

**TOWNSHIP OF KEARNY
BRANCH LIBRARY
ENERGY ASSESSMENT**

for

**NEW JERSEY
BUREAU OF PUBLIC UTILITIES**

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1.0 INTRODUCTION & BACKGROUND

This report summarizes the energy audit for the branch library, a 2,800 square foot building in Kearny, NJ. The first floor of the two story building is the library, and a portion of the second floor is used for office space. The building has a full unoccupied basement and attic.

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 consumptions while increasing comfort.

2.0 EXECUTIVE SUMMARY

This report details the results of the energy audit for the two story branch library, a 2,800 square foot building in Kearny, NJ. The first floor consists of the library, and a portion of the second floor is used for office space. The following areas were evaluated for energy conservation measures:

- Night setback
- Lighting replacements with occupancy sensors
- Insulation upgrades
- Domestic hot water heater
- Boiler replacement

Various potential Energy Conservation Measures (ECMs) were identified for the above categories. Measures which are recommended for implementation have a payback of 10 years or less. This threshold is considered a viable return on investment. Potential annual savings of \$1,600 for the recommended ECMs may be realized with a payback of 3.4 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 Smart Start Buildings Program. A summary of the costs, savings, and paybacks for the recommended ECMs follows:

ECM-3 Increase Wall Insulation

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		#2 Fuel Oil	Total				
\$	kW	kWh	Gallons	\$		\$	Years	Years
3,000	-	50	150	400	2.2	NA	7.5	NA

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

ECM-4 Night Setback

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		#2 Fuel Oil	Total				
\$	kW	kWh	Gallons	\$		\$	Years	Years
400	0	0	320	800	29.0	NA	0.5	NA

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

ECM-8 Lighting Replacements with Occupancy Sensors

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
\$	kW	kWh	Therms	\$		\$	Years	Years
2,000	0.9	2,680	0	400	2.0	300	5.0	4.3

* Incentives based on New Jersey Smart Start Prescriptive Lighting Measures.

3.0 EXISTING CONDITIONS

3.1 Building General

The 2,800 square foot branch library is a two story building with a full unoccupied basement and unoccupied attic. The building, formerly a colonial style single family house, is more than 100 years' old but was converted into a library about 30 years' ago. The building has undergone renovations including window and siding upgrade, and installation of a cooling system and handicapped access structures. The first floor houses book shelves, a lobby, and restrooms. The second floor has several unoccupied rooms and two occupied office areas.

The building's wall frame structure and roof are not insulated. The outside walls are finished with vinyl siding; inside walls with plaster. The windows are double pane.

The building is occupied Monday through Friday from 1:00 PM to 5:00 PM by two staff members, some visitors and it is typically closed during the unoccupied time.

3.1 Utility Usage

The building uses electricity, fuel oil, municipal water, and is connected to the municipal sewage system.

Electricity is purchased from the Public Service Electric and Gas Company (PSE&G). For 2008, the building consumed 11,500 kWh of electricity at an annual cost of about \$2,300. The average blended rate for electricity was about \$0.20 per kWh. Annual fuel oil usage was about 1,180 gallons of fuel oil at a cost of \$3,000.

Water usage was not available; the building is not charged for water usage.

The largest portion of energy charges was for fuel oil and the average blended rate is \$2.62 per gallon. The electricity usage trend shows a higher consumption during the winter months when the lights may need to be on during the day.

Utility data is provided in Appendix A.

The delivery component will always be the responsibility of the utility that connects the facility to the power grid; however, the supply can be purchased from a third party. The electricity commodity supply entity will require the submission of one to three years of past energy bills. Contract terms can vary among suppliers. A list of approved electrical commodity suppliers can be found in Appendix A.

3.2 HVAC Systems

The heating for the building is provided by a single steam boiler manufactured by IBR rated at 172 MBH output. The boiler is over 30 years' old and uses #2 heating oil as a fuel source. The steam is distributed through the building to the radiators by the use of a single pipe system. Three split ductless systems provide cooling for the first floor library area and second floor's offices.

3.3 Domestic Hot Water Systems

Domestic hot water is produced in 15 gallon A.O. Smith electric hot water heater installed in 1992.

3.4 Lighting/Electrical Systems

The lighting system within the building is manually controlled by individual switches or pull-strings in the spaces. One fluorescent fixture in the attic can only be controlled by a breaker in the electrical panel. The lighting in the building is turned on and off by occupants and is in use while the building is open to the public, about 20 hours a week. Most of the lighting is fluorescent using F32T8 32 watt, F34T12 34 watt, or energy saver F96T12 96 watt lamps. There are about 10 incandescent lamps still in use in the building; approximately seven have been replaced with compact fluorescent bulbs in the front vestibule. All exit signs within the building have been upgraded to LED technology.

The building's exterior lighting consists of about five 100 watt incandescent spot fixtures controlled by switches within the building.

3.5 Control Systems

Heating is controlled by a single nonprogrammable thermostat set to maintain space temperature at 68°F. The cooling is controlled manually at each of the three split system AC units, which are typically set between 70 and 74°F.

4.0 ENERGY CONSERVATION MEASURES

4.1 ECM-1 Increase Roof Insulation

The attic space above the second floor and the roof are not insulated. Noninsulated roofs can significantly increase the energy consumption of a building associated with space heating or cooling.

Heat conduction through the roof is a function of the resistance to heat flow and the difference between the indoor and outdoor temperature. Adding thermal insulation increases the structural resistance to sensible heat transfer and lowers the space-heating load.

This ECM proposes to install new batt insulation rated at R-19 or better in the attic. Installing roof insulation will reduce heat loss or gain in the space and thus saves energy.

The amount of heat conduction through the ceilings and roofs is proportional to its overall heat transfer coefficient (commonly called the U factor) and the temperature difference between the conditioned space and its surroundings.

It has been calculated that the building will save about 60 gallons of fuel oil and 20 kWh of electricity annually.

Insulation has an expected life of 24 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 480 kWh and 1,440 gallons #2 fuel oil, totaling \$4,800.

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

ECM-1 Increase Roof Insulation

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		#2 Fuel Oil	Total				
\$	kW	kWh	Gallons	\$		\$	Years	Years
6,000	0	20	60	200	(0.2)	NA	>25	NA

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

This measure is not recommended.

4.2 ECM-2 Replace Boiler

The existing steam boiler rated for a 172 MBH output, operates by utilizing fuel oil. This boiler is nearing the end of its useful life. This ECM proposes to replace the existing boiler with a new high efficiency steam boiler. The new oil fired steam boiler shall have an output capacity of about 180 MBH, and will be installed in the same location.

Service personnel estimated that the efficiency of the existing boiler is about 77%. To determine savings for this measure, the boiler's natural gas consumption was used. Utilizing a new high efficiency steam boiler would reduce the annual boiler consumption and result in energy savings of approximately 190 therms. The proposed boiler efficiency rating of 83% is based on the use of a new high efficiency steam boiler.

Steam boilers have an expected life of 30 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 3,000 gallons #2 fuel oil, totaling \$9,000.

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

ECM-2 Replace Boiler

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		#2 Fuel Oil	Total				
\$	kW	kWh	Gallons	\$		\$	Years	Years
9,100	0	0	100	300	0.0	300	>25	>25

* Incentive shown is per the New Jersey Smart Start Program, 2010 Gas Heating Application.

This measure is not recommended.

4.3 ECM-3 Increase Wall Insulation

The walls of the building are not insulated and have an R-value of about 7.5. This ECM assessed the energy savings of installing 3-1/2" of loose-fill insulation to the exterior walls of the occupied library rooms for an additional R-13 of heat transfer resistance. Reducing the amount of heat transferred through the building's exterior walls would reduce both the heating and cooling energy requirements.

In order to determine the amount of heat transfer, a base case block load was developed. The base case calculated the heat transfer during all outdoor temperatures, according to bin weather data. The amount of heat conduction through the walls is proportional to the overall heat transfer coefficient, surface area and the temperature difference between the conditioned space totals the and its surroundings. The base case totals the amount of heat transfer through the walls over the course of the year.

The same process was applied when modeling the proposed conditions; however, the heat transfer coefficient was adjusted to reflect the insulation added. The difference in heat transfer between the base case and the proposed model is the energy savings.

Insulation has an expected life of 24 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 1,200 kWh and 3,600 gallons #2 fuel oil, totaling \$9,600.

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

ECM-3 Increase Wall Insulation

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		#2 Fuel Oil	Total				
\$	kW	kWh	Gallons	\$		\$	Years	Years
3,000	-	50	150	400	2.2	NA	7.5	NA

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

This measure is recommended.

4.4 ECM-3 Night Setback

The heating system is controlled by a single nonprogrammable thermostat. The boiler, therefore, operates to deliver a constant temperature, regardless of building occupancy, which wastes energy.

This ECM evaluates the savings expected from the installation of a programmable thermostat that would be set for night and weekend temperature setbacks. The temperature for unoccupied time would be lowered from existing 68°F to 60°F.

To calculate the benefits of a night setback, a block load building model was created to approximate the existing energy load (base case). The block load model calculated the maximum overall heating loads, taking into account the building envelope and the outside air temperatures throughout the heating season. To determine the proposed energy usage during the temperature setback, the same procedure was used as in the base case with the exception that the unoccupied temperature was decreased as discussed above. The difference between the two models results in energy savings.

The implementation of this measure is expected to save approximately 450 gallons of fuel oil respectively resulting in monetary savings of \$1,100.

Programmable thermostats have an expected life of 15 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 4,800 gallons #2 fuel oil, totaling \$12,000.

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

ECM-4 Night Setback

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		#2 Fuel Oil	Total				
\$	kW	kWh	Gallons	\$		\$	Years	Years
400	0	0	320	800	29.0	NA	0.5	NA

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

This measure is recommended.

4.5 ECM-5 Replace Domestic Hot Water Heater

Domestic hot water for the building is generated by a 15 gallon A.O. Smith electric hot water heater. Due to a low demand for hot water in the building, there are extended periods of time with little or no use. However, the unit must still heat the water within the storage tank. The energy required to maintain the hot water temperature setpoints during the times of no demand, known as standby losses, is wasted.

This measure evaluates the possibility of replacing the existing electric domestic hot water heater with a tankless, on demand, oil-fired, condensing hot water heater. This measure would replace the existing source with the fuel oil and eliminate standby losses from the tank during periods of no demand. Since the fuel oil is already used for the heating system the existing oil supply tank would also provide the fuel oil for the new domestic hot water heater. The tankless unit would be installed in place of the existing electric unit. The unit would require additional fuel piping and installation of a flue venting system.

The proposed efficiency of the new heater is based on the Toyotomi on demand tankless oil fired hot water heater. The annual electricity consumption used for producing the hot water was estimated at 920 kWh. The standby losses were then converted to thermal units and the efficiency factor for the condensing unit was applied; 85 therms would be saved per year. The new water heater will require minor changes in gas piping, venting, water piping and some electrical connections. Typically 2.5% of the stored capacity is lost every hour during hot water heater standby. This value is applied to the total volume of the existing hot water heater storage tank in determining the annual standby losses.

Tankless water heaters have an expected life of 18 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 16,560 kWh and (180) gallons #2 fuel oil, totaling \$3,600.

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

ECM-5 Replace Domestic Hot Water Heater

Budgetary Cost	Annual Utility Savings			ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)	
	Electricity		#2 Fuel Oil					Total
\$	kW	kWh	Gallons	\$	\$	Years	Years	
4,900	1.5	920	(10)	200	(0.3)	300	>25	>25

* Incentive shown is per the New Jersey Smart Start Program, 2010 Water Heating Application.

This measure is not recommended.

4.6 ECM-6 Lighting Replacements

The EMS building contains approximately 10 fluorescent fixtures with inefficient T-12 lamps. Each fixture is equipped with either two - 4' lamps. There are many locations where the older T-12 technology has been replaced with newer more efficient T-8 fixtures. There are also about 10 inefficient incandescent bulbs still in use inside the building as well as about five incandescent bulbs used for exterior lighting. Overall energy consumption can be reduced by retrofitting the existing T-12 fixtures with more efficient T-8 fluorescent lamps, and replacing incandescent bulbs with compact fluorescent bulbs.

To compute the annual savings for this ECM, the energy consumption of the lighting fixtures was established, and it was determined to be 5,920 kWh per year. To calculate the annual energy consumption utilizing the replacement lamps and bulbs, the proposed fixture power requirement was used with the same annual hours of operation. The difference between the existing and proposed annual energy consumption was the energy savings. Calculations are provided in Appendix G.

Existing lamps and ballasts of each fixture would be replaced with electronic ballasts T-8 fluorescent lamps, the length and quantity varies based on application. Incandescent bulbs would also be replaced with compact fluorescent bulbs. This ECM will provide annual savings of 2,290 kWh.

