

**TOWNSHIP OF ANDOVER
NEWTON, NJ
ANDOVER TOWNSHIP HILLSIDE BARN
ENERGY ASSESSMENT**

for

**NEW JERSEY
BUREAU OF PUBLIC UTILITIES**

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CHA PROJECT NO. 20997

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1.0 INTRODUCTION & BACKGROUND

This report summarizes the energy audit performed at the Andover Township Hillside Barn building, in the Township of Andover located at 146 Lake Iliff Road in Newton, NJ. Built in 1933, the building is a 7,000 square foot, two-story structure. The building houses an office space, community room, kitchen, bar, restrooms, and auxiliary spaces.

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.

This report covers the energy audit for the Andover Township Hillside Barn.

2.0 EXECUTIVE SUMMARY

This report details the results of the Andover Township Hillside Barn, in the Township of Andover. The 7,000 square foot, two-story structure houses an office space, community room, kitchen, bar, restrooms, and auxiliary spaces. This facility also serves a two bay garage and storage area, a remote pump house, and provides power to the playground site lighting. The following areas were evaluated for energy conservation measures:

- Lighting upgrades with occupancy sensors
- Programmable thermostat control for rooftop units and downstairs office area
- Increase efficiency of office area cooling
- Convert standing pilot lights to electronic ignition
- Install weather stripping on exterior doors
- Replace refrigerators in kitchen

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 \$3,490 for the recommended ECMs may be realized with a payback of 5.5 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 Fixture Modifications (Downstairs Offices)

Budgetary Cost	Annual Utility Savings			ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Propane				
\$	kW	kWh	Gallons	\$	\$	Years	Years
4,100	0	3,500	0	700	1.6	5.9	4.4

* There is a \$30 per fixture incentive for replacing T12 fixtures with T8 fixtures available through the New Jersey Smart Start program's Prescriptive Lighting Application for this ECM.

ECM-1 Lighting Fixture Modifications (Upstairs Recreation)

Budgetary Cost	Annual Utility Savings			ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Propane				
\$	kW	kWh	gallons	\$	\$	Years	Years
800	0	2,200	0	500	8.4	1.6	1.2

* There is a \$30 per fixture incentive for replacing T12 fixtures with T8 fixtures available through the New Jersey Smart Start program's Prescriptive Lighting Application for this ECM.

ECM-2 Lighting Control Modifications (Fixtures Proposed in ECM-1)

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Propane	Total				
\$	kW	kWh	Gallons	\$		\$	Years	Years
750	0	1,200	0	250	4.0	160	3.0	2.4

* Incentive shown is per the New Jersey Smart Start Program, 2010 Lighting Controls Application. Incentive is based on the use of eight wall-mounted occupancy sensors.

ECM-3 Modify Rooftop Unit Control

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Propane	Total				
\$	kW	kWh	Gallons	\$		\$	Years	Years
300	-	600	30	190	16.8	NA	0.8	NA

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

ECM-4 Modify Downstairs Office HVAC Control

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Propane	Total				
\$	kW	kWh	Gallons	\$		\$	Years	Years
160	-	200	100	200	17.8	NA	0.8	NA

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

ECM-6 Convert Gas Range Pilot Lights to Electronic Ignition

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Propane	Total				
\$	kW	kWh	Gallons	\$		\$	Years	Years
6,000	-	0	360	600	1.0	NA	10.0	NA

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

ECM-7 New Weather Stripping on Exterior Doors

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Propane	Total				
\$	kW	kWh	Gallons	\$		\$	Years	Years
70	0	0	30	50	2.6	NA	1.4	NA

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

ECM-8 Replace Refrigerators and Freezers in Kitchen

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Propane	Total				
\$	kW	kWh	Gallons	\$		\$	Years	Years
7,000	0	4,900	0	1,000	1.9	NA	7.0	NA

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

3.0 EXISTING CONDITIONS

3.1 Building General

The Newton, New Jersey, Andover Township Hillside Barn, in the Township of Andover, was constructed in 1933 and has been partially renovated since that time. It is a 7,000 square foot, two-story structure. The building houses an office space, community room, kitchen, bar, restrooms, and auxiliary spaces. There is also a mechanical loft space located on the upper level. In addition, the facility serves a two bay garage and storage area, a remote pump house and lighting for the playground.

The lower level of the barn is an office area that the township rents to a third party. This lower level is occupied for a typical 40-hour workweek. The upper level of the barn is used as a recreation building or as a rental space for private parties. The upper level is rented approximately 73 times a year for 6-8 hours per rental. In addition, the aerobics program utilizes the building throughout the year; 30 hours in winter, 135 hours in spring, 30 hours in summer, and 135 hours in the fall. The summer recreation program utilizes the building for 24 hours. The garage is utilized for storage. The hockey rink and basketball court are utilized from 6 am to 11 pm all week.

The building was constructed in 1933 and the building's exterior shell is in good condition. The building shell was modified with new exterior siding on sheathing attached to the existing building's wood framing system with R-11 insulation within the wood stud space and wood paneling on the interior. The windows were replaced with insulated glass, double hung on fixed vinyl clad wood. The entry doors are wood. The roof was resingled. Insulation within the attic space is R-19. The building shell is in good condition. The window weather stripping is good, however, the door weather stripping should be replaced.

3.2 Utility Usage

Utilities include electricity, propane, and potable water. Electricity is purchased from Jersey Central Power & Light Company (JCP&L), propane is delivered by Amerigas, and potable water is provided by an on-site well.

During the period of December 2008 to November 2009, electric usage was approximately 40,080 kWh at a total cost of about \$8,621. Review of electricity bills during this period determined the building was charged a supply unit cost of \$0.16 per kWh, demand unit cost of \$3.05 per kW, and blended unit cost of \$0.2151 per kWh. During the same 2009 timeframe, the building heating and cooking utilized approximately 3,471 gallons of propane. Based on the annual cost of \$5,760, the blended price for propane was \$1.66 per gallon. Propane consumption is highest in the winter months to produce building heat. Propane deliveries occur as needed prior to and during the heating season. Utility data can be found in Appendix A.

Electricity supply and delivery is presently purchased from JCP&L. 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 submission of one to three years of past energy bills. Contract terms can vary among suppliers. A list of approved electrical energy commodity suppliers can be found in Appendix A.

3.3 HVAC Systems

Ventilation and air conditioning is provided to the upper level by two packaged propane/electric rooftop units. A propane-fired furnace with cooling coil and remote condensing unit conditions the lower level. There is no heat in the garage/storage building. The well house has heating only.

The following is a summary of this equipment and areas served:

Equipment	Cooling Tons	Heating MBH Input/Output	Efficiency (Cooling/Heating)	Area Served
Furnace/Condensing Unit	3	75 / 69	10 SEER / 92%	Downstairs Offices
Package Rooftop Unit (No Economizer)	15	358 / 279	11 EER / 78%	½ Upstairs Recreation Area
Package Rooftop Unit (No Economizer)	15	358 / 279	11 EER / 78%	½ Upstairs Recreation Area
Electric Heater	-	5.1 / 5.1	-	Well House

The package rooftop units provide an outdoor air rate of 15 cubic feet per minute per person.

There are 3 exhaust fans located on the lower level serving the two restrooms and kitchen. There is no exhaust from the public toilet rooms on the first floor and the hood over the range requires a working exhaust fan.

The lower floor furnace appears to have been installed in 1998 and the rooftop units in 1990. Service life is estimated at 15 years for the roof top package equipment and the split system equipment. A list of HVAC equipment can be found in Appendix B.

The rooftop units are at the end of their useful life and will need to be replaced soon. The units have the best efficiency for their fuel and capacity. It is recommended that when they are replaced an economizer section be included for free cooling when weather conditions permit. It is estimated that an economizer can reduce electrical consumption of the rooftop units by an additional 15%. HAP data for analysis of the units with an economizer is located in Appendix Q.

3.4 Lighting/Electrical Systems

The majority of lighting fixtures on the lower level utilize inefficient T-12 fluorescent lamps and fixtures. On the upper level the majority of lighting fixtures utilize incandescent lamps, although there are also T-12 fluorescent, spiral globes, and halogen lamps used. All exit signs within the building use LED bulbs and are extremely efficient.

Exterior building lighting, located on the porch, are incandescent lamps. Garage lighting consists of inefficient T-12 fixtures. Metal halide fixtures light the rink, basketball court and flagpole. The well house has an incandescent lamp.

Emergency lighting is provided by the use of self-contained battery systems.

3.5 Control Systems

3.5.1 HVAC Controls

Wall-mounted, non-programmable, standard thermostats with heat or cool operation control each HVAC unit.

Following are the existing occupied and unoccupied heating and cooling setpoints for each level:

Equipment	Heating Occ/Unocc	Cooling Occ/Unocc
Downstairs Offices	70°F / 70°F	75°F / 75°F
Upstairs Recreation Area*	70°F / 60°F	75°F / 80°F
Well House	60°F / 60°F	NA

* Because the upstairs space is utilized by the public, the energy analysis assumes that manual setback of the thermostat will rarely occur.

There is currently no programmed schedule for the thermostat to automatically enter occupied or unoccupied mode. Building occupants manually change the thermostat setting when entering and back to the previous setting when leaving.

The lower level toilet room and kitchen exhaust fans are switch controlled.

3.5.2 Lighting Controls

Except for exit lights and emergency lighting, manual wall switches control all lights in the barn. Exterior lighting is also controlled by switches except for the rink, which is on a timer.

3.6 Plumbing Systems

Two water heaters produce domestic hot water for the facility. The lower level water heater is a 52-gallon, 4.5 kW, National water heater. The heater is located on the lower level. The upper level water heater is a 50-gallon, 3.3 kW, A.O. Smith water heater. The heater is located in the kitchen. A hot water return loop is not currently installed. Plumbing fixtures include 1.6 gallon per flush tank-type water closets; urinals; countertop and wall hung restroom sinks; kitchen sink and commercial scullery sinks. All flush valves and faucets meet the maximum water flow requirements of the adopted plumbing codes.

4.0 ENERGY CONSERVATION MEASURES

4.1 ECM-1 Lighting Fixture Modifications

The downstairs office area has 35 fixtures that utilize T-12 fluorescent lamps and one fixture that utilizes an incandescent lamp. Overall energy consumption can be reduced by utilizing more efficient T-8 fluorescent lamps and compact fluorescent lamps. Although there are a few T-8 replacement fixtures with a payback period of more than 10 years, it is recommended to replace all T-12 fixtures with T-8 fixtures to simplify the inventory of replacement lamps.

Energy savings for the downstairs office area were calculated by applying the existing and proposed fixture wattages to the estimated time of operation. The difference resulted in an annual savings of 3,500 kWh per year, or \$750 per year. Supporting calculations, including all assumptions for lighting hours and the annual energy usage for each fixture can be found in Appendix C.

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 52,500 kWh and \$11,250.

The upstairs recreation area has 6 fixtures that utilize T-12 fluorescent lamps and 30 fixtures that utilize incandescent lamps. Overall energy consumption can be reduced by utilizing more efficient T-8 fluorescent lamps and compact fluorescent lamps. Although there are a few T-8 replacement fixtures with a payback period of more than 10 years, it is recommended to replace all T-12 fixtures with T-8 fixtures to simplify the inventory of replacement lamps.

Energy savings for the upstairs recreation area were calculated by applying the existing and proposed fixture wattages to the estimated time of operation. The difference resulted in an annual savings of 2,200 kWh per year, or \$500 per year. Supporting calculations, including all assumptions for lighting hours and the annual energy usage for each fixture can be found in Appendix C.

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 33,000 kWh and \$7,500.

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

ECM-1 Lighting Fixture Modifications (Downstairs Offices)

Budgetary Cost	Annual Utility Savings			ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Propane				
\$	kW	kWh	Gallons	\$	\$	Years	Years
4,100	0	3,500	0	750	1,050	5.5	4.1

* There is a \$30 per fixture incentive for replacing T12 fixtures with T8 fixtures available through the New Jersey Smart Start program's Prescriptive Lighting Application for this ECM.

ECM-1 Lighting Fixture Modifications (Upstairs Recreation)

Budgetary Cost	Annual Utility Savings			ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)	
	Electricity		Propane					Total
\$	kW	kWh	Gallons	\$		\$	Years	Years
800	0	2,200	0	500	8.4	180	1.6	1.2

* There is a \$30 per fixture incentive for replacing T12 fixtures with T8 fixtures available through the New Jersey Smart Start program's Prescriptive Lighting Application for this ECM.

This measure is recommended.

4.2 ECM-2 Lighting Control Modifications

Manual wall switches currently control lighting throughout the facility. By equipping the following areas downstairs with motion sensors, unoccupied energy use can be greatly reduced: individual offices, restrooms, storage rooms, and mechanical areas. This ECM proposes the addition of eight wall-mounted occupancy sensors in downstairs office areas. Analysis of motion sensors for the upstairs recreation area is shown in Appendix D, but none of the areas had a viable payback period.

The weekly occupied times for each space was determined by taking into account typical traffic patterns for the proposed areas. Applying the existing and proposed operating times to the combined wattage requirements for each room's lighting fixtures, it was determined that about 1,622 kWh per year, or \$349 per year, can be saved through implementation of this ECM.

Occupancy sensors have an expected life of 15 years, according to the manufacturer, and total energy savings over the life of the project are estimated at 24,330 kWh and \$5,235.

Supporting calculations, including the proposed rooms to install occupancy sensors; assumptions for lighting hours in each space; annual energy usage for each fixture; and the type of occupancy sensor recommended is included in Appendix D. The implementation cost and savings related to this ECM are summarized below:

ECM-2 Lighting Control Modifications (Existing Fixtures)

Budgetary Cost	Annual Utility Savings			ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)	
	Electricity		Propane					Total
\$	kW	kWh	Gallons	\$		\$	Years	Years
750	0	1,600	0	350	6.0	160	2.1	1.7

* Incentive shown is per the New Jersey Smart Start Program, 2010 Lighting Controls Application. Incentive is based on the use of eight wall-mounted occupancy sensors.

ECM-2 Lighting Control Modifications (Fixtures Proposed in ECM-1)

Budgetary Cost	Annual Utility Savings			ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)	
	Electricity		Propane					Total
\$	kW	kWh	Gallons	\$		\$	Years	Years
750	0	1,200	0	250	4.0	160	3.0	2.4

* Incentive shown is per the New Jersey Smart Start Program, 2010 Lighting Controls Application. Incentive is based on the use of eight wall-mounted occupancy sensors.

This measure is recommended.

4.3 ECM-3 Modify Rooftop Unit Control

Heating and cooling in the recreation area is currently controlled by a wall mounted, heat/cool thermostat. Currently the zone is set at a temperature for either the heating or cooling season and the temperature is maintained for both occupied and unoccupied periods. By utilizing a programmable thermostat, unoccupied periods can be defined which allows for a decrease in temperature during the heating season and an increase in temperature during the cooling season during the unoccupied times.

Utilizing a programmable thermostat for the rooftop units, a potential annual savings of approximately 30 gallons of propane and 600 kWh, or \$190 can be realized.

A programmable thermostat has an expected life of 15 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 450 gallons of propane and 9,000 kWh, or \$2,850.

This ECM was analyzed by modeling both the building and the hours of operation in the Carrier Hourly Analysis Program (HAP). Using this model, unoccupied setback periods were applied to the zone. The base building was modeled at an average occupied temperature 24 hours a day, 7 days a week. Because the building has varying occupancy times, the ECM analysis is conservative. It was assumed that the occupied settings would be maintained 5 a.m. to 10 p.m. Monday through Friday and 6 a.m. to 10 p.m. Saturday and Sunday. If this occupied time frame can be reduced greater energy savings can be realized. HAP data for this ECM is located in Appendix E. Base building data is located in Appendix P.

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

ECM-3 Modify Rooftop Unit Control

Budgetary Cost	Annual Utility Savings			ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Propane				
\$	kW	kWh	Gallons	\$	\$	Years	Years
300	-	600	30	190	16.8	NA	NA

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

This measure is recommended.

4.4 ECM-4 Modify Downstairs Office HVAC Control

Heating and cooling in the downstairs office area is currently controlled by a wall mounted, heat/cool thermostat. The area has regular operating hours, which allows the use of a programmable thermostat. Currently the zone is set at a temperature for either the heating or cooling season and the temperature is maintained for both occupied and unoccupied periods. By utilizing a programmable thermostat, unoccupied periods can be defined which allows for a decrease in temperature during the heating season and an increase in temperature during the cooling season during the unoccupied times.

Utilizing a programmable thermostat in the downstairs office space, a potential annual savings of approximately 100 gallons of propane and 200 kWh, or \$200 can be realized.

A programmable thermostat has an expected life of 15 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 1,500 gallons of propane and 3,000 kWh, or \$3,000.

This ECM was analyzed by modeling both the building and the hours of operation in the Carrier Hourly Analysis Program (HAP). Using this model, unoccupied setback periods were applied to the zone between 5 pm and 9 am. HAP data for this ECM is located in Appendix F. Base building data is located in Appendix O.

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

ECM-4 Modify Downstairs Office HVAC Control

Budgetary Cost	Annual Utility Savings			ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Propane				
\$	kW	kWh	Gallons	\$	\$	Years	Years
160	-	200	100	200	17.8	NA	0.8

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

This measure is recommended.

4.5 ECM-5 Replace Downstairs Office Condensing Unit and Cooling Coil with Higher Efficiency Units

The existing condensing unit serving the downstairs office area is 15 years old, at the end of its life expectancy, and has a SEER rating of 10. By replacing the existing unit with a unit that has a SEER rating of 16, the energy consumption of the unit will be reduced by approximately 38%.

Implementation of this ECM requires the removal of the existing condensing unit, cooling coil, capture of the existing refrigerant charge, and removal of the existing line-set. In addition, a new condensing unit, cooling coil, and refrigeration line-set must be installed in place of the removed units. R-22 is in the process of being phased out of use and it is recommended that the facility take the opportunity of the equipment ending its useful life to upgrade to a newer refrigerant.

This ECM was analyzed by modeling both the building and the hours of operation in the Carrier Hourly Analysis Program (HAP). Using this model, the energy use of replacement equipment can be compared to the existing equipment with a programmable thermostat installed. HAP data for this ECM is located in Appendix G. Base building data is located in Appendix P.

The implementation cost and savings related to this ECM are located in Appendix G and summarized on the following page:

ECM-5 Replace Downstairs Office Condensing Unit and Cooling Coil with Higher Efficiency Units

Budgetary Cost	Annual Utility Savings			ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas				
\$	kW	kWh	Therms	\$	\$	Years	Years
9,200	0	400	-	80	(0.9)	300	>25

* Incentive shown is per the New Jersey Smart Start Program, 2010 Electric Unitary HVAC Application. Incentive is based on the use of 3-ton, 16 SEER compressor.

This measure does not meet the required payback. However, it is recommended that installation of a new compressor and cooling coil be considered for overall energy efficiency, because the compressor is nearing the end of its useful life, and the refrigerant R-22 is being phased out of use.

4.6 ECM-6 Convert Gas Range Pilot Lights to Electronic Ignition

In the kitchen a 12-burner propane range with standing pilot lights is currently installed. The standing pilot lights are lit at all times and a constantly consume propane. It is estimated that each standing pilot light costs approximately \$50 a year to operate, or \$600 for the entire range. By replacing the range with a unit that has electronic ignition the standing pilot lights and the constant propane drain is eliminated. Cost of a new propane fired range is approximately \$5,500.

