CITY OF LINWOOD
EMERGENCY MEDICAL SERVICE BUILDING
ENERGY ASSESSMENT

for

NEW JERSEY
BOARD OF PUBLIC UTILITIES

CHA PROJECT NO. 22215

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1.0 INTRODUCTION AND BACKGROUND

Emergency Medical Services is a 3,000 SF building built in 1989, and is currently rented to a private firm that provides ambulance dispatch. It is a single story structure with an attached garage. The garage has parking for two vehicles and two overhead doors. There is a kitchen, breakroom, one sleeping area, and a restroom. Two to three people occupy the building at any time.

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

2.0 EXECUTIVE SUMMARY

This report details the results of the Emergency Medical Services building in Linwood, New Jersey. The 3,000 SF building constructed in 1989, is currently rented to a private firm that provides ambulance dispatch services. The single story structure includes a kitchen, breakroom, sleeping area, and restroom. An attached garage provides parking for two vehicles. The following areas were evaluated for energy conservation measures:

- Lighting replacement
- Furnace replacement
- Insulation upgrade
- Storm window installation
- Unit heater replacement

Various potential Energy Conservation Measures (ECMs) were identified for the above categories. Potential annual savings of $1,100 for the recommended ECMs may be realized with a payback of 5.2 years.

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

ECM-1 Lighting Replacement

Budgetary Cost	Annual Utility Savings					Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total	ROI			
$	kW	kWh	Therms	$		$	Years	Years
3,200	0	4,060	0	700	1.8	400	4.6	4.0

* Incentive available through the New Jersey Smart Start program for this ECM. See section 5.0 for other incentive opportunities.

ECM-2 Install Storm Windows

Budgetary Cost	Annual Utility Savings					Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total	ROI			
$	kW	kWh	Therms	$		$	Years	Years
2,900	0	210	350	400	2.6	NA	7.3	NA

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

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

- ECM-2 Boiler Replacement
- ECM-5 Replace Furnace

3.0 EXISTING CONDITIONS

3.1 Building – General

The Emergency Medical Services Building, 3,000 SF, constructed in 1989, is currently rented to a company which provides ambulance dispatch. The single story structure has an attached garage with parking for two vehicles and has two overhead doors. The facility includes a kitchen, breakroom, sleeping area, and unisex restroom. The facility is consistently occupied by two to three individuals.

The building's exterior walls consist of brick face with insulation and finished walls with sheetrock. There are single pane glass with wooden frames windows around the perimeter of the building. The front entrance is a glass door with a vestibule. The roof is pitched with asphalt shingles. There is batt insulation between the joists in the attic.

3.2 Utility Usage

Utilities include electricity, natural gas, and potable water. Electricity is purchased from Atlantic City Electric with supply provided by Constellation New Energy. Natural gas is purchased from South Jersey Gas Company; potable water is provided by New Jersey American Water.

From October 2009 through September 2010, electric usage was approximately 38,000 kWh at a cost of about $6,200. Analyzing electricity bills during this period showed that the building was charged at a blended unit cost of $0.16 per kWh. Electricity usage was generally higher in the summer months due to air conditioning. During the same timeframe, the building heat produced by natural gas-fired equipment required about 2,640 therms. Based on the annual cost of about $2,900, the blended price for natural gas was $1.11 per therm. Natural gas consumption was highest in the winter months when the building is in heating mode.

Review of potable water utility bills from September 2009 through August 2010 determined the facility used a total of 144,000 gallons of water over the course of a year. At a total cost of about $900, the unit cost for water was found to be $6.47 per kGal. Utility data can be found in Appendix A.

Electricity is purchased from Atlantic City Electric with supply provided by Constellation New Energy. Natural gas commodity supply and delivery is presently purchased from South Jersey Gas. The delivery components will always be the responsibility of the utility that connects the facility to the gas line; however, the supply can be purchased from a third party. The natural gas commodity supply entity will require submission of one to three years of past energy bills. Contract terms can vary among suppliers. A list of approved natural gas energy commodity suppliers can be found in Appendix A. According to the U.S. Energy Information Administration, the average commercial unit costs of electricity and natural gas in New Jersey during July 2010 was $0.152 per kWh and $1.09 per therm. The building is currently paying about the state average for electricity and natural gas; therefore, it is recommended that a third party supplier not be pursued at this time.

3.3 HVAC Systems

The building is heated and cooled by a furnace and cooling coil located in the attic. The Lennox gas fired furnace has input of 140 MBH and existing efficiency of approximately 80%. The cooling coil is also manufactured by Lennox. The three ton condensing unit located outside on grade is about four years' old.

The building had an exhaust fan in the restroom controlled by the light switch.

The garage area has two unit heaters of approximately 100 MBH each. One unit is a newer Reznor; the other unit was older and did not contain a nameplate. The heaters are controlled by local thermostats and are approximately 72% efficient.

3.4 Lighting/Electrical Systems

3.4.1 Interior Lighting

The lighting throughout the building utilizes older technology T-12 fluorescent fixtures and magnetic ballasts. The fixtures are four feet long and use two lamps per fixture.

3.4.2 Exterior Lighting

Wall mounted lights for the entrance vestibule were 150 W incandescent lamps.

3.5 Control Systems

3.5.1 HVAC Controls

The HVAC controls in the building consist of a wall mounted programmable thermostat. Temperature setpoints are on average 68°F for heating and 73°F for cooling. The setpoints cannot vary significantly because the building is always occupied.

The two unit heaters for the garage were controlled by two mechanical thermostats mounted on the wall and were usually set at 60°F.

3.5.2 Lighting/Electrical Controls

Lighting controls within the building are manual switches located within each space. All outside lighting is manually operated. Lights are typically turned off when a space is unoccupied.

3.6 Plumbing Systems

Domestic hot water is generated by a 40 gallon, AO Smith gas-fired water heater with an input of 40 MBH. It is in fair condition and is located in the attic space. It has an existing efficiency of about 80%. The sink and toilet in the restroom are standard flow type; the kitchen sink was also standard flow.

4.0 ENERGY CONSERVATION MEASURES

4.1 ECM-1 Lighting Replacements

During the site visit, a comprehensive fixture survey was conducted of the entire building. Each switch and circuit was identified, as well as the number of fixtures, locations, approximate operating times, and existing wattage consumption.

This measure addressed the expected energy savings of replacing the existing T-12 fluorescent fixtures with high efficiency T-8 fluorescent lamps and electronic ballasts. There were approximately 30 fixtures inside the building which used two lamp T-12 bulbs. All fixtures would be retrofitted with T-8 lamps and electronic ballasts.

Energy savings for this measure were calculated by applying the existing and proposed fixture wattages to the estimated time of operation to determine annual electricity consumptions. Supporting calculations, including all assumptions for lighting hours and the annual energy usage for each fixture is provided in Appendix B.

Lighting has an expected life of 15 years, according to the manufacturer, and total energy savings over the life of the project are estimated at 60,900 kWh, totaling $10,500.

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

ECM-1 Lighting Replacement

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
3,200	0	4,060	0	700	1.8	400	4.6	4.0

* Incentive available through the New Jersey Smart Start program for this ECM. See section 5.0 for other incentive opportunities.

This measure is recommended.

4.2 ECM-2 Install Storm Windows

Windows are single pane glass with wooden frames and exterior screens. Due to age, construction type, and condition, the windows incur excess air infiltration and offer little thermal resistance to heat transfer. Installing exterior storm windows to decrease heating and cooling energy losses was evaluated.

Per the building energy audit and engineering knowledge, it was estimated that the existing windows have a U-value of 1.05 and infiltration rate of about 0.50 CFM/LF. To calculate the savings for this measure, the baseline energy loss was found by applying these values to the total square footage and perimeter length of the existing windows in conjunction with weather bin data. The proposed energy loss was then determined using the expected U-value of 0.50 and infiltration rate of 0.20 CFM/LF, with exterior storm windows installed. The difference in heating and cooling losses through the windows resulted in an annual savings of about 210 therms and 350 kWh.

Storm windows have an expected life of 25 years, according to the manufacturer, and total energy savings over the life of the project are estimated at 8,750 therms and 5,250 kWh, totaling $10,000.

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

ECM-2 Install Storm Windows

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
2,900	0	210	350	400	2.6	NA	7.3	NA

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

This measure is recommended.

4.3 ECM-3 Replace Unit Heaters with Infrared Heaters

The garage area is heated by two gas fired unit heaters hung from the ceiling with an existing efficiency of around 72%. The ECM assessed replacing the unit heaters with two gas fired infrared (IR) heaters. IR heaters are effective in garage spaces and have higher burning efficiencies than standard unit heaters.

To calculate the savings associated with implementing infrared heaters, the efficiencies of the existing unit heaters were compared with the proposed efficiencies of the IR heaters. Additionally, the heating effectiveness between the two types of heaters was also compared to determine savings. Heating effectiveness is a ratio between the amount of heat being produced, compared to the amount of heat that actually reaches the floor space. IR heaters have an effectiveness ratio close to 100% because they use infrared wavelengths to distribute heat. The existing unit heaters must rely on a circulating fan to distribute heat which can cause certain areas of the space to be overheated or under heated.

The higher efficiencies and better effectiveness of the infrared heaters will save the EMS building about 300 therms of natural gas used for heating. The implementation costs were based on two low intensity infrared heaters; however, exact sizing requirements for the building should be assessed before this ECM is implemented.

Infrared heaters have a life expectancy of about 20 years according to ASHRAE. The savings over the life of the project would be about 6,600 therms and $14,000.

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

ECM-3 Replace Unit Heaters with Infrared Heaters

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Therms	Total				
$	kW	kWh	Natural Gas	$		$	Years	Years
9,800	0	1,800	330	700	0.4	NA	14	NA

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

This measure is not recommended.

4.4 ECM-4 Increase Wall Insulation – Garage Area

The exterior walls of the garage area are constructed of only CMU block which has a low existing R-value of 4. This ECM addressed adding 6" batt insulation to the interior side of the CMU block walls to minimize heat energy losses and increase the R value to 24. It is intended to install framing on the inside of the wall and install insulation between the new studs.

