12,736	31,841
Heating	-0.2	-2.5	0	0.0	0.0	0.0	0	0	0	0	0	0
Heating	-1.4	-7.5	0	0.0	0.0	0.0	0	0	0	0	0	0
Subtotal =			8,760	0	1,701	4,253	0	2,583,771	6,459,429 btu	0	1,968,834	4,922,085 btu

	Conduction + Infiltration		
Cooling Load =	(0) + (0) =		0 btu
	Cooling Load		
Cooling Energy =	(0)/(12000) * (1.50) =		0 kWh
	Cooling Energy x Cooling Cost		
Cooling Energy Cost =	(0.00) x ($0.165) =	$	-
	Conduction + Infiltration		
Heating Load =	(9043200) + (6890918) =		15,934,118 btu
	Heating Load / Heat Content		
Heating Energy =	(15934118)/(80%) / (100000) =		199 therms
	Heating Energy x Heating Cost		
Heating Energy Cost =	(199.18) x ($1.099) =	$	219

Summary

EXISTING COOLING ENERGY	**0.00**	**kWh**	**$**	**-**
EXISTING HEATING ENERGY	**506.00**	**therms**	**$**	**556.10**
EXISTING ENERGY COST			**$**	**556.10**

PROPOSED COOLING ENERGY	**0.00**	**kWh**	**$**	**-**
PROPOSED HEATING ENERGY	**199.18**	**therms**	**$**	**218.89**
PROPOSED ENERGY COST			**$**	**218.89**

COOLING ENERGY SAVINGS	**0.00**	**kWh**	**$**	**-**	**#DIV/0! of existing**
HEATING ENERGY SAVINGS	**306.83**	**therms**	**$**	**337.20**	**60.6% of existing**
ENERGY COST SAVINGS			**$**	**337.20**	**60.6% of existing**

Comments

NJBPU - Borough of Tenafly
CHA #21794
Building: Main DPW Building

ECM-8 Replace Overhead Doors and Install Seals

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.		
						$ -	$ -	$ -	$ -	
Garage Door Removal	4	EA		$ 200		$ -	$ 968	$ -	$ 968	
						$ -	$ -	$ -	$ -	
Garage Door Seals	78	LF	$ 1.25	$ 2.50	$ -	$ 96	$ 236	$ -	$ 332	Repair Shop Door
						$ -	$ -	$ -	$ -	
12'x10' Insulated Garage Door	4	EA	$ 1,200	$ 400		$ 4,704	$ 1,936	$ -	$ 6,640	Rear Garage Doors
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

$ 7,940	Subtotal
$ 794	10% Contingency
$ 873	10% Contractor O&P
$ -	Engineering
$ 9,607	**Total**

APPENDIX J

ECM-9 Replace Electric Domestic Hot Water Heaters

NJBPU - Borough of Tenafly
CHA #21794
Building: Main DPW Building

ECM-9: Replace Electric DHW Heater **Office Area Unit**

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	21	gal/day	Calculated from usage below
Annual Hot Water Energy Demand	3,127	MBTU/yr	Energy required to heat annual quantity of hot water to setpoint
Existing Tank Size	30	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)	0.3	MBH	
Annual Standby Hot Water Load	2,738	MBTU/yr	
Total Annual Hot Water Demand (w/ standby losses)	5,864	Mbtu/yr	Building demand plus standby losses
Existing Water Heater Efficiency	98%		Per Manufacturer
Total Annual Energy Required	5,984	Mbtu/yr	
Total Annual Electric Required	1,753	**kWh/yr**	**Electrical Savings**
Average Annual Electric Demand	0.20	kW	
Peak Electric Demand	4.50	**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)	3,127	MBTU/yr	
Proposed Avg. Hot water heater efficiency	92%		Based on Navien CR180 instantaneous, condensing DHW Heater
Proposed Total Annual Energy Required	3,410	MBTU/yr	
Proposed Fuel Use	34	Therms/yr	Standby Losses and inefficient DHW heater eliminated
Elec Utility Demand Unit Cost	$11.87	$/kW	
Elec Utility Supply Unit Cost	$0.13	$/kWh	
NG Utility Unit Cost	$1.10	$/Therm	
Existing Operating Cost of DHW	$860	$/yr	
Proposed Operating Cost of DHW	$37	$/yr	
Annual Utility Cost Savings	**$823**	**$/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 G	2.5	0.25	3	3	10	2	23	50%	11
SHOWER	2.5	5	1	1	1	0	13	75%	9
KITCHEN SINK	2.5	0.5	1	1	0	0	0	75%	0
MOP SINK	2.5	2	1	1	0	0	0	75%	0
Dishwasher (g	10	1	1	0	0	0	0	100%	0
						TOTAL	35		21

*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: Main DPW Building

ECM-9: Replace Electric DHW Heater **Break Room / Locker Room Areas**

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	14	gal/day	Calculated from usage below
Annual Hot Water Energy Demand	2,132	MBTU/yr	Energy required to heat annual quantity of hot water to setpoint
Existing Tank Size	40	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)	0.4	MBH	
Annual Standby Hot Water Load	3,650	MBTU/yr	
Total Annual Hot Water Demand (w/ standby losses)	5,782	Mbtu/yr	Building demand plus standby losses
Existing Water Heater Efficiency	98%		Per Manufacturer
Total Annual Energy Required	5,900	Mbtu/yr	
Total Annual Electric Required	1,729	**kWh/yr**	**Electrical Savings**
Average Annual Electric Demand	0.20	kW	
Peak Electric Demand	**4.50**	**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)	2,132	MBTU/yr	
Proposed Avg. Hot water heater efficiency	92%		Based on Navien CR180 instantaneous, condensing DHW Heater
Proposed Total Annual Energy Required	2,325	MBTU/yr	
Proposed Fuel Use	23	Therms/yr	Standby Losses and inefficient DHW heater eliminated
Elec Utility Demand Unit Cost	$11.87	$/kW	
Elec Utility Supply Unit Cost	$0.13	$/kWh	
NG Utility Unit Cost	$1.10	$/Therm	
Existing Operating Cost of DHW	$857	$/yr	
Proposed Operating Cost of DHW	$26	$/yr	
Annual Utility Cost Savings	**$832**	**$/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 G	2.5	0.25	3	3	15	0	28	50%	14
SHOWER	2.5	5	1	1	0	0	0	75%	0
KITCHEN SINK	2.5	0.5	1	1	0	0	0	75%	0
MOP SINK	2.5	2	1	1	0	0	0	75%	0
Dishwasher (g	10	1	1	0	0	0	0	100%	0
						TOTAL	28		14

*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: Main DPW Building

ECM-9: 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	2	LS		$ 50		$ -	$ 121	$ -	$ 121	
						$ -	$ -	$ -	$ -	
Instantaneous Gas-Fired DHW Heater	2	EA	$ 1,200	$ 280		$ 2,352	$ 678	$ -	$ 3,030	
Miscellaneous Electrical	2	LS	$ 50	$ 100		$ 98	$ 242	$ -	$ 340	
Venting	30	LF	$ 5.50	$ 6.70		$ 162	$ 243	$ -	$ 405	PVC piping
Miscellaneous Piping and Valves	2	LS	$ 500	$ 300		$ 980	$ 726	$ -	$ 1,706	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