Utilizing an electronic ignition range in lieu of a unit with standing pilot lights, a potential annual savings of approximately 360 gallons of propane, or \$600 can be realized.

A gas range has an expected life of 20 years, according to manufacturer's data, and total energy savings over the life of the project are estimated at 7,200 gallons of propane, or \$12,000.

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

ECM-6 Convert Gas Range Pilot Lights to Electronic Ignition

Budgetary Cost	Annual Utility Savings			ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Propane				
\$	kW	kWh	Gallons	\$	\$	Years	Years
6,000	-	0	360	600	1.0	NA	NA

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

This measure is recommended.

4.7 ECM-7 New Weather Stripping on Exterior Doors

Weather stripping on the exterior doors of the upper floor is damaged and missing. There are 3 exterior doors, 3'x7'. They include one set of double doors and a single door. Weather stripping prevents both heat from escaping in the winter and hot air entering in the summer. Based on the Carrier Design Manual, the infiltration difference through a weather-stripped and non-weather stripped average door is 0.29 CFM/sq. ft. Using the degree-day method annual heat loss through the non-weather stripped door is calculated in Appendix I.

Installation of weather stripping should be done as part of a normal maintenance program. Installation is a simple process and should be performed by the owner or Township maintenance staff.

Applying weather stripping to the 3 exterior doors on the upper floor, a potential annual savings of approximately 30 gallons of propane, or \$50 can be realized.

Weather stripping has a life expectancy of approximately 5 years, according to manufacturers. Total energy savings over the life of the project is approximately 150 gallons of propane, or \$250.

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

ECM-7 New Weather Stripping on Exterior Doors

Budgetary Cost	Annual Utility Savings			ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Propane				
\$	kW	kWh	Gallons	\$	\$	Years	Years
70	0	0	30	50	2.6	NA	1.4

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

This measure is recommended.

4.8 ECM-8 Replace Refrigerators and Freezers in Kitchen

The kitchen currently contains old refrigerators that are extremely inefficient compared to newer models. There are two upright refrigerators, a refrigerated display case, and a chest freezer. During the building survey, it was observed that the compressors on the upright refrigerators were running constantly. The compressor on the refrigerated display case was not running constantly, but is assumed to run approximately half of the time. The product data on the chest freezer indicates that the compressor runs a maximum of 35% of the time. Because the unit is past its life expectancy the compressor is likely less efficient, the internal insulation may be damaged, and the door seals will not seal as when new. The run time of the chest freezer's compressor is estimated at 50% of the time.

To replace the volume of the two upright refrigerators a 38 cubic foot commercial refrigerator will provide an equal amount storage space. The refrigerated display case is one of a kind and not easily replaceable. For this ECM it is proposed to replace the unit with a 38 cubic foot commercial refrigerator. After analyzing the replacement of the chest freezer with a newer model, it was determined that potential savings are insignificant. It is recommended that the freezer only be utilized when needed for events at the barn and unplugged when not in use.

Replacing the two upright refrigerators and the refrigerated display case with two commercial refrigerators will result in a potential annual savings of 4,900 kWh equaling \$1,000.

Refrigerators have a life expectancy of approximately 20 years, according to manufacturers. Total energy savings over the life of the project is approximately 98,000 kWh, or \$20,000

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

ECM-8 Replace Refrigerators and Freezers in Kitchen

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
\$	kW	kWh	Therms	\$		\$	Years	Years
7,000	0	4,900	0	1,000	1.9	NA	7.0	NA

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

This measure is recommended.

5.0 PROJECT INCENTIVES

5.1 Incentives Overview

5.1.1 New Jersey Pay For Performance Program

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

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

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

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

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

5.1.2 New Jersey Smart Start Program

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

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

5.1.3 Energy Efficient and Conservation Block Grant

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

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

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

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

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

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

5.1.4 ARRA Initiative “Energy Efficiency Programs through the Clean Energy Program”

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

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

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

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

5.2 Building Incentives

5.2.1 New Jersey Pay For Performance Program

The building is eligible for all three incentives available from the New Jersey P4P program. Incentive #1 is for the development of an energy reduction plan and will pay \$.05/ square foot of the building footprint, which equates to about \$350. Implementation of the energy conservation measures discussed in this report is expected to reduce the building's energy usage by over 15%, which qualifies it for both incentives #2 and #3. Combining incentives #2 and #3 will provide maximum savings of \$0.18/ not to exceed 50% of the total project cost. The building is projected to save about 12,600 kWh, which amounts to about \$2,300 in incentives. This reduces the overall payback of the project from 5.5 years to 4.8 years.

5.2.2 New Jersey Smart Start Program

The Andover Township Hillside Barn is eligible for multiple incentives from the New Jersey Smart Start Program.

The lighting replacement measure is eligible for \$1,200 in savings if all fixtures are replaced. An additional \$160 would be available for the installation of occupancy sensors. Totaling all these incentives would produce a savings of about \$1,360.

5.2.3 Energy Efficient and Conservation Block Grant

The Andover Township town hall building is owned by local government, which makes it eligible for this incentive. The incentive amount is determined by TRC Solutions and is not calculable at this time. Further information about this incentive, including the application, can be found at:

<http://www.njcleanenergy.com/commercial-industrial/programs/energy-efficiency-and-conservation-block-grants>

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

Based on the utility information that was provided by the borough for the hillside barn, it was determined that the building pays for the societal benefits charge. The hillside barn is not eligible for additional funding through this program.

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 primarily uses packaged rooftop units and a propane-fired furnace with cooling coil and remote condensing unit. 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. Significant site work is also required for the installation of the geothermal pipe loop.

This measure is not recommended due to the extent of HVAC system renovation needed for implementation and the additional site work.

6.2 Solar

6.2.1 Photovoltaic Rooftop Solar Power Generation

The facility was evaluated for the potential to install rooftop photovoltaic (PV) solar panels for power generation. Present technology incorporates the use of solar cell arrays that produce direct current (DC) electricity. This DC current is converted to alternating current (AC) with the use of an electrical device known as an inverter. The building's roof has sufficient room to install a large solar cell array. A structural analysis would be required to determine if the roof framing could support a cell array.

The PVWATTS solar power generation model was utilized to calculate PV power generation. The New Jersey Clean Energy Program recommends the use of the PVWATTS program to determine solar grid tied system production. Version 2 of the program was used, allowing the zip code of the Hillside Barn building to be analyzed. A fixed tilt array type was utilized to calculate energy production. The PVWATTS solar power generation model is provided in Appendix K. Additionally, further financial analysis was provided by www.solar-estimate.org. The result of this analysis is also located 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 of 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 \$689; 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 kW demand of 46.6 kW and a minimum of 36.6 kW over the previous 12 months. The monthly average over the observed 12-month period was 38.5 kW. Because the most frequent monthly demand is approximately 30 kW, a 30 kW system size was selected for the calculations. Based on local weather data, the solar energy calculator PVWATTS.org estimates that this will produce the majority of the buildings annual electricity consumption. The system costs for PV installations were derived from average installation costs for this area. It should be noted that the cost of installation is currently \$8 per watt or \$8,000 per kW of installed system. 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 – 40 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	\$	\$	\$	\$/yr	Years	Years
240,000	0	37,500	0	8,000	8,000	30,000	20,700	>25	~4

*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

Based on the above, it is recommended that a third party power purchase agreement (PPA) be considered to take advantage of the ITC, reduce the cost of the system to the township, and provide a guaranteed reduced cost of power.

6.2.2 Solar Thermal Hot Water Plant

Active solar water-heating systems for buildings use solar collectors to absorb the sun's energy to heat a fluid, either a liquid or air. The collector would then circulate the heated liquid to the normal system. If the liquid is water it may be circulated to the domestic water heater to increase the temperature further prior to entering the hot water supply system. There are also collectors that heat air which is then passed through an air to liquid heat exchanger to increase the temperature of another fluid. 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 for the Hillside Barn facility would utilize a solar circulation, domestic hot water system that pre-heats incoming water prior to entering the domestic water heater. Although this system is the both the simplest and least expensive to implement, the small amount of hot water used at the facility on an annual basis results in a payback period that greatly exceeds the useful life of the system itself. An electric water heater presently produces DHW and, therefore, this measure would save site electricity.

The selected solar water heater sizing was selected based on the downstairs office occupancy with an increase to cover some of the upstairs demand required for events. The system would be oversized the majority of the time if sized for upstairs demand because that demand only occurs approximately 75 times per year. The system was sized based on 10 office occupants using 6 gallons of hot water per person per day, 7 days per week.

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 Andover 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		Natural Gas				
\$	kW	kWh	Therms	\$	\$	Years	Years
9,300	0	3,600	0	800	800	NA	NA

* No incentive is available in New Jersey at this time.

This measure is not recommended.

6.3 Wind

Wind turbines are part of a renewable energy system that converts the kinetic energy of wind into usable mechanical and electrical energy. Small wind turbines comprise the group of turbines utilized for residential and small business applications.

The most common design for small wind turbines utilize a horizontal axis propeller that converts kinetic energy of the wind into rotary motion to drive a generator that 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 Andover Township area, the map indicates a mean annual wind speed of less than 4.5 meters per second, approximately 14 miles per hour. Most small wind turbines are not financially viable at such wind speeds. Therefore, the model indicates that a wind turbine installation may not be applicable at this location. The model was designed to provide a good indication of wind speeds at applicable locations throughout the state. Before moving forward with a small wind production project at the facility's location, a wind test tower will need to be installed at the 30 meter tower height and monitored for a year. Consideration must also be given to the effects of the turbine location on the neighbors and local ordinances.

A wind speed map is included in Appendix M.

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

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 facility does not have sufficient need for electrical generation or the ability to use most of the thermal byproduct during the winter or summer months. Thermal energy produced by the CHP plant in the

warmer months will be wasted. An absorption chiller could be installed to utilize the heat to produce chilled water; however, there is no chilled water distribution system in the building. The most viable selection for a CHP plant at this location would be a reciprocating engine natural gas-fired unit. Purchasing this system and performing modifications to the existing HVAC and electrical systems would greatly outweigh the savings over the life of the equipment.

This measure is not recommended.

6.5 Biomass Power Generation

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

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

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

The NJDEP evaluates biomass resources not identified in the RPS.

Examples of eligible facilities for a CORE incentive include:

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

* from NJOCE Website

This measure is not recommended because of noise issues, potential zoning issues, and the lack of a reliable waste stream that can be utilized.

6.6 Demand Response Curtailment

Presently, electricity is delivered by JCP&L, which receives the electricity from regional power grid RFC. PJM 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, also known as Economic Load Response, is an agreement with the PJM regional transmission organization and an approved Curtailment Service Provider (CSP) to reduce electrical demand 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 PJM 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 PJM pre-approved CSP will require a minimum of 100 kW of load reduction to participate in any curtailment program. The hillside barn had a monthly average kW demand of 38.5 kW and a maximum demand of 46.6 kW over the previous 12 months.

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

7.0 EPA PORTFOLIO MANAGER

The United State Energy 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 Hillside Barn facility is considered a moderate energy consumer per the Portfolio Manager with a Site Energy Usage Index (EUI) of 62 kBtu/ft²/year. In comparison, a site with an energy performance rating of 75 (the minimum to be eligible for ENERGY STAR) has a site EUI of 46 kBtu/ft²/year and the national average site EUI is 77 kBtu/ft²/year. The energy consumption of the building is slightly lower than the national average for buildings of similar occupancy.

If the recommended measures are implemented, ECM-1, ECM-2, ECM-3, ECM-4, ECM-6, ECM-7, and ECM-8, the facility's EUI will be reduced from 62 kBtu/ft²/year to 56 kBtu/ft²/year.

The EPA Portfolio Manager was not able to calculate an energy performance rating for this building because more than 50% of the floor area is defined as "Other" within the program. Although the Portfolio Manager does not calculate a rating for this building, we are still able to compare the building's performance with a building rated 75 and the national average for all buildings designated "Other" as follows:

Energy Performance Comparison

Performance Metrics	Evaluation Period	Comparisons	
	Baseline (Ending date 11/30/2009)	Rating of 75	National Average
Energy Intensity			
Site (kBtu/ft ²)	62	46	77
Source (kBtu/ft ²)	109	81	182
Energy Cost			
\$/year	\$13,562.99	\$10,059.22	\$16,736.38
\$/ft ² /year	\$1.94	\$1.44	\$2.39
Greenhouse Gas Emissions			
MtCO ₂ e/year	40	30	49
kgCO ₂ e/ft ² /year	6	4	7

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

The user name and password for the facility's EPA Portfolio Manager Account has been provided to Timothy B. Day, CFO/Treasurer for Andover Township.

8.0 CONCLUSIONS & RECOMMENDATIONS

The energy audit conducted by CHA at the Andover Township Hillside Barn, in the Township of Andover, New Jersey identified potential ECMs for lighting fixture upgrades and lighting fixture control modifications. Potential annual savings of \$3,490 may be realized for the recommended ECMs, with a summary of the costs, savings, and paybacks as follows:

ECM-1 Lighting Fixture Modifications (Downstairs Offices)

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Propane	Total				
\$	kW	kWh	Gallons	\$		\$	Years	Years
4,100	0	3,500	0	700	1.6	1,050	5.9	4.4

* There is a \$30 per fixture incentive for replacing T12 fixtures with T8 fixtures available through the New Jersey Smart Start program's Prescriptive Lighting Application for this ECM.

ECM-1 Lighting Fixture Modifications (Upstairs Recreation)

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Propane	Total				
\$	kW	kWh	Gallons	\$		\$	Years	Years
800	0	2,200	0	500	8.4	180	1.6	1.2

* There is a \$30 per fixture incentive for replacing T12 fixtures with T8 fixtures available through the New Jersey Smart Start program's Prescriptive Lighting Application for this ECM.

ECM-2 Lighting Control Modifications (Fixtures Proposed in ECM-1)

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Propane	Total				
\$	kW	kWh	Gallons	\$		\$	Years	Years
750	0	1,200	0	250	4.0	160	3.0	2.4

* Incentive shown is per the New Jersey Smart Start Program, 2010 Lighting Controls Application. Incentive is based on the use of eight wall-mounted occupancy sensors.

ECM-3 Modify Rooftop Unit Control

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Propane	Total				
\$	kW	kWh	Gallons	\$		\$	Years	Years
300	-	600	30	190	16.8	NA	0.8	NA

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

ECM-4 Modify Downstairs Office HVAC Control

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Propane	Total				
\$	kW	kWh	Gallons	\$		\$	Years	Years
160	-	200	100	200	17.8	NA	0.8	NA

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

ECM-6 Convert Gas Range Pilot Lights to Electronic Ignition

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Propane	Total				
\$	kW	kWh	Gallons	\$		\$	Years	Years
6,000	-	0	360	600	1.0	NA	10.0	NA

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

ECM-7 New Weather Stripping on Exterior Doors

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Propane	Total				
\$	kW	kWh	Gallons	\$		\$	Years	Years
70	0	0	30	50	2.6	NA	1.4	NA

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

ECM-8 Replace Refrigerators and Freezers in Kitchen

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Propane	Total				
\$	kW	kWh	Gallons	\$		\$	Years	Years
7,000	0	4,900	0	1,000	1.9	NA	7.0	NA

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

APPENDIX A

Utility Usage Analysis

BPU ENERGY AUDIT PROGRAM

Andover Hillside Barn

CHA Project #20997

Electricity Cost Summary: Meter #L86699265												
Period	Coustomer Charge	Demand kw	RGGI Recovery Charge	Delivery kWh	Societal Benefits kWh	System Control Charge kWh	Delivery Total	Basic Generation kWh	Non-Utility Generation kWh		Supply Total	Total
December	\$ 11.65	\$ 117.24		\$ 85.22	\$ 26.81	\$ 0.33	\$ 241.25	\$ 463.30	\$ 70.55		\$ 533.85	\$ 775.10
January	\$ 11.65	\$ 117.24		\$ 94.05	\$ 34.02	\$ 0.42	\$ 257.38	\$ 599.88	\$ 89.55		\$ 689.43	\$ 946.81
February	\$ 11.65	\$ 117.24		\$ 83.33	\$ 25.26	\$ 0.31	\$ 237.79	\$ 446.35	\$ 66.48		\$ 512.83	\$ 750.62
March	\$ 11.65	\$ 117.24		\$ 77.02	\$ 20.11	\$ 0.25	\$ 226.27	\$ 344.73	\$ 52.92		\$ 397.65	\$ 623.92
April	\$ 11.65	\$ 172.10		\$ 72.60	\$ 16.50	\$ 0.20	\$ 273.05	\$ 281.58	\$ 43.42		\$ 325.00	\$ 598.05
May	\$ 11.65	\$ 117.24	\$ 0.15	\$ 72.60	\$ 16.50	\$ 0.20	\$ 218.34	\$ 281.58	\$ 43.42		\$ 325.00	\$ 543.34
June	\$ 11.65	\$ 220.69	\$ 0.20	\$ 81.65	\$ 20.11	\$ 0.25	\$ 334.55	\$ 392.94	\$ 52.92		\$ 445.86	\$ 780.41
July	\$ 11.65	\$ 254.00	\$ 0.22	\$ 84.17	\$ 22.17	\$ 0.27	\$ 372.48	\$ 432.26	\$ 58.34		\$ 490.60	\$ 863.08
August	\$ 11.65	\$ 221.39	\$ 0.30	\$ 93.64	\$ 29.90	\$ 0.37	\$ 357.25	\$ 583.05	\$ 78.69		\$ 661.74	\$ 1,018.99
September	\$ 11.65	\$ 197.79	\$ 0.17	\$ 77.86	\$ 17.01	\$ 0.21	\$ 304.69	\$ 319.39	\$ 44.77		\$ 364.16	\$ 668.85
October	\$ 11.65	\$ 157.22	\$ 0.01	\$ 68.19	\$ 12.75	\$ 0.16	\$ 249.98	\$ 217.98	\$ 33.92		\$ 251.90	\$ 501.88
November	\$ 11.65	\$ 115.66		\$ 73.23	\$ 16.69	\$ 0.21	\$ 217.44	\$ 288.21	\$ 44.77		\$ 332.98	\$ 550.42
											\$ -	\$ -
Totals	\$ 139.80	\$ 1,925.05	\$ 1.05	\$ 963.56	\$ 257.83	\$ 3.18	\$ 3,290.47	\$ 4,651.25	\$ 679.75	\$ -	\$ 5,331.00	\$ 8,621.47

JCP&L Rate Schedule "GS Secondary, 3 phase"