To calculate the savings, the heat losses through the exterior walls of garage were found using the existing walls' R-value and bin weather data for Atlantic City, NJ, the closest city for which data is available. The values were then totaled to determine the existing annual heat losses. The heat loss values were then determined with a thermal resistance which included the additional 6" batt insulation. The annual energy savings of adding insulation to the exterior block walls is expected to be about 200 therms.

Batt insulation has an expected life of 25 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 4,000 therms and $5,000.

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

ECM-4 Increase Wall Insulation – Garage Area

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Therms	Total				
$	kW	kWh	Natural Gas	$		$	Years	Years
3,400	0	0	160	200	0.3	NA	17	NA

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

This measure is not recommended.

4.5 ECM-5 Furnace Replacement

The furnace is located in the attic space and provides heating to the building. It is over 10 years' old and has a thermal efficiency of about 80%. By replacing this unit with a direct vent condensing furnace, it will be possible to achieve a thermal efficiency of 92%, saving heating energy.

Utilizing historical utility data for the building, the savings for this measure were found by adjusting the heating efficiency to reflect the proposed equipment, and comparing the overall utility requirements to the original usage. The resulting annual energy reductions attributed to heating and cooling efficiency improvements were approximately 330 therms.

Condensing gas-fired furnaces have an expected life of 18 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 5,940 therms and $7,200.

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

ECM-5 Replace Furnace

Budgetary Cost	Annual Utility Savings					Estimated Maintenance Savings	Total Savings	ROI	Potential Incentive*	Payback (without Incentive)	Payback (with Incentive)
	Electricity		Natural Gas	Water	Total						
$	kW	kWh	Therms	kGals	$	$	$		$	Years	Years
6,600	0	0	330	0	400	0	400	(0.2)	300	16.5	15.8

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

This measure is not recommended.

5.0 PROJECT INCENTIVES

5.1 Incentives Overview

5.1.1 New Jersey Pay For Performance Program

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

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

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

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

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

5.1.2 New Jersey Smart Start Program

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

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

5.1.3 Energy Efficient and Conservation Block Grant

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

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

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

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

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

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

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

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

Funding for this program is dispersed on a first come, first serve basis until all funds are exhausted. The program does not limit the municipality to a minimum or maximum incentive, and the availability of

funding cannot be determined prior to application. If the municipality meets all qualifications, the application must be submitted to TRC Energy Solutions for review. TRC will then determine the amount of the incentive based on projected energy savings of the project. It is important to note that all applications for this incentive must be submitted before implementation of energy conservation measures.

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

5.1.5 Direct Install Program

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

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

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

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

5.2 Building Incentives

5.2.1 New Jersey Pay For Performance Program

Under incentive #1 of the New Jersey Pay for Performance Program, the 3,000 square foot building is eligible for about $150 for development of an Energy Reduction Plan. When calculating the total amount under Incentives #2 and #3, all energy conservation measures are applicable as the amount received is based on building wide energy improvements. Since the overall energy reduction for the building is estimated to exceed the 15% minimum, the building is eligible to receive monies based on Incentives #2 and #3 as discussed in section 5.1.1. In total, incentives through the NJ P4P program are expected to total about $4,400, reducing the total project payback from 11.2 years to 9.3 years. See Appendix G for calculations.

5.2.2 New Jersey Smart Start Program

The Emergency Medical Services building is eligible for several incentives available under New Jersey Smart Start Programs. The total amount of all qualified incentives is about $700 and includes upgrades to the lighting systems and heating systems.

5.2.3 Energy Efficient and Conservation Block Grant

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

5.2.4 Direct Install Program

The building is potentially eligible to receive funding from the Direct Install Program. This money will be in conjunction with the Energy Efficiency and Conservation Block Grant. The total implementation cost for all ECMs potentially eligible for Direct Install funding is about $19,500 and includes lighting, infrared heaters, and furnace replacement. This program would pay 60%, or about $11,700 of these initial costs. This funding has the potential to significantly affect the payback periods of ECMs. For the EMS building, the Direct Install Program brings the simple payback from about 11.5 years, to approximately 4.6 years.

6.0 ALTERNATIVE ENERGY SCREENING EVALUATION

6.1 Geothermal

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

The building uses a gas-fired furnace with direct expansion cooling to meet the HVAC requirements. Significant upgrades would need to be implemented in order to convert to a geothermal system.

This measure is not recommended.

6.2 Solar

6.2.1 Photovoltaic Rooftop Solar Power Generation

The facility was evaluated for the potential to install rooftop photovoltaic (PV) solar panels for power generation. Present technology incorporates the use of solar cell arrays that produce direct current (DC) electricity. This DC current is converted to alternating current (AC) with the use of an electrical device known as an inverter.

The building's roof has minimal room to install a solar cell array and this measure is not recommended at this time.

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.

Due to the lack of available roof area, 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. The EMS building is located adjacent to the DPW building and may have sufficient land to install a wind turbine. Further study should be conducted for this measure. A wind speed map is included in Appendix H.

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. This

measure is not recommended since the EMS building cannot use the heat produced in the summer months.

6.5 Biomass Power Generation

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

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

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

The NJDEP evaluates biomass resources not identified in the RPS.

Examples of eligible facilities for a CORE incentive include:

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

* from NJOCE Website

This measure is not recommended due to of noise issues and because the building 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 Atlantic City Electric, which receives the electricity from regional power grid. PJM Interconnection 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 PJM Interconnection 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. 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 pre-approved CSP will require a minimum of 100 kW of load reduction to participate in any curtailment program. The EMS building had an estimated maximum electricity demand of 14 kW in 2009.

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

7.0 EPA PORTFOLIO MANAGER

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

The EMS building has a Site Energy Usage Index (EUI) of 110 kBTU/ft^2/year. The EUI can be improved by implementing the noted energy savings measures. By implementing the measures discussed in this report, it is expected that the EUI can be reduced to approximately 62 kBTU/ft^2/year. The EPA Portfolio Manager did not generate an energy rating score for this building because more than 50% of the building type is not eligible for an energy star rating.

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

The user name and password for the building's EPA Portfolio Manager Account has been provided to Hank Kolakowski.

8.0 RECOMMENDATIONS & CONCLUSIONS

The energy audit conducted by CHA at Emergency Medical Services building in Linwood, New Jersey identified potential ECMs for lighting replacement and storm window installation. Potential annual savings of $1,100 may be realized for the recommended ECMs, with a summary of the costs, savings, and paybacks as follows:

ECM-1 Lighting Replacement

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
3,200	0	4,060	0	700	1.8	400	4.6	4.0

* Incentive available through the New Jersey Smart Start program for this ECM. See section 5.0 for other incentive opportunities.

ECM-2 Install Storm Windows

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
$	kW	kWh	Therms	$		$	Years	Years
2,900	0	210	350	400	2.6	NA	7.3	NA