$ 5,602		Subtotal
$ 840	15%	Contingency
$ 644	10%	Contractor O&P
$ -	0%	Engineering
$ 7,086		**Total**

New Jersey Smart Start Incentive Program	QTY	UNIT	$ / UNIT	TOTAL SAVINGS	Cost W/O INCENTIVE	Cost W/ INCENTIVE
Tankless Water Heater	2	EA	$300	$600	$ 3,030	$ 2,430
				$600	$3,030	$2,430

Total ECM Cost w/ Incentives	**$6,486**

APPENDIX K

ECM-10 Install Low-Flow Urinals

NJBPU - Borough of Tenafly
CHA #21794
Building: Main DPW Building

ECM-10 Install Low-Flow Urinals

Large Break Room Restroom

EXISTING CONDITIONS		
Cost of Water / 1000 Gallons	$5.36	$ / kGal
Urinals in Building	2	
Average Flushes / Day (All Urinals)	30	Uses
Average Gallons / Flush	1.5	Gal

PROPOSED CONDITIONS		
Proposed Urinals to be Replaced	2	
Proposed Gallons / Flush	0.125	Gal
Proposed Material Cost*	$590	1/8 gpf Urinals
Proposed Installation Cost	$250	
Total cost of new urinals & valves	$1,680	

*Cost based on sensor operated flush valves.

SAVINGS		
Current Urinal Water Use	16.4	kGal / year
Proposed Urinal Water Use	1.4	kGal / year
Water Savings	15.1	kGal / year
Cost Savings	$81	/ year
Simple Payback	20.8	years

APPENDIX L

ECM-11 Install Low-Flow Flush Valves on Toilets

NJBPU - Borough of Tenafly
CHA #21794
Building: Main DPW Building

ECM-11 Install Low-Flow Flush Valves on Toilets
Large Break Room Restroom

EXISTING CONDITIONS		
Cost of Water / 1000 Gallons	$5.36	$ / kGal
Toilets in Building	3	
Average Flushes / Day (All Toilets)	15	Uses
Average Gallons / Flush	3.5	Gal

PROPOSED CONDITIONS		
Proposed Toilets to be Replaced	3	
Proposed Gallons / Flush	1.28	per Zurn EcoVantage Toilet
Proposed Material Cost*	$395	
Proposed Installation cost	$52	
Total cost of new toilets & valves	$1,341	

*Cost based on sensor operated flush valves.

SAVINGS		
Current Toilet Water Use	19.2	kGal / year
Proposed Toilet Water Use	7.0	kGal / year
Water Savings	12.2	kGal / year
Cost Savings	$65	/ year
Simple Payback	20.6	years

APPENDIX M

ECM-12 Lighting Replacements

New Jersey BPU Energy Audit Program
CHA #21794
Borough of Tenafly - Main DPW Building
ECM-12 Lighting Replacements

Cost of Electricity: $0.125 $/kWh
$11.87 $/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
6	Front Office	9	T 34 R F 4 (MAG)	F44EE	144	1.3	SW	2496	3,235	9	T 28 R F 4	F44SSILL	96	0.9	SW	2,496	2,157	1,078	0.4	$ 196.32	$ 1,181.25	$135	6.0	5.3
6	Office Vestibule	1	T 34 R F 4 (MAG)	F44EE	144	0.1	SW	2496	359	1	T 28 R F 4	F44SSILL	96	0.1	SW	2,496	240	120	0.0	$ 21.81	$ 131.25	$15	6.0	5.3
6	Director's Office	5	T 34 R F 4 (MAG)	F44EE	144	0.7	SW	2496	1,797	5	T 28 R F 4	F44SSILL	96	0.5	SW	2,496	1,198	599	0.2	$ 109.07	$ 656.25	$75	6.0	5.3
6	Back Office	5	T 34 R F 4 (MAG)	F44EE	144	0.7	SW	2496	1,797	5	T 28 R F 4	F44SSILL	96	0.5	SW	2,496	1,198	599	0.2	$ 109.07	$ 656.25	$75	6.0	5.3
93	Office Men's Room	2	I 75	I75/1	75	0.2	SW	1248	187	2	CF 26	CFQ26/1-L	27	0.1	SW	1,248	67	120	0.1	$ 28.65	$ 10.00	$0	0.3	0.3
33	Office Women's Room	2	13 W CF 1	CFQ13/1-L	15	0.0	SW	1248	37	2	13 W CF 1	CFQ13/1-L	15	0.0	SW	1,248	37	-	0.0	$ -	$ -	$0		
6	Office Unisex Restroom	1	T 34 R F 4 (MAG)	F44EE	144	0.1	SW	1248	180	1	T 28 R F 4	F44SSILL	96	0.1	SW	1,248	120	60	0.0	$ 14.33	$ 131.25	$15	9.2	8.1
11	Hallway	3	S 34 P F 2 (MAG)	F42EE	72	0.2	SW	2496	539	3	C 28 P F 2	F42SSILL	48	0.1	SW	2,496	359	180	0.1	$ 32.72	$ 318.75	$45	9.7	8.4
6	Small Locker Room	3	T 34 R F 4 (MAG)	F44EE	144	0.4	SW	2496	1,078	3	T 28 R F 4	F44SSILL	96	0.3	SW	2,496	719	359	0.1	$ 65.44	$ 393.75	$45	6.0	5.3
78	Small Locker Restroom	2	EP I 100	I100/1	100	0.2	SW	1248	250	2	CF 26	CFQ26/1-L	27	0.1	SW	1,248	67	182	0.1	$ 43.57	$ 13.50	$0	0.3	0.3
6	Small Break Room	2	T 34 R F 4 (MAG)	F44EE	144	0.3	SW	2496	719	2	T 28 R F 4	F44SSILL	96	0.2	SW	2,496	479	240	0.1	$ 43.63	$ 262.50	$30	6.0	5.3
6	Large Break Room	8	T 34 R F 4 (MAG)	F44EE	144	1.2	SW	2496	2,875	8	T 28 R F 4	F44SSILL	96	0.8	SW	2,496	1,917	958	0.4	$ 174.50	$ 1,050.00	$120	6.0	5.3
11	Large Restroom	6	S 34 P F 2 (MAG)	F42EE	72	0.4	SW	1248	539	6	C 28 P F 2	F42SSILL	48	0.3	SW	1,248	359	180	0.1	$ 42.98	$ 637.50	$90	14.8	12.7
191	Front Garage	4	S 60 C F 2 (ELE) 8'	F62EE	123	0.5	SW	1248	614	4	0	F44GHL	234	0.9	SW	1,248	1,168	(554)	(0.4)	$ (132.51)	$ 525.00	$60		
191	Repair Shop	3	S 60 C F 2 (ELE) 8'	F62EE	123	0.4	SW	2808	1,036	3	0	F44GHL	234	0.7	SW	2,808	1,971	(935)	(0.3)	$ (164.32)	$ 393.75	$45		
146	Repair Shop	6	High Bay MH 400	MH400/1	458	2.7	SW	2808	7,716	6	P 54 C F 4	FC20	20	0.1	SW	2,808	337	7,379	2.6	$ 1,296.76	$ 3,078.00	$600	2.4	1.9
191	Storage Garage #1	5	S 60 C F 2 (ELE) 8'	F62EE	123	0.6	SW	2496	1,535	5	0	F44GHL	234	1.2	SW	2,496	2,920	(1,385)	(0.6)	$ (252.21)	$ 656.25	$75		
191	Parts Room	1	S 60 C F 2 (ELE) 8'	F62EE	123	0.1	SW	2496	307	1	0	F44GHL	234	0.2	SW	2,496	584	(277)	(0.1)	$ (50.44)	$ 131.25	$15		
191	Storage Garage #2	2	S 60 C F 2 (ELE) 8'	F62EE	123	0.2	SW	2496	614	2	0	F44GHL	234	0.5	SW	2,496	1,168	(554)	(0.2)	$ (100.89)	$ 262.50	$30		
6	Storage Garage #3	1	T 34 R F 4 (MAG)	F44EE	144	0.1	SW	2496	359	1	T 28 R F 4	F44SSILL	96	0.1	SW	2,496	240	120	0.0	$ 21.81	$ 131.25	$15	6.0	5.3
137	Exterior Flood Lights	6	SP 50 I	I50/1	50	0.3	Photocell	4380	1,314	6	CF 26	CFQ26/1-L	27	0.2	Photocell	4,380	710	604	0.1	$ 95.21	$ 81.00	$0	0.9	0.9
230	Exterior Shop Lights	2	WP400MH1	MH400/1	458	0.9	Photocell	4380	4,012	2	WP400MH1	MH400/1	458	0.9	Photocell	4,380	4,012	-	0.0	$ -	$ -	$0		
	Total	**79**				**11.9**			**31,101**	**79**			**2,704**	**8.6**			**22,028**	**9,073**	**3.2**	**$1,595**	**$10,701**	**$1,485**		
																	Demand Savings			**3.2**	**$461**			
																	kWh Savings			**9,073**	**$1,134**			
																	Total savings				**$1,595**		**6.7**	**5.8**