BPU ENERGY AUDIT PROGRAM

Andover Hillside Barn

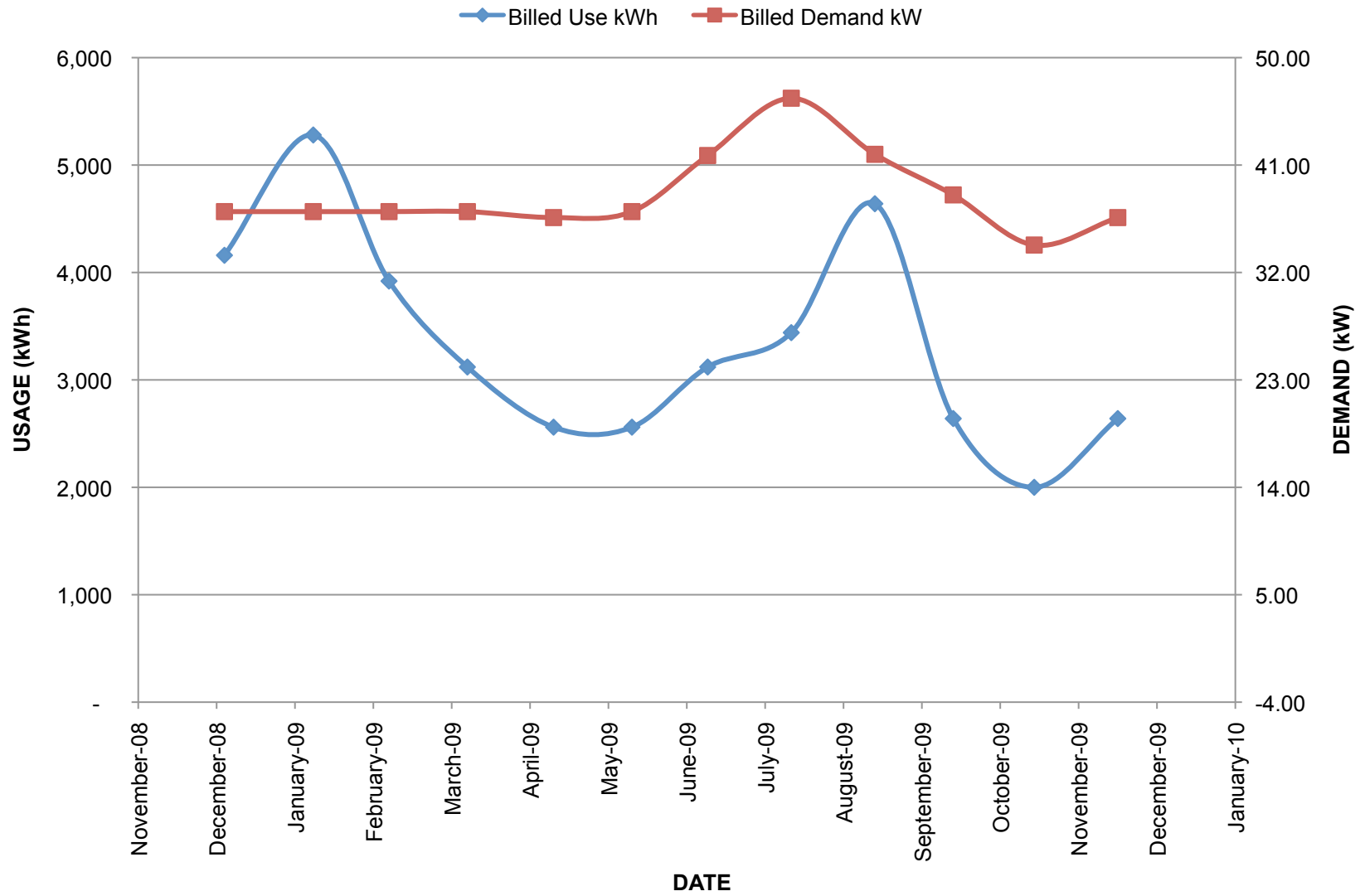
CHA Project #20997

Electricity Cost Summary: Meter #L86699265						
Period	Billed Use	Billed Demand	Total Cost	Demand Unit Cost	Supply Unit Cost	Blended Cost
	kWh	kW	\$	\$/kW	\$/kWh	\$/kWh
December-08	4,160	37.10	\$ 775.10	\$ 3.25	\$ 0.16	\$ 0.1863
January-09	5,280	37.10	\$ 946.81	\$ 3.17	\$ 0.15	\$ 0.1793
February-09	3,920	37.10	\$ 750.62	\$ 3.39	\$ 0.16	\$ 0.1915
March-09	3,120	37.10	\$ 623.92	\$ 3.18	\$ 0.16	\$ 0.2000
April-09	2,560	36.60	\$ 598.05	\$ 3.83	\$ 0.16	\$ 0.2336
May-09	2,560	37.10	\$ 543.34	\$ 4.17	\$ 0.16	\$ 0.2122
June-09	3,120	41.80	\$ 780.41	\$ 4.27	\$ 0.18	\$ 0.2501
July-09	3,440	46.60	\$ 863.08	\$ 4.55	\$ 0.17	\$ 0.2509
August-09	4,640	41.90	\$ 1,018.99	\$ 4.68	\$ 0.17	\$ 0.2196
September-09	2,640	38.50	\$ 668.85	\$ 4.26	\$ 0.17	\$ 0.2534
October-09	2,000	34.30	\$ 501.88	\$ 3.56	\$ 0.17	\$ 0.2509
November-09	2,640	36.60	\$ 550.42	\$ 3.89	\$ 0.16	\$ 0.2085
Totals	40,080	461.80	\$ 8,621.47			\$ 0.2151
Monthly Ave.	3,340	38.48	\$ 718.46	\$ 3.05	\$ 0.16	
Max. Demand		46.60				

Account Number: 10 00 02 4791 84
 Meter Number: L86699265
 Rate Schedule: GS Secondary 3 phase
 Utility Company: JCP&L

Notes: Total Billed Use kWh is the sum of each month's use in kWh.
 Total Billed Demand is the highest month's demand.
 Total Cost is sum of each month's total billing including all charges.
 (See Chart 2 "Total Column".)
 Demand Unit Cost per month is kW charges from Chart 2 divided by kW used.
 Does not include Service Charge from Chart 2.
 Supply Unit Cost per month is kWh charges from Chart 2 divided by kWh used.
 Does not include Service Charge from Chart 2
 Total Demand Unit Cost is total kW charges from chart 2 divided by total kW used.
 Total Supply Unit Cost per year total kWh charges from chart 2 divided by total kWh.
 Blended Rate per month is the Cost divided by the kWh used for that month.
 Total Blended Rate is the Total Cost divided by the Total Use for the year.

Andover Hillside Barn



Licensed Electric Generation Suppliers

(May 2010)

To sell electric generation service in New Jersey, electric power suppliers must be licensed by the New Jersey Board of Public Utilities (NJ BPU). They must also be registered with the local public utility to sell electric generation service in that utility's service area. Below is a list of suppliers who are licensed with the NJ BPU and are registered to sell electric generation service in the Jersey Central Power & Light Company service territory.

Supplier Name	Phone No.
BOC Energy Services	800-247-2644
Champion Energy Services, Inc.	281-653-5090
Commerce Energy, Inc.	800-556-8457
Con Edison Solutions, Inc.	888-686-1383
Constellation NewEnergy, Inc.	888-635-0827
Direct Energy, LLC	800-260-0300
Dominion Retail, Inc.	800-264-4754
FirstEnergy Solutions Corp.	800-977-0500
Gateway Energy Services Corp.	800-313-8333
Glacial Energy	877-569-2841
Hess Corp	800-437-7872
Integrus Energy Services, Inc.	877-763-9977
Liberty Power Holdings, LLC	866-POWER-99
Palmco Power NJ, LLC	877-726-5862
Pepco Energy Services, Inc.	800-ENERGY-9
PP&L EnergyPlus, LLC	800-281-2000
Sempra Energy Solutions	877-2SEMPRA
South Jersey Energy	800-756-3749
GDF Suez Energy Resources NA	888-644-1014
UGI Energy Services	800-427-8545

Contact the supplier directly to verify whether or not new customers are being accepted.

BPU ENERGY AUDIT PROGRAM

Andover Township Hillside Barn

CHA Project #20997

Propane Cost Summary										
Period		Quantity (Gal.)	Supply Charge	Fuel Recovery Fee	Hazmat Surcharge				Total Cost	Blended Cost \$/Quantity
January		727	\$ 902.57	\$ 3.22	\$ 5.85				\$ 911.64	\$ 1.25
February		356.1	\$ 411.51	\$ 3.22	\$ 5.85				\$ 420.58	\$ 1.18
March		955.3	\$ 1,066.59	\$ 2.95	\$ 5.85				\$ 1,075.39	\$ 1.13
April										
May										
June										
July										
August										
September		579.3	\$ 1,899.52	\$ 3.38	\$ 5.85				\$ 1,908.75	\$ 3.29
October										
November		378.1	\$ 615.92	\$ 3.39	\$ 5.85				\$ 625.16	\$ 1.65
December		474.9	\$ 808.66	\$ 3.63	\$ 5.85				\$ 818.14	\$ 1.72
Totals	\$ -	3470.7	\$ 5,704.77	\$ 19.79	\$ 35.10	\$ -	\$ -	\$ -	\$ 5,759.66	\$ 1.66

Account: 7500043310

Heating Only

Notes: **Chart 4** **Propane Cost Summary**

Only limited bills per winter months.

APPENDIX B

HVAC Equipment List

BPU ENERGY AUDIT PROGRAM
Andover Township Barn - Recreation Center and Downstair Offices
CHA Project number

[illegible]

APPENDIX C

ECM-1 Lighting Fixture Modifications

BPU ENERGY AUDIT PROGRAM
Andover Township Barn
CHA Project #20997

ECM-1 Lighting Fixture Modifications

Item	Budgetary Costs	Annual Utility Savings			Potential Incentive	Payback (Without Incentive)	Payback (With Incentive)
		Electricity	Natural Gas	Total			
	\$	KWH	Therms	\$	\$	Years	Years
A-Lamp to CFLs	\$ 300	3790	0	\$ 815	\$ -	0.4	0.4
T12 Fixtures to T8 Fixtures	\$ 5,800	1780	0	\$ 383	\$ 1,200	15.1	12.0
Combined	\$ 6,100	5570		\$ 1,198	\$ 1,200	5.1	4.1

BPU ENERGY AUDIT PROGRAM
Andover Township Barn - Downstairs Offices
CHA Project #20997

Existing Lighting Fixture Schedule										
Location	Fixture Description	No. of Fixture	Lamp Type & No.	Ballast Type & No.	Fixture Watts	Total Watts	Hours of Operation	Control	kwh/Year	Operational Cost/Year
Vestibule	2'x2' Fluorescent, (4) T8	1	(4) T8, 17W	(1) Electric	63	63	2080	Switch	131.04	\$28.19
Main Room	2'x4' Fluorescent, (4) T12	4	(4) T12, 34W	(2) Magnetic	164	656	2080	Switch	1364.48	\$293.50
Main Room	2'x4' Fluorescent, (4) T12	4	(4) T12, 34W	(2) Magnetic	164	656	2080	Switch	1364.48	\$293.50
Office	2'x4' Fluorescent, (4) T12	3	(4) T12, 34W	(2) Magnetic	164	492	2080	Switch	1023.36	\$220.12
Office	2'x4' Fluorescent, (4) T12	2	(4) T12, 34W	(2) Magnetic	164	328	2080	Switch	682.24	\$146.75
Office	2'x4' Fluorescent, (4) T12	2	(4) T12, 34W	(2) Magnetic	164	328	2080	Switch	682.24	\$146.75
Office	2'x4' Fluorescent, (4) T12	6	(4) T12, 34W	(2) Magnetic	164	984	2080	Switch	2046.72	\$440.25
Back Hall	2'x2' Fluorescent, (4) T8	3	(4) T8, 17W	(1) Electric	63	189	2080	Switch	393.12	\$84.56
Exit Signs	LED Exit Signs, 1 2W	1	LED, 1 2W	-	1 2	1 2	8760	Breaker	10.51	\$2.26
Arts & Crafts	2'x4' Fluorescent, (4) T12	6	(4) T12, 34W	(2) Magnetic	164	984	2080	Switch	2046.72	\$440.25
Arts & Crafts Closet	2'x4' Fluorescent, (4) T12	1	(4) T12, 34W	(2) Magnetic	164	164	2080	Switch	341.12	\$73.37
Men's Restroom	2'x4' Fluorescent, (4) T12	1	(4) T12, 34W	(2) Magnetic	164	164	2080	Switch	341.12	\$73.37
Hall & Men's & Women's Restrooms	2'x2' Fluorescent, (4) T8	3	(4) T8, 17W	(1) Electric	63	189	2080	Switch	393.12	\$84.56
Women's Restroom	2'x4' Fluorescent, (4) T12	1	(4) T12, 34W	(2) Magnetic	164	164	2080	Switch	341.12	\$73.37
Women's Restroom	2'x2' Fluorescent, (4) T8	2	(4) T8, 17W	(1) Electric	63	126	2080	Switch	262.08	\$56.37
Kitchen	2'x4' Fluorescent, (4) T12	2	(4) T12, 34W	(2) Magnetic	164	328	2080	Switch	682.24	\$146.75
Kitchen	4' Fluorescent Undercounter, (1) T12	1	(1) T12, 34W	(1) Magnetic	42	42	2080	Switch	87.36	\$18.79
Washer Room	2'x4' Fluorescent, (4) T12	1	(4) T12, 34W	(2) Magnetic	164	164	2080	Switch	341.12	\$73.37
Utility Room	Incandescent A Lamp	1	A-Lamp, 60W	-	60	60	130	Switch	7.80	\$1.68
Furnace Room	2'x4' Fluorescent, (2) T12	1	(2) T12, 34W	(1) Magnetic	82	82	130	Switch	10.66	\$2.29
TOTAL									12552.65	\$2,700.08

Energy Cost: \$0.2151

Notes: Existing Lighting Fixture Schedule
Total Watts = No. of Fixture x Fixture Watts
kwh/Year = Total Watts/1000 x Hours of Operation
Operational Cost/Year = kwh/Year x Energy Cost

BPU ENERGY AUDIT PROGRAM
Andover Township Barn - Recreation Center
CHA Project #20997

Existing Lighting Fixture Schedule										
Location	Fixture Description	No. of Fixture	Lamp Type & No.	Ballast Type & No.	Fixture Watts	Total Watts	Hours of Operation	Control	kwh/Year	Operational Cost/Year
Main Hall	(6) Incandescent Lamps on Wheel	2	(6) A-Lamp, 40W	-	240	480	946	Switch	454.08	\$97.67
Main Hall	(4) Energy Saving Lamps, Spiral Globe, Tables	6	(4) CFL, 54W	-	56	336	946	Switch	317.86	\$68.37
Main Hall	(1) Incandescent Spotlights	6	(1) A-Lamp, 65W	-	65	390	946	Switch	368.94	\$79.36
Main Hall	(4) Flood Lamps at Ceiling Fan	3	(4) A-Lamp, 50W	-	200	600	946	Switch	567.60	\$122.09
Main Hall	(1) Incandescent A Lamp at Bar	4	(1) A-Lamp, 60W	-	60	240	946	Switch	227.04	\$48.84
Main Hall	(1) Incandescent in Milk Barrell	6	(1) A-Lamp, 60W	-	60	360	946	Switch	340.56	\$73.25
Main Hall	LED Exit Signs	3	LED, 1 2W	-	1 2	3 6	8760	Breaker	31.54	\$6.78
Kitchen	8' Fluorescent Strip, (2) T12	2	(2) T12, 95W	(1) Magnetic	227	454	946	Switch	429.48	\$92.38
Kitchen	LED Exit Signs	1	LED, 1 2W	-	1 2	1 2	8760	Breaker	10.51	\$2.26
Men's Restroom	(1) Incandescent A Lamp	3	(1) A-Lamp, 60W	-	60	180	946	Switch	170.28	\$36.63
Men's Restroom Storage Closet	(1) Incandescent A Lamp	1	(1) A-Lamp, 60W	-	60	60	946	Switch	56.76	\$12.21
Women's Room	(1) Incandescent A Lamp	3	(1) A-Lamp, 60W	-	60	180	946	Switch	170.28	\$36.63
Loft/Maintenance Room	(1) Incandescent Globe	1	(1) A-Lamp, 40W	-	40	40	946	Switch	37.84	\$8.14
Exterior Porch	(1) Incandescent A Lamp	2	(1) A-Lamp, 60W	-	60	120	946	Switch	113.52	\$24.42
Garage	2'x4' Fluorescent, (4) T12	2	(4) T12, 34W	(2) Magnetic	164	328	946	Switch	310.29	\$66.74
Garage	1'x4' Fluorescent, (2) T12	1	(2) T12, 82W	(1) Magnetic	82	82	946	Switch	77.57	\$16.69
Garage	1'x2' Fluorescent, (3) T8	1	(3) T8, 17W	(1) Electronic	53	53	946	Switch	50.14	\$10.78
Rink	Metal Halide	8	(1) MH, 450W	(1) Magnetic	502	4016	946	Timer	3799.14	\$817.19
Flag Pole		1		-						
Well House	(1) Incandescent A Lamp	1	(1) A-Lamp, 60W	-	60	60	946	Switch	56.76	\$0.00
TOTAL									7590.18	\$1,620.44

Energy Cost: \$0.2151

Notes: Existing Lighting Fixture Schedule

Total Watts = No. of Fixture x Fixture Watts

kwh/Year = Total Watts/1000 x Hours of Operation

Operational Cost/Year = kwh/Year x Energy Cost

BPU ENERGY AUDIT PROGRAM

Andover Township Barn - Downstairs Offices

CHA Project #20997

Lighting Fixture Replacement Savings																
Existing Fixtures		Proposed Replacement Fixture										Savings				
Location	Fixture Description with System Watts	Controls	kwh/Year	Operational Cost/Year	Fixture Description	No. of Fixtures	Fixture Watts	Total Watts	Hours of Operation	kwh/Year	Operational Costs	Installed Cost Per Fixture*	Total Installed Cost	kwh/Year	Yearly \$ Savings	Payback in Years
Vestibule	2'x2' Fluorescent, (4) T8, 63W	Switch	131	\$28.19		1			2080							
Main Room	2'x4' Fluorescent, (4) T12, 164W	Switch	1364	\$293.50	2'x4' Fluorescent, (4) T8	4	114	456	2080	948	\$204.02	\$119.00	\$476.00	416	\$89.48	5.32
Main Room	2'x4' Fluorescent, (4) T12, 164W	Switch	1364	\$293.50	2'x4' Fluorescent, (4) T8	4	114	456	2080	948	\$204.02	\$119.00	\$476.00	416	\$89.48	5.32
Office	2'x4' Fluorescent, (4) T12, 164W	Switch	1023	\$220.12	2'x4' Fluorescent, (4) T8	3	114	342	2080	711	\$153.01	\$119.00	\$357.00	312	\$67.11	5.32
Office	2'x4' Fluorescent, (4) T12, 164W	Switch	682	\$146.75	2'x4' Fluorescent, (4) T8	2	114	228	2080	474	\$102.01	\$119.00	\$238.00	208	\$44.74	5.32
Office	2'x4' Fluorescent, (4) T12, 164W	Switch	682	\$146.75	2'x4' Fluorescent, (4) T8	2	114	228	2080	474	\$102.01	\$119.00	\$238.00	208	\$44.74	5.32
Office	2'x4' Fluorescent, (4) T12, 164W	Switch	2047	\$440.25	2'x4' Fluorescent, (4) T8	6	114	684	2080	1423	\$306.03	\$119.00	\$714.00	624	\$134.22	5.32
Back Hall	2'x2' Fluorescent, (4) T8, 63W	Switch	393	\$84.56		3			2080							
Exit Signs	LED Exit Signs, 1.2W	Breaker	11	\$2.26		1			8760							
Arts & Crafts	2'x4' Fluorescent, (4) T12, 164W	Switch	2047	\$440.25	2'x4' Fluorescent, (4) T8	6	114	684	2080	1423	\$306.03	\$119.00	\$714.00	624	\$134.22	5.32
Arts & Crafts Closet	2'x4' Fluorescent, (4) T12, 164W	Switch	341	\$73.37	2'x4' Fluorescent, (4) T8	1	114	114	2080	237	\$51.00	\$119.00	\$119.00	104	\$22.37	5.32
Men's Restroom	2'x4' Fluorescent, (4) T12, 164W	Switch	341	\$73.37	2'x4' Fluorescent, (4) T8	1	114	114	2080	237	\$51.00	\$119.00	\$119.00	104	\$22.37	5.32
Hall & Men's & Women's Restrooms	2'x2' Fluorescent, (4) T8, 63W	Switch	393	\$84.56		3			2080							
Women's Restroom	2'x4' Fluorescent, (4) T12, 164W	Switch	341	\$73.37	2'x4' Fluorescent, (4) T8	1	114	114	2080	237	\$51.00	\$119.00	\$119.00	104	\$22.37	5.32
Women's Restroom	2'x2' Fluorescent, (4) T8, 63W	Switch	262	\$56.37		2			2080							
Kitchen	2'x4' Fluorescent, (4) T12, 164W	Switch	682	\$146.75	2'x4' Fluorescent, (4) T8	2	114	228	2080	474	\$102.01	\$119.00	\$238.00	208	\$44.74	5.32
Kitchen	4' Fluorescent Undercounter, (1) T12, 42W	Switch	87	\$18.79	4' Fluorescent, (1) T8	1	32	32	2080	67	\$14.32	\$79.00	\$79.00	21	\$4.47	17.66
Washer Room	2'x4' Fluorescent, (4) T12, 164W	Switch	341	\$73.37	2'x4' Fluorescent, (4) T8	1	114	114	2080	237	\$51.00	\$119.00	\$119.00	104	\$22.37	5.32
Utility Room	Incandescent A Lamp, 60W	Switch	8	\$1.68	Compact Fluorescent	1	15	15	130	2	\$0.42	\$5.95	\$5.95	6	\$1.26	4.73
Furnace Room	2'x4' Fluorescent, (2) T12, 82W	Switch	11	\$2.29	2'x4' Fluorescent, (2) T8	1	62	62	130	8	\$1.73	\$89.00	\$89.00	3	\$0.56	159.14