The lighting retrofits have an expected life of 15 years, according to the manufacturers, and total energy savings over the life of the project are estimated at 34,350 kWh and \$6,000.

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

ECM-6 Lighting Replacements

Budgetary Cost	Annual Utility Savings			ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)	
	Electricity	Natural Gas	Total					
\$	kW	kWh	Therms	\$	\$	Years	Years	
1,200	0.9	2,290	0	400	4.0	100	3.0	2.8

* Incentives based on New Jersey Smart Start Prescriptive Lighting Measures.

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

4.7 ECM-7 Install Occupancy Sensors

Lighting fixtures throughout the building are manually switched on and off, and are operational with occupancy. The operating time of many of the building’s interior lighting fixtures can be reduced by installing occupancy sensors. Occupancy sensors were not considered for many areas because of safety concerns or low use.

Applying the same process used in the calculation of ECM-6, the existing baseline energy consumption for each fixture was determined. Typical traffic patterns for each space were then taken into account to approximate the actual occupancy hours per day. It was established that the annual energy consumption of the lighting fixtures can be reduced by 520 kWh.

Approximately four occupancy sensors and some standard electrical work are required for this measure.

Lighting controls have an expected life of 15 years, according to the manufacturer, and total energy savings over the life of the project are estimated at 7,650 kWh, and \$1,500.

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

ECM-7 Install Occupancy Sensors

Budgetary Cost	Annual Utility Savings			ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)	
	Electricity	Natural Gas	Total					
\$	kW	kWh	Therms	\$	\$	Years	Years	
800	0.0	510	0	100	0.9	300	8.0	5.0

* Incentives based on New Jersey Smart Start Prescriptive Lighting Measures.

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

4.8 ECM-8 Lighting Replacements with Occupancy Sensors

This measure is a combination of ECMs 6 and 7 to allow for maximum energy and demand reduction. Due to interactive effects, the energy and cost savings for occupancy sensors and lighting upgrades are not cumulative.

The lighting retrofits and controls have an expected lifetime of 15 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 40,200 kWh, and \$6,000.

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

ECM-8 Lighting Replacements with Occupancy Sensors

Budgetary Cost	Annual Utility Savings			ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)	
	Electricity		Natural Gas					Total
\$	kW	kWh	Therms	\$	\$	Years	Years	
2,000	0.9	2,680	0	400	2.0	300	5.0	4.3

* Incentives based on New Jersey Smart Start Prescriptive Lighting Measures.

This measure is recommended.

5.0 PROJECT INCENTIVES

5.1 Incentives Overview

5.1.1 New Jersey Pay For Performance and Smart Start Programs

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. Facilities that meet this criterion must also achieve a minimum performance target of 15% by using the EPA Portfolio Manager benchmarking tool before and after construction. Incentives for this program are in three parts. Incentive #1 energy reduction plan pays \$0.05 per square foot to a maximum of \$25,000 or 50% of facility annual energy cost paid after approval of application. Incentive #2 is paid after installation of recommended measures; base incentives deliver \$0.11/kWh and \$1.10/therm not to exceed 30% of total project cost. Incentive #3 post-construction benchmarking is paid after acceptance of a report proving energy savings over one year utilizing the 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 minimum performance target calculated with the EPA Portfolio Manager benchmarking tool not to exceed 50% of total project cost.

A new incentive structure is in place for projects exceeding 20% in energy savings, which doubles incentives #2 and #3 for a total of \$0.36/kWh and \$3.60/therm. For Incentive #1, the maximum incentive has been raised to 80% of project costs, or \$2 million per gas account and \$2 million per electric account. The 200 kW/month average minimum has been waived for buildings owned by local governments or municipalities and non-profit organizations. This new incentive structure has been extended to December 31, 2010.

Specific incentives for energy conservation measures were calculated on an individual basis utilizing the 2009 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 usage and savings to be applied towards the Pay for Performance incentive. A project is not applicable for incentives in both programs.

5.1.2 PSE&G Small Business Direct Install Program

PSE&G has a new Small Business Direct Install Program, and the following information was obtained from the current PSE&G customer service website. Small business and not-for-profit customers residing in the municipalities noted in the following listing, which includes Kearny, may be eligible to participate in the PSE&G Direct Install Program.

Bayonne	Gloucester City	Kearny	Orange	Plainfield
Camden	Guttenberg	Mt. Holly	Passaic	Roselle
Carteret	Hillside	New Brunswick	Paterson	Trenton
East Orange	Irvington	Newark	Pemberton	Union City
Elizabeth	Jersey City	North Bergen	Perth Amboy	West New York

PSE&G is offering this program to customers designated by the State of New Jersey as having “Urban Enterprise Zones”. Program guidelines require that customers be a PSE&G customer of record with a separately metered PSE&G electric or gas account; must have a qualifying energy usage profile - an average electric demand of 200 kW or less, or 40,300 kWh or less per month (the kW limit is waived for municipalities); and have a satisfactory payment history with PSE&G. Customers who lease their business are eligible for program participation; however, landlord permission is required.

As part of the PSE&G Direct Install Program, participants can obtain a free on-site energy audit of electrical equipment, proposal based on the audit with recommended energy efficiency measures; and installation of energy-saving equipment. PSE&G pays 100% of the cost to install the recommended energy efficiency measures. The customer is required to repay 20% of the total cost interest free, over two years as part of their PSE&G bill. The measures eligible for participation in this program are subject to approval by PSE&G.

Eligible energy efficiency equipment upgrades include:

- Lighting retrofits including sensors and controls
- Refrigeration, motors, and HVAC
- Site-specific custom projects

5.2 Building Incentives

The branch library is eligible for several incentives available under New Jersey Smart Start Programs. The total amount of all qualified incentives is about \$900 towards a new boiler, a tankless water heater and upgrades to the lighting system.

When calculating the total incentive for the New Jersey Pay For Performance program, 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 for Incentives #2 and #3 as previously discussed. This would result in a total incentive of about \$1,300, reducing the total project payback from 11.0 years to 10.5 years. See Appendix J for calculations.

Under PSE&G’s direct install program, the branch library is potentially eligible to receive \$25,400, and would be required to repay \$5,100. Incentives cannot be accepted under multiple programs.

6.0 ALTERNATIVE ENERGY SCREENING EVALUATION

6.1 Geothermal

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

The building uses a steam boiler and ductless split system DX 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 due to the extent of HVAC system renovation needed for implementation.

6.2 Solar

6.2.1 Photovoltaic Rooftop Solar Power Generation

The branch library 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 K.

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

Installation of (PV) arrays in the state New Jersey will allow the owner to participate in the New Jersey solar renewable energy certificates program (SREC). This is a program that has been set up to allow entities with large amounts of environmentally unfriendly emissions to purchase credits from zero emission (PV) solar-producers. An alternative compliance penalty (ACP) is paid for by the high emission

producers and is set each year on a declining scale of 3% per year. One SREC credit is equivalent to 1000 kilowatt hours of PV electrical production; these credits can be traded for period of 15 years from the date of installation. The cost of the ACP penalty for 2009 is \$700; this is the amount that must be paid per SERC by the high emission producers. The expected dollar amount that will be paid to the PV producer for 2009 is expected to be \$600/SREC credit. Payments that will be received from the PV producer will change from year to year dependent upon supply and demand. Renewable Energy Consultants is a third party SREC broker that has been approved by the New Jersey Clean Energy Program. As stated above there is no definitive way to calculate an exact price that will be received by the PV producer per SREC over the next 15 years. Renewable Energy Consultants estimated an average of \$487/ SERC per year and this number was utilized in the cash flow for this report.

The building had a maximum electricity demand of 16.8 kW and a minimum of 4.8 kW, from January 2008 through December 2008. The monthly average over the observed 12 month period was 8.3 kW. The existing load does not justify the use of the maximum incentive cap of 50 kW of installed PV solar array; therefore, a 6 kW system size was selected for the calculations. The system costs for PV installations were derived from the most recent NYSERDA (New York State Energy Research and Development Agency) estimates of total cost of system installation. It should be noted that the cost of installation is currently \$10 per watt or \$10,000 per kW of installed system. This has increased in the past few years due to the 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 K and summarized below:

Photovoltaic (PV) Rooftop Solar Power Generation – 6 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	
60,000	0	7,100	0	1,400	1,400	6,000	3,500	>25	11.0

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

While this measure is currently not recommended, future increases in the cost of electricity may make the payback period more attractive.

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 an electric water heater and, therefore, this measure would offer savings in site electricity consumption.

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 Township of Kearny 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 L 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		#2 Fuel Oil				
\$	kW	kWh	Gallons	\$	\$	Years	Years
27,100	0	1,160	0	200	200	NA	>25

* 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 Kearny area, the map indicates a mean annual wind speed of 10 miles per hour. For the branch library, there are site restrictions. Parking lots, trees and surrounding structures would greatly affect a tower location.

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

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

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 branch library 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, except there is currently no gas service to the building. Purchasing this system, providing a gas service 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 because of noise issues, potential zoning issues, and because the branch library does not have a steady waste stream to fuel the power generation system. Additionally, purchasing this system and performing modifications to the existing HVAC and electrical systems would greatly outweigh the savings over the life of the equipment.

6.6 Demand Response Curtailment

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

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

A PSE&G pre-approved CSP will require a minimum of 100 kW of load reduction to participate in any curtailment program. The branch library had a monthly average electricity demand of 8.3 kW and a maximum demand of 16.8 kW in 2008.

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 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 branch library is considered a low energy consumer per the Portfolio Manager with a Site Energy Usage Index (EUI) of 72 kBTU/ft²/year. The EUI can still be improved upon by addressing wasted energy from an inefficient boiler, excessive heating during unoccupied times, an electric water heater, and inefficient lighting systems. By implementing the measures discussed in this report, it is expected that the EUI can be reduced to approximately 68 kBTU/ft²/year; the national average for this building type is 104 kBTU/ft²/year. The EPA Portfolio Manager did not generate an energy rating score for this building because the building type (Library) is not eligible for an energy star rating.

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

The user name and password for the branch library's EPA Portfolio Manager Account has been provided to Gerry Kerr of the Township of Kearny.

8.0 CONCLUSIONS & RECOMMENDATIONS

The energy audit conducted by CHA at the branch library in Kearny, New Jersey identified potential ECMs for lighting upgrades with occupancy sensors, night setback, and insulation upgrades. Potential annual savings of \$1,600 may be realized for the recommended ECMs, with a summary of the costs, savings, and paybacks as follows:

ECM-3 Increase Wall Insulation

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		#2 Fuel Oil	Total				
\$	kW	kWh	Gallons	\$		\$	Years	Years
3,000	0	50	150	400	2.2	NA	7.5	NA

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

ECM-4 Night Setback

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		#2 Fuel Oil	Total				
\$	kW	kWh	Gallons	\$		\$	Years	Years
400	0	0	320	800	29.0	NA	0.5	NA

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

ECM-8 Lighting Replacements with Occupancy Sensors

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
\$	kW	kWh	Therms	\$		\$	Years	Years
2,000	0.9	2,680	0	400	2.0	300	5.0	4.3

* Incentives based on New Jersey Smart Start Prescriptive Lighting Measures.