APPENDIX N

ECM-13 Install Occupancy Sensors

New Jersey BPU Energy Audit Program
CHA #21794
Borough of Tenafly - Main DPW Building
ECM-13 Install Occupancy Sensors

Cost of Electricity: **$0.125 $/kWh**
$11.87 $/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
6	Front Office	9	T 34 R F 4 (MAG)	F44EE	144	1.3	SW	2496	3,234.8	9	T 34 R F 4 (MAG)	F44EE	144	1.3	None	2496	3,234.8	0.0	0.0	$0.00	$0.00	$0.00		
6	Office Vestibule	1	T 34 R F 4 (MAG)	F44EE	144	0.1	SW	2496	359.4	1	T 34 R F 4 (MAG)	F44EE	144	0.1	None	2496	359.4	0.0	0.0	$0.00	$0.00	$0.00		
6	Director's Office	5	T 34 R F 4 (MAG)	F44EE	144	0.7	SW	2496	1,797.1	5	T 34 R F 4 (MAG)	F44EE	144	0.7	OCC	1200	864.0	933.1	0.0	$116.64	$118.75	$20.00	1.0	0.8
6	Back Office	5	T 34 R F 4 (MAG)	F44EE	144	0.7	SW	2496	1,797.1	5	T 34 R F 4 (MAG)	F44EE	144	0.7	OCC	1200	864.0	933.1	0.0	$116.64	$118.75	$20.00	1.0	0.8
93	Office Men's Room	2	I 75	I75/1	75	0.2	SW	1248	187.2	2	I 75	I75/1	75	0.2	None	1248	187.2	0.0	0.0	$0.00	$0.00	$0.00		
33	Office Women's Room	2	13 W CF 1	CFQ13/1-L	15	0.0	SW	1248	37.4	2	13 W CF 1	CFQ13/1-L	15	0.0	None	1248	37.4	0.0	0.0	$0.00	$0.00	$0.00		
6	Office Unisex Restroom	1	T 34 R F 4 (MAG)	F44EE	144	0.1	SW	1248	179.7	1	T 34 R F 4 (MAG)	F44EE	144	0.1	None	1248	179.7	0.0	0.0	$0.00	$0.00	$0.00		
11	Hallway	3	S 34 P F 2 (MAG)	F42EE	72	0.2	SW	2496	539.1	3	S 34 P F 2 (MAG)	F42EE	72	0.2	None	2496	539.1	0.0	0.0	$0.00	$0.00	$0.00		
6	Small Locker Room	3	T 34 R F 4 (MAG)	F44EE	144	0.4	SW	2496	1,078.3	3	T 34 R F 4 (MAG)	F44EE	144	0.4	OCC	960	410.4	667.9	0.0	$83.48	$118.75	$20.00	1.4	1.2
78	Small Locker Restroom	2	EP I 100	I100/1	100	0.2	SW	1248	249.6	2	EP I 100	I100/1	100	0.2	None	1248	249.6	0.0	0.0	$0.00	$0.00	$0.00		
6	Small Break Room	2	T 34 R F 4 (MAG)	F44EE	144	0.3	SW	2496	718.8	2	T 34 R F 4 (MAG)	F44EE	144	0.3	OCC	960	273.6	445.2	0.0	$55.66	$118.75	$20.00	2.1	1.8
6	Large Break Room	8	T 34 R F 4 (MAG)	F44EE	144	1.2	SW	2496	2,875.4	8	T 34 R F 4 (MAG)	F44EE	144	1.2	OCC	960	1,094.4	1,781.0	0.0	$222.62	$118.75	$20.00	0.5	0.4
11	Large Restroom	6	S 34 P F 2 (MAG)	F42EE	72	0.4	SW	1248	539.1	6	S 34 P F 2 (MAG)	F42EE	72	0.4	C-OCC	1000	432.0	107.1	0.0	$13.39	$202.50	$35.00	15.1	12.5
191	Front Garage	4	S 60 C F 2 (ELE) 8'	F82EE	123	0.5	SW	1248	614.0	4	S 60 C F 2 (ELE) 8'	F82EE	123	0.5	SW	1248	614.0	0.0	0.0	$0.00	$0.00	$0.00		
191	Repair Shop	3	S 60 C F 2 (ELE) 8'	F82EE	123	0.4	SW	2808	1,036.2	3	S 60 C F 2 (ELE) 8'	F82EE	123	0.4	SW	2808	1,036.2	0.0	0.0	$0.00	$0.00	$0.00		
146	Repair Shop	6	High Bay MH 400	MH400/1	458	2.7	SW	2808	7,716.4	6	High Bay MH 400	MH400/1	458	2.7	SW	2808	7,716.4	0.0	0.0	$0.00	$0.00	$0.00		
191	Storage Garage #1	5	S 60 C F 2 (ELE) 8'	F82EE	123	0.6	SW	2496	1,535.0	5	S 60 C F 2 (ELE) 8'	F82EE	123	0.6	C-OCC	1200	738.0	797.0	0.0	$99.63	$202.50	$35.00	2.0	1.7
191	Parts Room	1	S 60 C F 2 (ELE) 8'	F82EE	123	0.1	SW	2496	307.0	1	S 60 C F 2 (ELE) 8'	F82EE	123	0.1	OCC	1200	147.6	159.4	0.0	$19.93	$118.75	$20.00	6.0	5.0
191	Storage Garage #2	2	S 60 C F 2 (ELE) 8'	F82EE	123	0.2	SW	2496	614.0	2	S 60 C F 2 (ELE) 8'	F82EE	123	0.2	C-OCC	1200	295.2	318.8	0.0	$39.85	$202.50	$35.00	5.1	4.2
6	Storage Garage #3	1	T 34 R F 4 (MAG)	F44EE	144	0.1	SW	2496	359.4	1	T 34 R F 4 (MAG)	F44EE	144	0.1	C-OCC	1200	172.8	186.6	0.0	$23.33	$202.50	$35.00	8.7	7.2
137	Exterior Flood Lights	6	SP 50 I	I50/1	50	0.3	Photocell	4380	1,314.0	6	SP 50 I	I50/1	50	0.3	None	4380	1,314.0	0.0	0.0	$0.00	$0.00	$0.00		
230	Exterior Shop Lights	2	WP400MH1	MH400/1	458	0.9	Photocell	4380	4,012.1	2	WP400MH1	MH400/1	458	0.9	None	4380	4,012.1	0.0	0.0	$0.00	$0.00	$0.00		
	Total	**79**				**11.9**			**31,101**	**79**				**12**			**24,772**	**6,329**	**0**	**$ 791**	**$ 1,523**	**$ 260**		
																		Demand Savings		**0.0**	**$0**			
																		kWh Savings		**6,329**	**$791**			
																		Total Savings			**$791**		**1.9**	**1.6**