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

APPENDIX A

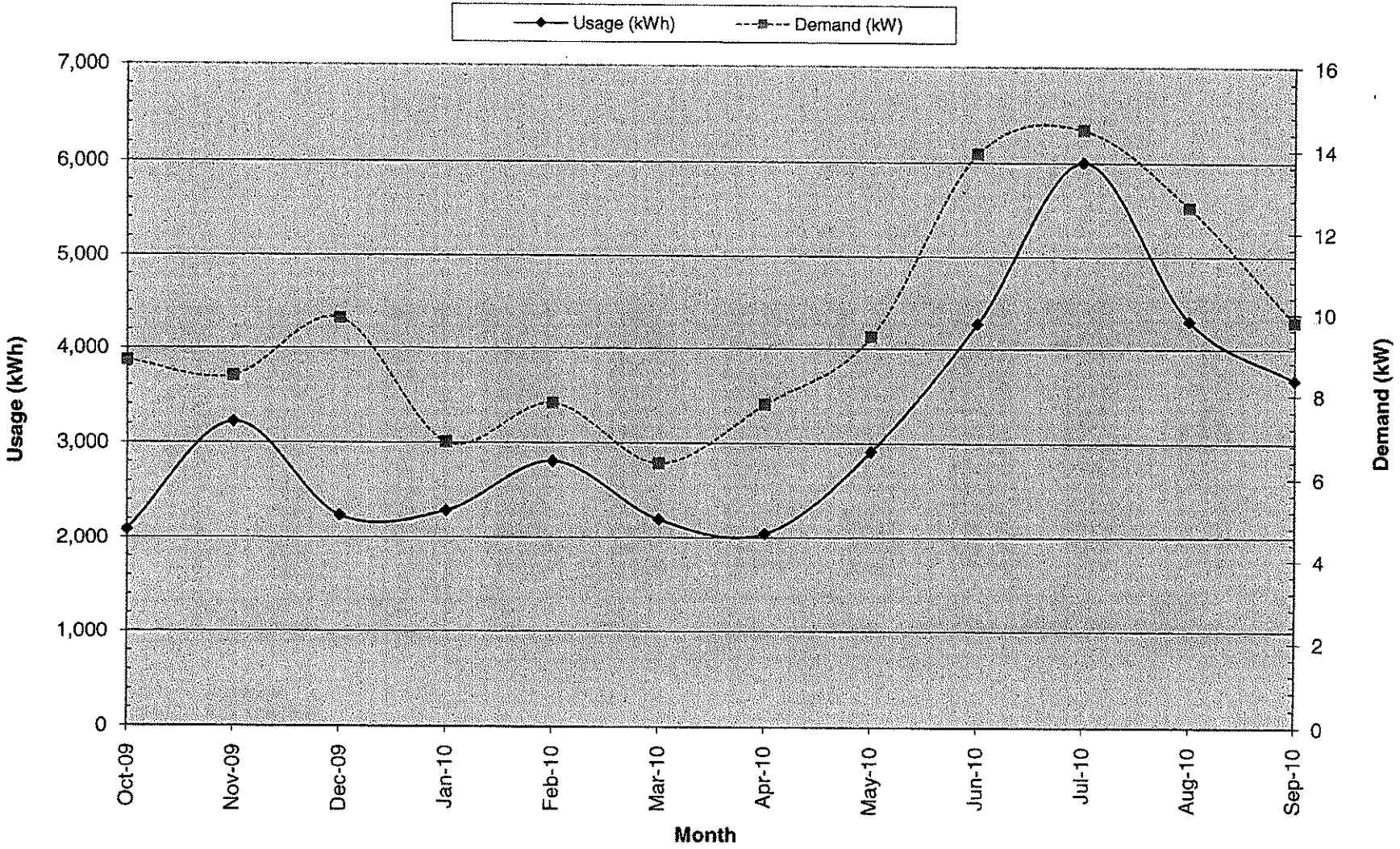
Utility Usage Analysis

City of Linwood
CHA Project Number: 22215
Emergency Medical Service Building

515 W Patcong Ave
Account Number: **0680 4269 9998**
Meter Number: **105737906**

Month	Consumption (kWh)	Demand (kW)	Charges					Unit Costs		
			Total ($)	Supply ($)	Delivery ($)	Demand ($)	Consumption ($)	Blended Rate ($/kWh)	Consumption ($/kWh)	Demand ($/kW)
October-09	2,087	8.8	$352.34	$245.18	$107.16	$23.51	$328.83	0.1688	0.1576	2.66
November-09	3,218	8.5	$506.95	$364.48	$142.47	$20.90	$486.05	0.1575	0.1510	2.47
December-09	2,236	9.9	$385.91	$266.69	$119.22	$29.72	$356.19	0.1726	0.1593	3.01
January-10	2,287	6.9	$360.01	$257.67	$102.34	$13.34	$346.67	0.1574	0.1516	1.94
February-10	2,809	7.8	$443.95	$317.58	$126.37	$18.24	$425.71	0.1580	0.1516	2.34
March-10	2,197	6.4	$345.97	$246.81	$99.16	$12.49	$333.48	0.1575	0.1518	1.96
April-10	2,046	7.8	$338.81	$236.76	$102.05	$19.46	$319.35	0.1656	0.1561	2.50
May-10	2,911	9.4	$477.69	$340.29	$137.40	$24.80	$452.89	0.1641	0.1556	2.63
June-10	4,270	13.9	$694.72	$465.47	$229.25	$52.89	$641.83	0.1627	0.1503	3.80
July-10	6,005	14.5	$977.00	$670.50	$306.50	$61.58	$915.42	0.1627	0.1524	4.24
August-10	4,301	12.6	$699.76	$472.77	$226.99	$48.19	$651.57	0.1627	0.1515	3.82
September-10	3,665	9.8	$596.29	$407.82	$188.47	$36.53	$559.76	0.1627	0.1527	3.73
Total	38,032	14.5	$6,179.40	$4,292.02	$1,887.38	$361.65	$5,817.75	0.1625	0.1530	3.11
Most Recent Yr	38,032	14.5	$6,179.40	$4,292.02	$1,887.38	$361.65	$5,817.75	0.1625	0.1530	3.11

Electric Usage - EMS - 515 W Patcong Ave



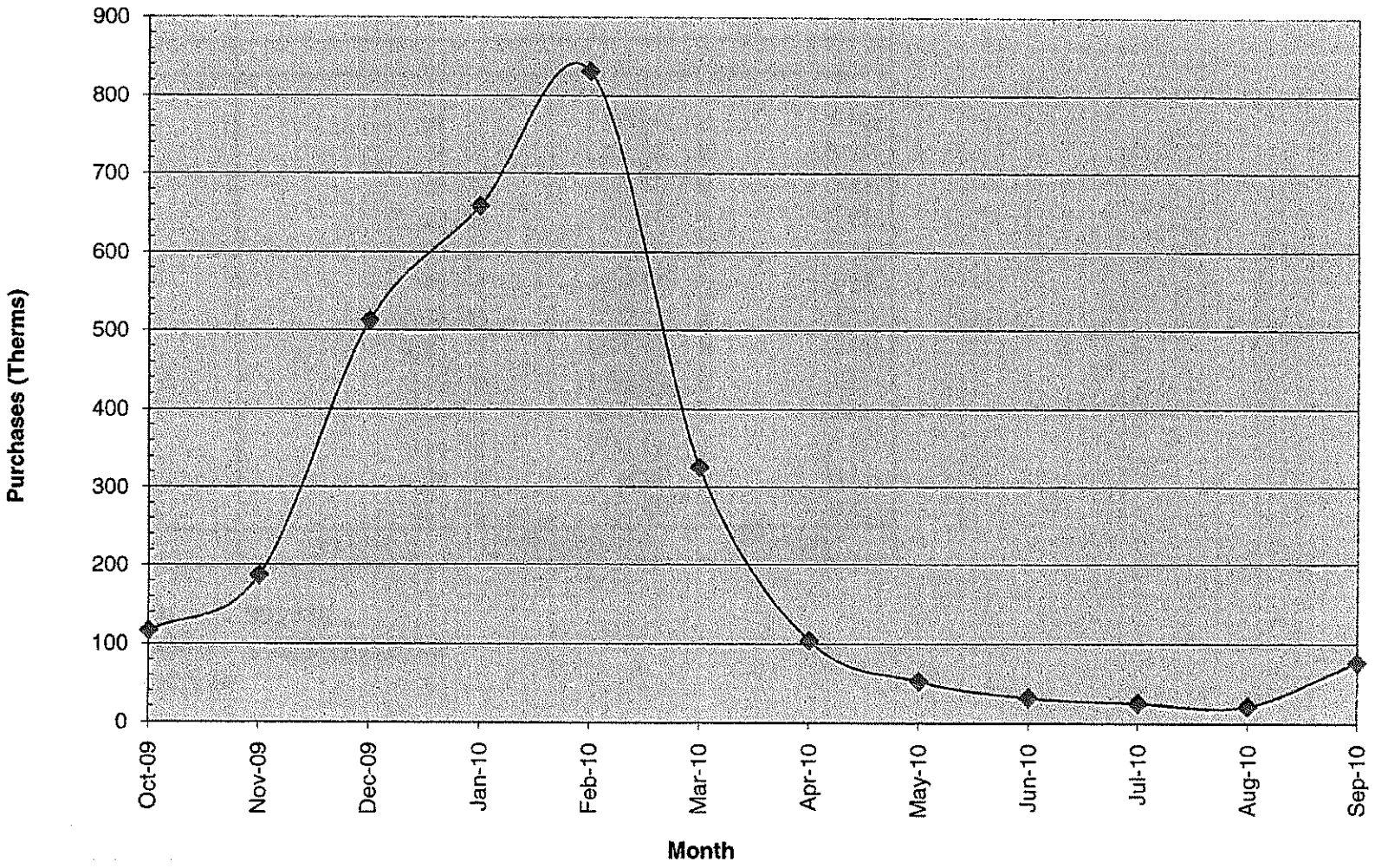
Electric Utility Data - Rev1
EMS - Electricity Chart

City of Linwood
CHA Project Number: 22215
Emergency Medical Service Building

515 W Patcong Ave
Account Number: 1 16 35 0028 0 8
Meter Number: 337415

Month	Therms	Total Charges	($/therm)
September-09	74	$ 32.44	$ 0.44
October-09	126	$ 116.36	$ 0.92
November-09	374	$ 186.08	$ 0.50
December-09	479	$ 512.38	$ 1.07
January-10	610	$ 658.43	$ 1.08
February-10	626	$ 831.47	$ 1.33
March-10	231	$ 325.41	$ 1.41
April-10	64	$ 103.96	$ 1.62
May-10	24	$ 51.96	$ 2.17
June-10	10	$ 31.46	$ 3.05
July-10	10	$ 25.28	$ 2.46
August-10	9	$ 21.69	$ 2.35
September-10	74	$ 76.00	$ 1.03
Most Recent Yr	2,638	$ 2,940	$ 1.11

Natural Gas Usage - Emergency Medical Serviice Building



Gas Utility Data - Rev1
EMS Gas Chart

City of Linwood
CHA Project Number: 22215
Emergency Medical Service Building
New Jersey American Water

515 W Patcong Ave
Account Number: 18-1109083-4
Meter Number: 86466394

Month	Gallons	Total Charges	($/Gal.)
August-09	21000	130.44	$ 6.21
September-09	18000	$ 113.23	$ 6.29
October-09	15000	$ 95.86	$ 6.39
November-09	5000	$ 37.95	$ 7.59
December-09	4000	$ 32.16	$ 8.04
January-10	4000	$ 32.19	$ 8.05
February-10	5000	$ 37.95	$ 7.59
March-10	5000	$ 37.95	$ 7.59
April-10	10000	$ 66.91	$ 6.69
May-10	24000	$ 147.97	$ 6.17
June-10	23000	$ 142.18	$ 6.18
July-10	20000	$ 124.78	$ 6.24
August-10	26000	$ 159.46	$ 6.13
September-10	18000	$ 112.00	$ 6.22
Total	198,000	$ 1,271	$ 6.42
Most Recent Yr	159,000	$ 1,027	$ 6.46

ELECTRIC MARKETERS LIST

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

GAS MARKETERS LIST

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

RPL Holdings, Inc
601 Carlson Pkwy
Minnetonka, MN 55305

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

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

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

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

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

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

APPENDIX B

ECM-1 Lighting Replacement

City of Linwood, NJ
CHA #22215
Emergency Medical Service Building

ECM-1 Lighting Replacement
New T-8 lamps with electronic ballasts

Building Schedule:
Existing conditions (master switch):
Supply Electric Rate $ 0.153
Demand Rate $ 9.11