APPENDIX A

Utility Usage Analysis



New Jersey BPU Energy Audit Program
 CHA Project No.: 20711
 Town of Kearny
 PSE&G - Electric Service

Branch Library - 759 Kearny Ave.
 Account No.: 11 925 362 07
 Meter No.: 1665915

Month	Consumption (kWh)	Demand (kW)	Charges			Unit Costs		
			Total (\$)	Demand (\$)	Consumption (\$)	Blended Rate (\$/kWh)	Consumption (\$/kWh)	Demand (\$/kW)
January-08	1,430	14.3	\$225.72	\$67.09	\$158.63	0.1578	0.1109	4.69
February-08	1,623	16.2	\$259.38	\$74.50	\$184.88	0.1598	0.1139	4.60
March-08	1,227	12.3	\$196.74	\$59.32	\$137.42	0.1603	0.1120	4.82
April-08	881	8.8	\$144.02	\$45.69	\$98.33	0.1635	0.1116	5.19
May-08	648	4.3	\$104.79	\$29.32	\$75.47	0.1617	0.1165	6.82
June-08	666	6.3	\$198.25	\$99.98	\$98.27	0.2977	0.1476	15.87
July-08	671	5.9	\$196.03	\$95.54	\$100.49	0.2921	0.1498	16.19
August-08	560	4.4	\$167.01	\$78.85	\$88.16	0.2982	0.1574	17.92
September-08	604	4.5	\$170.71	\$79.96	\$90.75	0.2826	0.1502	17.77
October-08	631	4.5	\$124.37	\$47.66	\$76.71	0.1971	0.1216	10.59
November-08	1,189	4.4	\$185.31	\$47.27	\$138.04	0.1559	0.1161	10.74
December-08	468	3.6	\$100.46	\$44.16	\$56.30	0.2147	0.1203	12.27
Most Recent Yr	10,598	16.2	\$2,072.79	\$769.34	\$1,303.45	0.1956	0.1230	8.60

Branch Library - 759 Kearny Ave. (2nd Floor)
 Account No.: 11 925 363 04
 Meter No.: 1684242

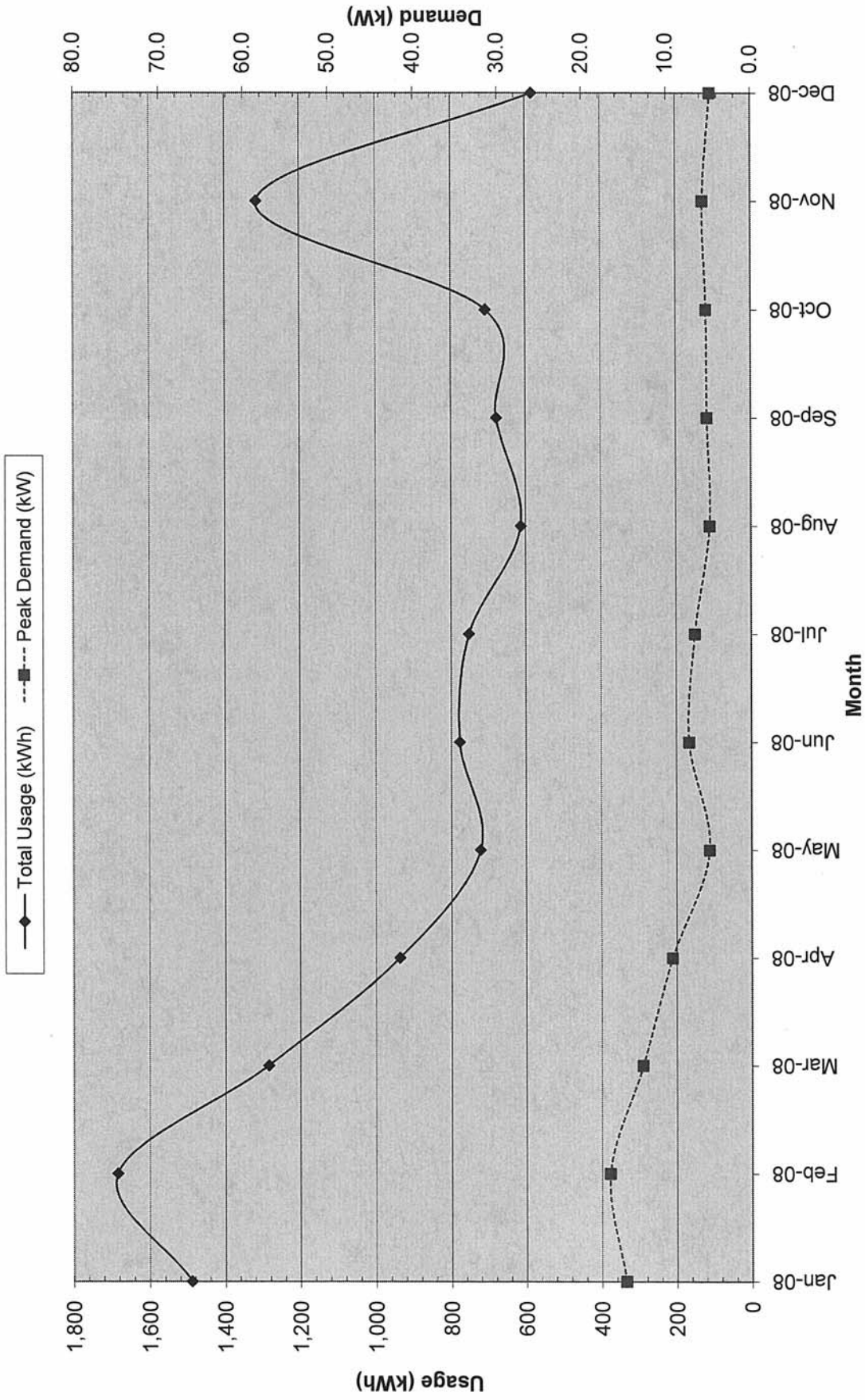
Month	Consumption (kWh)	Demand (kW)	Charges			Unit Costs		
			Total (\$)	Demand (\$)	Consumption (\$)	Blended Rate (\$/kWh)	Consumption (\$/kWh)	Demand (\$/kW)
January-08	59	0.6	\$13.95	\$3.35	\$10.60	0.2364	0.1797	5.58
February-08	61	0.6	\$14.39	\$3.35	\$11.04	0.2359	0.1810	5.58
March-08	58	0.6	\$13.89	\$3.35	\$10.54	0.2395	0.1817	5.58
April-08	56	0.6	\$13.58	\$3.35	\$10.23	0.2425	0.1827	5.58
May-08	74	0.7	\$16.19	\$3.79	\$12.40	0.2188	0.1676	5.41
June-08	111	1.1	\$35.48	\$15.57	\$19.91	0.3196	0.1794	14.15
July-08	81	0.8	\$28.10	\$12.24	\$15.86	0.3469	0.1958	15.30
August-08	53	0.5	\$21.09	\$8.90	\$12.19	0.3979	0.2300	17.80
September-08	74	0.7	\$25.97	\$11.13	\$14.84	0.3509	0.2005	15.90
October-08	76	0.8	\$19.46	\$6.48	\$12.98	0.2561	0.1708	8.10
November-08	126	1.3	\$26.84	\$8.42	\$18.42	0.2130	0.1462	6.48
December-08	115	1.2	\$25.06	\$8.03	\$17.03	0.2179	0.1481	6.69
Most Recent Yr	944	1.3	\$254.00	\$87.96	\$166.04	0.2691	0.1759	9.26

* Electric bills not available for shaded months.

Total (Both Meters):

Month	Consumption (kWh)	Demand (kW)	Charges			Unit Costs		
			Total (\$)	Demand (\$)	Consumption (\$)	Blended Rate (\$/kWh)	Consumption (\$/kWh)	Demand (\$/kW)
January-08	1,489	14.9	\$239.67	\$70.44	\$169.23	0.1610	0.1137	4.73
February-08	1,684	16.8	\$273.77	\$77.85	\$195.92	0.1626	0.1163	4.63
March-08	1,285	12.9	\$210.63	\$62.67	\$147.96	0.1639	0.1151	4.86
April-08	937	9.4	\$157.60	\$49.04	\$108.56	0.1682	0.1159	5.22
May-08	722	5.0	\$120.98	\$33.11	\$87.87	0.1676	0.1217	6.62
June-08	777	7.4	\$233.73	\$115.55	\$118.18	0.3008	0.1521	15.61
July-08	752	6.7	\$224.13	\$107.78	\$116.35	0.2980	0.1547	16.09
August-08	613	4.9	\$188.10	\$87.75	\$100.35	0.3069	0.1637	17.91
September-08	678	5.2	\$196.68	\$91.09	\$105.59	0.2901	0.1557	17.52
October-08	707	5.3	\$143.83	\$54.14	\$89.69	0.2034	0.1269	10.22
November-08	1,315	5.7	\$212.15	\$55.69	\$156.46	0.1613	0.1190	9.77
December-08	583	4.8	\$125.52	\$52.19	\$73.33	0.2153	0.1258	10.87
Most Recent Yr	11,542	16.8	\$2,326.79	\$857.30	\$1,469.49	0.2016	0.1273	8.66

Electric Usage - Town of Kearny Branch Library



New Jersey BPU Energy Audit Program
CHA Project No.: 20711
Town of Kearny
National Term Inc. - #2 Fuel Oil

Branch Library - 759 Kearny Ave.

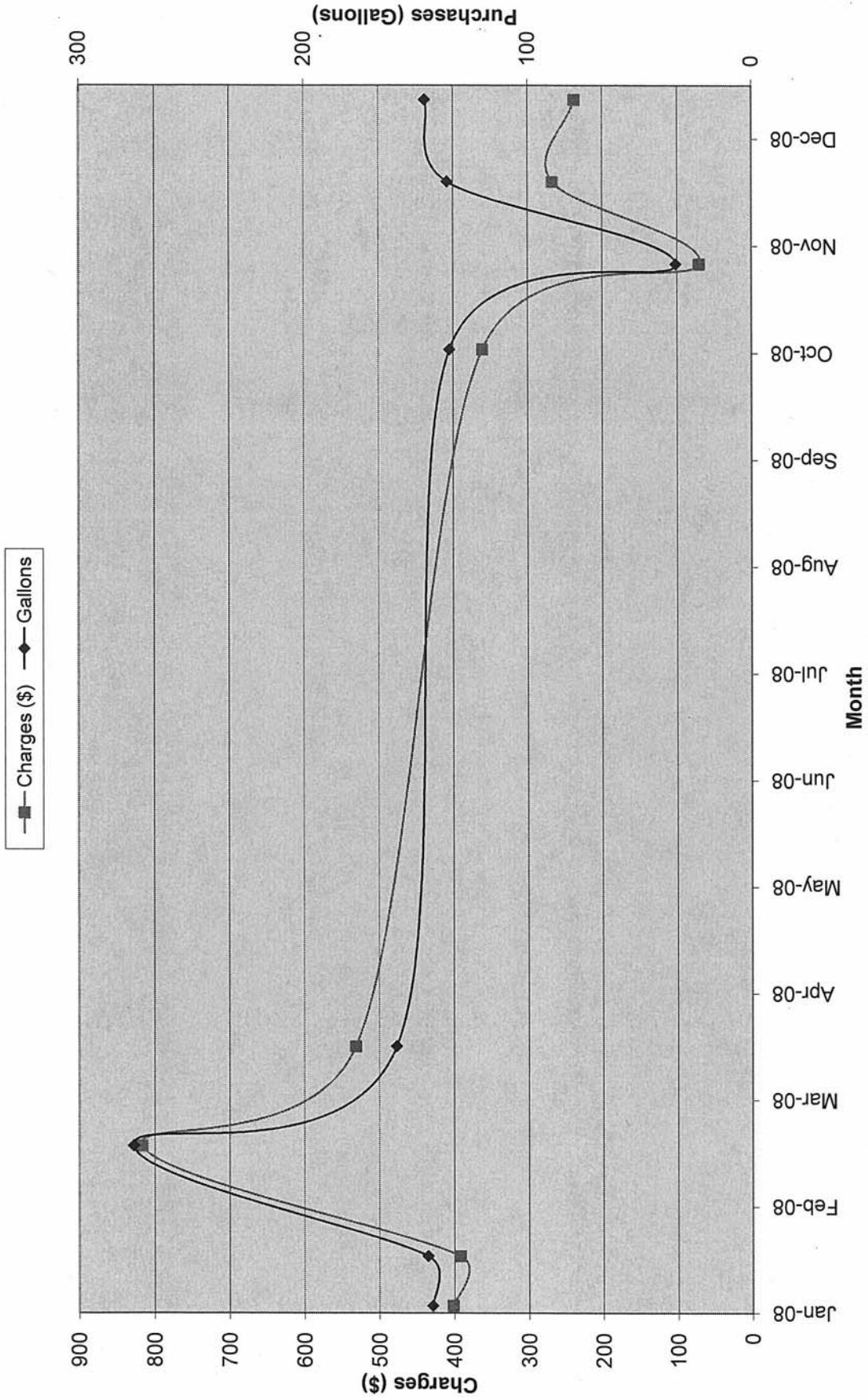
Account No.: n/a

Meter No.: n/a

Month	Gallons	Charges (\$)	(\$/Gallon)
1/15/08	143	402	2.81
1/29/08	145	392	2.70
2/29/08	276	817	2.96
3/28/08	159	532	3.34
10/10/08	135	361	2.67
11/3/08	34	70	2.07
11/26/08	136	267	1.96
12/19/08	146	237	1.62

Most Recent Yr	1,174	3,077	2.62
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#2 Fuel Oil Usage - Town of Kearny Branch Library



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

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

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

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

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

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

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

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

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

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

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

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

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

Integrus Energy Services, Inc
99 Wood Avenue, Suite 802
Iselin, NJ 08830
www.integrusenergy.com

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

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

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

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

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

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

APPENDIX B

ECM-1 Increase Roof Insulation



Kearny NJ
CHA #20711
Building: Branch Library

ECM-1 Install Roof Insulation

Existing Roof Area 1,540 sf
Existing U-value 0.06 Btu/hr/(sf°F)
Proposed R-value 36
Proposed U-value 0.03 Btu/hr/(sf°F)
Heating System Efficiency 77%
Cooling System Efficiency 1.20 kW/ton

Existing Cooling
Existing Cooling Load Temp Diff. 79 F
Existing Max. Roof Cooling Load 6,813 Btu/hr