APPENDIX O

ECM-14 Lighting Replacements with Occupancy Sensors

New Jersey BPU Energy Audit Program
CHA #21794
Borough of Tenafly - Main DPW Building
ECM-14 Lighting Replacements with Occupancy Sensors

Cost of Electricity: **$0.125 $/kWh**
$11.87 $/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
6	Front Office	9	T 34 R F 4 (MAG)	F44EE	144	1.3	SW	2496	3,235	9	T 28 R F 4	F44SSILL	96	0.9	None	2,496	2,157	1,078	0.4	$ 196.32	$ 1,181.25	$ 135	6.0	5.3
6	Office Vestibule	1	T 34 R F 4 (MAG)	F44EE	144	0.1	SW	2496	359	1	T 28 R F 4	F44SSILL	96	0.1	None	2,496	240	120	0.0	$ 21.81	$ 131.25	$ 15	6.0	5.3
6	Director's Office	5	T 34 R F 4 (MAG)	F44EE	144	0.7	SW	2496	1,797	5	T 28 R F 4	F44SSILL	96	0.5	OCC	1,200	576	1,221	0.2	$ 186.83	$ 775.00	$ 95	4.1	3.6
6	Back Office	5	T 34 R F 4 (MAG)	F44EE	144	0.7	SW	2496	1,797	5	T 28 R F 4	F44SSILL	96	0.5	OCC	1,200	576	1,221	0.2	$ 186.83	$ 775.00	$ 95	4.1	3.6
93	Office Men's Room	2	I 75	I75/1	75	0.2	SW	1248	187	2	CF 26	CFQ26/1-L	27	0.1	None	1,248	67	120	0.1	$ 28.65	$ 10.00	$ -	0.3	0.3
33	Office Women's Room	2	I3 W CF 1	CFQ13/1-L	15	0.0	SW	1248	37	2	I3 W CF 1	CFQ13/1-L	15	0.0	None	1,248	37	-	0.0	$ -	$ -	$ -		
6	Office Unisex Restroom	1	T 34 R F 4 (MAG)	F44EE	144	0.1	SW	1248	180	1	T 28 R F 4	F44SSILL	96	0.1	None	1,248	120	60	0.0	$ 14.33	$ 131.25	$ 15	9.2	8.1
11	Hallway	3	S 34 P F 2 (MAG)	F42EE	72	0.2	SW	2496	539	3	C 28 P F 2	F42SSILL	48	0.1	None	2,496	359	180	0.1	$ 32.72	$ 318.75	$ 45	9.7	8.4
6	Small Locker Room	3	T 34 R F 4 (MAG)	F44EE	144	0.4	SW	2496	1,078	3	T 28 R F 4	F44SSILL	96	0.3	OCC	950	274	805	0.1	$ 121.10	$ 512.50	$ 65	4.2	3.7
78	Small Locker Restroom	2	EP I 100	I100/1	100	0.2	SW	1248	250	2	CF 26	CFQ26/1-L	27	0.1	None	1,248	67	182	0.1	$ 43.57	$ 13.50	$ -	0.3	0.3
6	Small Break Room	2	T 34 R F 4 (MAG)	F44EE	144	0.3	SW	2496	719	2	T 28 R F 4	F44SSILL	96	0.2	OCC	950	182	536	0.1	$ 80.73	$ 381.25	$ 50	4.7	4.1
6	Large Break Room	8	T 34 R F 4 (MAG)	F44EE	144	1.2	SW	2496	2,875	8	T 28 R F 4	F44SSILL	96	0.8	OCC	950	730	2,146	0.4	$ 322.92	$ 1,168.75	$ 140	3.6	3.2
11	Large Restroom	6	S 34 P F 2 (MAG)	F42EE	72	0.4	SW	1248	539	6	C 28 P F 2	F42SSILL	48	0.3	C-OCC	1,000	288	251	0.1	$ 51.90	$ 840.00	$ 125	16.2	13.8
191	Front Garage	4	S 60 C F 2 (ELE) 8'	F82EE	123	0.5	SW	1248	614	4	0	F44GHL	234	0.9	SW	1,248	1,168	(554)	(0.4)	$ (132.51)	$ 525.00	$ 60		
191	Repair Shop	3	S 60 C F 2 (ELE) 8'	F82EE	123	0.4	SW	2808	1,036	3	0	F44GHL	234	0.7	SW	2,808	1,971	(935)	(0.3)	$ (164.32)	$ 393.75	$ 45		
146	Repair Shop	6	High Bay MH 400	MH400/1	458	2.7	SW	2808	7,716	6	P 54 C F 4	FC20	20	0.1	SW	2,808	337	7,379	2.6	$ 1,296.76	$ 3,078.00	$ 600	2.4	1.9
191	Storage Garage #1	5	S 60 C F 2 (ELE) 8'	F82EE	123	0.6	SW	2496	1,535	5	0	F44GHL	234	1.2	C-OCC	1,200	1,404	131	(0.6)	$ (62.67)	$ 858.75	$ 110		
191	Parts Room	1	S 60 C F 2 (ELE) 8'	F82EE	123	0.1	SW	2496	307	1	0	F44GHL	234	0.2	OCC	1,200	281	26	(0.1)	$ (12.53)	$ 250.00	$ 35		
191	Storage Garage #2	2	S 60 C F 2 (ELE) 8'	F82EE	123	0.2	SW	2496	614	2	0	F44GHL	234	0.5	C-OCC	1,200	562	52	(0.2)	$ (25.07)	$ 465.00	$ 65		
6	Storage Garage #3	1	T 34 R F 4 (MAG)	F44EE	144	0.1	SW	2496	359	1	T 28 R F 4	F44SSILL	96	0.1	C-OCC	1,200	115	244	0.0	$ 37.37	$ 333.75	$ 50	8.9	7.6
137	Exterior Flood Lights	6	SP 50 I	I50/1	50	0.3	Photocell	4380	1,314	6	CF 26	CFQ26/1-L	27	0.2	None	4,380	710	604	0.1	$ 95.21	$ 81.00	$ -	0.9	0.9
230	Exterior Shop Lights	2	WP400MH1	MH400/1	458	0.9	Photocell	4380	4,012	2	WP400MH1	MH400/1	458	0.9	None	4,380	4,012	-	0.0	$ -	$ -	$ -		
	Total	**79**				**11.9**			**31,101**	**79**				**8.6**			**16,233**		**3.2**	**$ 2,320**	**$ 12,224**	**$ 1,745**		
																	Demand Savings			**3.2**	**$461**			
																	kWh Savings			**14,869**	**$1,859**			
																	Total Savings				**$2,320**		**5.3**	**4.5**