Energy Cost: \$0.2151

*Installed cost per fixture includes \$30 per fixture incentive

Notes: Lighting Fixture Replacement Savings

Total Watts = No. of Fixture x Fixture Watts

kwh/Year = Total Watts/1000 x Hours of Operation

Operational Cost/Year = kwh/Year x Energy Cost

Total Installed Cost = Number of Fixtures x Installed Cost Per Fixture

Yearly \$ Savings = Savings kwh/Year x Energy Cost

BPU ENERGY AUDIT PROGRAM

Andover Township Barn - Recreation Center

CHA Project #20997

Lighting Fixture Replacement Savings																
Existing Fixtures		Proposed Replacement Fixture												Savings		
Location	Fixture Description with System Watts	Controls	kwh/Year	Operational Cost/Year	Fixture Description	No. of Fixtures	Fixture Watts	Total Watts	Hours of Operation	kwh/Year	Operational Costs	Installed Cost Per Fixture*	Total Installed Cost	kwh/Year	Yearly \$ Savings	Payback in Years
Main Hall	(6) Incandescent Lamps on Wheel, 240W	Switch	454	\$97.67	(6) 10W Compact Fluorescent, 60W	2	60	120	946	114	\$24.42	\$35.70	\$71.40	341	\$73.25	0.97
Main Hall	(4) Energy Saving Lamps, Spiral Globe, Tables, 56W	Switch	318	\$68.37		6			946							
Main Hall	(1) Incandescent Spotlights, 65W	Switch	369	\$79.36	(1) 20W Compact Fluorescent, 20W	6	20	120	946	114	\$24.42	\$5.95	\$35.70	255	\$54.94	0.65
Main Hall	(4) Flood Lamps at Ceiling Fan, 200W	Switch	568	\$122.09	(4) 20W Compact Fluorescent, 80W	3	80	240	946	227	\$48.84	\$23.80	\$71.40	341	\$73.25	0.97
Main Hall	(1) Incandescent A Lamp at Bar, 60W	Switch	227	\$48.84	(1) 15W Compact Fluorescent, 15W	4	15	60	946	57	\$12.21	\$5.95	\$23.80	170	\$36.63	0.65
Main Hall	(1) Incandescent in Milk Barrell, 60W	Switch	341	\$73.25	(1) 15W Compact Fluorescent, 15W	6	15	90	946	85	\$18.31	\$5.95	\$35.70	255	\$54.94	0.65
Main Hall	LED Exit Signs, 1.2W	Breaker	32	\$6.78		3			8760							
Kitchen	8' Fluorescent Strip, (2) T12, 227W	Switch	429	\$92.38	8' Fluorescent Strip, (2) T8, 110W	2	110	220	946	208	\$44.77	\$89.00	\$178.00	221	\$47.62	3.74
Kitchen	LED Exit Signs, 1.2W	Breaker	11	\$2.26		1			8760							
Men's Restroom	(1) Incandescent A Lamp, 60W	Switch	170	\$36.63	(1) 15W Compact Fluorescent, 15W	3	15.0	45	946	43	\$9.16	\$5.95	\$17.85	128	\$27.47	0.65
Men's Restroom Storage Closet	(1) Incandescent A Lamp, 60W	Switch	57	\$12.21	(1) 15W Compact Fluorescent, 15W	1	15	15	946	14	\$3.05	\$5.95	\$5.95	43	\$9.16	0.65
Women's Room	(1) Incandescent A Lamp, 60W	Switch	170	\$36.63	(1) 15W Compact Fluorescent, 15W	3	15	45	946	43	\$9.16	\$5.95	\$17.85	128	\$27.47	0.65
Loft/Maintenance Room	(1) Incandescent Globe, 40W	Switch	38	\$8.14	(1) 10W Compact Fluorescent, 10W	1	10	10	946	9	\$2.03	\$5.95	\$5.95	28	\$6.10	0.97
Exterior Porch	(1) Incandescent A Lamp, 60W	Switch	114	\$24.42	(1) 15W Compact Fluorescent, 15W	2	15	30	946	28	\$6.10	\$5.95	\$11.90	85	\$18.31	0.65
Garage	2'x4' Fluorescent, (4) T12, 164W	Switch	310	\$66.74	2'x4' Fluorescent Surface Mtd, (4) T8	2	114	228	946	216	\$46.39	\$119.00	\$238.00	95	\$20.35	11.70
Garage	1'x4' Fluorescent, (2) T12, 82W	Switch	78	\$16.69	4' Fluorescent Channel, (2) T8	1	62	62	946	59	\$12.62	\$89.00	\$89.00	19	\$4.07	21.87
Garage	1'x2' Fluorescent, (3) T8, 53W	Switch	50	\$10.78		1			946							
Rink	Metal Halide, 502W	Timer	3799	\$817.20		8			946							
Flag Pole						1										
Well House	(1) Incandescent A Lamp, 60W	Switch	57	\$12.26	(1) 15W Compact Fluorescent, 15W	1	15	15	946	14	\$3.05	\$5.95	\$5.95	43	\$9.21	0.65

Energy Cost: \$0.2151

*Installed cost per fixture includes \$30 per fixture incentive

Notes: Lighting Fixture Replacement Savings

Total Watts = No. of Fixture x Fixture Watts

kwh/Year = Total Watts/1000 x Hours of Operation

Operational Cost/Year = kwh/Year x Energy Cost

Total Installed Cost = Number of Fixtures x Installed Cost Per Fixture

Yearly \$ Savings = Savings kwh/Year x Energy Cost

BPU ENERGY AUDIT PROGRAM
Andover Township Barn
CHA Project #20997

ECM-1 Lighting Fixture Modifications
T-12 to T-8 Fixtures

Multipliers	
Material	1
Labor	1.21
Equipment	1.07

Installation Costs											
	Qty	Unit	Unit Costs			Subtotal Costs			Total Cost w/o Incentive	Incentive Available	Remarks
			Material	Labor	Equipment	Material	Labor	Equipment			
8', 2 Lamp, T-12 to T-8 Fixture	2	ea	\$70	\$49	\$0	\$140	\$119	\$0	\$259	\$60	
4', 4 Lamp, T-12 to T-8 Fixture	35	ea	\$100	\$49	\$0	\$3,500	\$2,075	\$0	\$5,575	\$1,050	
4', 2 Lamp, T-12 to T-8 Fixture	2	ea	\$70	\$49	\$0	\$140	\$119	\$0	\$259	\$60	
4', 1 Lamp, T-12 to T-8 Fixture	1	ea	\$60	\$49	\$0	\$60	\$59	\$0	\$119	\$30	

Subtotal	\$6,212
10% Contingency	\$0
10% OH	\$0
10% Profit	\$0
Total	\$6,212
Incentive	\$0
Total Cost with Incentive	\$6,212

APPENDIX D

ECM-2 Lighting Control Modifications

BPU ENERGY AUDIT PROGRAM
Andover Township Barn - Downstairs Offices
CHA Project #20997

ECM-2 Lighting Control Modifications

Item	Budgetary Costs	Annual Utility Savings			ROI	Potential Incentive	Payback (Without Incentive)	Payback (With Incentive)
		Electricity	Natural Gas	Total				
	\$	KWH	Therms	\$		\$	Years	Years
Motion Sensor Control								
Areas Indicated	\$ 750	1150	0	\$ 250	4.0	\$ 160	3.0	2.4

BPU ENERGY AUDIT PROGRAM
Andover Township Barn - Downstairs Offices
CHA Project #20997

Existing Lighting Fixture Schedule										
Location	Fixture Description	No. of Fixture	Lamp Type & No.	Ballast Type & No.	Fixture Watts	Total Watts	Hours of Operation	Control	kwh/Year	Operational Cost/Year
Vestibule	2'x2' Fluorescent, (4) T8	1	(4) T8, 17W	(1) Electric	63	63	2080	Switch	131.04	\$28.19
Main Room	2'x4' Fluorescent, (4) T12	4	(4) T12, 34W	(2) Magnetic	164	656	2080	Switch	1364.48	\$293.50
Main Room	2'x4' Fluorescent, (4) T12	4	(4) T12, 34W	(2) Magnetic	164	656	2080	Switch	1364.48	\$293.50
Office	2'x4' Fluorescent, (4) T12	3	(4) T12, 34W	(2) Magnetic	164	492	2080	Switch	1023.36	\$220.12
Office	2'x4' Fluorescent, (4) T12	2	(4) T12, 34W	(2) Magnetic	164	328	2080	Switch	682.24	\$146.75
Office	2'x4' Fluorescent, (4) T12	2	(4) T12, 34W	(2) Magnetic	164	328	2080	Switch	682.24	\$146.75
Office	2'x4' Fluorescent, (4) T12	6	(4) T12, 34W	(2) Magnetic	164	984	2080	Switch	2046.72	\$440.25
Back Hall	2'x2' Fluorescent, (4) T8	3	(4) T8, 17W	(1) Electric	63	189	2080	Switch	393.12	\$84.56
Exit Signs	LED Exit Signs, 1 2W	1	LED, 1 2W	-	1 2	1 2	8760	Breaker	10.51	\$2.26
Arts & Crafts	2'x4' Fluorescent, (4) T12	6	(4) T12, 34W	(2) Magnetic	164	984	2080	Switch	2046.72	\$440.25
Arts & Crafts Closet	2'x4' Fluorescent, (4) T12	1	(4) T12, 34W	(2) Magnetic	164	164	2080	Switch	341.12	\$73.37
Men's Restroom	2'x4' Fluorescent, (4) T12	1	(4) T12, 34W	(2) Magnetic	164	164	2080	Switch	341.12	\$73.37
Hall & Men's & Women's Restrooms	2'x2' Fluorescent, (4) T8	3	(4) T8, 17W	(1) Electric	63	189	2080	Switch	393.12	\$84.56
Women's Restroom	2'x4' Fluorescent, (4) T12	1	(4) T12, 34W	(2) Magnetic	164	164	2080	Switch	341.12	\$73.37
Women's Restroom	2'x2' Fluorescent, (4) T8	2	(4) T8, 17W	(1) Electric	63	126	2080	Switch	262.08	\$56.37
Kitchen	2'x4' Fluorescent, (4) T12	2	(4) T12, 34W	(2) Magnetic	164	328	2080	Switch	682.24	\$146.75
Kitchen	4' Fluorescent Undercounter, (1) T12	1	(1) T12, 34W	(1) Magnetic	42	42	2080	Switch	87.36	\$18.79
Washer Room	2'x4' Fluorescent, (4) T12	1	(4) T12, 34W	(2) Magnetic	164	164	2080	Switch	341.12	\$73.37
Utility Room	Incandescent A Lamp	1	A-Lamp, 60W	-	60	60	130	Switch	7.80	\$1.68
Furnace Room	2'x4' Fluorescent, (2) T12	1	(2) T12, 34W	(1) Magnetic	82	82	130	Switch	10.66	\$2.29
TOTAL									12552.65	\$2,700.08

Energy Cost: \$0.2151

Notes: Existing Lighting Fixture Schedule

Total Watts = No. of Fixture x Fixture Watts

kwh/Year = Total Watts/1000 x Hours of Operation

Operational Cost/Year = kwh/Year x Energy Cost

BPU ENERGY AUDIT PROGRAM
Andover Township Barn - Recreation Center
CHA Project #20997

Existing Lighting Fixture Schedule										
Location	Fixture Description	No. of Fixture	Lamp Type & No.	Ballast Type & No.	Fixture Watts	Total Watts	Hours of Operation	Control	kwh/Year	Operational Cost/Year
Main Hall	(6) Incandescent Lamps on Wheel	2	(6) A-Lamp, 40W	-	240	480	946	Switch	454.08	\$97.67
Main Hall	(4) Energy Saving Lamps, Spiral Globe, Tables	6	(4) CFL, 54W	-	56	336	946	Switch	317.86	\$68.37
Main Hall	(1) Incandescent Spotlights	6	(1) A-Lamp, 65W	-	65	390	946	Switch	368.94	\$79.36
Main Hall	(4) Flood Lamps at Ceiling Fan	3	(4) A-Lamp, 50W	-	200	600	946	Switch	567.60	\$122.09
Main Hall	(1) Incandescent A Lamp at Bar	4	(1) A-Lamp, 60W	-	60	240	946	Switch	227.04	\$48.84
Main Hall	(1) Incandescent in Milk Barrell	6	(1) A-Lamp, 60W	-	60	360	946	Switch	340.56	\$73.25
Main Hall	LED Exit Signs	3	LED, 1 2W	-	1 2	3 6	8760	Breaker	31 54	\$6 78
Kitchen	8' Fluorescent Strip, (2) T12	2	(2) T12, 95W	(1) Magnetic	227	454	946	Switch	429.48	\$92.38
Kitchen	LED Exit Signs	1	LED, 1 2W	-	1 2	1 2	8760	Breaker	10 51	\$2 26
Men's Restroom	(1) Incandescent A Lamp	3	(1) A-Lamp, 60W	-	60	180	946	Switch	170.28	\$36.63
Men's Restroom Storage Closet	(1) Incandescent A Lamp	1	(1) A-Lamp, 60W	-	60	60	946	Switch	56.76	\$12.21
Women's Room	(1) Incandescent A Lamp	3	(1) A-Lamp, 60W	-	60	180	946	Switch	170.28	\$36.63
Loft/Maintenance Room	(1) Incandescent Globe	1	(1) A-Lamp, 40W	-	40	40	946	Switch	37.84	\$8.14
Exterior Porch	(1) Incandescent A Lamp	2	(1) A-Lamp, 60W	-	60	120	946	Switch	113.52	\$24.42
Garage	2'x4' Fluorescent, (4) T12	2	(4) T12, 34W	(2) Magnetic	164	328	946	Switch	310.29	\$66.74
Garage	1'x4' Fluorescent, (2) T12	1	(2) T12, 82W	(1) Magnetic	82	82	946	Switch	77.57	\$16.69
Garage	1'x2' Fluorescent, (3) T8	1	(3) T8, 17W	(1) Electronic	53	53	946	Switch	50.14	\$10.78
Rink	Metal Halide	8	(1) MH, 450W	(1) Magnetic	502	4016	946	Timer	3799.14	\$817.19
Flag Pole		1		-					0.00	\$0.00
Well House	(1) Incandescent A Lamp	1	(1) A-Lamp, 60W	-	60	60	946	Switch	56.76	\$0.00
TOTAL									7590.18	\$1,620.44

Energy Cost: \$0.2151

Notes: Existing Lighting Fixture Schedule

Total Watts = No. of Fixture x Fixture Watts

kwh/Year = Total Watts/1000 x Hours of Operation

Operational Cost/Year = kwh/Year x Energy Cost

BPU ENERGY AUDIT PROGRAM
Andover Township Barn
CHA Project #20997

ECM-2 Lighting Control Modifications

Multipliers	
Material	0.98
Labor	1.21
Equipment	1.07

Installation Costs											
	Qty	Unit	Unit Costs			Subtotal Costs			Total Cost w/o Incentive	Incentive Available	Remarks
			Material	Labor	Equipment	Material	Labor	Equipment			
Motion Sensor (Wall Mounted)	8	ea	25	50		196	484	-	680	20	

Subtotal	680
10% Contingency	68
10% OH	75
10% Profit	82
Total	905
Incentive	20
Total Cost with Incentive	885

**BPJ ENERGY AUDIT PROGRAM
Andover Township Barn - Downstairs Offices
CHA Project #20997**

Existing Lighting Fixture Controls (Existing Fixtures)									Proposed Lighting Fixture Controls					Savings After Retrofit	
Location	Fixture Description	No. of Fixtures	Lamp Type & No.	Total Watts	Hours of Operation	Control	kwh/Year	Operational Cost/Year	Modified Control	New Hours of Operation	kwh/Year	Operational Cost/Year	Installation Cost*	Cost Savings/Year	Payback in Years
Vestibule	2x2' Fluorescent, (4) T8	1	(4) T8, 17W	63	2080	Switch	131	\$28.19							
Main Room	2x4' Fluorescent, (4) T12	4	(4) T12, 34W	656	2080	Switch	1364	\$293.50							
Main Room	2x4' Fluorescent, (4) T12	4	(4) T12, 34W	656	2080	Switch	1364	\$293.50							
Office	2x4' Fluorescent, (4) T12	3	(4) T12, 34W	402	2080	Switch	1023	\$220.12	Motion Sensor	1560	768	\$165.09	\$93.14	\$55.03	1.7
Office	2x4' Fluorescent, (4) T12	2	(4) T12, 34W	328	2080	Switch	682	\$146.75	Motion Sensor	1560	512	\$110.06	\$93.14	\$36.69	2.5
Office	2x4' Fluorescent, (4) T12	2	(4) T12, 34W	328	2080	Switch	682	\$146.75	Motion Sensor	1560	512	\$110.06	\$93.14	\$36.69	2.5
Office	2x4' Fluorescent, (4) T12	6	(4) T12, 34W	984	2080	Switch	2047	\$440.25	Motion Sensor	1560	1535	\$338.19	\$93.14	\$110.06	0.8
Back Hall	2x2' Fluorescent, (4) T8	3	(4) T8, 17W	189	2080	Switch	393	\$84.56							
Exit Signs	LED Exit Signs, 1.2W	1	LED, 1.2W	1.2	8760	Breaker	11	\$2.26							
Arts & Crafts	2x4' Fluorescent, (4) T12	6	(4) T12, 34W	984	2080	Switch	2047	\$440.25							
Arts & Crafts Closet	2x4' Fluorescent, (4) T12	1	(4) T12, 34W	164	2080	Switch	341	\$73.37							
Men's Restroom	2x4' Fluorescent, (4) T12	1	(4) T12, 34W	164	2080	Switch	341	\$73.37	Motion Sensor	1560	256	\$55.03	\$93.14	\$18.34	5.1
Hall & Men's & Women's Restrooms	2x2' Fluorescent, (4) T8	3	(4) T8, 17W	189	2080	Switch	393	\$84.56							
Women's Restroom	2x4' Fluorescent, (4) T12	1	(4) T12, 34W	164	2080	Switch	341	\$73.37	Motion Sensor	1560	256	\$55.03	\$46.57	\$18.34	2.5
Women's Restroom	2x2' Fluorescent, (4) T8	2	(4) T8, 17W	126	2080	Switch	262	\$56.37	Motion Sensor	1560	197	\$42.28	\$46.57	\$14.09	3.3
Kitchen	2x4' Fluorescent, (4) T12	2	(4) T12, 34W	328	2080	Switch	682	\$146.75	Motion Sensor	1560	512	\$110.06	\$46.57	\$36.69	1.3
Kitchen	4' Fluorescent Undercounter, (1) T12	1	(1) T12, 34W	42	2080	Switch	87	\$18.79	Motion Sensor	1560	66	\$14.09	\$46.57	\$4.70	9.9
Washer Room	2x4' Fluorescent, (4) T12	1	(4) T12, 34W	164	2080	Switch	341	\$73.37	Motion Sensor	1560	256	\$55.03	\$93.14	\$18.34	5.1
Utility Room	Incandescent A-Lamp	1	A-Lamp, 60W	60	130	Switch	8	\$1.68							
Furnace Room	2x4' Fluorescent, (2) T12	1	(2) T12, 34W	82	130	Switch	11	\$2.29							

Energy Cost: \$0.2151

*Installation costs do not include potential incentive.