Proposed Cooling
Proposed Cooling Load 3,123 Btu/hr

Occupied Cooling Setpoint 74 F
Unoccupied Cooling Setpoint 80 F

Existing Heating
Existing Heating Load Temp Diff. 54 F
Existing Max. Roof Heating Load 4,892 Btu/hr

Proposed Heating
Proposed Heating Load 2,310 Btu/hr

Occupied Heating Setpoint 68 F
Unoccupied Heating Setpoint 68 F

Existing Heating Total 13,034,651 Btu/yr
Proposed Heating Total 6,155,252 Btu/yr
Savings 6,879,399 Btu/yr
Input 64 gallons

Existing Cooling Total 31 kWh/yr
Proposed Cooling Total 15 kWh/yr
Savings 16 kWh/yr

Avg Outdoor Air Temp. Bins °F	Existing Equipment Bin Hours	Occupied Equipment Bin Hours	Unoccupied Equipment Bin Hours	Occupied				Unoccupied				Existing Heating Load (Btu/yr)	Existing Cooling Load (kWh/yr)	Proposed Heating Load (Btu/yr)	Proposed Cooling Load (kWh/yr)	Savings (kWh/yr)	Savings (gallons)
				Existing Heat Gain (Btu/hr)	Proposed Heat Gain (Btu/hr)	Existing Heat Loss (Btu/hr)	Proposed Heat Loss (Btu/hr)	Existing Heat Gain (Btu/hr)	Proposed Heat Gain (Btu/hr)	Existing Heat Loss (Btu/hr)	Proposed Heat Loss (Btu/hr)						
102.5	0	0	0	2,582	1,219	-	-	2,038	963	-	-	-	-	-	-	-	-
97.5	3	0	3	2,129	1,005	-	-	1,585	749	-	-	-	-	-	-	-	-
92.5	34	4	30	1,676	791	-	-	1,132	535	-	-	-	-	-	-	-	-
87.5	131	16	115	1,223	578	-	-	679	321	-	-	-	-	-	-	-	-
82.5	500	60	440	770	364	-	-	226	107	-	-	-	-	-	-	-	-
77.5	620	74	546	317	150	-	-	-	-	-	-	-	-	-	-	-	-
72.5	664	79	585	-	-	45	21	-	-	-	-	45	21	-	-	-	-
67.5	854	102	752	-	-	498	235	-	-	-	-	498	235	-	-	-	-
62.5	927	110	817	-	-	951	449	-	-	-	-	951	449	-	-	-	-
57.5	600	71	529	-	-	1,404	663	-	-	-	-	1,404	663	-	-	-	-
52.5	610	73	537	-	-	1,857	877	-	-	-	-	1,857	877	-	-	-	-
47.5	611	73	538	-	-	2,310	1,091	-	-	-	-	2,310	1,091	-	-	-	-
42.5	656	78	578	-	-	2,763	1,305	-	-	-	-	2,763	1,305	-	-	-	-
37.5	1,023	122	901	-	-	3,216	1,519	-	-	-	-	3,216	1,519	-	-	-	-
32.5	734	87	647	-	-	3,669	1,733	-	-	-	-	3,669	1,733	-	-	-	-
27.5	334	40	294	-	-	4,122	1,946	-	-	-	-	4,122	1,946	-	-	-	-
22.5	252	30	222	-	-	4,575	2,160	-	-	-	-	4,575	2,160	-	-	-	-
17.5	125	15	110	-	-	5,028	2,374	-	-	-	-	5,028	2,374	-	-	-	-
12.5	47	6	41	-	-	5,481	2,588	-	-	-	-	5,481	2,588	-	-	-	-
7.5	22	3	19	-	-	5,934	2,802	-	-	-	-	5,934	2,802	-	-	-	-
2.5	13	2	11	-	-	6,386	3,016	-	-	-	-	6,386	3,016	-	-	-	-
-2.5	0	0	0	-	-	6,839	3,230	-	-	-	-	6,839	3,230	-	-	-	-
-7.5	0	0	0	-	-	6,839	3,230	-	-	-	-	6,839	3,230	-	-	-	-
TOTALS	8,760	1,043	7,717											31		15	-6,155,252

Kearny NJ
 CHA #20711
 Building: Branch Library
 ECM-1 Install Roof 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.		
Install 24" wide 6" insulation	1,540	sf	\$1.34	\$0.50		\$ 2,022	\$ 932	\$ -	\$ 2,954	
Misc/access	1,540	sf	\$ 0.75			\$ -	\$ 1,398	\$ -	\$ 1,398	
						\$ -	\$ -	\$ -	\$ -	
						\$ -	\$ -	\$ -	\$ -	
						\$ -	\$ -	\$ -	\$ -	
						\$ -	\$ -	\$ -	\$ -	
						\$ -	\$ -	\$ -	\$ -	
						\$ -	\$ -	\$ -	\$ -	
						\$ -	\$ -	\$ -	\$ -	
						\$ -	\$ -	\$ -	\$ -	
						\$ -	\$ -	\$ -	\$ -	
						\$ -	\$ -	\$ -	\$ -	

\$ 4,352	Subtotal
\$ 870	20% Contingency
\$ 783	Contractor 15% O&P
\$ -	Engineering
\$ 6,005	Total

APPENDIX C

ECM-2 Replace Boiler

Kearny NJ
 CHA #20711
 Building: Branch Library

ECM-2 Boiler Replacement

#2 Oil	▼
#2 Oil	▼

Existing Fuel
 Proposed Fuel

Item	Value	Units	Formula/Comments
Baseline Fuel Cost	\$ 2.62		
Proposed Fuel Cost	\$ 2.62		
Baseline Fuel Use	1,174	Gals #2	Based on historical utility data
Existing Boiler Plant Efficiency	77%		Estimated or Measured
Baseline Boiler Load	125,382	Mbtu/yr	Baseline Fuel Use x Existing Efficiency x 138.7 Mbtu/Gals #2
Baseline Fuel Cost	\$ 3,076		
Proposed Boiler Plant Efficiency	84%		New Boiler Efficiency
Proposed Fuel Use	1,076	Gals #2	Baseline Boiler Load / Proposed Efficiency / 138.7 Mbtu/Gals #2
Proposed Fuel Cost	\$ 2,820		
Annual Savings	98	Gals #2	
Annual Savings	\$ 256	/yr	

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

Kearny NJ
 CHA #20711
 Building: Branch Library
 ECM-2 Boiler Replacement

Multipliers	
Material:	0.98
Labor:	1.21
Equipment:	1.09

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
Demo	1	ea		\$ 250		\$ -	\$ -	\$ -	\$ 303	
Gas Fired Steam Boiler (180MBH)	1	ea	\$ 2,700	\$ 1,675		\$ 2,646	\$ 2,027	\$ -	\$ 4,673	
Flue Attachment	1	ls	\$ 300	\$ 120		\$ 294	\$ 145	\$ -	\$ 439	
Gas piping and steam connections	1	ls	\$ 140	\$ 360		\$ 137	\$ 436	\$ -	\$ 573	
Miscellaneous Electrical	1	ea	\$ 150	\$ 250		\$ 147	\$ 303	\$ -	\$ 450	
Boiler Controls	1	ls	\$ 250	\$ 450		\$ 245	\$ 545	\$ -	\$ 790	
						\$ -	\$ -	\$ -	\$ -	
						\$ -	\$ -	\$ -	\$ -	
						\$ -	\$ -	\$ -	\$ -	

\$ 7,226	Subtotal
\$ 723	10% Contingency
\$ 1,192	Contractor O&P
\$ -	Engineering
\$ 9,141	Total

	QTY	UNIT	\$/UNIT	TOTAL SAVINGS	Cost W/O INCENTIVE	Cost W/ INCENTIVE
New Jersey Smart Start Incentive					\$ -	\$ -
<300 MBH	160	Tons	\$2	\$320	\$ 4,673	\$ 4,353
				\$320	\$4,673	\$4,353

Total ECM Cost w/ Incentives \$8,821

APPENDIX D

ECM-3 Increase Wall Insulation



Kearny NJ
 CHA #20711
 Building: Branch Library
 ECM-3 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.		
Existing conditions	1	ls		\$ 500		\$ -	\$ 605	\$ -	\$ 605	
Blown in 3 1/2" thick - R-13	2,030	SF	\$ 0.23	\$ 0.15	\$ 0.06	\$ 460	\$ 378	\$ 122	\$ 960	
Repair walls	1	ls		\$ 440		\$ -	\$ 532	\$ -	\$ 532	
Touch up	1	ls		\$ 220		\$ -	\$ 266	\$ -	\$ 266	
						\$ -	\$ -	\$ -	\$ -	
						\$ -	\$ -	\$ -	\$ -	
						\$ -	\$ -	\$ -	\$ -	
						\$ -	\$ -	\$ -	\$ -	
						\$ -	\$ -	\$ -	\$ -	
						\$ -	\$ -	\$ -	\$ -	
						\$ -	\$ -	\$ -	\$ -	
						\$ -	\$ -	\$ -	\$ -	
						\$ -	\$ -	\$ -	\$ -	
						\$ -	\$ -	\$ -	\$ -	
						\$ -	\$ -	\$ -	\$ -	

\$	2,363	Subtotal
\$	236	10% Contingency
\$	390	Contractor
\$	-	15% O&P
\$	2,989	Engineering
\$	2,989	Total

APPENDIX E

ECM-4 Night Setback



Kearny NJ
 CHA #20711
 Building: Branch Library

ECM-4 Night Setback

Building Footprint	1,680	SF
Heating Efficiency	77%	
Cooling Efficiency	1.2	kW/ton
Building Balance Temp.	60	*F
Internal Gains	10,176	btu/h
Unoc Internal Gain factor	0.03	
Ave Occ Internal Gain Factor	0.7	

Ex Occupied Cing Temp.	74	*F
Ex Unoccupied Cing Temp.	74	*F
Prop Occupied Cing Temp.	74	*F
Prop Unoccupied Cing Temp.	74	*F
Occupied Cooling UA	-1,937	btu/hr*F
Unoccupied Cooling UA	-1,030	btu/hr*F
Cooling Occ Enthalpy Setpoint	27.5	Btu/lb
Cooling Unocc Enthalpy Setpoint	27.5	Btu/lb

Ex Occupied Htg Temp.	68	*F
Ex Unoccupied Htg Temp.	68	*F
Prop Occupied Htg Temp.	68	*F
Prop Unoccupied Htg Temp.	60	*F
Occupied Heating UA	630	btu/hr*F
Unoccupied Heating UA	630	btu/hr*F

Heating Energy Savings	316	gallons
Cooling Energy Savings	-48	kWh

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

Avg Outdoor Air Temp. Bins °F	Avg Outdoor Air Enthalpy	EXISTING LOADS									PROPOSED LOADS									Existing Cooling Energy kWh	Proposed Cooling Energy kWh	Existing Heating Energy gallons	Proposed Heating Energy gallons
		Occupied			Unoccupied			Occupied			Unoccupied												
		Existing Equipment Hours	Occupied Equipment Hours	Unoccupied Equipment 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							
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	-55,217	-28,966	-7,123	-29,364	-28,966	-305	-55,217	-28,966	-7,123	-29,364	-28,966	-305	0	0	0	0			
97.5	42.5	3	0	3	-45,530	-20,115	-7,123	-24,213	-20,115	-305	-45,530	-20,115	-7,123	-24,213	-20,115	-305	14	14	0	0			
92.5	39.5	34	4	30	-35,843	-16,092	-7,123	-19,061	-16,092	-305	-35,843	-16,092	-7,123	-19,061	-16,092	-305	130	130	0	0			
87.5	36.6	131	16	115	-26,156	-12,203	-7,123	-13,909	-12,203	-305	-26,156	-12,203	-7,123	-13,909	-12,203	-305	376	376	0	0			
82.5	34	500	60	440	-16,468	-8,717	-7,123	-8,758	-8,717	-305	-16,468	-8,717	-7,123	-8,758	-8,717	-305	975	975	0	0			
77.5	31.6	620	74	546	-6,781	-5,498	-7,123	-3,606	-5,498	-305	-6,781	-5,498	-7,123	-3,606	-5,498	-305	657	657	0	0			
72.5	29.2	664	79	585	0	0	-7,123	0	0	-305	0	0	-7,123	0	0	-305	74	74	0	0			
67.5	27	854	102	752	315	161	-7,123	315	161	-305	315	161	-7,123	0	0	-305	68	91	0	0			
62.5	24.5	927	110	817	3,465	1,770	-7,123	3,465	1,770	-305	3,465	1,770	-7,123	0	0	-305	21	46	0	0			
57.5	21.4	600	71	529	6,615	3,379	-7,123	6,615	3,379	-305	6,615	3,379	-7,123	1,575	805	-305	0	0	50	12			
52.5	18.7	610	73	537	9,765	4,989	-7,123	9,765	4,989	-305	9,765	4,989	-7,123	4,725	2,414	-305	0	0	78	40			
47.5	16.2	611	73	538	12,914	6,598	-7,123	12,914	6,598	-305	12,914	6,598	-7,123	7,875	4,023	-305	0	0	105	67			
42.5	14.4	656	78	578	16,064	8,207	-7,123	16,064	8,207	-305	16,064	8,207	-7,123	11,024	5,632	-305	0	0	142	101			
37.5	12.6	1,023	122	901	19,214	9,816	-7,123	19,214	9,816	-305	19,214	9,816	-7,123	14,174	7,241	-305	0	0	267	203			
32.5	10.7	734	87	647	22,364	11,425	-7,123	22,364	11,425	-305	22,364	11,425	-7,123	17,324	8,851	-305	0	0	225	178			
27.5	8.6	334	40	294	25,514	13,035	-7,123	25,514	13,035	-305	25,514	13,035	-7,123	20,474	10,460	-305	0	0	117	96			
22.5	6.8	252	30	222	28,664	14,644	-7,123	28,664	14,644	-305	28,664	14,644	-7,123	23,624	12,069	-305	0	0	100	84			
17.5	5.5	125	15	110	31,813	16,253	-7,123	31,813	16,253	-305	31,813	16,253	-7,123	26,774	13,678	-305	0	0	55	47			
12.5	4.1	47	6	41	34,963	17,862	-7,123	34,963	17,862	-305	34,963	17,862	-7,123	29,924	15,287	-305	0	0	23	20			
7.5	2.6	22	3	19	38,113	19,471	-7,123	38,113	19,471	-305	38,113	19,471	-7,123	33,073	16,897	-305	0	0	12	10			
2.5	1	13	2	11	41,263	21,081	-7,123	41,263	21,081	-305	41,263	21,081	-7,123	36,223	18,506	-305	0	0	7	7			
-2.5	0	0	0	0	44,413	22,690	-7,123	44,413	22,690	-305	44,413	22,690	-7,123	39,373	20,115	-305	0	0	0	0			
-7.5	-1.5	0	0	0	47,563	24,299	-7,123	47,563	24,299	-305	47,563	24,299	-7,123	42,523	21,724	-305	0	0	0	0			
TOTALS		8,760	1,043	7,717													2,315	2,363	1,181	865			