Area Description	Number of Lamps	EXISTING CONDITIONS											RETROFIT CONDITIONS								COST ANALYSIS					
		Number of Fixtures	Fixture Type	Lamp Type	Watts per Fixture	Number of Non-Operational Fixtures	Watts per Non-Operational Fixtures	kW/Space	Exist Control	Daily Hours	Annual Hours	Annual kWh	Number of Fixtures	Watts per Fixture	New Lamp Type	kW/Space	Retrofit Control	Daily Hours	Annual Hours	Annual kWh	kW Saved	Annual kWh Saved	Annual $ Saved	Retrofit Cost	Simple Payback
Room 1	2	7	2x2	T-12	82	0	0	0.574	switch	1	365	209.51	7	33	T-8	0.231	switch	1	365	84	0.34	125	$ 32	$ 560	17.5
Hallway	2	3	1x4	T-12	86	0	0	0.258	switch	24	8760	2260.08	3	59	T-8	0.177	switch	24	8,760	1,551	0.08	710	$ 112	$ 240	2.2
Mens	1	1	1x3	T-12	37	0	0	0.037	switch	3	1095	40.515	1	25	T-8	0.026	switch	3	1,095	28	0.01	12	$ 2	$ 80	35.5
Women	1	1	1x3	T-12	37	0	0	0.037	switch	3	1095	40.515	1	25	T-8	0.026	switch	3	1,095	28	0.01	12	$ 2	$ 80	35.5
Main Entrance	2	14	1x4	T-12	86	0	0	1.204	switch	16	5840	7031.36	14	59	T-8	0.826	switch	16	5,840	4,824	0.38	2,208	$ 352	$ 1,120	3.2
Supervisor	2	2	2x2	T-12	82	0	0	0.164	switch	3	1095	179.58	2	33	T-8	0.066	switch	3	1,095	72	0.10	107	$ 20	$ 160	8.0
Hall	2	1	1x4	T-12	86	0	0	0.086	switch	8	2920	251.12	1	59	T-8	0.059	switch	8	2,920	172	0.03	79	$ 13	$ 80	6.1
Office	2	1	2x4	T-12	86	0	0	0.086	switch	5	1825	156.95	1	59	T-8	0.059	switch	5	1,825	108	0.03	49	$ 9	$ 80	9.4
Storage	2	1	2x4	T-12	86	0	0	0.086	switch	1	365	31.39	1	59	T-8	0.059	switch	1	365	22	0.03	10	$ 3	$ 80	31.8
Truck Bay	2	9	1x8	T-12	173	0		1.557	switch	3	1095	1704.915	9	88	T-8	0.882	switch	3	1,095	966	0.68	739	$ 136	$ 720	5.2
TOTALS -		40				0		4.1				11,908	40			2.4				7,855	1.7	4,051	$ 882	$ 3,200	4.7

APPENDIX C

ECM-2 Replace Install Storm Windows

City of Linwood, NJ
CHA #22215
Building: Emergency Medical Service Building

*Change U-value and air infiltration rates based on new windows or storm windows
See block load spreadsheet for U-values

ECM-2 Install Storm Windows

Given	Occupied Cooling Hours per Week	168	Hours	
	Occupied Heating Hours per Week	168	Hours	
	Heating Energy Cost	$1.11	$/therm	
	Cooling Cost	$0.162	$/kWh	
	Occupied Cooling Setpoint Temperature	72.0	Degrees F	(Assumption)
	Occupied Cooling Avg Space Air Enthalpy	29.0	btu/# air	(Assumption)
	Occupied Heatng Setpoint Temperature	72.0	Degrees F Occupied	(Assumption)
	Unoccupied Heating Setpoint Temperature	72.0	Degrees F Unoccupied	(Assumption)
	Window Area	180	sq.ft.	(From window survey)
	Window Perimeter	132	ft	(From window survey)
	Proposed U factor	0.50	Btu/(h*sqft*degf)	(From window vendor)
	Proposed Air Infiltration	0.20	cfm/ft	(From window vendor)
	Cooling Conversion	12,000	Btu/ton	
	Heating Btu Conversion	1,000,000	Btu/MMBtu	
Assumptions	Existing U factor	1.06	Btu/(h*sqft*degf)	(From ASHRAE Fundamentals)
	Existing Air Infiltration	0.50	cfm/ft	(From ASHRAE Fundamentals)
	Heating System Efficiency	75%		
	Cooling System Efficiency	1.20	kW/ton	

Formula

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

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

Existing

Operation	OA Enthalpy	OA Temp	Total Hours	Cooling Occupied Hours	Heating Occupied Hours	Heating Unoccupied Hours	Cooling Occupied Conduction	Heating Occupied Conduction	Heating Unoccupied Conduction	Cooling Occupied Infiltration	Heating Occupied Infiltration	Heating Unoccupied Infiltration
Cooling	38.3	92.5	78	78.0	0.0	0.0	302,211	0	0	215,444	0	0
Cooling	36.6	87.5	132	132.0	0.0	0.0	386,694	0	0	297,950	0	0
Cooling	33.5	82.5	344	344.0	0.0	0.0	682,668	0	0	459,756	0	0
Cooling	31.6	77.5	566	566.0	0.0	0.0	588,357	0	0	437,065	0	0
Cooling	30.3	72.5	755	755.0	0.0	0.0	71,348	0	0	281,506	0	0
Heating	27.9	67.5	780	0.0	780.0	0.0	0	663,360	0	0	250,193	0
Heating	24.6	62.5	889	0.0	889.0	0.0	0	1,598,200	0	0	601,995	0
Heating	21.6	57.5	742	0.0	742.0	0.0	0	2,033,451	0	0	766,902	0
Heating	18.7	52.5	627	0.0	627.0	0.0	0	2,310,609	0	0	871,505	0
Heating	16.2	47.5	725	0.0	725.0	0.0	0	3,357,113	0	0	1,266,111	0
Heating	14.3	42.5	795	0.0	795.0	0.0	0	4,432,523	0	0	1,671,694	0
Heating	12.4	37.5	784	0.0	784.0	0.0	0	5,112,072	0	0	1,927,981	0
Heating	10.4	32.5	682	0.0	682.0	0.0	0	5,091,471	0	0	1,920,212	0
Heating	8.7	27.5	345	0.0	345.0	0.0	0	2,901,523	0	0	1,094,326	0
Heating	7	22.5	229	0.0	229.0	0.0	0	2,142,410	0	0	807,994	0
Heating	5.4	17.5	189	0.0	189.0	0.0	0	1,946,785	0	0	734,220	0
Heating	3.9	12.5	70	0.0	70.0	0.0	0	787,185	0	0	296,861	0
Heating	2.5	7.5	20	0.0	20.0	0.0	0	243,810	0	0	91,951	0
Heating	1.2	2.5	8	0.0	8.0	0.0	0	105,084	0	0	39,632	0
Heating	-0.2	-2.5	0	0.0	0.0	0.0	0	0	0	0	0	0
Heating	-1.4	-7.5	0	0.0	0.0	0.0	0	0	0	0	0	0
Subtotal =			8,760	1,876	6,885	0	2,031,278	32,723,933	0 btu	1,701,721	12,341,597	0 btu

	Conduction	Infiltration		
Cooling Load =	(2031278) + (	1701721) =	3,732,998 btu	
	Cooling Load			
Cooling Energy =	(3732998)/(	12000) * (	1.20) =	373 kWh
	Cooling Energy	Cooling Cost		
Cooling Energy Cost =	(373.30) x (	$0.162) =	$	60.65
	Conduction	Infiltration		

Heating Load = (32723933) + (12341697) = 45,065,530 btu
(Heating Load, Heat Content)

Heating Energy = (45065530)/(72%)/(100000) = 625 therms
(Heating Load, Heat Content, Heating Energy)

Heating Energy Cost = (625.91) x ($1.115) = $ 698
(Heating Energy, Heating Cost)

Operation	OA Enthalpy	OA Temp	Total Hours	Cooling Occupied Hours	Heating Occupied Hours	Heating Unoccupied Hours	Cooling Occupied Conduction	Heating Occupied Conduction	Heating Unoccupied Conduction	Cooling Occupied Infiltration	Heating Occupied Infiltration	Heating Unoccupied Infiltration
Cooling	38.3	92.5	78	78.0	0.0	0.0	143,910	0	0	86,176	0	0
Cooling	36.6	87.5	132	132.0	0.0	0.0	184,140	0	0	119,160	0	0
Cooling	33.5	82.5	344	344.0	0.0	0.0	325,080	0	0	183,602	0	0
Cooling	31.8	77.5	566	566.0	0.0	0.0	280,170	0	0	174,826	0	0
Cooling	30.3	72.5	755	755.0	0.0	0.0	33,975	0	0	116,602	0	0
Heating	27.9	67.5	780	0.0	780.0	0.0	0	316,900	0	0	100,077	0
Heating	24.8	62.5	889	0.0	889.0	0.0	0	760,095	0	0	240,798	0
Heating	21.6	57.5	742	0.0	742.0	0.0	0	968,310	0	0	306,761	0
Heating	18.7	52.5	627	0.0	627.0	0.0	0	1,100,385	0	0	348,602	0
Heating	16.2	47.5	725	0.0	725.0	0.0	0	1,598,625	0	0	506,444	0
Heating	14.3	42.5	795	0.0	795.0	0.0	0	2,110,725	0	0	668,678	0
Heating	12.4	37.5	784	0.0	784.0	0.0	0	2,434,320	0	0	771,193	0
Heating	10.4	32.5	682	0.0	682.0	0.0	0	2,424,510	0	0	768,085	0
Heating	8.7	27.5	345	0.0	345.0	0.0	0	1,381,725	0	0	437,730	0
Heating	7	22.5	229	0.0	229.0	0.0	0	1,020,195	0	0	323,198	0
Heating	5.4	17.5	189	0.0	189.0	0.0	0	927,045	0	0	293,688	0
Heating	3.9	12.5	70	0.0	70.0	0.0	0	374,850	0	0	118,752	0
Heating	2.5	7.5	20	0.0	20.0	0.0	0	116,100	0	0	36,780	0
Heating	1.2	2.5	8	0.0	8.0	0.0	0	50,040	0	0	15,853	0
Heating	-0.2	-2.5	0	0.0	0.0	0.0	0	0	0	0	0	0
Heating	-1.4	-7.5	0	0.0	0.0	0.0	0	0	0	0	0	0
Subtotal =			8,760	1,875	6,885	0	967,275	15,582,825	0 btu	680,688	4,936,639	0 btu

Cooling Load = (Conduction 967275) + (Infiltration 680688) = 1,647,963 btu

Cooling Energy = (Cooling Load 1647963)/(12000) * (1.20) = 165 kWh

Cooling Energy Cost = (Cooling Energy 164.80) x (Cooling Cost $0.162) = $ 26.78

Heating Load = (Conduction 15582825) + (Infiltration 4936639) = 20,519,464 btu

Heating Energy = (Heating Load 20519464)/(Heat Content 72%) / (100000) = 285 therms