APPENDIX P

New Jersey Pay For Performance Incentive Program

NJBPU - Borough of Tenafly
CHA #21794
Building: Main DPW Building

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)	7,700
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)	$15,300	$9,600
Existing Usage (from utility)	92,720	8,740
Proposed Savings	26,790	3,310
Existing Total MMBtus	1,190	
Proposed Savings MMBtus	422.434	
% Energy Reduction	**35.5%**	
Proposed Annual Savings	$9,300	

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

	Incentives $		
	Elec	Gas	Total
Incentive #1	$0	$0	$385
Incentive #2	$2,947	$3,641	$6,588
Incentive #3	$1,875	$2,317	$4,192
Total All Incentives	**$4,822**	**$5,958**	**$11,165**

Total Project Cost	$102,600

		Allowable Incentive
% Incentives #1 of Utility Cost*	1.5%	$385
% Incentives #2 of Project Cost**	6.4%	$6,588
% Incentives #3 of Project Cost**	4.1%	$4,192
Total Eligible Incentives***	**$11,165**	
Project Cost w/ Incentives	$91,435	

Project Payback (years)	
w/o Incentives	w/ Incentives
11.0	9.8

* 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 Q

Photovoltaic (PV) Rooftop Solar Power Generation

Borough of Tenafly
Main DPW Building

Cost of Electricity	$0.165	$/kWh
System Capacity	30.0	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
$240,000	**0.0**	**35,490**	**0**	**$5,900**	**0**	**$5,900**	**$22,500**	**$17,300**	**40.7**	**9.4**

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:	30.0 kW
DC to AC Derate Factor:	0.770
AC Rating:	23.1 kW
Array Type:	Fixed Tilt
Array Tilt:	40.7°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	16.5 ¢/kWh

Results			
Month	Solar Radiation (kWh/m²/day)	AC Energy (kWh)	Energy Value ($)
1	3.36	2483	409.69
2	4.05	2682	442.53
3	4.58	3253	536.75
4	4.84	3179	524.53
5	5.30	3503	578.00
6	5.33	3304	545.16
7	5.27	3336	550.44
8	5.25	3302	544.83
9	5.06	3203	528.50
10	4.46	3016	497.64
11	3.15	2153	355.25
12	2.87	2076	342.54
Year	4.46	35490	5855.85

Output Hourly Performance Data

About the Hourly Performance Data

Output Results as Text

Saving Text from a Browser

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

Please send questions and comments regarding PVWATTS to Webmaster

Disclaimer and copyright notice

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.

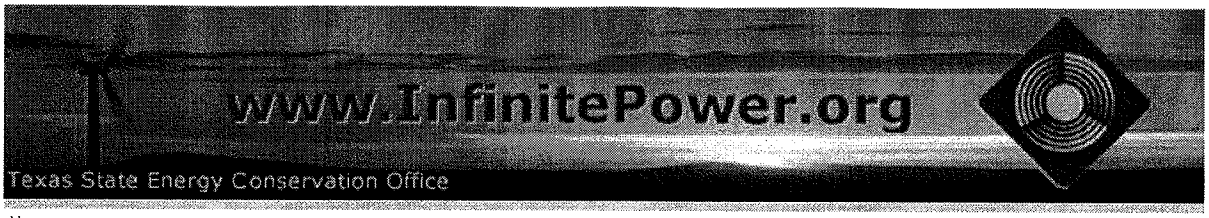
If net-metering isn't available and the PV system sends surplus electricity to the utility grid, the utility generally buys the electricity from the owner at a lower price than the owner pays the utility for electricity. In this case, the cost savings shown in the table should be reduced.

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.

APPENDIX R

Solar Thermal Domestic Hot Water Plant



Interactive Energy Calculators

RENEWABLE ENERGY THE INFINITE POWER OF TEXAS

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

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

Solar Water Heating Calculator

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

Water Heater Characteristics			
Physical		**Thermal**	
? Diameter (feet)	1.5	? Water Inlet Temperature (Degrees F)	50
? Capacity (gallons)	70	? Ambient Temperature (Degrees F)	68
? Surface Area (calculated - sq ft)	28.49	? Hot Water Temperature (Degrees F)	120
? Effective R-value	NaN	? Hot Water Usage (Gallons per Day)	35
Energy Use			
838.1		? 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
1048 BTU/hr	? Power Into Water Heater	855.2 BTU/hr
Cost		
$ 1.10 /Therm	? Utility Rates	$ 0.165 /kWh
$ 100.985	? Yearly Water Heating Cost	$ 362.024
How Does Solar Compare?		
? Solar Water Heater Cost: $ 27100		? Percentage Solar: 70
383.365 years for gas	? Payback Time for Solar System	106.938 years for electric