Notes: **Lighting Control Modifications**

Total Watts = No. of Fixture x Fixture Watts

kwh/Year = Total Watts/1000 x Hours of Operation

Operational Cost/Year = kwh/Year x Energy Cost

Motions Sensors with 10 Years or Less Payback			
kwh Savings/Year	Installation Cost	Cost Savings/Year	Payback in Years
1622	\$745.12	\$348.98	2.1

BPU ENERGY AUDIT PROGRAM
Andover Township Barn - Recreation Center
CHA Project #20997

Existing Lighting Fixture Controls (Existing Fixtures)									Proposed Lighting Fixture Controls					Savings After Retrofit	
Location	Fixture Description	No. of Fixtures	Lamp Type & No.	Total Watts	Hours of Operation	Control	kwh/Year	Operational Cost/Year	Modified Control	New Hours of Operation	kwh/Year	Operational Cost/Year	Installation Cost*	Cost Savings/Year	Payback in Years
Main Hall	(6) Incandescent Lamps on Wheel	2	(6) A-Lamp, 40W	480	946	Switch	454	\$97.67							
Main Hall	(4) Energy Saving Lamps, Sural Globe, Tables	6	(4) CFL, 54W	336	946	Switch	318	\$68.37							
Main Hall	(1) Incandescent Spotlight	6	(1) A-Lamp, 65W	390	946	Switch	369	\$79.36							
Main Hall	(4) Flood Lamps at Ceiling Fan	3	(4) A-Lamp, 50W	600	946	Switch	568	\$122.09							
Main Hall	(1) Incandescent A Lamp at Bar	4	(1) A-Lamp, 60W	240	946	Switch	227	\$48.84							
Main Hall	(1) Incandescent in Milk Barrell	6	(1) A-Lamp, 60W	360	946	Switch	341	\$73.25							
Main Hall	LED Exit Signs	3	LED, 1.2W	3.6	8760	Breaker	32	\$6.78							
Kitchen	8' Fluorescent Strip, (2) T12	2	(2) T12, 95W	454	946	Switch	429	\$92.38							
Kitchen	LED Exit Signs	1	LED, 1.2W	1.2	8760	Breaker	11	\$2.26							
Men's Restroom	(1) Incandescent A Lamp	3	(1) A-Lamp, 60W	180	946	Switch	170	\$36.63	Motion Sensor	710	128	\$27.47	\$93.14	\$9.16	10.2
Men's Restroom Storage Closet	(1) Incandescent A Lamp	1	(1) A-Lamp, 60W	60	946	Switch	57	\$12.21							
Women's Room	(1) Incandescent A Lamp	3	(1) A-Lamp, 60W	180	946	Switch	170	\$36.63	Motion Sensor	710	128	\$27.47	\$93.14	\$9.16	10.2
Loft/Maintenance Room	(1) Incandescent Globe	1	(1) A-Lamp, 40W	40	946	Switch	38	\$8.14							
Exterior Porch	(1) Incandescent A Lamp	2	(1) A-Lamp, 60W	120	946	Switch	114	\$24.42							
Garage	2x4' Fluorescent, (4) T12	2	(4) T12, 34W	328	946	Switch	310	\$66.74							
Garage	1x4' Fluorescent, (2) T12	1	(2) T12, 82W	82	946	Switch	78	\$16.69							
Garage	1x2' Fluorescent, (3) T8	1	(3) T8, 17W	51	946	Switch	50	\$10.78							
Bank	Metal Halide	8	(1) MH, 450W	4016	946	Timer	3799	\$817.19							
Flag Pole		1													
Well House	(1) Incandescent A Lamp	1	(1) A-Lamp, 60W	60	946	Switch	57	\$12.26	Motion Sensor	\$473.00	28	\$6.10	\$93.14	\$6.16	15.1

Energy Cost: \$0.2151

*Installation costs do not include potential incentive.

Notes: **Lighting Control Modifications**

Total Watts = No. of Fixture x Fixture Watts

kwh/Year = Total Watts/1000 x Hours of Operation

Operational Cost/Year = kwh/Year x Energy Cost

Motions Sensors with 10 Years or Less Payback			
kwh Savings/Year	Installation Cost	Cost Savings/Year	Payback in Years
-	-	-	-

BPJ ENERGY AUDIT PROGRAM
Andover Township Barn - Downstairs Offices
CHA Project #20997

Existing Lighting Fixture Controls (Fixtures Proposed in ECM-1)									Proposed Lighting Fixture Controls					Savings After Retrofit	
Location	Fixture Description	No. of Fixtures	Lamp Type & No.	Total Watts	Hours of Operation	Control	kwh/Year	Operational Cost/Year	Modified Control	New Hours of Operation	kwh/Year	Operational Cost/Year	Installation Cost*	Cost Savings/Year	Payback in Years
Vestibule	2'x2' Fluorescent, (4) T8	1	(4) T8, 17W	63	2080	Switch	131	\$28.19							
Main Room	2'x4' Fluorescent, (4) T8	4	(4) T8, 32W	456	2080	Switch	948	\$204.02							
Main Room	2'x4' Fluorescent, (4) T8	4	(4) T8, 32W	456	2080	Switch	948	\$204.02							
Office	2'x4' Fluorescent, (4) T8	3	(4) T8, 32W	342	2080	Switch	711	\$153.01	Motion Sensor	1560	334	\$114.76	\$93.14	\$38.25	2.4
Office	2'x4' Fluorescent, (4) T8	2	(4) T8, 32W	228	2080	Switch	474	\$102.01	Motion Sensor	1560	356	\$76.51	\$93.14	\$25.50	3.7
Office	2'x4' Fluorescent, (4) T8	2	(4) T8, 32W	228	2080	Switch	474	\$102.01	Motion Sensor	1560	356	\$76.51	\$93.14	\$25.50	3.7
Office	2'x4' Fluorescent, (4) T8	6	(4) T8, 32W	684	2080	Switch	1423	\$306.03	Motion Sensor	1560	1067	\$229.52	\$93.14	\$76.51	1.2
Back Hall	2'x2' Fluorescent, (4) T8	3	(4) T8, 17W	189	2080	Switch	393	\$84.56							
Exit Signs	LED Exit Signs, 1.2W	1	LED, 1.2W	1.2	8760	Breaker	11	\$2.26							
Arts & Crafts	2'x4' Fluorescent, (4) T8	6	(4) T8, 32W	684	2080	Switch	1423	\$306.03							
Arts & Crafts Closet	2'x4' Fluorescent, (4) T8	1	(4) T8, 32W	114	2080	Switch	237	\$51.00							
Men's Restroom	2'x4' Fluorescent, (4) T8	1	(4) T8, 32W	114	2080	Switch	237	\$51.00	Motion Sensor	1560	178	\$38.25	\$93.14	\$12.75	7.3
Hall & Men's & Women's Restrooms	2'x2' Fluorescent, (4) T8	3	(4) T8, 17W	189	2080	Switch	393	\$84.56							
Women's Restroom	2'x4' Fluorescent, (4) T8	1	(4) T8, 32W	114	2080	Switch	237	\$51.00	Motion Sensor	1560	178	\$38.25	\$46.57	\$12.75	3.7
Women's Restroom	2'x2' Fluorescent, (4) T8	2	(4) T8, 17W	126	2080	Switch	262	\$56.37	Motion Sensor	1560	197	\$42.28	\$46.57	\$14.09	3.3
Kitchen	2'x4' Fluorescent, (4) T8	2	(4) T8, 32W	228	2080	Switch	474	\$102.01	Motion Sensor	1560	356	\$76.51	\$46.57	\$25.50	1.8
Kitchen	4' Fluorescent, (1) T8	1	(1) T8, 32W	32	2080	Switch	67	\$14.32	Motion Sensor	1560	50	\$10.74	\$46.57	\$3.58	13.0
Washer Room	2'x4' Fluorescent, (4) T8	1	(4) T8, 32W	114	2080	Switch	237	\$51.00	Motion Sensor	1560	178	\$38.25	\$93.14	\$12.75	7.3
Utility Room	Compact Fluorescent	1	CFL, 15W	15	130	Switch	2	\$0.42							
Furnace Room	2'x4' Fluorescent, (2) T8	1	(2) T8, 32W	62	130	Switch	8	\$1.73							

Energy Cost: \$0.2151

*Installation costs do not include potential incentive.

Notes: **Lighting Control Modifications**

Total Watts = No. of Fixture x Fixture Watts

kwh/Year = Total Watts/1000 x Hours of Operation

Operational Cost/Year = kwh/Year x Energy Cost

Motions Sensors with 10 Years or Less Payback			
kwh Savings/Year	Installation Cost	Cost Savings/Year	Payback in Years
1149	\$745.12	\$247.19	3.0

**BPU ENERGY AUDIT PROGRAM
Andover Township Barn - Recreation Center
CHA Project #20997**

Existing Lighting Fixture Controls (Fixtures Proposed in ECM-1)									Proposed Lighting Fixture Controls					Savings After Retrofit	
Location	Fixture Description	No. of Fixtures	Lamp Type & No.	Total Watts	Hours of Operation	Control	kwh/Year	Operational Cost/Year	Modified Control	New Hours of Operation	kwh/Year	Operational Cost/Year	Installation Cost*	Cost Savings/Year	Payback in Years
Main Hall	(6) 10W Compact Fluorescent, 60W	2	(6) CFL, 10W	120	946	Switch	114	\$24.42							
Main Hall	(4) Energy Saving Lamps, Smaul Globe, Tables	6	(4) CFL, 54W	336	946	Switch	318	\$68.37							
Main Hall	(1) 20W Compact Fluorescent, 20W	6	(1) CFL, 20W	120	946	Switch	114	\$24.42							
Main Hall	(4) 20W Compact Fluorescent, 80W	3	(4) CFL, 20W	240	946	Switch	227	\$48.84							
Main Hall	(1) 15W Compact Fluorescent, 15W	4	(1) CFL, 15W	60	946	Switch	57	\$12.21							
Main Hall	(1) 15W Compact Fluorescent, 15W	6	(1) CFL, 15W	90	946	Switch	85	\$18.31							
Main Hall	LED Exit Signs	3	LED, 1.2W	3.6	8760	Breaker	32	\$6.78							
Kitchen	8" Fluorescent Strip, (2) T8, 110W	2	(2) T8, 59W	220	946	Switch	208	\$44.77							
Kitchen	LED Exit Signs	1	LED, 1.2W	1.2	8760	Breaker	11	\$2.26							
Men's Restroom	(1) 15W Compact Fluorescent, 15W	3	(1) CFL, 15W	45	946	Switch	43	\$9.16	Motion Sensor	710	32	\$6.87	\$93.14	\$2.29	40.7
Men's Restroom Storage Closet	(1) 15W Compact Fluorescent, 15W	1	(1) CFL, 15W	15	946	Switch	14	\$3.05							
Women's Room	(1) 15W Compact Fluorescent, 15W	3	(1) CFL, 15W	45	946	Switch	43	\$9.16	Motion Sensor	710	32	\$6.87	\$93.14	\$2.29	40.7
Loft/Maintenance Room	(1) 10W Compact Fluorescent, 10W	1	(1) CFL, 10W	10	946	Switch	9	\$2.03							
Exterior Porch	(1) 15W Compact Fluorescent, 15W	2	(1) CFL, 15W	30	946	Switch	28	\$6.10							
Garage	2x4" Fluorescent Surface Mtd, (4) T8	2	(4) T8, 32W	228	946	Switch	216	\$46.39							
Garage	4" Fluorescent Chandel, (2) T8	1	(2) T8, 32W	62	946	Switch	59	\$12.62							
Garage	1x2" Fluorescent, (3) T8	1	(3) T8, 17W	51	946	Switch	50	\$10.78							
Bank	Metal Halide	8	(1) MH, 450W	4016	946	Timer	3799	\$817.19							
Flag Pole		1													
Well House	(1) 15W Compact Fluorescent, 15W	1	(1) CFL, 15W	15	946	Switch	14	\$3.05	Motion Sensor	710	11	\$2.29	\$93.14	\$0.76	122.1

Energy Cost: \$0.2151

*Installation costs do not include potential incentive.

Notes: **Lighting Control Modifications**

Total Watts = No. of Fixture x Fixture Watts
kwh/Year = Total Watts/1000 x Hours of Operation
Operational Cost/Year = kwh/Year x Energy Cost

Motions Sensors with 10 Years or Less Payback			
kwh Savings/Year	Installation Cost	Cost Savings/Year	Payback in Years
-	-	-	-

APPENDIX E

ECM-3 Modify Rooftop Unit Control

BPU ENERGY AUDIT PROGRAM
Andover Township Hillside Barn
CHA Project #20997

ECM-3 Modify Rooftop Unit Control

Multipliers	
Material	0.98
Labor	1.21
Equipment	1.07

Installation Costs										
	Qty	Unit	Unit Costs			Subtotal Costs			Total Cost	Remarks
			Material	Labor	Equipment	Material	Labor	Equipment		
Programmable Thermostat	2	ea	\$75	\$50		\$147	\$121	\$0	\$268	

Subtotal	\$268
10% OH, 10% Profit	\$27
10% Contingency	\$27
Total	\$322

BPU ENERGY AUDIT PROGRAM
Andover Township Hillside Barn
CHA Project #20997

ECM-3 Modify Rooftop Unit Control

Annual Energy Use Comparison			
	Electricity kWh	Propane gallons	Cost \$
Existing Manual Thermostat Control	27,422	1,890	\$ 9,036.00
Proposed Programmable Thermostat	26,784	1,861	\$ 8,850.00
Difference	638	29	\$ 186.00

ECM_1_NightSB Input Data

Project Name: Hillside Barn
Prepared by: Kitchen and Associates

05/27/2010
07:03PM

1. General Details:

Air System Name ECM_1_NightSB
Equipment Type Packaged Rooftop Units
Air System Type Single Zone CAV
Number of zones 1

2. System Components:

Ventilation Air Data:

Airflow Control Constant Ventilation Airflow
Ventilation Sizing Method Sum of Space OA Airflows
Unocc. Damper Position Closed
Damper Leak Rate 0 %
Outdoor Air CO2 Level 400 ppm

Central Cooling Data:

Supply Air Temperature 58.0 °F
Coil Bypass Factor 0.100
Cooling Source Air-Cooled DX
Schedule JFMAMJJASOND
Capacity Control Cycled or Staged Capacity - Fan On

Central Heating Data:

Supply Temperature 100.0 °F
Heating Source Combustion - Propane
Schedule JFMAMJJASOND
Capacity Control Cycled or Staged Capacity - Fan On

Supply Fan Data:

Fan Type Forward Curved
Configuration Draw-thru
Fan Performance 2.5 BHP

Duct System Data:

Supply Duct Data:

Duct Heat Gain 0 %
Duct Leakage 0 %

Return Duct or Plenum Data:

Return Air Via Ducted Return

3. Zone Components:

Space Assignments:

Zone 1: BLD1-F001-Z01	
ECM_1_NightSB_FL1	x1

Thermostats and Zone Data:

Zone All
Cooling T-stat: Occ. 75.0 °F
Cooling T-stat: Unocc. 85.0 °F
Heating T-stat: Occ. 70.0 °F
Heating T-stat: Unocc. 60.0 °F
T-stat Throttling Range 1.50 °F
Diversity Factor 100 %
Direct Exhaust Airflow 0.0 CFM
Direct Exhaust Fan kW 0.0 kW

Thermostat Schedule 90.1 Assembly HVAC
Unoccupied Cooling is Available

Supply Terminals Data:

Zone All
Terminal Type Diffuser
Minimum Airflow 0.00 CFM/person

Zone Heating Units:

Zone All
Zone Heating Unit Type None

Zone Unit Heat Source Electric Resistance
Zone Heating Unit Schedule JFMAMJJASOND

ECM_1_NightSB Input Data

Project Name: Hillside Barn
Prepared by: Kitchen and Associates

05/27/2010
07:03PM

4. Sizing Data (Computer-Generated):

System Sizing Data:

Cooling Supply Temperature 58.0 °F
Supply Fan Airflow 7112.1 CFM
Ventilation Airflow 1800.0 CFM
Heating Supply Temperature 100.0 °F

Hydronic Sizing Specifications:

Chilled Water Delta-T 10.0 °F
Hot Water Delta-T 20.0 °F

Safety Factors:

Cooling Sensible 0 %
Cooling Latent 0 %
Heating 0 %

Zone Sizing Data:

Zone Airflow Sizing Method Sum of space airflow rates
Space Airflow Sizing Method Individual peak space loads

Zone	Supply Airflow (CFM)	Zone Htg Unit (MBH)	Reheat Coil (MBH)	- (CFM)
1	7112.1	-	-	

5. Equipment Data

Central Cooling Unit - Air-Cooled DX

Estimated Maximum Load 291.1 MBH
Design OAT 95.0 °F
Equipment Sizing User-Defined
Gross Cooling Capacity 208.0 MBH
ARI Performance Rating 11.00 EER
Conventional Cutoff OAT 55.0 °F
Low Temperature Operation Used
Low Temperature Cutoff OAT 15.0 °F