Heating Energy Cost = (Heating Energy 284.99) x (Heating Cost $1.115) = $ 318

Summary

EXISTING COOLING ENERGY	373.30	kWh	$	60.65
EXISTING HEATING ENERGY	625.91	therms	$	697.77
EXISTING ENERGY COST			$	758.42
PROPOSED COOLING ENERGY	164.80	kWh	$	26.78
PROPOSED HEATING ENERGY	284.99	therms	$	317.71
PROPOSED ENERGY COST			$	344.49
COOLING ENERGY SAVINGS	208.50	kWh	$	33.88
HEATING ENERGY SAVINGS	340.92	therms	$	380.06
ENERGY COST SAVINGS			$	413.94

55.9% of existing
54.5% of existing
54.6% of existing

Comments

City of Linwood, NJ
CHA #22215
Building: Emergency Medical Service Building

ECM-2 Install Storm Windows

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 New Storm Windows	6	EA	$ 200.00	$ 150.00		$ 1,176	$ 1,089	$ -	$ 2,265	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

$ 2,265	Subtotal
$ 226.50	10% Contingency
$ 373.73	Contractor 15% O&P
$ 2,865	**Total**

APPENDIX D

ECM-3 Replace Unit Heaters with Infrared Heaters

City of Linwood, NJ
CHA #22215
Building: Emergency Medical Service Building

ECM-3: Replace Unit Heaters with Infrared Heaters

Building Footprint	600	SF	Ex Occupied Htg Temp.	60	°F	Heating Energy Savings	324 Therms/yr
Natural Gas Heat Content	100,000	Btu/Therm	Ex Unoccupied Htg Temp.	60	°F	Electric Energy Savings	1,753 kWh/yr
Building Balance Temp.	60	°F	Occupied Heating UA	210	btu/hr/°F		
Internal Gains	1,638	btu/h	Unoccupied Heating UA	210	btu/hr/°F		
Unocc Internal Gain factor	0.03						
Ave Occ Internal Gain Factor	0.9						

Existing Burner Efficiency	72.0%	Existing unit heater burner efficiency
Existing Heat Distribution Effectiveness	85.0%	Heat Distribution Factor per ASHRAE Handbook - Fundamentals for Unit Heaters
Proposed Burner Efficiency	85.0%	Based on Reznor Infrared Tube Heaters
Proposed Heat Distribution Effectiveness	100%	Heat Distribution Factor per ASHRAE Handbook - Fundamentals for Infrared Heaters

				EXISTING LOADS						PROPOSED LOADS							
				Occupied			Unoccupied			Occupied			Unoccupied				
Avg Outdoor Air Temp. Bins °F	Avg Outdoor Air Enthalpy	Existing Equipment Bin Hours	Occupied Equipment Bin Hours	Unoccupied Equipment Bin Hours	Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Unoccupied Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Unoccupied Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Existing Heating Energy Therms	Proposed Heating Energy Therms
A		B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	M	N
102.5	42.5	0	0	0	0	0	-1,474	0	0	-49	0	0	-1,474	0	0	-49	0	0
97.5	39.5	9	9	0	0	0	-1,474	0	0	-49	0	0	-1,474	0	0	-49	0	0
92.5	36.6	69	69	0	0	0	-1,474	0	0	-49	0	0	-1,474	0	0	-49	0	0
87.5	34.0	132	132	0	0	0	-1,474	0	0	-49	0	0	-1,474	0	0	-49	0	0
82.5	31.6	344	344	0	0	0	-1,474	0	0	-49	0	0	-1,474	0	0	-49	0	0
77.5	29.2	566	566	0	0	0	-1,474	0	0	-49	0	0	-1,474	0	0	-49	0	0
72.5	27.0	755	755	0	0	0	-1,474	0	0	-49	0	0	-1,474	0	0	-49	0	0
67.5	24.5	780	780	0	0	0	-1,474	0	0	-49	0	0	-1,474	0	0	-49	0	0
62.5	21.4	889	889	0	0	0	-1,474	0	0	-49	0	0	-1,474	0	0	-49	0	0
57.5	18.7	742	742	0	0	0	-1,474	0	0	-49	0	0	-1,474	0	0	-49	0	0
52.5	16.2	627	627	0	945	2,297	-1,474	945	1,838	-49	945	2,297	-1,474	945	1,838	-49	21	15
47.5	14.4	725	725	0	1,995	4,850	-1,474	1,995	3,880	-49	1,995	4,850	-1,474	1,995	3,880	-49	55	40
42.5	12.6	795	795	0	3,045	7,402	-1,474	3,045	5,922	-49	3,045	7,402	-1,474	3,045	5,922	-49	106	77
37.5	10.7	784	784	0	4,095	9,955	-1,474	4,095	7,964	-49	4,095	9,955	-1,474	4,095	7,964	-49	163	118
32.5	8.6	682	682	0	5,145	12,507	-1,474	5,145	10,006	-49	5,145	12,507	-1,474	5,145	10,006	-49	207	149
27.5	6.8	345	345	0	6,195	15,060	-1,474	6,195	12,048	-49	6,195	15,060	-1,474	6,195	12,048	-49	220	159
22.5	5.5	229	229	0	7,245	17,612	-1,474	7,245	14,090	-49	7,245	17,612	-1,474	7,245	14,090	-49	132	95
17.5	4.1	189	189	0	8,295	20,165	-1,474	8,295	16,132	-49	8,295	20,165	-1,474	8,295	16,132	-49	101	73
12.5	2.8	70	70	0	9,345	22,717	-1,474	9,345	18,174	-49	9,345	22,717	-1,474	9,345	18,174	-49	94	68
7.5	1.0	20	20	0	10,395	25,270	-1,474	10,395	20,216	-49	10,395	25,270	-1,474	10,395	20,216	-49	39	28
2.5	0.0	8	8	0	11,445	27,822	-1,474	11,445	22,258	-49	11,445	27,822	-1,474	11,445	22,258	-49	12	9
-2.5	-1.5	0	0	0	12,495	30,375	-1,474	12,495	24,300	-49	12,495	30,375	-1,474	12,495	24,300	-49	5	4
-7.5	0.0	0	0	0	13,545	32,927	-1,474	13,545	26,342	-49	13,545	32,927	-1,474	13,545	26,342	-49	0	0
TOTALS		8,760	8,760	0	14,595	35,480	-1,474	14,595	28,384	-49	14,595	35,480	-1,474	14,595	28,384	-49	0	0
																	1,158	834

Existing Building Ventilation & Infiltration (occ) 378 cfm
Overheat Ventilation Factor 1.25 **Due to opening of overhead doors**
Additional ventilation to offset overheat 95 cfm
Existing Building Ventilation & Infiltration (unocc) 378 cfm

Electrical Requirements for Heating Equipment

Existing Equipment

Unit	Htng Hrs	Amps	Volts	Phase	Power Factor	Annual kWh
UH-1	2,119	5.7	115	1	0.8	1111
UH-2	2,119	5.7	115	1	0.8	1111
Total						2222

Proposed Equipment

Unit	Htng Hrs	Amps	Volts	Phase	Power Factor	Annual kWh
Infrared Htr	2,119	1.1	115	1	0.8	214
Infrared Htr	2,119	1.1	115	1	0.8	214
Total						429

*Electrical data based on Reznor VR Series Infrared Heaters

Avg OA Temp °F	Heating Hrs	Assumed % Time of Operation	hrs of Operation
102.5	0	0%	0
97.5	0	0%	0
92.5	0	0%	0
87.5	0	0%	0
82.5	0	0%	0
77.5	0	0%	0
72.5	0	0%	0
67.5	0	0%	0
62.5	0	8%	0
57.5	742	15%	114
52.5	627	23%	145
47.5	725	31%	223
42.5	795	38%	306
37.5	784	46%	362
32.5	682	54%	367
27.5	345	62%	212
22.5	229	69%	159
17.5	189	77%	145
12.5	70	85%	59
7.5	20	92%	18
2.5	8	100%	8
-2.5	0	100%	0
-7.5	0	100%	0
	5,216	41%	2,119

City of Linwood, NJ
CHA #22215
Building: Emergency Medical Service Building

ECM-3: Replace Unit Heaters with Infrared Heaters

Multipliers	
Material:	0.98
Labor:	1.21
Equipment:	1.09

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
						$ -	$ -	$ -	$ -	
Unit Heater Removal	2	EA		$ 450		$ -	$ 1,089	$ -	$ 1,089	
20' NG Infrared Tube Heater 75 MBH	2	EA	$ 1,200	$ 325		$ 2,352	$ 787	$ -	$ 3,139	Includes Controls
Miscellaneous Gas Piping, Valves, etc.	2	EA	$ 200	$ 250		$ 392	$ 605	$ -	$ 997	
4" Class B Vent Piping	75	LF	$ 6.70	$ 10		$ 492	$ 908	$ -	$ 1,400	Use Common Vents
4" Chimney Cap	2	EA	$ 11	$ 10		$ 22	$ 24	$ -	$ 46	Use Common Vents
Roof Flashing	2	EA	$ 28	$ 10		$ 55	$ 24	$ -	$ 79	Use Common Vents
Miscellaneous electrical	1	LS		$ 500		$ -	$ 605	$ -	$ 605	
						$ -	$ -	$ -	$ -	

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

$7,354	Subtotal
$1,103	15% Contingency
$1,269	15% Contractor O&P
$0	0% Engineering
$9,726	**Total**

APPENDIX E

ECM-4 Increase Wall Insulation

City of Linwood, NJ
CHA #22215
Building: Emergency Medical Service Building

ECM-4 Increase Wall Insulation Garage Area

Total Existing Wall Area	500	sf
Existing U-value	0.25	Btu/hr/(sf*F)
Existing R-value	4.0	
Proposed U-value	0.04	Btu/hr/(sf*F)
Proposed R-value	24.12	Install 6" batt insulation R-19 and (2) layers 5/8" gypsum
Heating Efficiency	72%	
Cooling Efficiency	0.00	kW/ton

Existing Cooling

Max. North Wall Cooling Load	0	Btu/hr
Max. East Wall Cooling Load	2,456	Btu/hr
Max. South Wall Cooling Load	1,485	Btu/hr
Max. West Wall Cooling Load	1,375	Btu/hr

Existing Heating

Existing Heating Load Temp Diff.	48	F
Existing Max. Wall Heating Load	8,640	Btu/hr
Heating On Point	60	F