Existing Building Ventilation & Infiltration (occ)	298	cfm
Overheat Ventilation Factor	1.00	
Additional ventilation to offset overheat	0	cfm
Existing Building Ventilation & Infiltration (unocc)	298	cfm

Kearny NJ
CHA #20711
Building: Branch Library

Reconcile Thermal Model

Building Footprint 1,980 SF
Heating Efficiency 77%
Cooling Efficiency 1.20 kW/ton
Internal Gains 10.176 btu/h
Unoc Internal Gain factor 0.03
Ave Occ Internal Gain Factor 0.7
Economizer available (Y/N) No

Ex Occupied Cing Temp. 74 °F
Ex Unoccupied Cing Temp. 80 °F
Occupied Cooling UA (1,937) btu/hr°F
Unoccupied Cooling UA (1,030) btu/hr°F
Cooling Occ Enthalpy Setpoint 27.5 Btu/lb
Cooling Unocc Enthalpy Setpoint 27.5 Btu/lb

Ex Occupied Htg Temp. 68 °F
Ex Unoccupied Htg Temp. 68 °F
Occupied Heating UA 630 btu/hr°F
Unoccupied Heating UA 630 btu/hr°F

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

Avg Outdoor Air Temp. Bins °F	Avg Outdoor Air Enthalpy	EXISTING LOADS										Necessary Cooling Energy kWh	Existing Cooling Energy kWh	Existing Heating Energy gallons
		Occupied					Unoccupied							
		Total Bin Hours	Occupied Equipment Bin Hours	Unoccupied Equipment Bin Hours	Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Available Economizer Cooling kWh			
A		B	C	D	E	F	G	H	I	J	K	L	M	M
102.5	49.1	0	0	0	-55,217	-28,966	-7,123	-23,182	-28,966	-305	0	0	0	0
97.5	42.5	3	0	3	-45,530	-20,115	-7,123	-18,031	-20,115	-305	0	13	0	0
92.5	39.5	34	4	30	-35,843	-16,092	-7,123	-12,879	-16,092	-305	0	112	0	0
87.5	36.6	131	16	115	-26,156	-12,203	-7,123	-7,727	-12,203	-305	0	304	0	0
82.5	34.0	500	60	440	-16,468	-8,717	-7,123	-2,576	-8,717	-305	0	703	0	0
77.5	31.6	620	74	546	-6,781	-5,498	-7,123	0	0	-305	0	160	0	0
72.5	29.2	664	79	585	0	0	-7,123	0	0	-305	0	74	0	0
67.5	27.0	854	102	752	315	161	-7,123	315	161	-305	0	68	0	0
62.5	24.5	927	110	817	3,465	1,770	-7,123	3,465	1,770	-305	0	21	0	0
57.5	21.4	600	71	529	6,615	3,379	-7,123	6,615	3,379	-305	0	0	50	0
52.5	18.7	610	73	537	9,765	4,989	-7,123	9,765	4,989	-305	0	0	78	0
47.5	16.2	611	73	538	12,914	6,598	-7,123	12,914	6,598	-305	0	0	105	0
42.5	14.4	656	78	578	16,064	8,207	-7,123	16,064	8,207	-305	0	0	142	0
37.5	12.6	1,023	122	901	19,214	9,816	-7,123	19,214	9,816	-305	0	0	267	0
32.5	10.7	734	87	647	22,364	11,425	-7,123	22,364	11,425	-305	0	0	225	0
27.5	8.6	334	40	294	25,514	13,035	-7,123	25,514	13,035	-305	0	0	117	0
22.5	6.8	252	30	222	28,664	14,644	-7,123	28,664	14,644	-305	0	0	100	0
17.5	5.5	125	15	110	31,813	16,253	-7,123	31,813	16,253	-305	0	0	55	0
12.5	4.1	47	6	41	34,963	17,862	-7,123	34,963	17,862	-305	0	0	23	0
7.5	2.6	22	3	19	38,113	19,471	-7,123	38,113	19,471	-305	0	0	7	0
2.5	1.0	13	2	11	41,263	21,081	-7,123	41,263	21,081	-305	0	0	0	0
-2.5	0.0	0	0	0	44,413	22,690	-7,123	44,413	22,690	-305	0	0	0	0
-7.5	-1.5	0	0	0	47,563	24,299	-7,123	47,563	24,299	-305	0	0	0	0
TOTALS		8,760	1,043	7,717								1,454	1,454	1,181

Existing Building Ventilation & Infiltration (occ) 298 cfm
Overheat Ventilation Factor 1.00
Additional ventilation to offset overheat 0 cfm
Existing Building Ventilation & Infiltration (unocc) 298 cfm
Economizer Ventilation (from AHU's) 0 cfm

Energy Use Indices (calculated)

Base Case	1,181
Heating	1,174
Target ->	100.6%

Base Case	1,454
Cooling	1,460
Target ->	99.6%

gallons

HEAT GAIN/LOSS WORKSHEET

Project Name:
 Location:
 Building Name:
 Engineer:

Project No.:
 Site Elevation: Feet
 Date:
 Specific Volume: CF/#

Building/Facility Designation:

Outdoor Winter Design DB Temperature	<input type="text" value="14"/> *F	Indoor Winter Design DB Temperature	<input type="text" value="68"/> *F
Outdoor Summer Design DB Temperature	<input type="text" value="91"/> *F	Indoor Summer Design DB Temperature	<input type="text" value="74"/> *F
Outdoor Summer Design WB Temperature	<input type="text" value="73"/> *F	Indoor Summer Design WB Temperature	<input type="text" value="60"/> *F
Outdoor Summer Humidity Ratio	<input type="text" value="0.0121"/> ##	Indoor Air (70°F) Humidity Ratio	<input type="text" value="0.0079"/> ##

ENVELOPE DESCRIPTIONS (Descriptions are from Interior to Exterior)

Walls (Select One - Type X)

	R Value	Wall Type
<input type="checkbox"/> Steel Siding, 4" Insulation, Steel Siding	15.2	1
<input type="checkbox"/> Plaster or Gypsum, frame construction, 5" Insulation, 1" stucco	18.2	1
<input type="checkbox"/> 4" WH CMU, 1" Insulation, Finished Exterior	5.2	2
<input type="checkbox"/> Plaster or Gypsum, frame construction, 3" Insulation, 8" LW CMU	7.8	5
<input type="checkbox"/> 4" Face Brick, 2" Concrete, 1" Insulation, Exterior Finish	5.1	12
<input type="checkbox"/> 4" Face Brick, 4" Concrete, 1" Insulation, Exterior Finish	4.0	11
<input type="checkbox"/> Interior Finish, 2" Insulation, 8" CMU, 4" Face Brick	10.9	16
<input type="checkbox"/> Finished Surface, 8" LW CMU (filled), Air Space, 4" Face Brick	11.1	16
<input type="checkbox"/> Stucco or Gypsum, 2.5" Insul, Face Brick	14.3	10
<input type="checkbox"/> 4" Block, 1" insulation, 8" Block	19.9	16
<input checked="" type="checkbox"/> Siding, air space, furring strip, plaster	7.5	

Roofs (Select One)

	R Value	Roof Type
<input type="checkbox"/> Tectum Deck, 3.3" Insul., BU Roof	13.0	1
<input type="checkbox"/> Steel Deck, 5" Insul., BU Roof	18.2	1
<input type="checkbox"/> Attic Roof with 6" Insul.	25.0	4
<input type="checkbox"/> 4" HW Concrete Deck, BU Roof	2.7	2
<input type="checkbox"/> Ceiling, 3" Insulation, 4" Concrete Deck, BU Roof	14.9	4
<input type="checkbox"/> Ceiling, 4" Concrete Deck, 3" Insulation, BU Roof	18.5	13
<input type="checkbox"/> Ceiling, 4" Concrete Deck, 6" Insulation, BU Roof	21.7	14
<input type="checkbox"/> Ceiling, Wood Deck, 6" Insulation, Felt & Membrane	22.7	10
<input type="checkbox"/> Wood Deck, 6" insulation, Felt & Membrane	18.0	
<input checked="" type="checkbox"/> Attic, wood boards, shingles	17.00	

Windows (Select One)

	U Value
<input type="checkbox"/> Aluminum Frame, 1/8" SP Glazing	1.05
<input checked="" type="checkbox"/> Aluminum Frame, 1/4" DP Glazing	0.60
<input type="checkbox"/> Aluminum Frame, 3/16" DP Glazing	0.62
<input type="checkbox"/> Aluminum Frame, 1/2" DP Glazing	0.50
<input type="checkbox"/> Skylights	0.90
<input type="checkbox"/> Other	

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

BUILDING CHARACTERISTICS

Roof Area: SF
 Occupied Area: SF
 Return Plenum?