Central Heating Unit - Combustion

Estimated Maximum Load 162.6 MBH
Equipment Sizing User-Defined
Gross Heating Capacity 350.0 MBH
Average Efficiency 80.1 %
Misc. Electric 0.000 kW

Billing Details - Electric - ECM_1_NightSB

Hillside Barn
Kitchen and Associates

05/27/2010
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1. Component Charges

Billing Period	Energy Charges (\$)	Demand Charges (\$)	Customer Charges (\$)	Taxes (\$)	Total Charge (\$)
Jan	829	0	0	0	829
Feb	772	0	0	0	772
Mar	890	0	0	0	890
Apr	909	0	0	0	909
May	1,117	0	0	0	1,117
Jun	1,402	0	0	0	1,402
Jul	1,669	0	0	0	1,669
Aug	1,625	0	0	0	1,625
Sep	1,259	0	0	0	1,259
Oct	1,015	0	0	0	1,015
Nov	864	0	0	0	864
Dec	879	0	0	0	879
Totals	13,229	0	0	0	13,229

2. Totals

Billing Period	Total Charges (\$)	Total Consumption (kWh)	Avg Price (\$/kWh)
Jan	829	3,854	0.2151
Feb	772	3,591	0.2151
Mar	890	4,137	0.2151
Apr	909	4,227	0.2151
May	1,117	5,192	0.2151
Jun	1,402	6,517	0.2151
Jul	1,669	7,760	0.2151
Aug	1,625	7,554	0.2151
Sep	1,259	5,851	0.2151
Oct	1,015	4,720	0.2151
Nov	864	4,015	0.2151
Dec	879	4,085	0.2151
Totals	13,229	61,502	0.2151

3. Consumption Totals

Billing Period	Peak (kWh)	Mid-Peak (kWh)	Normal Peak (kWh)	Off-Peak (kWh)	Overall (kWh)
Jan	0	0	0	0	3,854
Feb	0	0	0	0	3,591
Mar	0	0	0	0	4,137
Apr	0	0	0	0	4,227
May	0	0	0	0	5,192
Jun	0	0	0	0	6,517
Jul	0	0	0	0	7,760
Aug	0	0	0	0	7,554
Sep	0	0	0	0	5,851
Oct	0	0	0	0	4,720
Nov	0	0	0	0	4,015
Dec	0	0	0	0	4,085
Totals	0	0	0	0	61,502

Billing Details - Electric - ECM_1_NightSB

Hillside Barn
Kitchen and Associates

05/27/2010
07:03PM

4. Billing Demands

Billing Period	Peak (kW)	Mid-Peak (kW)	Normal Peak (kW)	Off-Peak (kW)	Overall (kW)
Jan	0.0	0.0	0.0	0.0	12.6
Feb	0.0	0.0	0.0	0.0	13.7
Mar	0.0	0.0	0.0	0.0	17.7
Apr	0.0	0.0	0.0	0.0	22.1
May	0.0	0.0	0.0	0.0	29.0
Jun	0.0	0.0	0.0	0.0	28.3
Jul	0.0	0.0	0.0	0.0	29.5
Aug	0.0	0.0	0.0	0.0	28.2
Sep	0.0	0.0	0.0	0.0	25.7
Oct	0.0	0.0	0.0	0.0	25.3
Nov	0.0	0.0	0.0	0.0	17.1
Dec	0.0	0.0	0.0	0.0	15.4

5. Maximum Demands

Billing Period	Peak (kW)	Mid-Peak (kW)	Normal Peak (kW)	Off-Peak (kW)	Overall (kW)
Jan	0.0	0.0	0.0	0.0	12.6
Feb	0.0	0.0	0.0	0.0	13.7
Mar	0.0	0.0	0.0	0.0	17.7
Apr	0.0	0.0	0.0	0.0	22.1
May	0.0	0.0	0.0	0.0	29.0
Jun	0.0	0.0	0.0	0.0	28.3
Jul	0.0	0.0	0.0	0.0	29.5
Aug	0.0	0.0	0.0	0.0	28.2
Sep	0.0	0.0	0.0	0.0	25.7
Oct	0.0	0.0	0.0	0.0	25.3
Nov	0.0	0.0	0.0	0.0	17.1
Dec	0.0	0.0	0.0	0.0	15.4

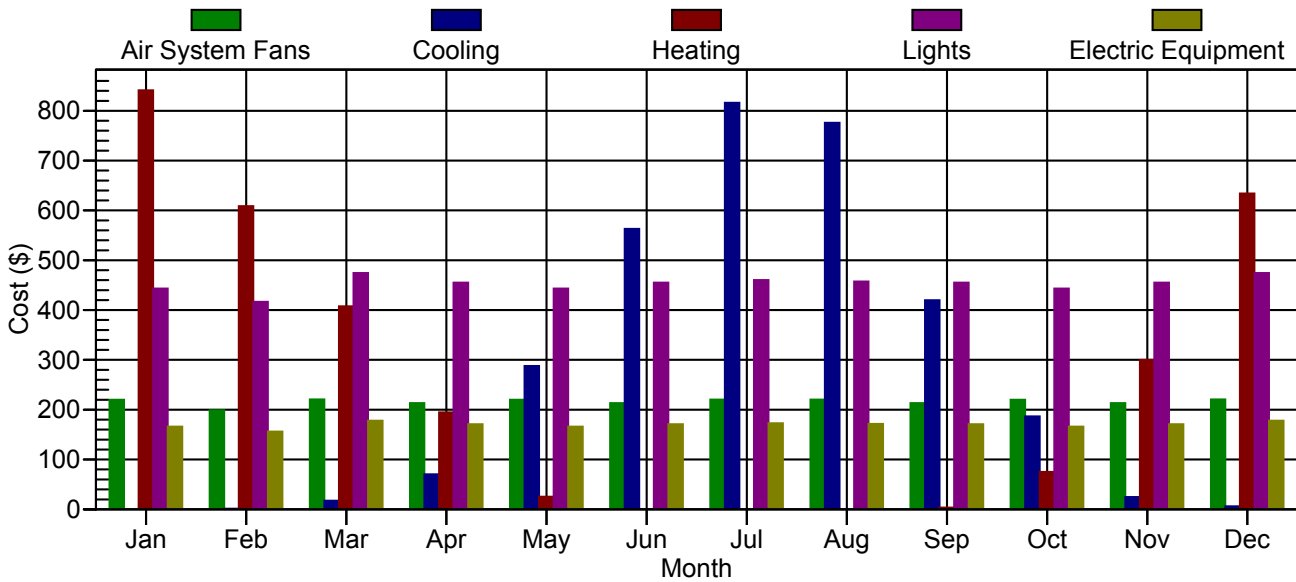
6. Time Of Maximum Demands

Billing Period	Peak (m/d/h)	Mid-Peak (m/d/h)	Normal Peak (m/d/h)	Off-Peak (m/d/h)	Overall (m/d/h)
Jan	n/a	n/a	n/a	n/a	1/1/0800
Feb	n/a	n/a	n/a	n/a	2/12/1600
Mar	n/a	n/a	n/a	n/a	3/5/1600
Apr	n/a	n/a	n/a	n/a	4/19/1600
May	n/a	n/a	n/a	n/a	5/17/1500
Jun	n/a	n/a	n/a	n/a	6/11/1500
Jul	n/a	n/a	n/a	n/a	7/1/1500
Aug	n/a	n/a	n/a	n/a	8/30/1400
Sep	n/a	n/a	n/a	n/a	9/20/1500
Oct	n/a	n/a	n/a	n/a	10/1/1500
Nov	n/a	n/a	n/a	n/a	11/3/1600
Dec	n/a	n/a	n/a	n/a	12/2/1500

Monthly Component Costs - ECM_1_NightSB

Hillside Barn
Kitchen and Associates

05/27/2010
07:03PM



1. HVAC Component Costs

Month	Air System Fans (\$)	Cooling (\$)	Heating (\$)	Pumps (\$)	Cooling Towers (\$)	HVAC Total (\$)
January	220	0	841	0	0	1,061
February	199	1	609	0	0	809
March	221	17	408	0	0	646
April	213	70	194	0	0	477
May	220	288	25	0	0	533
June	213	563	0	0	0	776
July	220	816	0	0	0	1,036
August	220	776	0	0	0	996
September	213	420	3	0	0	636
October	220	186	75	0	0	481
November	213	25	300	0	0	538
December	221	6	634	0	0	861
Total	2,593	3,168	3,089	0	0	8,850

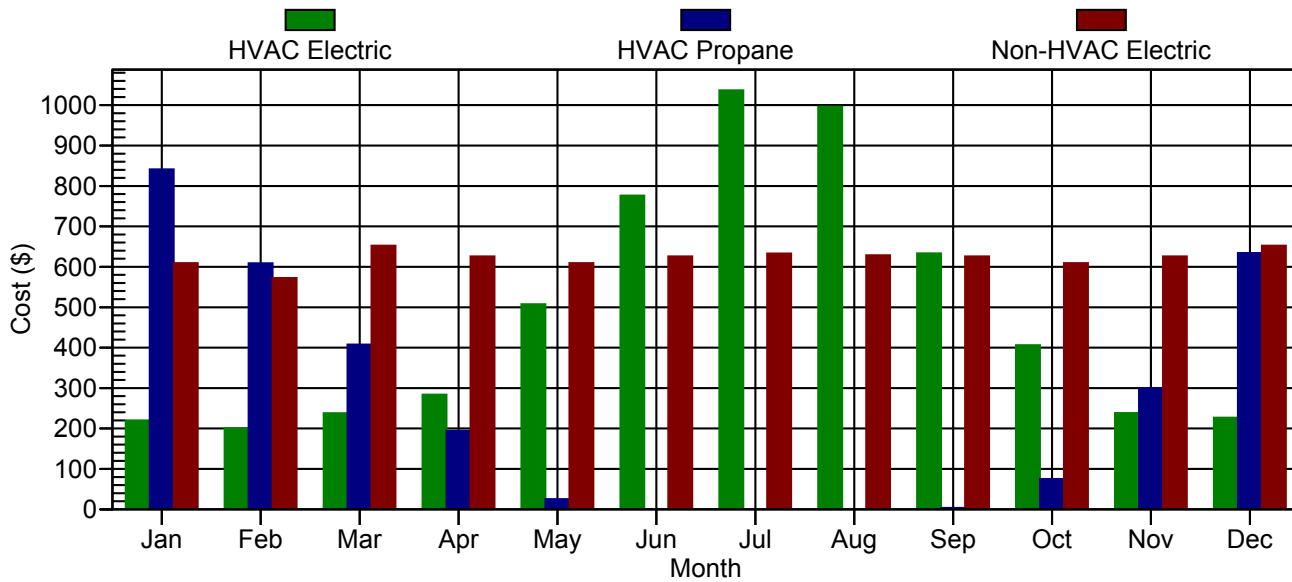
2. Non-HVAC Component Costs

Month	Lights (\$)	Electric Equipment (\$)	Misc. Electric (\$)	Misc. Fuel Use (\$)	Non-HVAC Total (\$)	Grand Total (\$)
January	443	166	0	0	609	1,670
February	416	156	0	0	572	1,381
March	474	178	0	0	652	1,298
April	455	171	0	0	626	1,103
May	443	166	0	0	609	1,142
June	455	171	0	0	626	1,402
July	460	173	0	0	633	1,669
August	457	171	0	0	629	1,625
September	455	171	0	0	626	1,262
October	443	166	0	0	609	1,090
November	455	171	0	0	626	1,164
December	474	178	0	0	652	1,513
Total	5,431	2,037	0	0	7,468	16,318

Monthly Energy Costs - ECM_1_NightSB

Hillside Barn
Kitchen and Associates

05/27/2010
07:03PM



1. HVAC Costs

Month	Electric (\$)	Natural Gas (\$)	Fuel Oil (\$)	Propane (\$)	Remote Hot Water (\$)	Remote Steam (\$)	Remote Chilled Water (\$)
January	220	0	0	841	0	0	0
February	200	0	0	609	0	0	0
March	238	0	0	408	0	0	0
April	284	0	0	194	0	0	0
May	508	0	0	25	0	0	0
June	776	0	0	0	0	0	0
July	1,036	0	0	0	0	0	0
August	996	0	0	0	0	0	0
September	633	0	0	3	0	0	0
October	406	0	0	75	0	0	0
November	238	0	0	300	0	0	0
December	227	0	0	634	0	0	0
Total	5,761	0	0	3,089	0	0	0

2. Non-HVAC Costs

Month	Electric (\$)	Natural Gas (\$)	Fuel Oil (\$)	Propane (\$)	Remote Hot Water (\$)	Remote Steam (\$)
January	609	0	0	0	0	0
February	572	0	0	0	0	0
March	652	0	0	0	0	0
April	626	0	0	0	0	0
May	609	0	0	0	0	0
June	626	0	0	0	0	0
July	633	0	0	0	0	0
August	629	0	0	0	0	0
September	626	0	0	0	0	0
October	609	0	0	0	0	0
November	626	0	0	0	0	0
December	652	0	0	0	0	0
Total	7,468	0	0	0	0	0

Monthly Energy Use by Energy Type - ECM_1_NightSB

Hillside Barn
Kitchen and Associates

05/27/2010
07:03PM

1. HVAC Energy Use

Month	Electric (kWh)	Natural Gas (na)	Fuel Oil (na)	Propane (gal)	Remote HW (na)	Remote Steam (na)	Remote CW (na)
Jan	1,022	0	0	507	0	0	0
Feb	930	0	0	367	0	0	0
Mar	1,105	0	0	245	0	0	0
Apr	1,318	0	0	117	0	0	0
May	2,359	0	0	15	0	0	0
Jun	3,609	0	0	0	0	0	0
Jul	4,818	0	0	0	0	0	0
Aug	4,631	0	0	0	0	0	0
Sep	2,943	0	0	2	0	0	0
Oct	1,888	0	0	45	0	0	0
Nov	1,106	0	0	181	0	0	0
Dec	1,053	0	0	382	0	0	0
Totals	26,784	0	0	1,861	0	0	0

2. Non-HVAC Energy Use

Month	Electric (kWh)	Natural Gas (na)	Fuel Oil (na)	Propane (gal)	Remote HW (na)	Remote Steam (na)
Jan	2,832	0	0	0	0	0
Feb	2,661	0	0	0	0	0
Mar	3,032	0	0	0	0	0
Apr	2,908	0	0	0	0	0
May	2,832	0	0	0	0	0
Jun	2,908	0	0	0	0	0
Jul	2,942	0	0	0	0	0
Aug	2,923	0	0	0	0	0
Sep	2,908	0	0	0	0	0
Oct	2,832	0	0	0	0	0
Nov	2,908	0	0	0	0	0
Dec	3,032	0	0	0	0	0
Totals	34,719	0	0	0	0	0

Monthly Energy Use by Component - ECM_1_NightSB

Hillside Barn
Kitchen and Associates

05/27/2010
07:03PM

1. Monthly Energy Use by System Component

Component	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Air System Fans (kWh)	1022	925	1025	992	1022	992	1023	1023	992	1022	992	1025
<i>Cooling</i>												
Electric (kWh)	0	5	80	327	1338	2617	3795	3608	1951	867	115	28
Natural Gas (na)	0	0	0	0	0	0	0	0	0	0	0	0
Fuel Oil (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (gal)	0	0	0	0	0	0	0	0	0	0	0	0
Remote HW (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote CW (na)	0	0	0	0	0	0	0	0	0	0	0	0
<i>Heating</i>												
Electric (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
Natural Gas (na)	0	0	0	0	0	0	0	0	0	0	0	0
Fuel Oil (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (gal)	507	367	245	117	15	0	0	0	2	45	181	382
Remote HW (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0	0	0	0	0	0	0	0
Pumps (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
Clg. Tower Fans (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
Lighting (kWh)	2060	1935	2205	2115	2060	2115	2139	2125	2115	2060	2115	2205
Electric Eqpt. (kWh)	772	726	827	793	772	793	802	797	793	772	793	827
Misc. Electric (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
<i>Misc. Fuel</i>												
Natural Gas (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (gal)	0	0	0	0	0	0	0	0	0	0	0	0
Remote HW (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0	0	0	0	0	0	0	0

Annual Cost Summary

Hillside Barn
Kitchen and Associates

05/27/2010
07:03PM

Table 1. Annual Costs

Component	ECM_1_NightSB (\$)
Air System Fans	2,593
Cooling	3,168
Heating	3,089
Pumps	0
Cooling Tower Fans	0
HVAC Sub-Total	8,850
Lights	5,431
Electric Equipment	2,037
Misc. Electric	0
Misc. Fuel Use	0
Non-HVAC Sub-Total	7,468
Grand Total	16,318

Table 2. Annual Cost per Unit Floor Area

Component	ECM_1_NightSB (\$/ft²)
Air System Fans	0.600
Cooling	0.733
Heating	0.715
Pumps	0.000
Cooling Tower Fans	0.000
HVAC Sub-Total	2.049
Lights	1.257
Electric Equipment	0.472
Misc. Electric	0.000
Misc. Fuel Use	0.000
Non-HVAC Sub-Total	1.729
Grand Total	3.777
Gross Floor Area (ft²)	4320.0
Conditioned Floor Area (ft²)	4320.0

Note: Values in this table are calculated using the Gross Floor Area.

Table 3. Component Cost as a Percentage of Total Cost

Component	ECM_1_NightSB (%)
Air System Fans	15.9
Cooling	19.4
Heating	18.9
Pumps	0.0
Cooling Tower Fans	0.0
HVAC Sub-Total	54.2
Lights	33.3
Electric Equipment	12.5
Misc. Electric	0.0
Misc. Fuel Use	0.0
Non-HVAC Sub-Total	45.8
Grand Total	100.0

Annual Energy and Emissions Summary

Hillside Barn
Kitchen and Associates

05/27/2010
07:03PM

Table 1. Annual Costs

Component	ECM_1_NightSB (\$)
HVAC Components	
Electric	5,761
Natural Gas	0
Fuel Oil	0
Propane	3,089
Remote HW	0
Remote Steam	0
Remote CW	0
HVAC Sub-Total	8,850
Non-HVAC Components	
Electric	7,468
Natural Gas	0
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Non-HVAC Sub-Total	7,468
Grand Total	16,318

Table 2. Annual Energy Consumption

Component	ECM_1_NightSB
HVAC Components	
Electric (kWh)	26,784
Natural Gas (na)	0
Fuel Oil (na)	0
Propane (gal)	1,861
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0
Non-HVAC Components	
Electric (kWh)	34,719
Natural Gas (na)	0
Fuel Oil (na)	0
Propane (gal)	0
Remote HW (na)	0
Remote Steam (na)	0
Totals	
Electric (kWh)	61,502
Natural Gas (na)	0
Fuel Oil (na)	0
Propane (gal)	1,861
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0

Annual Energy and Emissions Summary

Hillside Barn
Kitchen and Associates

05/27/2010
07:03PM

Table 3. Annual Emissions

Component	ECM_1_NightSB
CO2 Equivalent (lb)	0

Table 4. Annual Cost per Unit Floor Area

Component	ECM_1_NightSB (\$/ft²)
HVAC Components	
Electric	1.334
Natural Gas	0.000
Fuel Oil	0.000
Propane	0.715
Remote HW	0.000
Remote Steam	0.000
Remote CW	0.000
HVAC Sub-Total	2.049
Non-HVAC Components	
Electric	1.729
Natural Gas	0.000
Fuel Oil	0.000
Propane	0.000
Remote HW	0.000
Remote Steam	0.000
Non-HVAC Sub-Total	1.729
Grand Total	3.777
Gross Floor Area (ft²)	4320.0
Conditioned Floor Area (ft²)	4320.0

Note: Values in this table are calculated using the Gross Floor Area.