Proposed Cooling

Max. North Wall Cooling Load	-	Btu/hr
Max. East Wall Cooling Load	404	Btu/hr
Max. South Wall Cooling Load	248	Btu/hr
Max. West Wall Cooling Load	229	Btu/hr

Proposed Heating

Proposed Max. Heating Load	1,433	Btu/hr

Occupied Cooling Setpoint	80	F
Unoccupied Cooling Setpoint	80	F
Occupied Heating Setpoint	62	F
Unoccupied Heating Setpoint	62	F

Existing Cooling Total		kWh/yr
Proposed Cooling Total		kWh/yr
Savings		kWh/yr
Existing Heating Total	13,628,375	Btu/yr
Proposed Heating Total	2,260,095	Btu/yr
Savings	11,368,280	Btu/yr
Input	158	therms

				Occupied				Unoccupied							
Avg Outdoor Air Temp. Bins *F	Existing Equipment Bin Hours	Occupied Equipment Bin Hours	Unoccupied Equipment Bin Hours	Existing Heat Gain	Proposed Heat Gain	Existing Heat Loss	Proposed Heat Loss	Existing Heat Gain	Proposed Heat Gain	Existing Heat Loss	Proposed Heat Loss	Existing Cooling Load	Existing Heating Load	Proposed Cooling Load	Proposed Heating Load
				(Btu/hr)	(Btu/hr)	(Btu/hr)	(Btu/hr)	(Btu/hr)	(Btu/hr)	(Btu/hr)	(Btu/hr)	(kWh/yr)	(Btu/yr)	(kWh/yr)	(Btu/yr)
97.5	9	9	0	5,298	879	-	-	5,298	879	-	-	-	-	-	-
92.5	69	69	0	4,591	761	-	-	4,591	761	-	-	-	-	-	-
87.5	132	132	0	3,885	644	-	-	3,885	644	-	-	-	-	-	-
82.5	344	344	0	3,179	527	-	-	3,179	527	-	-	-	-	-	-
77.5	566	566	0	2,472	410	-	-	2,472	410	-	-	-	-	-	-
72.5	755	755	0	1,766	293	-	-	1,766	293	-	-	-	-	-	-
67.5	780	780	0	938	176	-	-	1,060	176	-	-	-	-	-	-
62.5	889	889	0	313	59	-	-	353	59	-	-	-	-	-	-
57.5	742	742	0	-	-	563	93	-	-	563	93	-	417,375	-	69,216
52.5	627	627	0	-	-	1,188	197	-	-	1,188	197	-	744,563	-	123,476
47.5	725	725	0	-	-	1,813	301	-	-	1,813	301	-	1,314,063	-	217,921
42.5	795	795	0	-	-	2,438	404	-	-	2,438	404	-	1,937,813	-	321,362
37.5	784	784	0	-	-	3,063	508	-	-	3,063	508	-	2,401,000	-	398,176
32.5	682	682	0	-	-	3,688	612	-	-	3,688	612	-	2,514,875	-	417,061
27.5	345	345	0	-	-	4,313	715	-	-	4,313	715	-	1,487,813	-	246,735
22.5	229	229	0	-	-	4,938	819	-	-	4,938	819	-	1,130,688	-	187,510
17.5	189	189	0	-	-	5,563	922	-	-	5,563	922	-	1,051,313	-	174,347
12.5	70	70	0	-	-	6,188	1,026	-	-	6,188	1,026	-	433,125	-	71,828
7.5	20	20	0	-	-	6,813	1,130	-	-	6,813	1,130	-	136,250	-	22,595
2.5	8	8	0	-	-	7,438	1,233	-	-	7,438	1,233	-	59,500	-	9,867
-2.5	0	0	0	-	-	8,063	1,337	-	-	8,063	1,337	-	-	-	-
-7.5	0	0	0	-	-	8,688	1,441	-	-	8,688	1,441	-	-	-	-
TOTALS	8,760	8,760	0									-	13,628,375	-	2,260,095

City of Linwood, NJ
CHA #22215
Building: Emergency Medical Service Building

ECM-4 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.		
Batt Insulation	500	SF	$ 0.84	$ 0.36		$ 412	$ 218	$ -	$ 629	
2 layers 5/8" sheet rock	500	SF	$ 0.85	$ 1.68		$ 417	$ 1,014	$ -	$ 1,431	
10' High Metal Stud wall	50	LF	$ 12	$ 7		$ 588	$ 424	$ -	$ 1,012	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

$ 3,072	Subtotal
$ 153.59	5% Contingency
$ 161.27	Contractor 5% O&P
$ 3,387	**Total**

APPENDIX F

ECM-5 Furnace Replacement

City of Linwood, NJ
CHA #22215
Emergency Medical Service Building

ECM-5 Furnace Replacement

Existing Fuel	Nat.Gas
Proposed Fuel	Nat.Gas

Item	Value	Units	Formula/Comments
Baseline Fuel Cost	$ 1.11		
Proposed Fuel Cost	$ 1.11		
Baseline Fuel Use	2,518	Therms	Based on historical utility data
Existing Boiler Plant Efficiency	80%		Estimated
Baseline Boiler Load	201,429	Mbtu/yr	Baseline Fuel Use x Existing Efficiency x 100 Mbtu/Therms
Baseline Fuel Cost	$ 2,807		
Proposed Boiler Plant Efficiency	92%		New Condensing Furnace
Proposed Fuel Use	2,189	Therms	Baseline Boiler Load / Proposed Efficiency / 100 Mbtu/Therms
Proposed Fuel Cost	$ 2,441		
Annual Savings	328	Therms	
Annual Savings	$ 366	**/yr**	

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

City of Linwood, NJ
CHA #22215
Building: Emergency Medical Service Building

ECM-5 Furnace Replacement

Multipliers	
Material:	0.98
Labor:	1.21
Equipment:	1.09

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
New Lennox Furnace						$ -	$ -	$ -	$ -	
G-51 direct vent	1	EA	$ 2,000.00	$ 1,500.00		$ 1,960	$ 1,815	$ -	$ 3,775	
new direct vent	1	LS	$ 150	$ 100		$ 147	$ 121	$ -	$ 268	
gas re-connection	1	LS	$ 100	$ 75		$ 98	$ 91	$ -	$ 189	
electrical +thermostat	1	LS	$ 400	$ 400		$ 392	$ 484	$ -	$ 876	
Ductwork reconnection	1	LS	$ 400	$ 400		$ 392	$ 484	$ -	$ 876	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

$ 5,984	Subtotal
$ 299.19	5% Contingency
$ 314.15	Contractor 5% O&P
$ 6,597	**Total**

APPENDIX G

New Jersey Pay For Performance Incentive Program

City of Linwood, NJ
CHA #22215
Emergency Medical Service Building

New Jersey Pay For Performance Incentive Program

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

Total Building Area (Square Feet)	3,000
Is this audit funded by the NJ BPU (Y/N)	Yes

Bureau of Public Utilites (BPU)

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

	Annual Utilities	
	kWh	Therms
Existing Cost (from utility)	$4,163	$2,940
Existing Usage (from utility)	38,032	2,638
Proposed Savings	6,053	1,151
Existing Total MMBtus	394	
Proposed Savings MMBtus	136	
% Energy Reduction	34.5%	
Proposed Annual Savings	$2,291	

	Min (Savings = 15%)		Increase (Savings > 15%)		Max Incentive		Achieved Incentive	
	$/kWh	$/therm	$/kWh	$/therm	$/kWh	$/therm	$/kWh	$/therm
Incentive #2	$0.11	$1.10	$0.005	$0.05	$0.13	$1.45	$0.13	$1.45
Incentive #3	$0.07	$0.70	$0.005	$0.05	$0.09	$1.05	$0.09	$1.05

	Incentives $		
	Elec	Gas	Total
Incentive #1	$0	$0	$150
Incentive #2	$787	$1,670	$2,456
Incentive #3	$545	$1,209	$1,754
Total All Incentives	**$1,332**	**$2,879**	**$4,360**

Total Project Cost	$25,775

		Allowable Incentive
% Incentives #1 of Utility Cost*	2.1%	$150
% Incentives #2 of Project Cost**	9.5%	$2,456
% Incentives #3 of Project Cost**	6.8%	$1,754
Total Eligible Incentives***	**$4,360**	
Project Cost w/ Incentives	$21,415	