NJBPU Energy Audits
CHA #21794
Borough of Tenafly - Main DPW Building

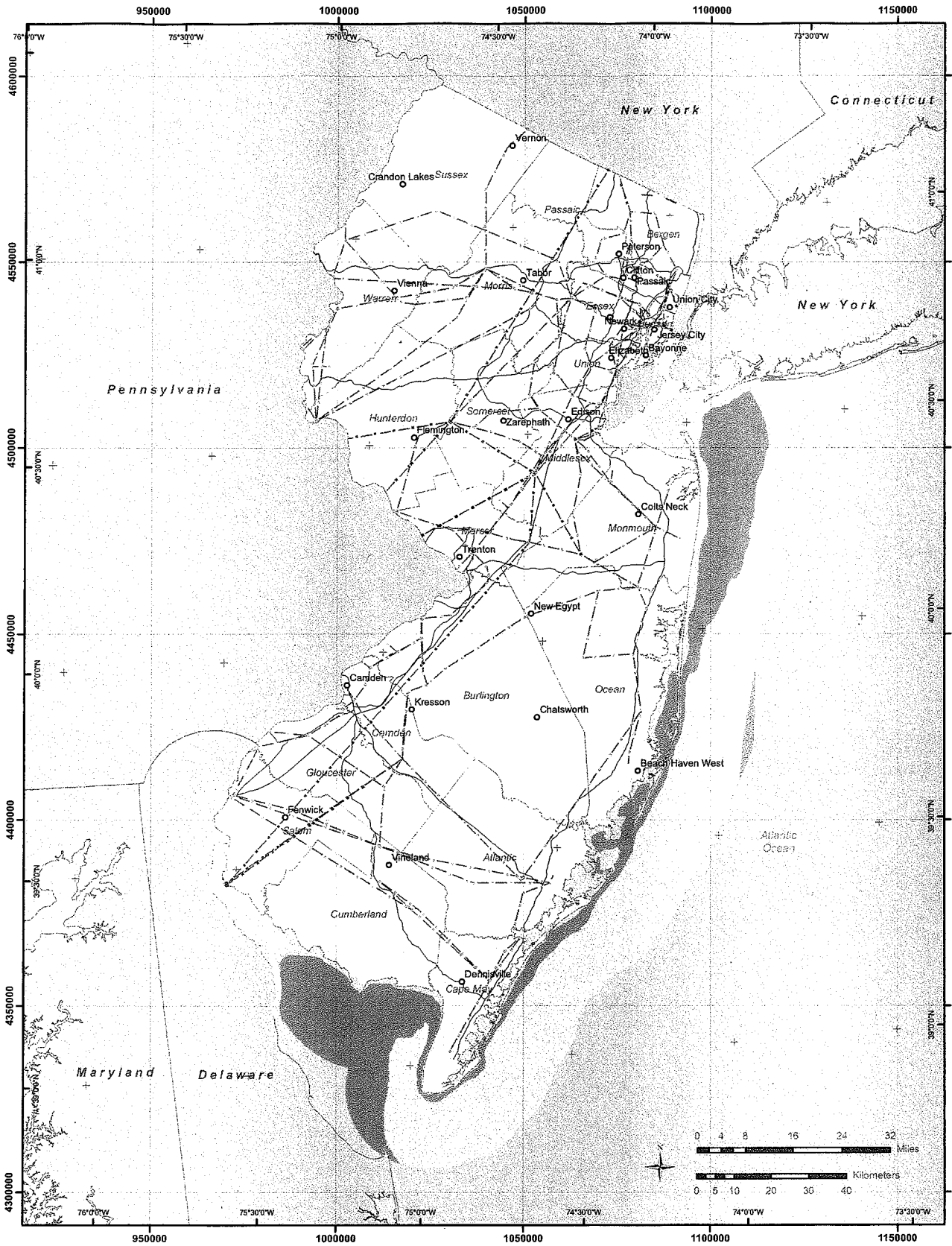
Multipliers	
Material:	0.98
Labor:	1.21
Equipment:	1.09

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 S

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, LLC

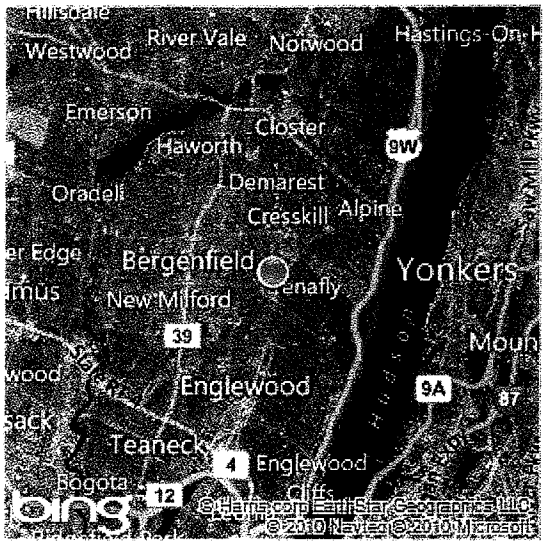
Print

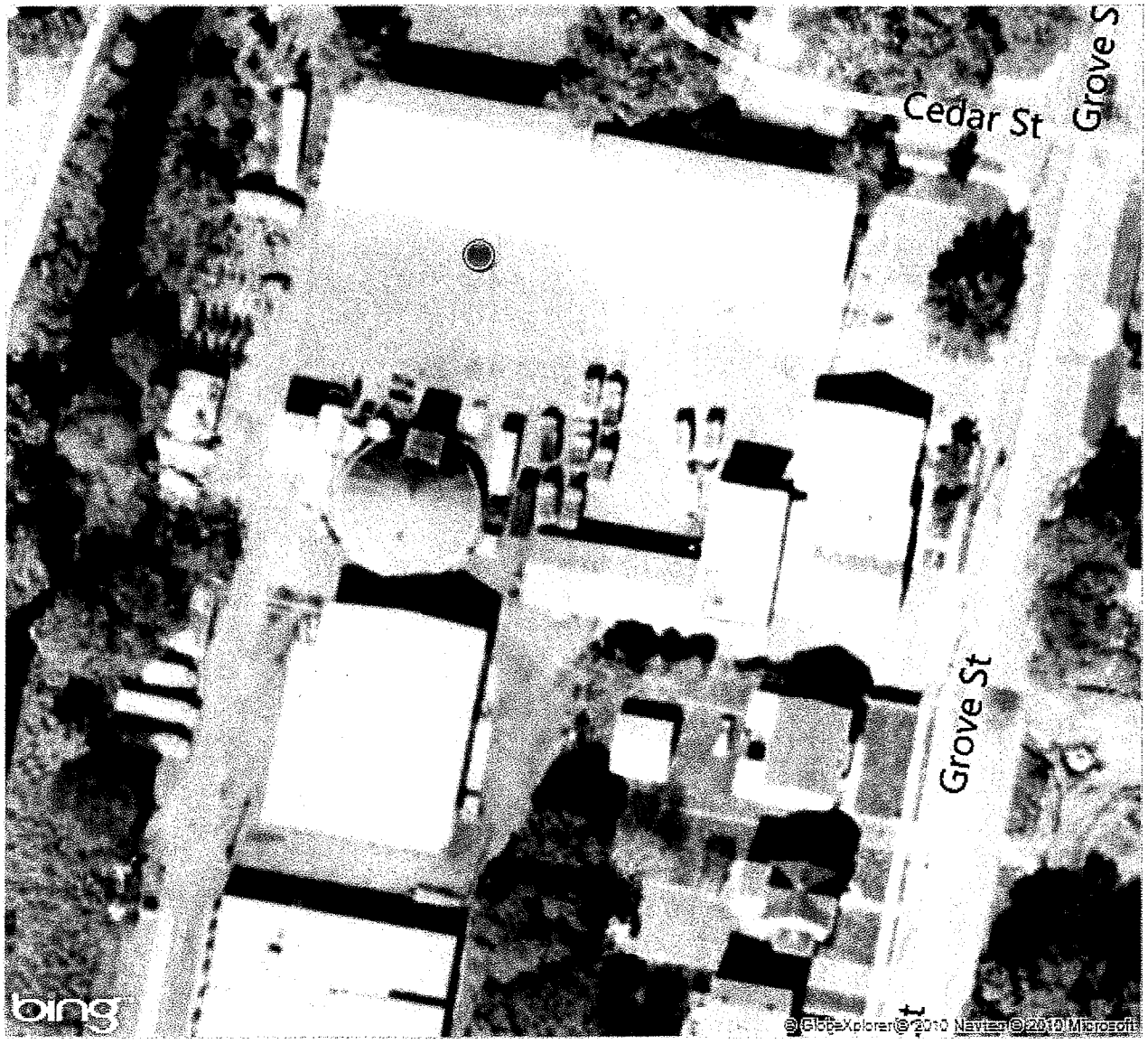
Bing Maps

107 Grove St, Tenafly, NJ 07670-1720

My Notes

FREE! Use **Bing 411** to find movies, businesses & more: **800-BING-411**





APPENDIX T

EPA Portfolio Manager

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
DPW Complex

Building ID: 2413446
For 12-month Period Ending: December 31, 2009[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: August 19, 2010