Table 5. Component Cost as a Percentage of Total Cost

Component	ECM_1_NightSB (%)
HVAC Components	
Electric	35.3
Natural Gas	0.0
Fuel Oil	0.0
Propane	18.9
Remote HW	0.0
Remote Steam	0.0
Remote CW	0.0
HVAC Sub-Total	54.2
Non-HVAC Components	
Electric	45.8
Natural Gas	0.0
Fuel Oil	0.0
Propane	0.0
Remote HW	0.0
Remote Steam	0.0
Non-HVAC Sub-Total	45.8
Grand Total	100.0

APPENDIX F

ECM-4 Modify Downstairs Office HVAC Control

BPU ENERGY AUDIT PROGRAM
Andover Township Hillside Barn
CHA Project #20997

ECM-4 Modify Downstairs Office HVAC Control

Multipliers	
Material	0.98
Labor	1.21
Equipment	1.07

Installation Costs										
	Qty	Unit	Unit Costs			Subtotal Costs			Total Cost	Remarks
			Material	Labor	Equipment	Material	Labor	Equipment		
Programmable Thermostat	1	ea	\$75	\$50		\$74	\$61	\$0	\$134	

Subtotal	\$134
10% OH, 10% Profit	\$13
10% Contingency	\$13
Total	\$161

BPU ENERGY AUDIT PROGRAM
Andover Township Hillside Barn
CHA Project #20997

ECM-4 Modify Downstairs Office HVAC Control

Annual Energy Use Comparison			
	Electricity kWh	Propane gallons	Cost \$
Existing Manual Thermostat Control	4,190	684	\$ 2,037.00
Proposed Programmable Thermostat	3,947	577	\$ 1,807.00
Difference	243	107	\$ 230.00

ALT1 - Floor 1 BLD1-F001-Z01 Input Data

Project Name: Hillside Barn
Prepared by: Kitchen and Associates

06/02/2010
06:47PM

1. General Details:

Air System Name ALT1 - Floor 1 BLD1-F001-Z01
Equipment Type Packaged Rooftop Units
Air System Type Single Zone CAV
Number of zones 1

2. System Components:

Ventilation Air Data:

Airflow Control Constant Ventilation Airflow
Ventilation Sizing Method Sum of Space OA Airflows
Unocc. Damper Position Closed
Damper Leak Rate 0 %
Outdoor Air CO2 Level 400 ppm

Central Cooling Data:

Supply Air Temperature 58.0 °F
Coil Bypass Factor 0.100
Cooling Source Air-Cooled DX
Schedule JFMAMJJASOND
Capacity Control Cycled or Staged Capacity - Fan On

Central Heating Data:

Supply Temperature 100.0 °F
Heating Source Combustion - Propane
Schedule JFMAMJJASOND
Capacity Control Cycled or Staged Capacity - Fan On

Supply Fan Data:

Fan Type Forward Curved
Configuration Draw-thru
Fan Performance 2.5 BHP

Duct System Data:

Supply Duct Data:

Duct Heat Gain 0 %
Duct Leakage 0 %

Return Duct or Plenum Data:

Return Air Via Ducted Return

3. Zone Components:

Space Assignments:

Zone 1: BLD1-F001-Z01	
BLD1-F001-Z01	x1

Thermostats and Zone Data:

Zone All
Cooling T-stat: Occ. 75.0 °F
Cooling T-stat: Unocc. 75.0 °F
Heating T-stat: Occ. 70.0 °F
Heating T-stat: Unocc. 70.0 °F
T-stat Throttling Range 1.50 °F
Diversity Factor 100 %
Direct Exhaust Airflow 0.0 CFM
Direct Exhaust Fan kW 0.0 kW

Thermostat Schedule 90.1 Assembly HVAC
Unoccupied Cooling is Available

Supply Terminals Data:

Zone All
Terminal Type Diffuser
Minimum Airflow 0.00 CFM/person

Zone Heating Units:

Zone All
Zone Heating Unit Type None

Zone Unit Heat Source Electric Resistance
Zone Heating Unit Schedule JFMAMJJASOND

ALT1 - Floor 1 BLD1-F001-Z01 Input Data

Project Name: Hillside Barn
Prepared by: Kitchen and Associates

06/02/2010
06:47PM

4. Sizing Data (Computer-Generated):

System Sizing Data:

Cooling Supply Temperature 58.0 °F
Supply Fan Airflow 7112.1 CFM
Ventilation Airflow 1800.0 CFM
Heating Supply Temperature 100.0 °F

Hydronic Sizing Specifications:

Chilled Water Delta-T 10.0 °F
Hot Water Delta-T 20.0 °F

Safety Factors:

Cooling Sensible 0 %
Cooling Latent 0 %
Heating 0 %

Zone Sizing Data:

Zone Airflow Sizing Method Sum of space airflow rates
Space Airflow Sizing Method Individual peak space loads

Zone	Supply Airflow (CFM)	Zone Htg Unit (MBH)	Reheat Coil (MBH)	- (CFM)
1	7112.1	-	-	

5. Equipment Data

Central Cooling Unit - Air-Cooled DX

Estimated Maximum Load 278.2 MBH
Design OAT 95.0 °F
Equipment Sizing User-Defined
Gross Cooling Capacity 208.0 MBH
ARI Performance Rating 11.00 EER
Conventional Cutoff OAT 55.0 °F
Low Temperature Operation Used
Low Temperature Cutoff OAT 15.0 °F

Central Heating Unit - Combustion

Estimated Maximum Load 162.6 MBH
Equipment Sizing User-Defined
Gross Heating Capacity 350.0 MBH
Average Efficiency 80.1 %
Misc. Electric 0.000 kW

Billing Details - Electric - Basement_NightSB

Hillside Barn
Kitchen and Associates

06/02/2010
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1. Component Charges

Billing Period	Energy Charges (\$)	Demand Charges (\$)	Customer Charges (\$)	Taxes (\$)	Total Charge (\$)
Jan	388	0	0	0	388
Feb	363	0	0	0	363
Mar	415	0	0	0	415
Apr	406	0	0	0	406
May	420	0	0	0	420
Jun	452	0	0	0	452
Jul	502	0	0	0	502
Aug	494	0	0	0	494
Sep	440	0	0	0	440
Oct	412	0	0	0	412
Nov	402	0	0	0	402
Dec	413	0	0	0	413
Totals	5,106	0	0	0	5,106

2. Totals

Billing Period	Total Charges (\$)	Total Consumption (kWh)	Avg Price (\$/kWh)
Jan	388	1,802	0.2151
Feb	363	1,687	0.2151
Mar	415	1,929	0.2151
Apr	406	1,888	0.2151
May	420	1,952	0.2151
Jun	452	2,104	0.2151
Jul	502	2,333	0.2151
Aug	494	2,298	0.2151
Sep	440	2,045	0.2151
Oct	412	1,913	0.2151
Nov	402	1,867	0.2151
Dec	413	1,922	0.2151
Totals	5,106	23,739	0.2151

3. Consumption Totals

Billing Period	Peak (kWh)	Mid-Peak (kWh)	Normal Peak (kWh)	Off-Peak (kWh)	Overall (kWh)
Jan	0	0	0	0	1,802
Feb	0	0	0	0	1,687
Mar	0	0	0	0	1,929
Apr	0	0	0	0	1,888
May	0	0	0	0	1,952
Jun	0	0	0	0	2,104
Jul	0	0	0	0	2,333
Aug	0	0	0	0	2,298
Sep	0	0	0	0	2,045
Oct	0	0	0	0	1,913
Nov	0	0	0	0	1,867
Dec	0	0	0	0	1,922
Totals	0	0	0	0	23,739

Billing Details - Electric - Basement_NightSB

Hillside Barn
Kitchen and Associates

06/02/2010
06:48PM

4. Billing Demands

Billing Period	Peak (kW)	Mid-Peak (kW)	Normal Peak (kW)	Off-Peak (kW)	Overall (kW)
Jan	0.0	0.0	0.0	0.0	6.4
Feb	0.0	0.0	0.0	0.0	6.8
Mar	0.0	0.0	0.0	0.0	6.9
Apr	0.0	0.0	0.0	0.0	7.1
May	0.0	0.0	0.0	0.0	8.8
Jun	0.0	0.0	0.0	0.0	8.7
Jul	0.0	0.0	0.0	0.0	9.3
Aug	0.0	0.0	0.0	0.0	8.9
Sep	0.0	0.0	0.0	0.0	8.1
Oct	0.0	0.0	0.0	0.0	7.9
Nov	0.0	0.0	0.0	0.0	6.9
Dec	0.0	0.0	0.0	0.0	6.9

5. Maximum Demands

Billing Period	Peak (kW)	Mid-Peak (kW)	Normal Peak (kW)	Off-Peak (kW)	Overall (kW)
Jan	0.0	0.0	0.0	0.0	6.4
Feb	0.0	0.0	0.0	0.0	6.8
Mar	0.0	0.0	0.0	0.0	6.9
Apr	0.0	0.0	0.0	0.0	7.1
May	0.0	0.0	0.0	0.0	8.8
Jun	0.0	0.0	0.0	0.0	8.7
Jul	0.0	0.0	0.0	0.0	9.3
Aug	0.0	0.0	0.0	0.0	8.9
Sep	0.0	0.0	0.0	0.0	8.1
Oct	0.0	0.0	0.0	0.0	7.9
Nov	0.0	0.0	0.0	0.0	6.9
Dec	0.0	0.0	0.0	0.0	6.9

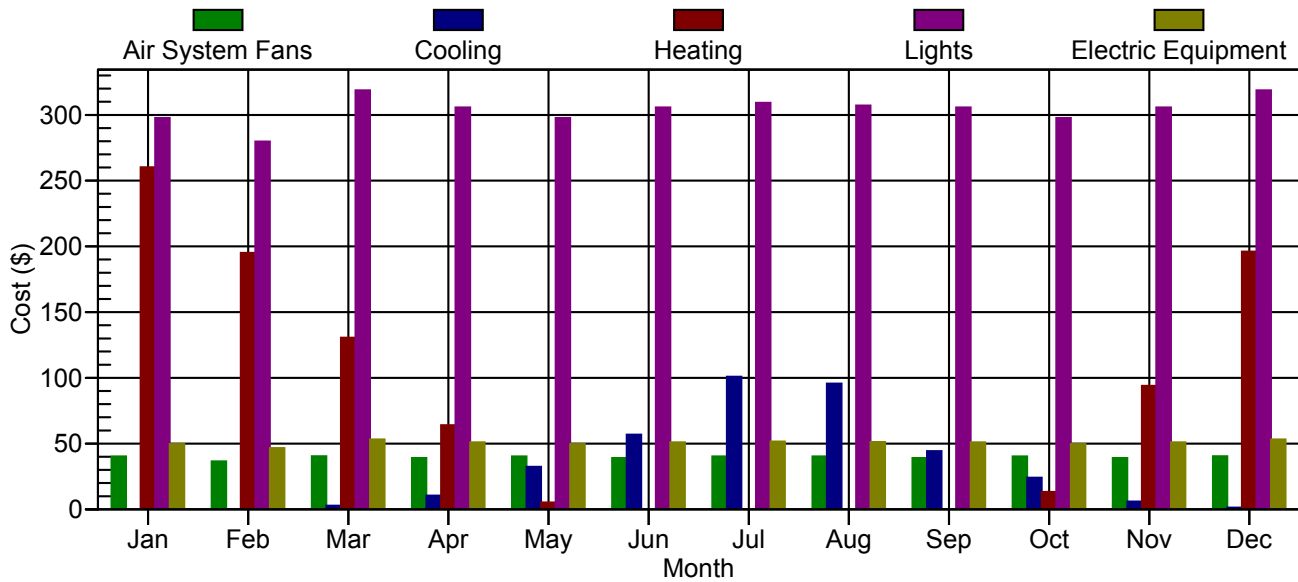
6. Time Of Maximum Demands

Billing Period	Peak (m/d/h)	Mid-Peak (m/d/h)	Normal Peak (m/d/h)	Off-Peak (m/d/h)	Overall (m/d/h)
Jan	n/a	n/a	n/a	n/a	1/1/0800
Feb	n/a	n/a	n/a	n/a	2/12/1600
Mar	n/a	n/a	n/a	n/a	3/5/1600
Apr	n/a	n/a	n/a	n/a	4/19/1600
May	n/a	n/a	n/a	n/a	5/17/1600
Jun	n/a	n/a	n/a	n/a	6/11/1600
Jul	n/a	n/a	n/a	n/a	7/29/1600
Aug	n/a	n/a	n/a	n/a	8/4/1600
Sep	n/a	n/a	n/a	n/a	9/1/1600
Oct	n/a	n/a	n/a	n/a	10/1/1500
Nov	n/a	n/a	n/a	n/a	11/3/1300
Dec	n/a	n/a	n/a	n/a	12/2/1400

Monthly Component Costs - Basement_NightSB

Hillside Barn
Kitchen and Associates

06/02/2010
06:48PM



1. HVAC Component Costs

Month	Air System Fans (\$)	Cooling (\$)	Heating (\$)	Pumps (\$)	Cooling Towers (\$)	HVAC Total (\$)
January	40	0	260	0	0	300
February	36	0	195	0	0	231
March	40	3	131	0	0	174
April	39	10	64	0	0	113
May	40	32	5	0	0	77
June	39	57	0	0	0	96
July	40	101	0	0	0	141
August	40	96	0	0	0	136
September	39	44	0	0	0	83
October	40	24	13	0	0	77
November	39	6	94	0	0	139
December	40	1	196	0	0	237
Total	475	375	958	0	0	1,807

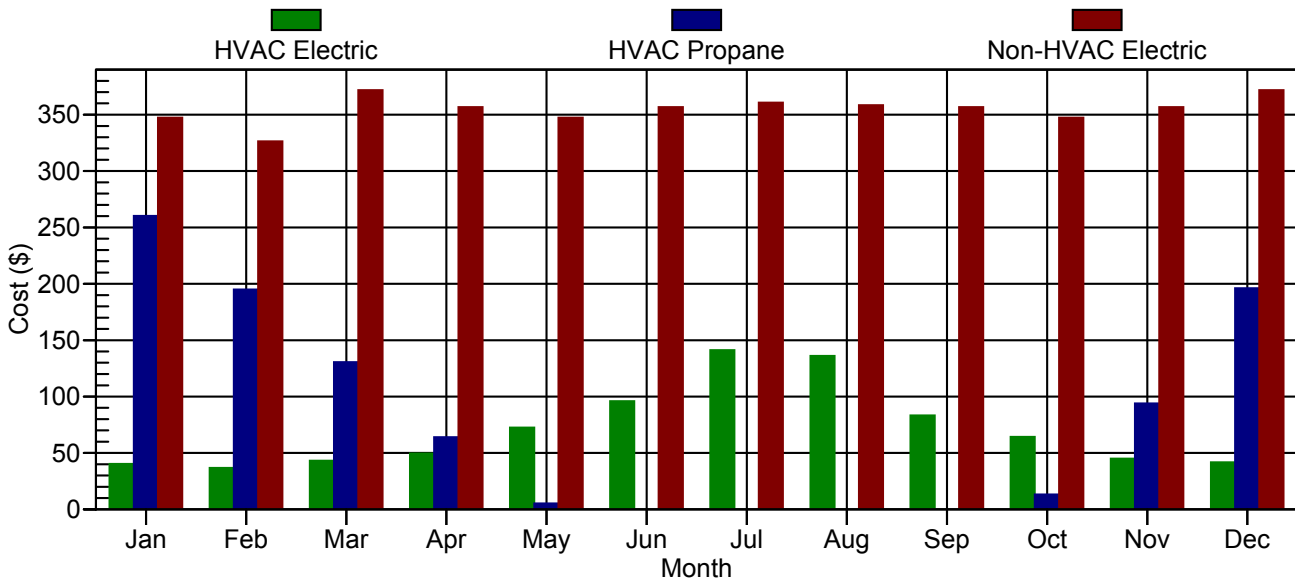
2. Non-HVAC Component Costs

Month	Lights (\$)	Electric Equipment (\$)	Misc. Electric (\$)	Misc. Fuel Use (\$)	Non-HVAC Total (\$)	Grand Total (\$)
January	298	50	0	0	347	647
February	280	47	0	0	326	557
March	319	53	0	0	372	546
April	306	51	0	0	357	470
May	298	50	0	0	347	424
June	306	51	0	0	357	453
July	309	52	0	0	361	502
August	307	51	0	0	358	494
September	306	51	0	0	357	440
October	298	50	0	0	347	424
November	306	51	0	0	357	496
December	319	53	0	0	372	609
Total	3,649	608	0	0	4,257	6,064

Monthly Energy Costs - Basement_NightSB

Hillside Barn
Kitchen and Associates

06/02/2010
06:48PM



1. HVAC Costs

Month	Electric (\$)	Natural Gas (\$)	Fuel Oil (\$)	Propane (\$)	Remote Hot Water (\$)	Remote Steam (\$)	Remote Chilled Water (\$)
January	40	0	0	260	0	0	0
February	37	0	0	195	0	0	0
March	43	0	0	131	0	0	0
April	49	0	0	64	0	0	0
May	73	0	0	5	0	0	0
June	96	0	0	0	0	0	0
July	141	0	0	0	0	0	0
August	136	0	0	0	0	0	0
September	83	0	0	0	0	0	0
October	64	0	0	13	0	0	0
November	45	0	0	94	0	0	0
December	42	0	0	196	0	0	0
Total	849	0	0	958	0	0	0

2. Non-HVAC Costs

Month	Electric (\$)	Natural Gas (\$)	Fuel Oil (\$)	Propane (\$)	Remote Hot Water (\$)	Remote Steam (\$)
January	347	0	0	0	0	0
February	326	0	0	0	0	0
March	372	0	0	0	0	0
April	357	0	0	0	0	0
May	347	0	0	0	0	0
June	357	0	0	0	0	0
July	361	0	0	0	0	0
August	358	0	0	0	0	0
September	357	0	0	0	0	0
October	347	0	0	0	0	0
November	357	0	0	0	0	0
December	372	0	0	0	0	0
Total	4,257	0	0	0	0	0

Monthly Energy Use by Energy Type - Basement_NightSB

Hillside Barn
Kitchen and Associates

06/02/2010
06:48PM

1. HVAC Energy Use

Month	Electric (kWh)	Natural Gas (na)	Fuel Oil (na)	Propane (gal)	Remote HW (na)	Remote Steam (na)	Remote CW (na)
Jan	187	0	0	157	0	0	0
Feb	170	0	0	117	0	0	0
Mar	201	0	0	79	0	0	0
Apr	230	0	0	39	0	0	0
May	337	0	0	3	0	0	0
Jun	446	0	0	0	0	0	0
Jul	656	0	0	0	0	0	0
Aug	632	0	0	0	0	0	0
Sep	387	0	0	0	0	0	0
Oct	299	0	0	8	0	0	0
Nov	209	0	0	57	0	0	0
Dec	194	0	0	118	0	0	0
Totals	3,947	0	0	577	0	0	0