Project Payback (years)	
w/o Incentives	w/ Incentives
11.2	9.3

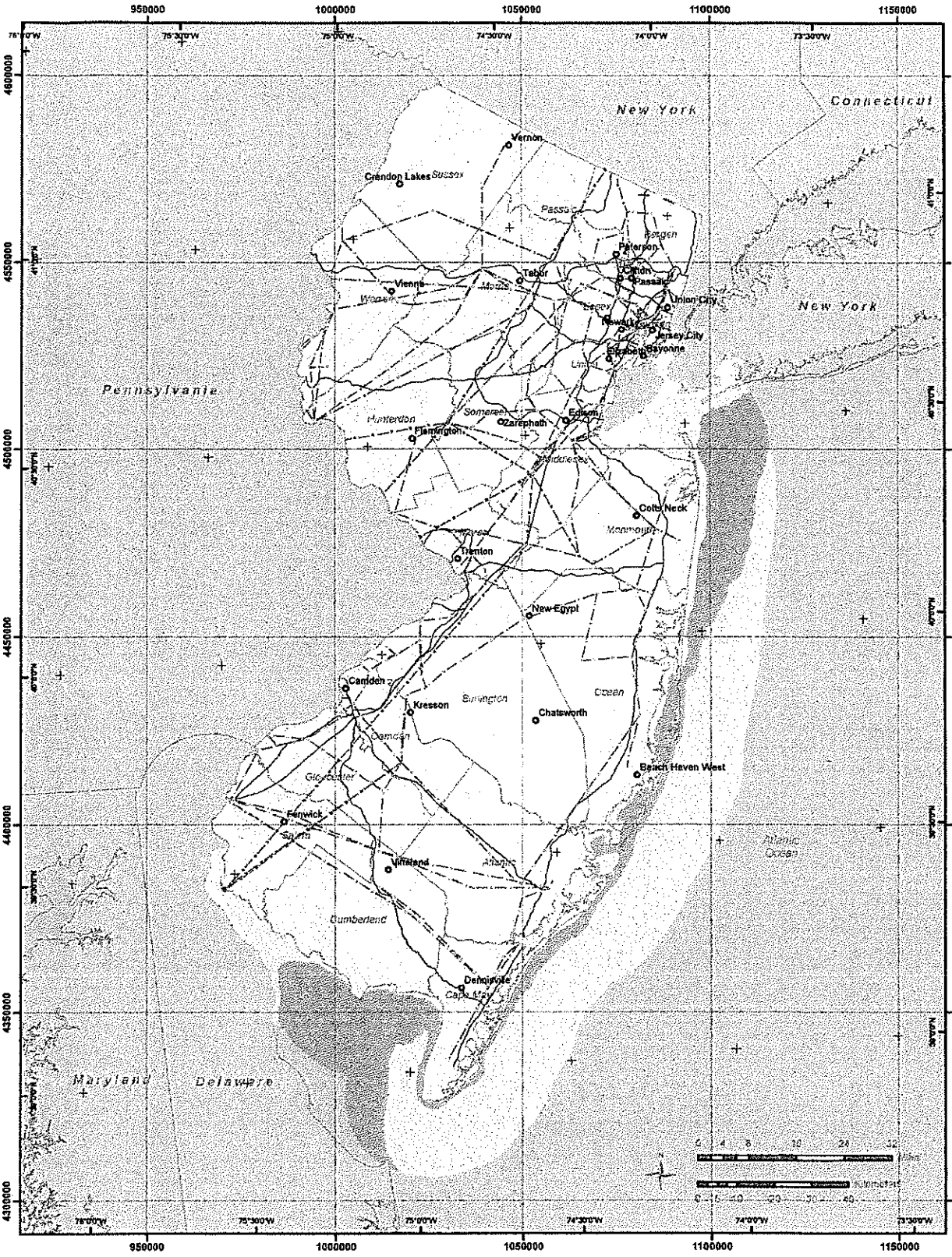
* Maximum allowable incentive is 50% of annual utility cost if not funded by NJ BPU, and %25 if it is.

** Maximum allowable amount of Incentive #2 is 30% of total project cost.
Maximum allowable amount of Incentive #3 is 20% of total project cost.

*** Maximum allowable amount of Incentive #1 is $50,000 if not funded by NJ BPU, and $25,000 if it is.
Maximum allowable amount of Incentive #2 & #3 is $1 million per gas account and $1 million per electric account

APPENDIX H

Wind



Wind Resource of New Jersey

Mean Annual Wind Speed at 30 Meters

Features

- City
- Interstate Highway
- County Boundary
- Water Body

Generalized Transmission Line

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

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

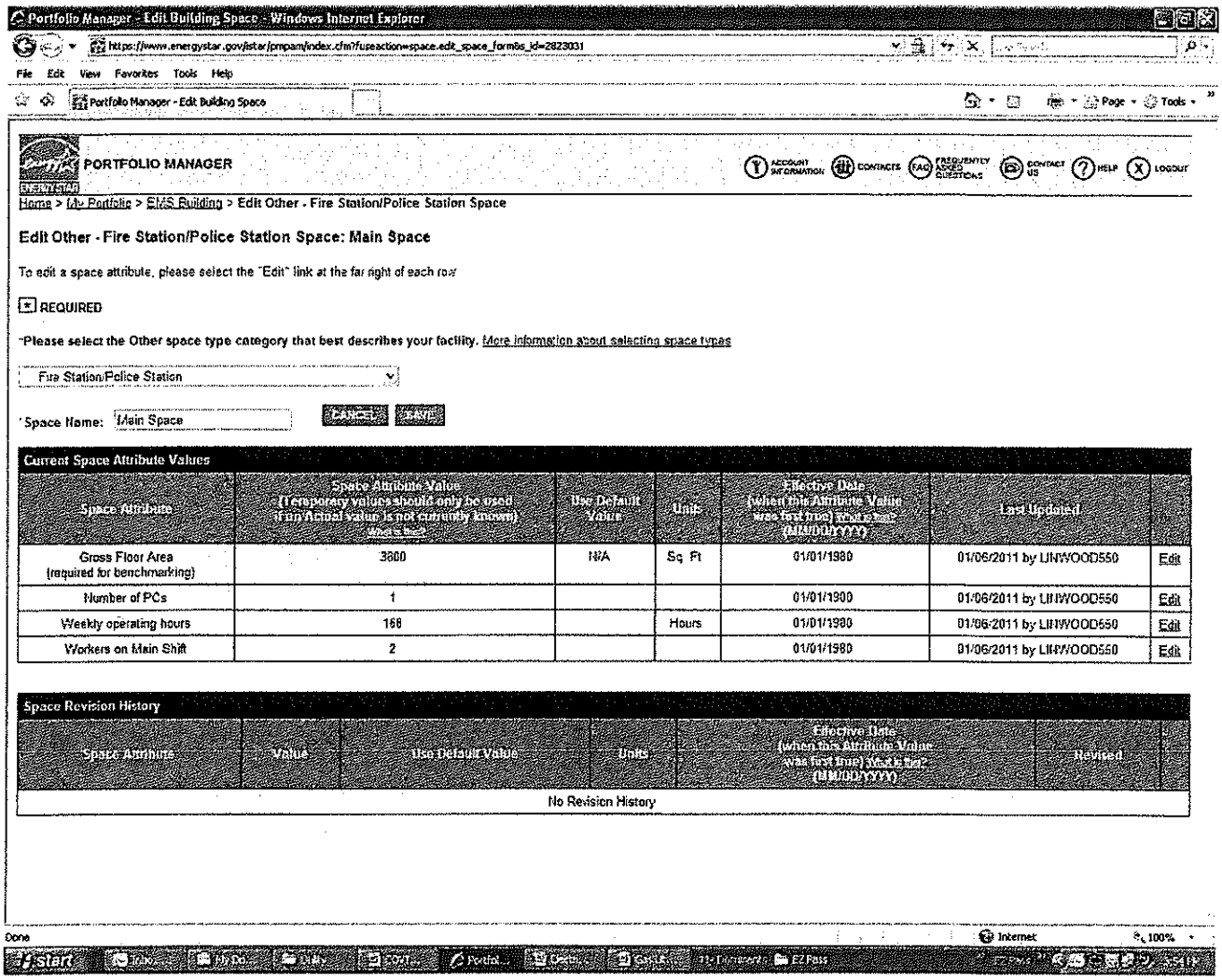
AWS Truewind

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

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

APPENDIX I

EPA Portfolio Manager


Portfolio Manager - Edit Building Space - Windows Internet Explorer
https://www.energystar.gov/istar/pmpam/index.cfm?fuseaction=space.edit_space_form&s_id=2823031
File Edit View Favorites Tools Help
Portfolio Manager - Edit Building Space
PORTFOLIO MANAGER
ACCOUNT INFORMATION
CONTACTS
FREQUENTLY ASKED QUESTIONS
CONTACT US
HELP
LOGOUT
Home > My Portfolio > EMS Building > Edit Other - Fire Station/Police Station Space
Edit Other - Fire Station/Police Station Space: Main Space
To edit a space attribute, please select the "Edit" link at the far right of each row
REQUIRED
*Please select the Other space type category that best describes your facility. More information about selecting space types
Fire Station/Police Station
*Space Name: Main Space
CANCEL
SAVE
Current Space Attribute Values
Space Attribute
Space Attribute Value (Temporary values should only be used if any Actual value is not currently known) What is this?
Use Default Value
Units
Effective Date (when this Attribute Value was first true) What is this? (MM/DD/YYYY)
Last Updated
Gross Floor Area (required for benchmarking)
3800
N/A
Sq. Ft
01/01/1980
01/06/2011 by LINWOOD550
Edit
Number of PCs
1
01/01/1900
01/06/2011 by LINWOOD550
Edit
Weekly operating hours
168
Hours
01/01/1980
01/06/2011 by LINWOOD550
Edit
Workers on Main Shift
2
01/01/1980
01/06/2011 by LINWOOD550
Edit
Space Revision History
Space Attribute
Value
Use Default Value
Units
Effective Date (when this Attribute Value was first true) What is this? (MM/DD/YYYY)
Revised
No Revision History
Done
Internet
100%
start
EZ Pass

APPENDIX J

Block Load Models & Equipment Inventory

HEAT GAIN/LOSS WORKSHEET

Project Name:	City of Linwood, NJ	Project No.:	CHA #22215		
Location	Linwood, NJ	Site Elevation:	17 Feet	Specific Volume	14.00 CF/#
Building Name	Emergency Medical Service Building	Date:	12/01/10		
Engineer:	Frank Cuttita				

Building/Facility Designation: Emergency Medical Service Building

Outdoor Winter Design DB Temperature	14 °F		Indoor Winter Design DB Temperature	72	°F
Outdoor Summer Design DB Temperature	91 °F		Indoor Summer Design DB Temperature	72	°F
Outdoor Summer Design WB Temperature	73 °F		Indoor Summer Design WB Temperature	60	°F
Outdoor Summer Humidity Ratio	0.0121 #/#		Indoor Air (70°F) Humidity Ratio	0.0079	#/#

ENVELOPE DESCRIPTIONS (Descriptions are from Interior to Exterior)

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

Roofs (Select One)		R Value	Roof Type
	Tectum Deck, 3.3" Insul., BU Roof	13.0	1
	Steel Deck, 5" insul., BU Roof	18.2	1
	Attic Roof with 6" Insul.	25.0	4
	4" HW Concrete Deck, BU Roof	2.7	2
	Ceiling, 3" Insulation, 4" Concrete Deck, BU Roof	14.9	4
	Ceiling, 4" Concrete Deck, 3" Insulation, BU Roof	16.5	13
	Ceiling, 4" Concrete Deck, 6" Insulation, BU Roof	21.7	14
X	Ceiling, Wood Deck, 6" Insulation, Felt & Membrane	20.0	10
	Wood Deck, 6" Insulation, Felt & Membrane	18.0	
	U value calculator	22.1	