Facility	**Facility Owner**	**Primary Contact for this Facility**
DPW Complex 107 Grove Street Tenafly, NJ 07670	Tenafly Department of Public Works 107 Grove Street Tenafly, NJ 07670	Robert Beutel 107 Grove Street Tenafly, NJ 07670

Year Built: 1900
Gross Floor Area (ft²): 7,700

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

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	452,841
Natural Gas (kBtu)[4]	874,100
Total Energy (kBtu)	1,326,941
Energy Intensity[5]	
Site (kBtu/ft²/yr)	172
Source (kBtu/ft²/yr)	315
Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	115
Electric Distribution Utility	
Public Service Elec & Gas Co	
National Average Comparison	
National Average Site EUI	77
National Average Source EUI	150
% Difference from National Average Source EUI	110%
Building Type	Service (Vehicle Repair/Service, Postal Service)

Stamp of Certifying Professional

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

Certifying Professional
N/A

Meets Industry Standards[6] **for Indoor Environmental Conditions:**	
Ventilation for Acceptable Indoor Air Quality	**N/A**
Acceptable Thermal Environmental Conditions	**N/A**
Adequate Illumination	**N/A**

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

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

ENERGY STAR® Data Checklist for Commercial Buildings

In order for a building to qualify for the ENERGY STAR, a Professional Engineer (PE) 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	DPW Complex	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	Service (Vehicle Repair/Service, Postal Service)	Is this an accurate description of the space in question?		☐
Location	107 Grove 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		☐
Office Area (Office)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	☑
Gross Floor Area	1,730 Sq. Ft.	Does this square footage include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, atria, vent shafts, etc. Also note that existing atriums should only include the base floor area that it occupies. Interstitial (plenum) space between floors should not be included in the total. Finally gross floor area is not the same as leasable space. Leasable space is a subset of gross floor area.		☐
Weekly operating hours	40 Hours	Is this the total number of hours per week that the Office space is 75% occupied? This number should exclude hours when the facility is occupied only by maintenance, security, or other support personnel. For facilities with a schedule that varies during the year, "operating hours/week" refers to the total weekly hours for the schedule most often followed.		☐
Workers on Main Shift	4	Is this the number of employees present during the main shift? Note this is not the total number of employees or visitors who are in a building during an entire 24 hour period. For example, if there are two daily 8 hour shifts of 100 workers each, the Workers on Main Shift value is 100. The normal worker density ranges between 0.3 and 10 workers per 1000 square feet (92.8 square meters)		☐
Number of PCs	9	Is this the number of personal computers in the Office?		☐
Percent Cooled	50% or more	Is this the percentage of the total floor space within the facility that is served by mechanical cooling equipment?		☐
Percent Heated	50% or more	Is this the percentage of the total floor space within the facility that is served by mechanical heating equipment?		☐
Break Rooms (Other)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	☑

Gross Floor Area	1,130 Sq. Ft.	Does this square footage include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, atria, vent shafts, etc. Also note that existing atriums should only include the base floor area that it occupies. Interstitial (plenum) space between floors should not be included in the total. Finally gross floor area is not the same as leasable space. Leasable space is a subset of gross floor area.		☐
Number of PCs	1(Optional)	Is this the number of personal computers in the space?		☐
Weekly operating hours	40Hours(Optional)	Is this the total number of hours per week that the space is 75% occupied? This number should exclude hours when the facility is occupied only by maintenance, security, or other support personnel. For facilities with a schedule that varies during the year, "operating hours/week" refers to the total weekly hours for the schedule most often followed.		☐
Workers on Main Shift	10(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.		☐

Garages & Shop (Other)

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☑
Gross Floor Area	4,840 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	0(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	2(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	11,040.00
11/01/2009	11/30/2009	18,320.00
10/01/2009	10/31/2009	7,760.00
09/01/2009	09/30/2009	10,080.00
08/01/2009	08/31/2009	8,720.00
07/01/2009	07/31/2009	8,640.00
06/01/2009	06/30/2009	8,640.00
05/01/2009	05/31/2009	8,720.00
04/01/2009	04/30/2009	12,400.00
03/01/2009	03/31/2009	12,320.00
02/01/2009	02/28/2009	13,840.00
01/01/2009	01/31/2009	12,240.00
PSE&G Electric Consumption (kWh (thousand Watt-hours))		**132,720.00**
PSE&G Electric Consumption (kBtu (thousand Btu))		**452,840.64**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		**452,840.64**
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?		☐

Fuel Type: Natural Gas

Meter: PSE&G NG 2732994 (therms)
Space(s): Break Rooms, Garages & Shop, Office Area

Start Date	End Date	Energy Use (therms)
12/01/2009	12/31/2009	1,059.00
11/01/2009	11/30/2009	1,059.00
10/01/2009	10/31/2009	1,058.00
09/01/2009	09/30/2009	0.00
08/01/2009	08/31/2009	0.00
07/01/2009	07/31/2009	0.00
06/01/2009	06/30/2009	1,097.00
05/01/2009	05/31/2009	77.00
04/01/2009	04/30/2009	838.00
03/01/2009	03/31/2009	663.00

02/01/2009	02/28/2009	1,348.00
01/01/2009	01/31/2009	1,542.00
PSE&G NG 2732994 Consumption (therms)		**8,741.00**
PSE&G NG 2732994 Consumption (kBtu (thousand Btu))		**874,100.00**
Total Natural Gas Consumption (kBtu (thousand Btu))		**874,100.00**
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
DPW Complex
107 Grove 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

DPW Complex	
Gross Floor Area Excluding Parking: (ft²)	7,700
Year Built	1900
For 12-month Evaluation Period Ending Date:	December 31, 2009

Facility Space Use Summary

Office Area	
Space Type	Office
Gross Floor Area(ft²)	1,730
Weekly operating hours	40
Workers on Main Shift	4
Number of PCs	9
Percent Cooled	50% or more
Percent Heated	50% or more

Garages & Shop	
Space Type	Other - Service (Vehicle Repair/Service, Postal Service)
Gross Floor Area(ft²)	4,840
Number of PCs°	0
Weekly operating hours°	40
Workers on Main Shift°	2

Break Rooms	
Space Type	Other - Other
Gross Floor Area(ft²)	1,130
Number of PCs°	1
Weekly operating hours°	40
Workers on Main Shift°	10

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)	172	172	58	N/A	77
Source (kBtu/ft²)	315	315	107	N/A	150
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	115	115	39	N/A	51
$kgCO_2e$/ft²/year	15	15	5	N/A	7

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

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

APPENDIX U

Equipment Inventory

New Jersey BPU Energy Audit Program
CHA #21794
Borough of Tenafly - Main DPW Building