	Gross Wall Length	Average Wall Height	Ceiling Height	Window Area	Door Area	Net Wall Area
North Exposure	<input type="text" value="43"/> Ft	<input type="text" value="14.3"/> Ft	<input type="text" value="13.0"/> Ft	<input type="text" value="67"/> SF	<input type="text" value="21"/> SF	526 SF
East Exposure	<input type="text" value="36"/> Ft	<input type="text" value="16.0"/> Ft	<input type="text" value="15.0"/> Ft	<input type="text" value="95"/> SF	<input type="text" value="25"/> SF	457 SF
South Exposure	<input type="text" value="43"/> Ft	<input type="text" value="14.8"/> Ft	<input type="text" value="13.0"/> Ft	<input type="text" value="100"/> SF	<input type="text" value="0"/> SF	536 SF
West Exposure	<input type="text" value="36"/> Ft	<input type="text" value="17.0"/> Ft	<input type="text" value="15.0"/> Ft	<input type="text" value="75"/> SF	<input type="text" value="25"/> SF	513 SF

Forced Ventilation: cfm

HEAT GAIN/LOSS WORKSHEET

Project Name: Kearny NJ
 Location: Branch Library
 Building Name: ND
 Engineer: ND

Project No.: CHA #20711
 Site Elevation: 460 Feet
 Date:

Specific Volume: 14.00 CF/#

Building/Facility Designation: Entire building

COOLING HEAT GAINS TO THE ROOM - SENSIBLE

SOLAR GAINS

WINDOWS	AREA (SF)	SHGF	Shade Coef	Cooling Load Factor	Glass Type	Solar Heat Gain
North Exposure	67	38 btu/h/sf	0.8	0.75	Glass Type C	1,516 Btu/hr
East Exposure	95	216 btu/h/sf	0.8	0.31	Glass Type C	5,089 Btu/hr
South Exposure	100	109 btu/h/sf	0.8	0.58	Glass Type C	5,058 Btu/hr
West Exposure	75	216 btu/h/sf	0.8	0.29	Glass Type C	3,758 Btu/hr
						15,421 Btu/h

CONDUCTION

	NET AREA (SF)	U-VALUE	Cooling Load Temp. Dif.	Return Air Factor	Room Heat Gain	
North Exposure	472	0.13	20 °F	1.0	1,257 Btu/hr	
East Exposure	421	0.13	39 °F	1.0	2,187 Btu/hr	
South Exposure	459	0.13	27 °F	1.0	1,652 Btu/hr	
West Exposure	441	0.13	22 °F	1.0	1,292 Btu/hr	
Roof	1,540	0.06	73 °F	1.0	6,613 Btu/hr	
Fenestration	337	0.60	17 °F		3,432 Btu/hr	
Doors	70	0.14	27 °F		264 Btu/hr	
Ceiling	1,680	0.14	0 °F		0 Btu/hr	
Partition		0.05	0 °F		0 Btu/hr	
Floor	1,680	0.04	0 °F		0 Btu/hr	
						16,698 Btu/h

INTERNAL HEAT GAINS

Lights	1.25 w/sf x 1,680 Occ Area =	2.1 kW x 3.4x	1.0 RAF =	7,167 Btu/h
Plug Load	0.15 w/sf x 1,680 Occ Area =	0.3 kW x 3.4x	1.0 RAF =	860 Btu/h
People	8 people x 255 btu/person x	25% time in space =		510 Btu/h
Computer Work Stations	4 Units x 120 W/Unit x	3414 =		1,638 Btu/h
Equipment	kW x 3.413 =			0 Btu/h
Misc.				0 Btu/h
10,176 Btu/h				

VENTILATION AND INFILTRATION

	Infiltration Factor	Perimeter Ratio	Coef	Temp. Diff.	Room Heat Gain
Walls	1,792 SF x 0.10 CFM/SF		1.04	17 °F	3,433 Btu/h
Doors	70 SF x 0.20 CFM/LF	0.89 LF/SF	1.04	17 °F	238 Btu/h
Windows	337 SF x 0.20 CFM/LF	1.23 LF/SF	1.04	17 °F	1,583 Btu/h
Ventilation	0 cfm		1.04	17 °F	0 Btu/h
5,254 Btu/h					

COOLING HEAT GAINS TO THE RA PLENUM - SENSIBLE

4,950

CONDUCTION

	NET AREA (SF)	U-VALUE	Cooling Load Temp. Dif.	Return Air Factor	Room Heat Gain
North Exposure	54	0.13	20	1.0	144 Btu/hr
East Exposure	36	0.13	39	1.0	187 Btu/hr
South Exposure	77	0.13	27	1.0	275 Btu/hr
West Exposure	72	0.13	22	1.0	211 Btu/hr
Roof	1,540	0.06	73	0.0	0 Btu/hr
818 Btu/h					

INTERNAL HEAT GAINS

Lights	1.25 w/sf x 1,680 Occ Area =	2.1 kW x 3.413x	0.00 RAF =	0 Btu/h
Misc.				0 Btu/h
0 Btu/h				

SENSIBLE HEAT GAINS - TEMP. DEPENDENT

Solar	15,421
Conduction to Room	16,698
Conduction to Plenum	818
Ventilation and Infiltration	5,254
Sub Total	38,191

SENSIBLE HEAT GAINS - TEMP. INDEPENDENT

Internal Gains to Room	10,176
Internal Gains to Plenum	0
Sub Total	10,176

HEAT GAIN/LOSS WORKSHEET

Project Name: Kearny NJ
 Location: Branch Library
 Building Name: ND
 Engineer:

Project No.: CHA #20711
 Site Elevation: 460 Feet
 Date:

Specific Volume 14.00 CF/#

Building/Facility Designation Entire building

LATENT COOLING LOADS

Infiltration	Infiltration Factor	Air Density	Humidity Ratio Dif.	Room Heat Gain
Walls 1,779 SF	0.10 CFM/SF	4,629	0.0042 ##	3,493 Btu/h
Doors 70 SF	0.20 CFM/LF	4,629	0.0042 ##	244 Btu/h
Windows 337 SF	0.20 CFM/LF	4,629	0.0042 ##	1,622 Btu/h
Ventilation 0 cfm		4,629	0.0042 ##	0 Btu/h
People 8 people	0.25 time in space		250 Btu/hr/person	500 Btu/h
				5,858 Btu/h

Cooling Load Summary

	Sensible	Latent	Total	SHR=
Temperature Dependent Gains	38,191	5,858	44,049	0.89
Temperature Indep. Gains	10,176		10,176	
Total	48,366	5,858	54,224	

Building Cooling Load 4.5 Tons at 372 SF/Ton

Building Air Flow to Condition Space based on a 12°F Temp Rise is 3,796 CFM
2.26 CFM/sf

HEATING CALCULATION

CONDUCTION

NET AREA (SF)	U-VALUE	Heating Load Temp. Dif.	Room Heat Gain
North Exposure 526	0.13	54	3,784 Btu/h
East Exposure 457	0.13	54	3,287 Btu/h
South Exposure 536	0.13	54	3,856 Btu/h
West Exposure 513	0.13	54	3,690 Btu/h
Fenestration 337	0.60	54	10,903 Btu/h
Roof 1,540	0.06	54	4,892 Btu/h
Doors 70	0.14	54	528 Btu/h
Ceiling 1,680	0.14	0	0 Btu/h
Partition 0	0.05	0	0 Btu/h
Floor 1,540	0.04	50	3,080 Btu/h

Ventilation and Infiltration

Infiltration Factor	Coef	Temp. Difference	Air Flow	Room Heat Gain
Walls 2,030 SF	0.10 CFM/SF	54	203 cfm	11,442 Btu/h
Doors 70 SF	0.20 CFM/LF	54	12 cfm	699 Btu/h
Windows 337 SF	0.20 CFM/LF	54	83 cfm	4,656 Btu/h
Ventilation Load 0 cfm		54	0 cfm	0 Btu/h
Total Ventilation & Infiltration Load			298 cfm	16,797 Btu/h

Building Heating Load 50,815 btu/h
 30.2 btu/sf

Kearny NJ
 CHA #20711
 Building: Branch Library

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	3.5	7.0	1	24.5	21.0
				0.0	0.0
				0.0	0.0
			Sub-total	24.5	21.0
South				0.0	0.0
				0.0	0.0
				0.0	0.0
				0.0	0.0
			Sub-total	0.0	0.0
West	3.5	7.0	1	24.5	21.0
				0.0	0.0
			Sub-total	24.5	21.0
			Total	70.0	62.0

LF/SF
0.89

Walls

	Width (ft)	Height (ft)	Quantity	Area (SF)	Lineal Feet	
North	33.0	16.0	1	528.0	98.0	All wall quantities must remain equal to 1
	10.0	8.5	1	85.0	37.0	
				0.0	0.0	
				0.0	0.0	
	43.0			613.0	135.0	
					Average height wall automatically linked to	
East	36.0	16.0	1	576.0	104.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
	36.0			576.0	104.0	Ave. height 16.0
					Average height wall automatically linked to	
South	7.0	8.5	1	59.5	31.0	
	33.0	16.0	1	528.0	98.0	
	3.0	16.0	1	48.0	38.0	
				0.0	0.0	
	43.0			635.5	167.0	Ave. height 14.8
					Average height wall automatically linked to	
West	36.0	17.0	1	612.0	106.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
	36.0			612.0	106.0	Ave. height 17.0
					Average height auto linked to block load sheet	

Windows

	Width (ft)	Height (ft)	Quantity	Area (SF)	Lineal Feet	
North	2.5	5.0	5	62.5	75.0	
	1.0	2.0	2	4.0	12.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
			Sub-total	66.5	87.0	
East	2.5	5.0	6	75.0	90.0	
	2.5	4.0	2	20.0	26.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
			Sub-total	95.0	116.0	
South	2.5	5.0	8	100.0	120.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
			Sub-total	100.0	120.0	
West	2.5	5.0	6	75.0	90.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
			Sub-total	75.0	90.0	
			Total	336.5	413.0	LF/SF 1.23

APPENDIX F

ECM-5 Replace Domestic Hot Water Heater



Kearny NJ
 CHA #20711
 Building: Branch Library

ECM-5 Replace DHW Heater

Summary

* Replace electric hot water heater w/ tankless high efficiency oil fired unit

Item	Value	Units	Formula/Comments
Avg. Monthly Utility Demand by Water Heater	77	kWh/month	Estimated base on rating and utilization
Electric Demand	1.5	KW	
Total Annual Utility Demand by Water Heater	3,138	MBTU/yr	1MBTHU = 1000 BTU
Existing DHW Heater Efficiency	100%		Per manufacturer nameplate
Total Annual Hot Water Demand	3,138	MBTU/yr	
Existing Tank Size	15	Gallons	Per manufacturer nameplate
Hot Water Piping System Capacity	3	Gallons	Estimated Per existing system
Hot Water Temperature	120	*F	Per building personnel
Room Temperature	70	*F	
Standby Losses (% by Volume)	2.5%		(2.5% of stored capacity per hour, per U.S. Department of Energy)
Standby Losses (Heat Loss)	0.2	MBH	
Annual Standby Hot Water Load	1,643	MBTU/yr	
New Tank Size	0	Gallons	Based on Toyotomi instantaneous, condensing DHW Heater
Hot Water Piping System Capacity	3	Gallons	Estimated Per existing system (includes HWR piping)
Hot Water Temperature	120	*F	
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	274	MBTU/yr	
Total Annual Hot Water Demand	1,770	MBTU/yr	
Proposed Avg. Hot water heater efficiency	87%		Based on Toyotomi condensing DHW Heater
Proposed Fuel Use	2,034	MBTU/yr	Standby Losses and inefficient DHW heater eliminated
Electricity cost	0.127	\$/kWh	
Oil Cost	\$2.62	\$/gallon	
Existing Operating Cost of DHW	\$117	\$/yr	
Proposed Operating Cost of DHW	\$38	\$/yr	

Savings Summary:

Utility	Energy	Cost Savings
Total Operating Cost Electric (kWh)	920	\$273
#2 fuel oil (gallons)	(15)	(\$38)
Cost savings		\$234

Kearny NJ
CHA #20711
Building: Branch Library

ECM-5 Replace DHW Heater

Multipliers	
Material:	0.98
Labor:	1.21
Equipment:	1.09

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
Electric DHW Heater Removal	1	LS		\$ 50		\$ -	\$ 61	\$ -		
On demand tankless oil-fired DHW Heater	1	EA	\$ 1,960	\$ 280		\$ 1,921	\$ 339	\$ -	2,260	Toyotomi oil fired
Miscellaneous Electrical	1	LS		\$ 300		\$ -	\$ 363	\$ -	\$ 363	
Venting Kit	1	EA	\$ 300	\$ 250		\$ 294	\$ 303	\$ -	\$ 597	
Miscellaneous Piping and Valves	1	LS	\$ 200	\$ 220		\$ 196	\$ 266	\$ -	\$ 462	
						\$ -	\$ -	\$ -	\$ -	
						\$ -	\$ -	\$ -	\$ -	
						\$ -	\$ -	\$ -	\$ -	
						\$ -	\$ -	\$ -	\$ -	
						\$ -	\$ -	\$ -	\$ -	

\$ 3,742	Subtotal
\$ 561	Contingenc 15% y
\$ 645	Contractor 15% O&P
\$ -	0% Engineering
\$ 4,949	Total