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

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

BUILDING CHARACTERISTICS

Roof Area	2,400 SF			
Occupied Area	2,400 SF		Return Plenum?	n

	Gross Wall Length		Average Wall Height		Ceiling Height		Window Area		Door Area		Net Wall Area
North Exposure	68	Ft	10.0	Ft	9.0	Ft	30	SF	56	SF	594 SF
East Exposure	44	Ft	10.0	Ft	9.0	Ft	0	SF	0	SF	440 SF
South Exposure	68	Ft	10.0	Ft	9.0	Ft	30	SF	15	SF	635 SF
West Exposure	44	Ft	10.0	Ft	9.0	Ft	120	SF	0	SF	320 SF

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

HEAT GAIN/LOSS WORKSHEET

Project Name:	City of Linwood, NJ	Project No.:	CHA #22215		
Location	Linwood, NJ	Site Elevation:	17 Feet	Specific Volume	14.00 CF/#
Building Name	Emergency Medical Service Building	Date:	12/01/10		
Engineer:	Frank Cunha				

Building/Facility Designation: Emergency Medical Service Building

COOLING HEAT GAINS TO THE ROOM - SENSIBLE

SOLAR GAINS

WINDOWS	AREA (SF)	SHGF		Shade Coef	Cooling Load Factor		Solar Heat Gain
North Exposure	30	38	btu/h/sf	0.8	0.75	Glass Type C	684 Btu/hr
East Exposure	0	216	btu/h/sf	0.8	0.31	Glass Type C	0 Btu/hr
South Exposure	30	109	btu/h/sf	0.8	0.58	Glass Type C	1,517 Btu/hr
West Exposure	120	216	btu/h/sf	0.8	0.29	Glass Type C	6,013 Btu/hr
							8,215 Btu/h

CONDUCTION

	NET AREA (SF)	U-VALUE	Cooling Load Temp. Dif.	Return Air Factor	Room Heat Gain
North Exposure	526	0.09	20 °F	1.0	968 Btu/hr
East Exposure	396	0.09	39 °F	1.0	1,421 Btu/hr
South Exposure	567	0.09	27 °F	1.0	1,408 Btu/hr
West Exposure	276	0.09	22 °F	1.0	559 Btu/hr
Roof	2,400	0.05	73 °F	1.0	8,760 Btu/hr
Fenestration	180	1.05	19 °F		3,591 Btu/hr
Doors	71	0.14	27 °F		268 Btu/hr
Ceiling	2,400	0.14	0 °F		0 Btu/hr
Partition		0.05	0 °F		0 Btu/hr
Floor	2,400	0.04	0 °F		0 Btu/hr
					16,974 Btu/h

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

								Room Heat Gain
Lights	1.00	w/sf x	2,400	Occ Area =	2.4 kW x 3.4x	1.0 RAF =		8,191 Btu/h
Plug Load	0.25	w/sf x	2,400	Occ Area =	0.6 kW x 3.4x	1.0 RAF =		2,048 Btu/h
People	1	people x	255	btu/person x	50% time in space =			128 Btu/h
Computer Work Stations			1	Units x	100 W/Unit x 3414 =			341 Btu/h
Equipment	0.0	kW x 3.413 =						0 Btu/h
Misc.								0 Btu/h
								10,708 Btu/h

VENTILATION AND INFILTRATION

		Infiltration Factor		Perimeter Ratio		Coef	Temp. Diff.	Room Heat Gain
Walls	1,765 SF	0.15	CFM/SF			1.04	19 °F	5,671 Btu/h
Doors	71 SF	0.30	CFM/LF	0.65	LF/SF	1.04	19 °F	296 Btu/h
Windows	180 SF	0.50	CFM/LF	0.73	LF/SF	1.04	19 °F	1,414 Btu/h
Ventilation	0 cfm					1.04	19 °F	0 Btu/h
								7,380 Btu/h
Infiltration	345 cfm	#DIV/0!	AC/hr					

COOLING HEAT GAINS TO THE RA PLENUM - SENSIBLE

4,950

CONDUCTION

	NET AREA (SF)	U-VALUE	Cooling Load Temp. Dif.	Return Air Factor	Room Heat Gain 1
North Exposure	68	0.09	20	1.0	125 Btu/hr
East Exposure	44	0.09	39	1.0	158 Btu/hr
South Exposure	68	0.09	27	1.0	169 Btu/hr
West Exposure	44	0.09	22	1.0	89 Btu/hr
Roof	2,400	0.05	73	0.0	0 Btu/hr
					541 Btu/h

INTERNAL HEAT GAINS

Lights	1.00 w/sf x	2,400	Occ Area =	2.4 kW x3413x	0.00 RAF =	0 Btu/h
Misc.						0 Btu/h
						0 Btu/h

SENSIBLE HEAT GAINS - TEMP. DEPENDENT		SENSIBLE HEAT GAINS - TEMP. INDEPENDENT	
Solar	8,215	Internal Gains to Room	10,708
Conduction to Room	16,974	Internal Gains to Plenum	0
Conduction to Plenum	541		
Ventilaton and Infiltration	7,380		
Sub Total	33,110	Sub Total	10,708

HEAT GAIN/LOSS WORKSHEET

Project Name:	City of Linwood, NJ	Project No.:	CHA #22215		
Location	Linwood, NJ	Site Elevation:	17 Feet	Specific Volume	14.00 CF/#
Building Name	Emergency Medical Service Building	Date:	12/01/10		
Engineer:	Frank Cuttita				

Building/Facility Designation: Emergency Medical Service Building

LATENT COOLING LOADS

Infiltration

		Infiltration Factor	Air Density	Humidity Ratio Dif.	Room Heat Gain
Walls	2,624 SF	0.15 CFM/SF	4,629	0.0042 #/#	7,730 Btu/h
Doors	71 SF	0.30 CFM/LF	4,629	0.0042 #/#	271 Btu/h
Windows	180 SF	0.50 CFM/LF	4,629	0.0042 #/#	1,296 Btu/h
Ventilation	0 cfm		4,629	0.0042 #/#	0 Btu/h
People	1 people	0.50 time in space		250 Btu/hr/person	125 Btu/h
					9,422 Btu/h

Cooling Load Summary

	Sensible	Latent	Total	
Temperature Dependent Gains	33,110	9,422	42,532	
Temperature Indep. Gains	10,708	0	10,708	SHR= 0.82
Total	43,818	9,422	53,240	

Building Cooling Load: 4.4 Tons at 541 SF/Ton

Building Air Flow to Condition Space based on a 12°F Temp Rise Is: 3,455 CFM / 1.44 CFM/sf

HEATING CALCULATION

CONDUCTION

	NET AREA (SF)	U-VALUE	Heating Load Temp. Dif.	Room Heat Gain
North Exposure	594	0.09	58	3,170 Btu/h
East Exposure	440	0.09	58	2,348 Btu/h
South Exposure	635	0.09	58	3,388 Btu/h
West Exposure	320	0.09	58	1,708 Btu/h
Fenestration	180	1.05	58	10,962 Btu/h
Roof	2,400	0.05	58	6,960 Btu/h
Doors	71	0.14	58	575 Btu/h
Ceiling	2,400	0.14	5	1,667 Btu/h
Partition	0	0.05	0	0 Btu/h
Floor	2,400	0.04	0	0 Btu/h

Ventilation and Infiltration

		Infiltration Factor	Coef	Temp. Difference	Air Flow	Room Heat Gain
Walls	1,989 SF	0.15 CFM/SF	1.04	58	298 cfm	18,062 Btu/h
Doors	71 SF	0.30 CFM/LF	1.04	58	14 cfm	835 Btu/h
Windows	180 SF	0.50 CFM/LF	1.04	58	66 cfm	3,996 Btu/h
Ventilation Load	0 cfm		1.04	58	0 cfm	0 Btu/h
Total Ventilation & Infiltration Load					378 cfm	22,894 Btu/h

Building Heating Load	53,671	btu/h
		22.4 btu/sf

City of Linwood, NJ
CHA #22215
Building: Emergency Medical Service Building

Doors

	Width (ft)	Height (ft)	Quantity	Area (SF)	Lineal Feet
North	8.0	7.0	1	56.0	30.0
				0.0	0.0
				0.0	0.0
				0.0	0.0
				0.0	0.0
				0.0	0.0
			Sub-total	56.0	30.0
East				0.0	0.0
				0.0	0.0
				0.0	0.0
			Sub-total	0.0	0.0
South	3.0	5.0	1	15.0	16.0
				0.0	0.0
				0.0	0.0
				0.0	0.0
			Sub-total	15.0	16.0
West				0.0	0.0
				0.0	0.0
			Sub-total	0.0	0.0
			Total	71.0	46.0

LF/SF
0.65

Walls

	Width (ft)	Height (ft)	Quantity	Area (SF)	Lineal Feet		
North	68.0	10.0	1	680.0	156.0		All wall quantities must remain equal to 1
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0	Ave. height	
	68.0			680.0	156.0	10.0	Average height wall automatically linked
East	44.0	10.0	1	440.0	108.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0	Ave. height	
	44.0			440.0	108.0	10.0	Average height wall automatically linked
South	68.0	10.0	1	680.0	156.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0	Ave. height	
	68.0			680.0	156.0	10.0	Average height wall automatically linked
West	44.0	10.0	1	440.0	108.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0	Ave. height	
	44.0			440.0	108.0	10.0	Average height auto linked to block load sheet

Windows

	Width (ft)	Height (ft)	Quantity	Area (SF)	Lineal Feet
North	5.0	6.0	1	30.0	22.0
				0.0	0.0
				0.0	0.0
				0.0	0.0
				0.0	0.0
				0.0	0.0
			Sub-total	30.0	22.0
East				0.0	0.0
				0.0	0.0
				0.0	0.0
				0.0	0.0
				0.0	0.0
				0.0	0.0
			Sub-total	0.0	0.0
South	6.0	5.0	1	30.0	22.0
				0.0	0.0
				0.0	0.0
				0.0	0.0
				0.0	0.0
				0.0	0.0
			Sub-total	30.0	22.0
West	6.0	5.0	4	120.0	88.0
				0.0	0.0
				0.0	0.0
				0.0	0.0
				0.0	0.0
			Sub-total	120.0	88.0
			Total	180.0	132.0

LF/SF
0.73