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.
Furnace	1	Singer	G-U-313125-16M	0000210532-J31-0091	HVAC / Natural Gas & Electric	125,000 Btuh input; about 76% thermal efficiency	Mech Closet	Offices	1976	-16	Remote condenser outside on grade; Fair condition
Condensing Unit	1	Rheem	RACB-048CAS	2564 M0783 7935	Cooling / Electric	4 Tons	On Grade	Offices	1983	-7	Works with furnace
Domestic Hot Water Heater	1	Rheem	82SV30-2	RH 0407213905	Hot water / Electric	4,500 watts; 30 gals	Closet	Offices	2007	11	Good condition
Packaged Rooftop Unit	1	Inter-City Products	PGMB024G050INT	R920300013	HVAC / Natural Gas & Electric	50,000 Btuh input; 39,000 Btuh output; 2 Tons	Roof	Large Locker Room	1988	-7	Fair condition
Window AC Unit	1	Tadiran Electronics	TAC 1510 C	260258133	Cooling / Electric	9,500 Btuh; 960 watts	Wall	Small Locker Room	-	0	Poor condition
Wall Heater	1	Comfort Glow	CGR30N	7811 000031	Heating / Natural Gas	6,000-30,000 Btuh input	Wall	Small Locker Room	1993	-4	Fair condition
Window AC Unit	1	General Electric	Quiet Aire	-	Cooling / Electric	8,000 Btuh	Wall	Small Breakroom	-	-	Fair condition
Wall Heater	1	Dyna-Glow	RMI-70NG	300147	Heating / Natural Gas	6,400-18,000 Btuh input	Wall	Small Breakroom	2002	5	Fair condition
Furnace	1	Comfort Maker	GUF100AO12-TN	0000211401-P44-0197	Heating / Natural Gas	100,000 Btuh input 76,000 Btuh output	Front Garage	Front Garage	1984	-8	Fair condition
Domestic Hot Water Heater	1	A.O. Smith	ELJF 40 914	MG95-0023279-914	Hot water / Electric	4,500 watts; 40 gals	Front Garage	Locker Rooms	-	-	Good condition
Exhaust Fan	4	-	-	-	Exhaust / Electric	Varies	Varies	Restrooms / Locker Rooms	-	-	All switch operated
Air Compressor	1	Ingersol Rand	T-30 Model 242-5N	30T332759	Compressed Air	Vertical Tank	Front Garage	Front Garage	-	-	Fair condition
Unit Heater	1	Reznor	CEEXL170	-	Heating / Natural Gas	170,000 Btuh input 136,000 Btuh output	Repair Shop	Repair Shop	1985	-12	Fair condition
Unit Heater	1	Modine	PD 150AA011	-	Heating / Natural Gas	150,000 Btuh input 120,000 Btuh output	Repair Shop	Repair Shop	2006	9	Excellent condition
Unit Heater	1	Reznor	-	-	Heating / Natural Gas	125,000 Btuh input 100,000 Btuh output	Repair Shop	Repair Shop	1985	-12	Fair condition
Air Filtration Unit	2	-	-	-	Filter / Electric	-	Repair Shop	Repair Shop	-	-	Excellent condition
Air Filtration Unit	1	MicroCon	MCD 002	MCD072A0234	Filter / Electric	-	Repair Shop	Repair Shop Welding	-	-	Good condition
Vehicle Exhaust System	1	-	-	-	Exhaust / Electric	-	Repair Shop	Repair Shop	-	-	Good condition
Exhaust Fan	1	-	-	-	Exhaust / Electric	1 HP	Repair Shop	Repair Shop	-	-	Fair condition
Unit Heater	1	Modine	PD 150AA011	39011013205-0443	Heating / Natural Gas	150,000 Btuh input 120,000 Btuh output	Storage Garage Bay 1	Storage Garage Bay 1	2006	9	Excellent condition
Window AC Unit	1	Tadiran Electronics	-	-	Cooling / Electric	12,000 Btuh	Parts Room	Parts Room	-	0	Poor Condition
Unit Heater	1	Reznor	CEEXL170	AKD52F9N22217	Heating / Natural Gas	170,000 Btuh input 136,000 Btuh output	Storage Garage Bay 2	Storage Garage Bay 2	1985	-5	Fair condition
Unit Heater	1	Dayton	-	-	Heating / Electric	5 KW	Storage Garage Bay 3	Storage Garage Bay 3	-	-	Fair condition

New Jersey BPU Energy Audit Program
CHA #21794
Borough of Tenafly - Main DPW Building
Existing Lighting

Cost of Electricity: **$0.125 $/kWh**
$11.87 $/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
6	Front Office	9	T 34 R F 4 (MAG)	F44EE	144	1.3	SW	2496	None	3,235	
6	Office Vestibule	1	T 34 R F 4 (MAG)	F44EE	144	0.1	SW	2496	None	359	
6	Director's Office	5	T 34 R F 4 (MAG)	F44EE	144	0.7	SW	2496	OCC	1,797	
6	Back Office	5	T 34 R F 4 (MAG)	F44EE	144	0.7	SW	2496	OCC	1,797	
93	Office Men's Room	2	I 75	I75/1	75	0.2	SW	1248	None	187	Exhaust fan connected to light switch
33	Office Women's Room	2	13 W CF 1	CFQ13/1-L	15	0.0	SW	1248	None	37	Exhaust fan connected to light switch
6	Office Unisex Restroom	1	T 34 R F 4 (MAG)	F44EE	144	0.1	SW	1248	None	180	Exhaust fan connected to light switch
11	Hallway	3	S 34 P F 2 (MAG)	F42EE	72	0.2	SW	2496	None	539	
6	Small Locker Room	3	T 34 R F 4 (MAG)	F44EE	144	0.4	SW	2496	OCC	1,078	
78	Small Locker Restroom	2	EP I 100	I100/1	100	0.2	SW	1248	None	250	Exhaust fan connected to light switch
6	Small Break Room	2	T 34 R F 4 (MAG)	F44EE	144	0.3	SW	2496	OCC	719	
6	Large Break Room	8	T 34 R F 4 (MAG)	F44EE	144	1.2	SW	2496	OCC	2,875	
11	Large Restroom	6	S 34 P F 2 (MAG)	F42EE	72	0.4	SW	1248	C-OCC	539	
191	Front Garage	4	S 60 C F 2 (ELE) 8'	F82EE	123	0.5	SW	1248	SW	614	
191	Repair Shop	3	S 60 C F 2 (ELE) 8'	F82EE	123	0.4	SW	2808	SW	1,036	
146	Repair Shop	6	High Bay MH 400	MH400/1	458	2.7	SW	2808	SW	7,716	
191	Storage Garage #1	5	S 60 C F 2 (ELE) 8'	F82EE	123	0.6	SW	2496	C-OCC	1,535	
191	Parts Room	1	S 60 C F 2 (ELE) 8'	F82EE	123	0.1	SW	2496	OCC	307	
191	Storage Garage #2	2	S 60 C F 2 (ELE) 8'	F82EE	123	0.2	SW	2496	C-OCC	614	
6	Storage Garage #3	1	T 34 R F 4 (MAG)	F44EE	144	0.1	SW	2496	C-OCC	359	
137	Exterior Flood Lights	6	SP 50 I	I50/1	50	0.3	Photocell	4380	None	1,314	
230	Exterior Shop Lights	2	WP400MH1	MH400/1	458	0.9	Photocell	4380	None	4,012	
	Total	**79**				**11.9**				**31,101**	