APPENDIX G

ECM-6 Lighting Replacements



APPENDIX H

ECM-7 Install Occupancy Sensors



0 \$0.127 \$/kWh
 \$8.66 \$/kW

Field Code	Area Description	EXISTING CONDITIONS								RETROFIT CONDITIONS								COST & SAVINGS ANALYSIS						
		No. of Fixtures	Standard Fixture Code	NYSERDA Fixture Code	Watts per Fixture	kW/Space	Exist Control	Annual Hours	Annual kWh	No. 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
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) = 2x2 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) = 2x2 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	
71	BASEMENT	3	I60	I60/1	60	0.2	SW	500	90.0	3	I60	I60/1	60	0.2	None	500	90.0	0.0	0.0	\$0.00	\$0.00	\$0.00		
18	1ST FL MAIN RM	1	T 32 C F 4 (ELE)	F44ILL	112	0.1	SW	1040	116.5	1	T 32 C F 4 (ELE)	F44ILL	112	0.1	None	1040	116.5	0.0	0.0	\$0.00	\$0.00	\$0.00		
204	1ST FL MAIN RM	1	S 96 C F 2 (MAG) 8"	F82EHE	207	0.2	SW	1040	215.3	1	S 96 C F 2 (MAG) 8"	F82EHE	207	0.2	None	1040	215.3	0.0	0.0	\$0.00	\$0.00	\$0.00		
38	1ST FL MAIN RM	6	T 32 C F 2 (ELE)	F42LL	60	0.4	SW	1040	374.4	6	T 32 C F 2 (ELE)	F42LL	60	0.4	None	1040	374.4	0.0	0.0	\$0.00	\$0.00	\$0.00		
18	1ST FL MAIN RM	1	T 32 C F 4 (ELE)	F44ILL	112	0.1	SW	1040	116.5	1	T 32 C F 4 (ELE)	F44ILL	112	0.1	None	1040	116.5	0.0	0.0	\$0.00	\$0.00	\$0.00		
204	1ST FL MAIN RM	2	S 96 C F 2 (MAG) 8"	F82EHE	207	0.4	SW	1040	430.6	2	S 96 C F 2 (MAG) 8"	F82EHE	207	0.4	None	1040	430.6	0.0	0.0	\$0.00	\$0.00	\$0.00		
18	1ST FL MAIN RM	1	T 32 C F 4 (ELE)	F44ILL	112	0.1	SW	1040	116.5	1	T 32 C F 4 (ELE)	F44ILL	112	0.1	None	1040	116.5	0.0	0.0	\$0.00	\$0.00	\$0.00		
71	1ST FL BATH	1	I60	I60/1	60	0.1	PULL STRING	800	48.0	1	I60	I60/1	60	0.1	None	800	48.0	0.0	0.0	\$0.00	\$0.00	\$0.00		
18	1ST FL RIGHT RM	1	T 32 C F 4 (ELE)	F44ILL	112	0.1	SW	1040	116.5	1	T 32 C F 4 (ELE)	F44ILL	112	0.1	OCC	300	33.6	82.9	0.0	\$10.53	\$118.75	\$40.00	11.3	7.5
38	1ST FL EXTRUSTION RM	1	T 32 C F 2 (ELE)	F42LL	60	0.1	PULL STRING	1040	62.4	1	T 32 C F 2 (ELE)	F42LL	60	0.1	None	1040	62.4	0.0	0.0	\$0.00	\$0.00	\$0.00		
204	2ND FL OFFICE	1	S 96 C F 2 (MAG) 8"	F82EHE	207	0.2	SW	1040	215.3	1	S 96 C F 2 (MAG) 8"	F82EHE	207	0.2	OCC	300	62.1	153.2	0.0	\$19.45	\$118.75	\$40.00	6.1	4.0
16	2ND FL RADIO RM	1	T 34 R F 2 (MAG)	F42EE	72	0.1	SW	1040	74.9	1	T 34 R F 2 (MAG)	F42EE	72	0.1	OCC	300	21.6	53.3	0.0	\$6.77	\$118.75	\$40.00	17.5	11.6
172	2ND FL STORAGE RM	2	T 34 R F 2 (MAG)	F42EE	72	0.1	PULL STRING	1040	149.8	2	T 34 R F 2 (MAG)	F42EE	72	0.1	None	1040	149.8	0.0	0.0	\$0.00	\$0.00	\$0.00		
71	2ND FL BATH	1	I60	I60/1	60	0.1	SW	800	48.0	1	I60	I60/1	60	0.1	OCC	300	18.0	30.0	0.0	\$3.81	\$118.75	\$40.00	31.2	20.7
71	2ND FL STAIRWELL	1	I60	I60/1	60	0.1	SW	1040	62.4	1	I60	I60/1	60	0.1	None	1040	62.4	0.0	0.0	\$0.00	\$0.00	\$0.00		
16	2ND FL LVA RM	1	T 34 R F 2 (MAG)	F42EE	72	0.1	SW	1040	74.9	1	T 34 R F 2 (MAG)	F42EE	72	0.1	OCC	300	21.6	53.3	0.0	\$6.77	\$118.75	\$40.00	17.5	11.6
71	2ND FL STAIRWELL #2	2	I60	I60/1	60	0.1	SW	800	96.0	2	I60	I60/1	60	0.1	None	800	96.0	0.0	0.0	\$0.00	\$0.00	\$0.00		
16	2ND FL SM RM	1	T 34 R F 2 (MAG)	F42EE	72	0.1	SW	1040	74.9	1	T 34 R F 2 (MAG)	F42EE	72	0.1	OCC	300	21.6	53.3	0.0	\$6.77	\$118.75	\$20.00	17.5	14.6
71	2ND FL CORNER RM	2	I60	I60/1	60	0.1	PULL STRING	1040	124.8	2	I60	I60/1	60	0.1	OCC	300	36.0	88.8	0.0	\$11.28	\$118.75	\$40.00	10.5	7.0
16	ATTIC RM #1	1	T 34 R F 2 (MAG)	F42EE	72	0.1	Breaker	8760	630.7	1	T 34 R F 2 (MAG)	F42EE	72	0.1	None	8760	630.7	0.0	0.0	\$0.00	\$0.00	\$0.00		
16	ATTIC RM #1	2	T 34 R F 2 (MAG)	F42EE	72	0.1	SW	1040	149.8	2	T 34 R F 2 (MAG)	F42EE	72	0.1	None	1040	149.8	0.0	0.0	\$0.00	\$0.00	\$0.00		
16	ATTIC RM #2	1	T 34 R F 2 (MAG)	F42EE	72	0.1	SW	1040	74.9	1	T 34 R F 2 (MAG)	F42EE	72	0.1	None	1040	74.9	0.0	0.0	\$0.00	\$0.00	\$0.00		
16	ATTIC RM #3	1	T 34 R F 2 (MAG)	F42EE	72	0.1	SW	1040	74.9	1	T 34 R F 2 (MAG)	F42EE	72	0.1	None	1040	74.9	0.0	0.0	\$0.00	\$0.00	\$0.00		
102	FRONT VESTIBULE	7	CF 26	CFQ26/1-L	27	0.2	SW	1040	196.6	7	CF 26	CFQ26/1-L	27	0.2	None	1040	196.6	0.0	0.0	\$0.00	\$0.00	\$0.00		
X1	FRONT VESTIBULE	2	X 1.5 W LED	ELED1.5/1	1.5	0.0	Breaker	1040	3.1	2	X 1.5 W LED	ELED1.5/1	1.5	0.0	None	1040	3.1	0.0	0.0	\$0.00	\$0.00	\$0.00		
79	OUTSIDE LIGHTS	5	SP I 100	I100/1	100	0.5	SW	4368	2,184.0	5	SP I 100	I100/1	100	0.5	None	4368	2,184.0	0.0	0.0	\$0.00	\$0.00	\$0.00		
Total		49			3.7			4368	5,921	49			4		5,407	515	0	65	\$831	260				
				</																				

APPENDIX I

ECM-8 Lighting Replacements with Occupancy Sensors



APPENDIX J

**New Jersey Pay For Performance
Incentive Program**



**Kearny NJ
CHA #20711
Building: Branch Library**

New Jersey Pay For Performance Incentive Program

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

	Annual Utilities	
	kWh	Therms
Existing Usage (from utility)	11,540	0
Proposed Savings	3,670	0
Existing Total MMBtus	39	
Proposed Savings MMBtus	12.526	
% Reduction	31.8%	
Proposed Annual Savings	\$2,300	

	≥ %15 - < 20%	
	\$/kWh	\$/therm
Incentive #2	\$0.11	\$1.10
Incentive #3	\$0.07	\$0.70

	≥ 20%	
	\$/kWh	\$/therm
Incentive #2	\$0.22	\$2.20
Incentive #3	\$0.14	\$1.40

	Incentives \$		
	Elec	Gas	Total
Incentive #2	\$807	\$0	\$807
Incentive #3	\$514	\$0	\$514
Totals	\$1,321	\$0	\$1,321

Total Project Cost	\$25,400
% Incentives of Project Cost*	5.2%
Project Cost w/ Incentives*	\$24,079

Project Payback (years)	
w/o Incentives	w/ Incentives
11.0	10.5

* Maximum allowable incentive is 80% of total project cost, or \$2 million per gas account and \$2 million per electric account

APPENDIX K

Photovoltaic (PV) Rooftop Solar Power Generation





**AC Energy
&
Cost Savings**



Station Identification	
City:	Newark
State:	New_Jersey
Latitude:	40.70° N
Longitude:	74.17° W
Elevation:	9 m
PV System Specifications	
DC Rating:	6.0 kW
DC to AC Derate Factor:	0.770
AC Rating:	4.6 kW
Array Type:	Fixed Tilt
Array Tilt:	40.7°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	20.2 ¢/kWh

Results			
Month	Solar Radiation (kWh/m ² /day)	AC Energy (kWh)	Energy Value (\$)
1	3.36	497	100.20
2	4.05	536	108.06
3	4.58	651	131.24
4	4.84	636	128.22
5	5.30	701	141.32
6	5.33	661	133.26
7	5.27	667	134.47
8	5.25	660	133.06
9	5.06	641	129.23
10	4.46	603	121.56
11	3.15	431	86.89
12	2.87	415	83.66
Year	4.46	7098	1430.96

[Output Hourly Performance Data](#)

[Output Results as Text](#)

*

[About the Hourly Performance Data](#)

[Saving Text from a Browser](#)

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

Please send questions and comments regarding PVWATTS to Webmaster

Disclaimer and copyright notice



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 $\pm 30\%$ for monthly values and $\pm 10\%$ 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.

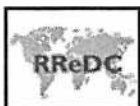
If net-metering isn't available and the PV system sends surplus electricity to the utility grid, the utility generally buys the electricity from the owner at a lower price than the owner pays the utility for electricity. In this case, the cost savings shown in the table should be reduced.

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.

Please send questions and comments to Webmaster

Disclaimer and copyright notice.



Return to RReDC Home Page (<http://rredc.nrel.gov/>)

Township of Kearny
Branch Library

Cost of Electricity \$0.202 \$/kWh

Photovoltaic (PV) Rooftop Solar Power Generation-6 kW System

Budgetary Cost	Annual Utility Savings			Estimated Maintenance Savings	Total Savings	New Jersey Renewable * Energy Incentive	New Jersey Renewable ** SREC	Payback (without incentive) Years	Payback (with incentive) Years
	kWh	therms	\$						
\$60,000	0.0	7,100	0	\$1,400	\$0	\$6,000	\$3,500	42.9	11.0

Note: Budgetary cost is based on \$10,000/kW.

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

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

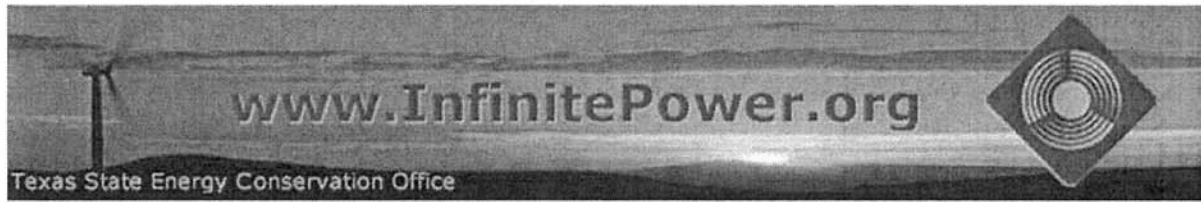
Estimated Solar Renewable Energy Certificate Program (SREC) payments for 15 Years from RR Renewable Energy Consultants

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

APPENDIX L

Solar Thermal Domestic Hot Water Plant





- [Home](#)
- [What Can I Do?](#)
- [Electric Choice](#)
- [Home Energy](#)
- [FAQs](#)
- LEARN**
- [Fact Sheets](#)
- [Lesson Plans](#)

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?](#)

PLAY
[Calculators](#)

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.

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Water Heater Characteristics			
Physical		Thermal	
? Diameter (feet)	1	? Water Inlet Temperature (Degrees F)	55
? Capacity (gallons)	15	? Ambient Temperature (Degrees F)	70
? Surface Area (calculated - sq ft)	9.592	? Hot Water Temperature (Degrees F)	120
? Effective R-value	NaN	? Hot Water Usage (Gallons per Day)	20
Energy Use			
	444.7	? Heat Delivered in Hot Water (BTU/hr)	
	0	? Heat loss through insulation (BTU/hr)	

Gas vs. Electric Water Heating		
Gas		Electric
0	? Overall Efficiency	0.98
0	? Conversion Efficiency	0.98
NaN BTU/hr	? Power Into Water Heater	453.8 BTU/hr
Cost		
\$ 1.20 /Therm	? Utility Rates	\$ 0.2016 /kWh
\$ NaN	? Yearly Water Heating Cost	\$ 234.715
How Does Solar Compare?		
? Solar Water Heater Cost: \$ 27100	? Percentage Solar:	70
NaN years for gas	? Payback Time for Solar System	164.941 years for electric

NJBPU Energy Audits
 CHA # 20711
 Township of Kearny
 Branch Library

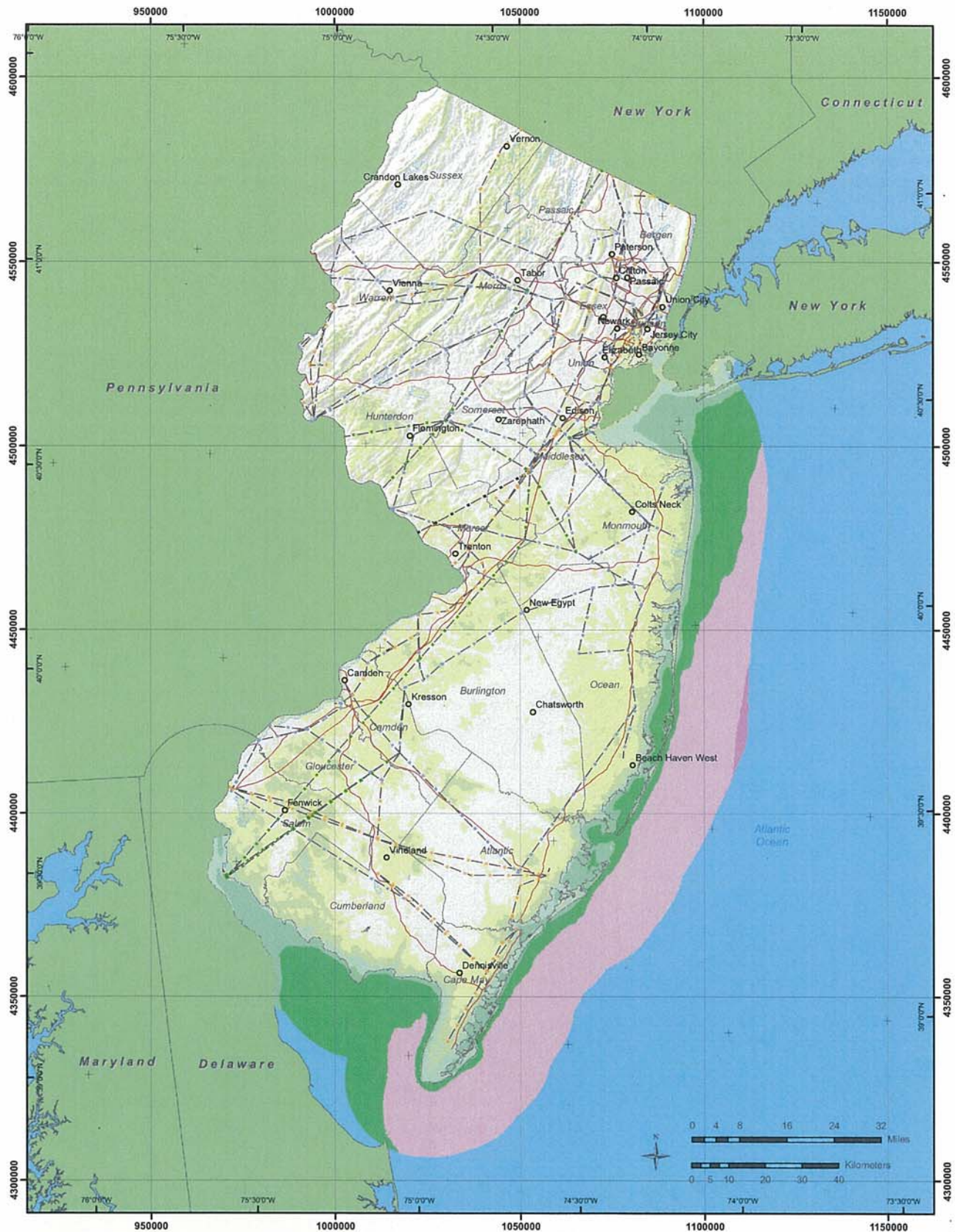
Multipliers	
Material:	0.98
Labor:	1.21
Equipment:	1.09

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		
Piping modifications	1	ls	\$ 2,000	\$ 3,500		\$ 1,960	\$ 4,235	\$ -		
Electrical modifications	1	ls	\$ 1,000	\$ 1,000		\$ 980	\$ 1,210	\$ -		
65 Gallon Storage Tanks	2	ea	\$ 200	\$ 250		\$ 400	\$ 500	\$ -		
10 Gallon Drip Tank	2	ea	\$ 100	\$ 78		\$ 200	\$ 156	\$ -		
						\$ -	\$ -	\$ -		

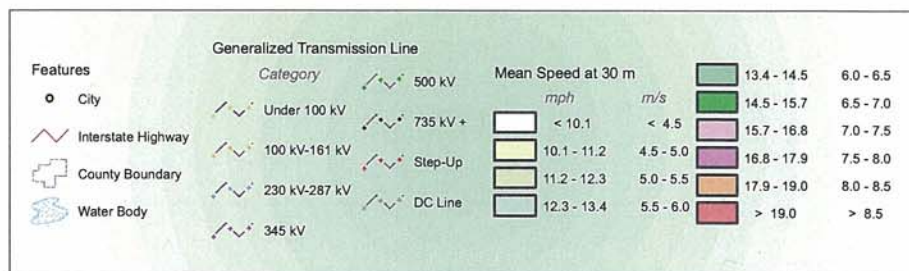
\$17,489	Subtotal
\$ 2,623	15% Contingency
\$ 2,623	15% Contractor O&P
\$ 4,372	25% Engineering
\$27,108	Total

APPENDIX M

Wind



Wind Resource of New Jersey *Mean Annual Wind Speed at 30 Meters*



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

Bing Maps

759 Kearny Ave, Kearny, NJ 07032-3146

My Notes

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



APPENDIX N

EPA Portfolio Manager



STATEMENT OF ENERGY PERFORMANCE

Branch Library

Building ID: 2240051
 For 12-month Period Ending: December 31, 2008¹
 Date SEP becomes ineligible: N/A

Date SEP Generated: March 17, 2010

Facility Branch Library 759 Kearny Avenue Kearny, NJ 07032	Facility Owner Township of Kearny 357 Bergen Ave Kearny, NJ 07032	Primary Contact for this Facility Gerry Kerr 357 Bergen Ave Kearny, NJ 07032
--	---	--

Year Built: 1900
 Gross Floor Area (ft²): 2,800

Energy Performance Rating² (1-100) N/A

Site Energy Use Summary³

Electricity - Grid Purchase(kBtu)	39,381
Fuel Oil (No. 2) (kBtu)	162,823
Natural Gas - (kBtu) ⁴	0
Total Energy (kBtu)	202,204

Energy Intensity⁵

Site (kBtu/ft ² /yr)	72
Source (kBtu/ft ² /yr)	106

Emissions (based on site energy use)

Greenhouse Gas Emissions (MtCO ₂ e/year)	18
---	----

Electric Distribution Utility

Public Service Elec & Gas Co

National Average Comparison

National Average Site EUI	104
National Average Source EUI	246
% Difference from National Average Source EUI	-57%
Building Type	Library

Stamp of Certifying Professional

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

Meets Industry Standards⁶ for Indoor Environmental Conditions:

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

Certifying Professional

N/A

Notes:

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

ENERGY STAR® Data Checklist for Commercial Buildings

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

Please complete and sign this checklist and include it with the stamped, signed Statement of Energy Performance.

NOTE: You must check each box to indicate that each value is correct, OR include a note.

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	<input checked="" type="checkbox"/>
Building Name	Branch Library	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		<input type="checkbox"/>
Type	Library	Is this an accurate description of the space in question?		<input type="checkbox"/>
Location	759 Kearny Avenue, Kearny, NJ 07032	Is this address accurate and complete? Correct weather normalization requires an accurate zip code.		<input type="checkbox"/>
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		<input type="checkbox"/>
Library (Other)				
CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	<input checked="" type="checkbox"/>
Gross Floor Area	2,800 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.		<input type="checkbox"/>
Number of PCs	4(Optional)	Is this the number of personal computers in the space?		<input type="checkbox"/>
Weekly operating hours	20Hours(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.		<input type="checkbox"/>
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.		<input type="checkbox"/>

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 (Main) (kWh (thousand Watt-hours)) Space(s): Entire Facility Generation Method: Grid Purchase		
Start Date	End Date	Energy Use (kWh (thousand Watt-hours))
12/01/2008	12/31/2008	468.00
11/01/2008	11/30/2008	1,189.00
10/01/2008	10/31/2008	631.00
09/01/2008	09/30/2008	604.00
08/01/2008	08/31/2008	560.00
07/01/2008	07/31/2008	671.00
06/01/2008	06/30/2008	666.00
05/01/2008	05/31/2008	648.00
04/01/2008	04/30/2008	881.00
03/01/2008	03/31/2008	1,227.00
02/01/2008	02/29/2008	1,623.00
01/01/2008	01/31/2008	1,430.00
PSE&G Electric (Main) Consumption (kWh (thousand Watt-hours))		10,598.00
PSE&G Electric (Main) Consumption (kBtu (thousand Btu))		36,160.38
Meter: PSE&G Electric (second floor) (kWh (thousand Watt-hours)) Space(s): Entire Facility Generation Method: Grid Purchase		
Start Date	End Date	Energy Use (kWh (thousand Watt-hours))
12/01/2008	12/31/2008	115.00
11/01/2008	11/30/2008	126.00
10/01/2008	10/31/2008	76.00
09/01/2008	09/30/2008	74.00
08/01/2008	08/31/2008	53.00
07/01/2008	07/31/2008	81.00
06/01/2008	06/30/2008	111.00
05/01/2008	05/31/2008	74.00
04/01/2008	04/30/2008	56.00
03/01/2008	03/31/2008	58.00
02/01/2008	02/29/2008	61.00
01/01/2008	01/31/2008	59.00
PSE&G Electric (second floor) Consumption (kWh (thousand Watt-hours))		944.00

PSE&G Electric (second floor) Consumption (kBtu (thousand Btu))	3,220.93	
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))	39,381.30	
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?	<input type="checkbox"/>	
Fuel Type: Fuel Oil (No. 2)		
Meter: PSE&G #2 Fuel Oil (Gallons) Space(s): Entire Facility		
Start Date	End Date	Energy Use (Gallons)
12/01/2008	12/31/2008	146.00
11/01/2008	11/30/2008	170.00
10/01/2008	10/31/2008	135.00
09/01/2008	09/30/2008	0.00
08/01/2008	08/31/2008	0.00
07/01/2008	07/31/2008	0.00
06/01/2008	06/30/2008	0.00
05/01/2008	05/31/2008	0.00
04/01/2008	04/30/2008	0.00
03/01/2008	03/31/2008	159.00
02/01/2008	02/29/2008	276.00
01/01/2008	01/31/2008	288.00
PSE&G #2 Fuel Oil Consumption (Gallons)	1,174.00	
PSE&G #2 Fuel Oil Consumption (kBtu (thousand Btu))	162,822.65	
Total Fuel Oil (No. 2) Consumption (kBtu (thousand Btu))	162,822.65	
Is this the total Fuel Oil (No. 2) consumption at this building including all Fuel Oil (No. 2) meters?	<input type="checkbox"/>	

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.	<input type="checkbox"/>

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.	<input type="checkbox"/>

Certifying Professional

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

Name: _____ Date: _____

Signature: _____

Signature is required when applying for the ENERGY STAR.

FOR YOUR RECORDS ONLY. DO NOT SUBMIT TO EPA.

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

Facility
Branch Library
759 Kearny Avenue
Kearny, NJ 07032

Facility Owner
Township of Kearny
357 Bergen Ave
Kearny, NJ 07032

Primary Contact for this Facility
Gerry Kerr
357 Bergen Ave
Kearny, NJ 07032

General Information

Branch Library	
Gross Floor Area Excluding Parking: (ft ²)	2,800
Year Built	1900
For 12-month Evaluation Period Ending Date:	December 31, 2008

Facility Space Use Summary

Library	
Space Type	Other - Library
Gross Floor Area(ft ²)	2,800
Number of PCs*	4
Weekly operating hours*	20
Workers on Main Shift*	2

Energy Performance Comparison

Performance Metrics	Evaluation Periods		Comparisons		
	Current (Ending Date 12/31/2008)	Baseline (Ending Date 12/31/2008)	Rating of 75	Target	National Average
Energy Performance Rating	N/A	N/A	75	N/A	N/A
Energy Intensity					
Site (kBtu/ft ²)	72	72	0	N/A	104
Source (kBtu/ft ²)	106	106	0	N/A	246
Energy Cost					
\$/year	N/A	N/A	N/A	N/A	N/A
\$/ft ² /year	N/A	N/A	N/A	N/A	N/A
Greenhouse Gas Emissions					
MtCO ₂ e/year	18	18	0	N/A	26
kgCO ₂ e/ft ² /year	6	6	0	N/A	9

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

Notes:

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

APPENDIX O

Equipment Inventory