2. Non-HVAC Energy Use

Month	Electric (kWh)	Natural Gas (na)	Fuel Oil (na)	Propane (gal)	Remote HW (na)	Remote Steam (na)
Jan	1,615	0	0	0	0	0
Feb	1,517	0	0	0	0	0
Mar	1,728	0	0	0	0	0
Apr	1,658	0	0	0	0	0
May	1,615	0	0	0	0	0
Jun	1,658	0	0	0	0	0
Jul	1,677	0	0	0	0	0
Aug	1,666	0	0	0	0	0
Sep	1,658	0	0	0	0	0
Oct	1,615	0	0	0	0	0
Nov	1,658	0	0	0	0	0
Dec	1,728	0	0	0	0	0
Totals	19,792	0	0	0	0	0

Monthly Energy Use by Component - Basement_NightSB

Hillside Barn
Kitchen and Associates

06/02/2010
06:48PM

1. Monthly Energy Use by System Component

Component	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Air System Fans (kWh)	187	169	188	182	187	182	187	187	182	187	182	188
<i>Cooling</i>												
Electric (kWh)	0	1	13	48	150	264	469	445	206	112	27	6
Natural Gas (na)	0	0	0	0	0	0	0	0	0	0	0	0
Fuel Oil (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (gal)	0	0	0	0	0	0	0	0	0	0	0	0
Remote HW (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote CW (na)	0	0	0	0	0	0	0	0	0	0	0	0
<i>Heating</i>												
Electric (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
Natural Gas (na)	0	0	0	0	0	0	0	0	0	0	0	0
Fuel Oil (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (gal)	157	117	79	39	3	0	0	0	0	8	57	118
Remote HW (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0	0	0	0	0	0	0	0
Pumps (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
Clg. Tower Fans (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
Lighting (kWh)	1384	1300	1481	1421	1384	1421	1437	1428	1421	1384	1421	1481
Electric Eqpt. (kWh)	231	217	247	237	231	237	240	238	237	231	237	247
Misc. Electric (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
<i>Misc. Fuel</i>												
Natural Gas (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (gal)	0	0	0	0	0	0	0	0	0	0	0	0
Remote HW (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0	0	0	0	0	0	0	0

Annual Cost Summary

Hillside Barn
Kitchen and Associates

06/02/2010
06:48PM

Table 1. Annual Costs

Component	Basement_NightS B (\$)
Air System Fans	475
Cooling	375
Heating	958
Pumps	0
Cooling Tower Fans	0
HVAC Sub-Total	1,807
Lights	3,649
Electric Equipment	608
Misc. Electric	0
Misc. Fuel Use	0
Non-HVAC Sub-Total	4,257
Grand Total	6,064

Table 2. Annual Cost per Unit Floor Area

Component	Basement_NightS B (\$/ft²)
Air System Fans	0.123
Cooling	0.097
Heating	0.248
Pumps	0.000
Cooling Tower Fans	0.000
HVAC Sub-Total	0.467
Lights	0.943
Electric Equipment	0.157
Misc. Electric	0.000
Misc. Fuel Use	0.000
Non-HVAC Sub-Total	1.100
Grand Total	1.567
Gross Floor Area (ft²)	3870.0
Conditioned Floor Area (ft²)	3870.0

Note: Values in this table are calculated using the Gross Floor Area.

Table 3. Component Cost as a Percentage of Total Cost

Component	Basement_NightS B (%)
Air System Fans	7.8
Cooling	6.2
Heating	15.8
Pumps	0.0
Cooling Tower Fans	0.0
HVAC Sub-Total	29.8
Lights	60.2
Electric Equipment	10.0
Misc. Electric	0.0
Misc. Fuel Use	0.0
Non-HVAC Sub-Total	70.2
Grand Total	100.0

Annual Energy and Emissions Summary

Hillside Barn
Kitchen and Associates

06/02/2010
06:48PM

Table 1. Annual Costs

Component	Basement_NightS B (\$)
HVAC Components	
Electric	849
Natural Gas	0
Fuel Oil	0
Propane	958
Remote HW	0
Remote Steam	0
Remote CW	0
HVAC Sub-Total	1,807
Non-HVAC Components	
Electric	4,257
Natural Gas	0
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Non-HVAC Sub-Total	4,257
Grand Total	6,064

Table 2. Annual Energy Consumption

Component	Basement_NightS B
HVAC Components	
Electric (kWh)	3,947
Natural Gas (na)	0
Fuel Oil (na)	0
Propane (gal)	577
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0
Non-HVAC Components	
Electric (kWh)	19,792
Natural Gas (na)	0
Fuel Oil (na)	0
Propane (gal)	0
Remote HW (na)	0
Remote Steam (na)	0
Totals	
Electric (kWh)	23,739
Natural Gas (na)	0
Fuel Oil (na)	0
Propane (gal)	577
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0

Annual Energy and Emissions Summary

Hillside Barn
Kitchen and Associates

06/02/2010
06:48PM

Table 3. Annual Emissions

Component	Basement_NightS B
CO2 Equivalent (lb)	0

Table 4. Annual Cost per Unit Floor Area

Component	Basement_NightS B (\$/ft²)
HVAC Components	
Electric	0.219
Natural Gas	0.000
Fuel Oil	0.000
Propane	0.248
Remote HW	0.000
Remote Steam	0.000
Remote CW	0.000
HVAC Sub-Total	0.467
Non-HVAC Components	
Electric	1.100
Natural Gas	0.000
Fuel Oil	0.000
Propane	0.000
Remote HW	0.000
Remote Steam	0.000
Non-HVAC Sub-Total	1.100
Grand Total	1.567
Gross Floor Area (ft²)	3870.0
Conditioned Floor Area (ft²)	3870.0

Note: Values in this table are calculated using the Gross Floor Area.

Table 5. Component Cost as a Percentage of Total Cost

Component	Basement_NightS B (%)
HVAC Components	
Electric	14.0
Natural Gas	0.0
Fuel Oil	0.0
Propane	15.8
Remote HW	0.0
Remote Steam	0.0
Remote CW	0.0
HVAC Sub-Total	29.8
Non-HVAC Components	
Electric	70.2
Natural Gas	0.0
Fuel Oil	0.0
Propane	0.0
Remote HW	0.0
Remote Steam	0.0
Non-HVAC Sub-Total	70.2
Grand Total	100.0

APPENDIX G

ECM-5 Replace Downstairs Office Condensing Unit And Cooling Coil with Higher Efficiency Units

BPU ENERGY AUDIT PROGRAM
Andover Township Hillside Barn
CHA Project #20997

ECM-5 Replace Downstairs Office Condensing Unit and Cooling Coil with Higher Efficiency Units

Multipliers	
Material	0.98
Labor	1.21
Equipment	1.07

Installation Costs										
	Qty	Unit	Unit Costs			Subtotal Costs			Total Cost	Remarks
			Material	Labor	Equipment	Material	Labor	Equipment		
Condensing Unit Demo	1	ea		\$ 740.00		\$ -	\$ -	\$ -	\$ -	
Cooling Coil and Line-Set Demo	1	ea		\$ 950.00		\$ -	\$ 1,149.50	\$ -	\$ 1,149.50	
New 3 Ton Condensing Unit and Cooling Coil	1	ea	\$ 3,524.00	\$ 686.00		\$ 3,453.52	\$ 830.06	\$ -	\$ 4,283.58	
New Refrigeration Line-Set	1	ea	\$ 276.00	\$ 851.00		\$ 270.48	\$ 1,029.71	\$ -	\$ 1,300.19	

*Material cost of condensing unit and cooling coil includes a \$92/ton incentive

Subtotal	\$ 7,628.67
10% OH, 10% Profit	\$ 762.87
10% Contingency	\$ 762.87
Total	\$ 9,154.40

BPU ENERGY AUDIT PROGRAM
Andover Township Town Hall
CHA Project #20997

ECM-5 Replace Downstairs Office Condensing Unit and Cooling Coil with Higher Efficiency Units

Annual Energy Use Comparison			
	Electricity kWh	Propane Gallons	Cost \$
Existing 10 SEER Compressor and Coil	3,947	-	\$ 849
Proposed 16 SEER Compressor and Coil	3,582	-	\$ 770
Difference	365	-	\$ 79

ECM_2_16SEER Input Data

Project Name: Hillside Barn
Prepared by: Kitchen and Associates

05/27/2010
07:04PM

1. General Details:

Air System Name ECM_2_16SEER
Equipment Type Split AHU
Air System Type Single Zone CAV
Number of zones 1

2. System Components:

Ventilation Air Data:

Airflow Control Constant Ventilation Airflow
Ventilation Sizing Method Sum of Space OA Airflows
Unocc. Damper Position Closed
Damper Leak Rate 0 %
Outdoor Air CO2 Level 400 ppm

Central Cooling Data:

Supply Air Temperature 58.0 °F
Coil Bypass Factor 0.100
Cooling Source Air-Cooled DX
Schedule JFMAMJJASOND
Capacity Control Cycled or Staged Capacity - Fan On

Central Heating Data:

Supply Temperature 100.0 °F
Heating Source Combustion - Propane
Schedule JFMAMJJASOND
Capacity Control Cycled or Staged Capacity - Fan On

Supply Fan Data:

Fan Type Forward Curved
Configuration Blow-thru
Fan Performance 1.00 in wg
Overall Efficiency 54 %

Duct System Data:

Supply Duct Data:

Duct Heat Gain 0 %
Duct Leakage 0 %

Return Duct or Plenum Data:

Return Air Via Return Air Plenum
Wall Heat Gain to Plenum 0 %
Roof Heat Gain to Plenum 70 %
Lighting Heat Gain to Plenum 30 %

3. Zone Components:

Space Assignments:

Zone 1: BLD1-F002-Z01	
ECM_2_16SEER_FLBasement	x1

Thermostats and Zone Data:

Zone All
Cooling T-stat: Occ. 75.0 °F
Cooling T-stat: Unocc. 85.0 °F
Heating T-stat: Occ. 70.0 °F
Heating T-stat: Unocc. 65.0 °F
T-stat Throttling Range 1.50 °F
Diversity Factor 100 %
Direct Exhaust Airflow 0.0 CFM
Direct Exhaust Fan kW 0.0 kW

Thermostat Schedule 90.1 Assembly HVAC
Unoccupied Cooling is Available

Supply Terminals Data:

Zone All
Terminal Type Diffuser
Minimum Airflow 0.00 CFM/person

Zone Heating Units:

Zone All

ECM_2_16SEER Input Data

Project Name: Hillside Barn
Prepared by: Kitchen and Associates

05/27/2010
07:04PM

Zone Heating Unit Type **None**

Zone Unit Heat Source **Electric Resistance**

Zone Heating Unit Schedule **JFMAMJJASOND**

4. Sizing Data (Computer-Generated):

System Sizing Data:

Cooling Supply Temperature **58.0** °F
Supply Fan Airflow **1570.3** CFM
Ventilation Airflow **0.0** CFM
Heating Supply Temperature **100.0** °F

Hydronic Sizing Specifications:

Chilled Water Delta-T **10.0** °F
Hot Water Delta-T **20.0** °F

Safety Factors:

Cooling Sensible **0** %
Cooling Latent **0** %
Heating **0** %

Zone Sizing Data:

Zone Airflow Sizing Method **Sum of space airflow rates**
Space Airflow Sizing Method **Individual peak space loads**

Zone	Supply Airflow (CFM)	Zone Htg Unit (MBH)	Reheat Coil (MBH)	- (CFM)
1	1570.3	-	-	

5. Equipment Data

Central Cooling Unit - Air-Cooled DX

Estimated Maximum Load **39.1** MBH
Design OAT **95.0** °F
Equipment Sizing **User-Defined**
Gross Cooling Capacity **36.0** MBH
ARI Performance Rating **16.00** SEER
Conventional Cutoff OAT **55.0** °F
Low Temperature Operation **Used**
Low Temperature Cutoff OAT **15.0** °F

Central Heating Unit - Combustion

Estimated Maximum Load **46.5** MBH
Equipment Sizing **User-Defined**
Gross Heating Capacity **75.0** MBH
Average Efficiency **92.2** %
Misc. Electric **0.000** kW

Billing Details - Electric - ECM_2_16SEER

Hillside Barn
Kitchen and Associates

05/27/2010
07:04PM

1. Component Charges

Billing Period	Energy Charges (\$)	Demand Charges (\$)	Customer Charges (\$)	Taxes (\$)	Total Charge (\$)
Jan	388	0	0	0	388
Feb	363	0	0	0	363
Mar	414	0	0	0	414
Apr	404	0	0	0	404
May	413	0	0	0	413
Jun	440	0	0	0	440
Jul	480	0	0	0	480
Aug	474	0	0	0	474
Sep	430	0	0	0	430
Oct	406	0	0	0	406
Nov	400	0	0	0	400
Dec	413	0	0	0	413
Totals	5,028	0	0	0	5,028

2. Totals

Billing Period	Total Charges (\$)	Total Consumption (kWh)	Avg Price (\$/kWh)
Jan	388	1,804	0.2151
Feb	363	1,688	0.2151
Mar	414	1,926	0.2151
Apr	404	1,877	0.2151
May	413	1,920	0.2151
Jun	440	2,047	0.2151
Jul	480	2,233	0.2151
Aug	474	2,204	0.2151
Sep	430	2,001	0.2151
Oct	406	1,890	0.2151
Nov	400	1,861	0.2151
Dec	413	1,921	0.2151
Totals	5,028	23,374	0.2151

3. Consumption Totals

Billing Period	Peak (kWh)	Mid-Peak (kWh)	Normal Peak (kWh)	Off-Peak (kWh)	Overall (kWh)
Jan	0	0	0	0	1,804
Feb	0	0	0	0	1,688
Mar	0	0	0	0	1,926
Apr	0	0	0	0	1,877
May	0	0	0	0	1,920
Jun	0	0	0	0	2,047
Jul	0	0	0	0	2,233
Aug	0	0	0	0	2,204
Sep	0	0	0	0	2,001
Oct	0	0	0	0	1,890
Nov	0	0	0	0	1,861
Dec	0	0	0	0	1,921
Totals	0	0	0	0	23,374

Billing Details - Electric - ECM_2_16SEER

Hillside Barn
Kitchen and Associates

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4. Billing Demands

Billing Period	Peak (kW)	Mid-Peak (kW)	Normal Peak (kW)	Off-Peak (kW)	Overall (kW)
Jan	0.0	0.0	0.0	0.0	6.4
Feb	0.0	0.0	0.0	0.0	6.7
Mar	0.0	0.0	0.0	0.0	6.8
Apr	0.0	0.0	0.0	0.0	6.9
May	0.0	0.0	0.0	0.0	8.3
Jun	0.0	0.0	0.0	0.0	8.2
Jul	0.0	0.0	0.0	0.0	8.7
Aug	0.0	0.0	0.0	0.0	8.4
Sep	0.0	0.0	0.0	0.0	7.8
Oct	0.0	0.0	0.0	0.0	7.6
Nov	0.0	0.0	0.0	0.0	6.8
Dec	0.0	0.0	0.0	0.0	6.8

5. Maximum Demands

Billing Period	Peak (kW)	Mid-Peak (kW)	Normal Peak (kW)	Off-Peak (kW)	Overall (kW)
Jan	0.0	0.0	0.0	0.0	6.4
Feb	0.0	0.0	0.0	0.0	6.7
Mar	0.0	0.0	0.0	0.0	6.8
Apr	0.0	0.0	0.0	0.0	6.9
May	0.0	0.0	0.0	0.0	8.3
Jun	0.0	0.0	0.0	0.0	8.2
Jul	0.0	0.0	0.0	0.0	8.7
Aug	0.0	0.0	0.0	0.0	8.4
Sep	0.0	0.0	0.0	0.0	7.8
Oct	0.0	0.0	0.0	0.0	7.6
Nov	0.0	0.0	0.0	0.0	6.8
Dec	0.0	0.0	0.0	0.0	6.8

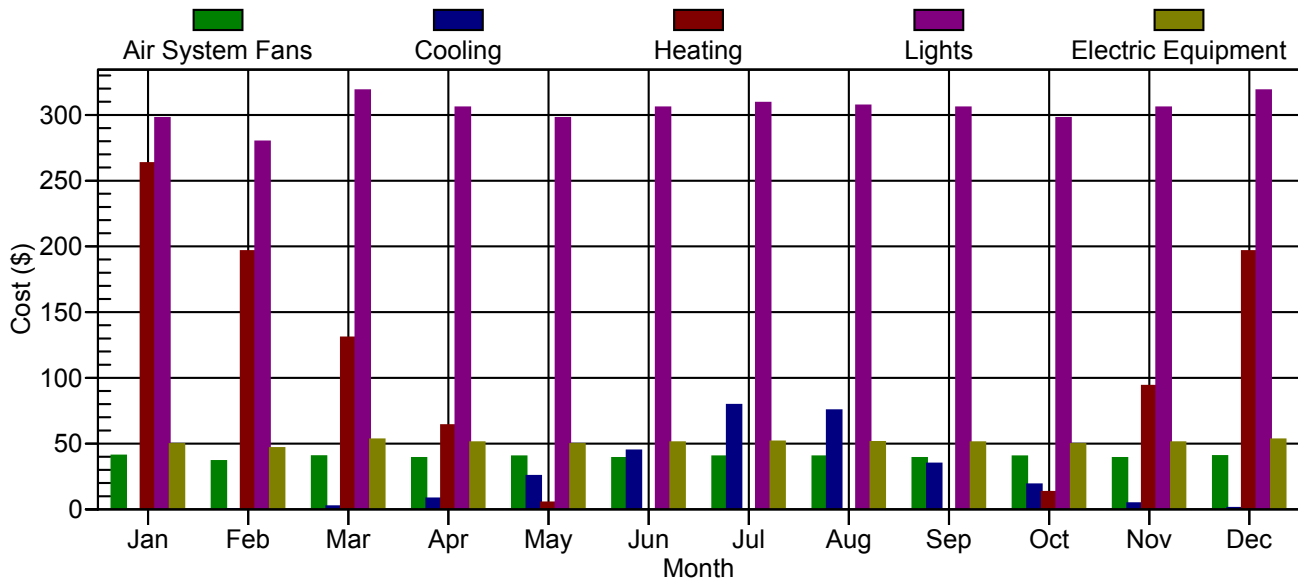
6. Time Of Maximum Demands

Billing Period	Peak (m/d/h)	Mid-Peak (m/d/h)	Normal Peak (m/d/h)	Off-Peak (m/d/h)	Overall (m/d/h)
Jan	n/a	n/a	n/a	n/a	1/1/0800
Feb	n/a	n/a	n/a	n/a	2/12/1600
Mar	n/a	n/a	n/a	n/a	3/5/1600
Apr	n/a	n/a	n/a	n/a	4/19/1600
May	n/a	n/a	n/a	n/a	5/17/1600
Jun	n/a	n/a	n/a	n/a	6/11/1600
Jul	n/a	n/a	n/a	n/a	7/29/1600
Aug	n/a	n/a	n/a	n/a	8/4/1600
Sep	n/a	n/a	n/a	n/a	9/1/1600
Oct	n/a	n/a	n/a	n/a	10/1/1500
Nov	n/a	n/a	n/a	n/a	11/3/1300
Dec	n/a	n/a	n/a	n/a	12/2/1400

Monthly Component Costs - ECM_2_16SEER

Hillside Barn
Kitchen and Associates

05/27/2010
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1. HVAC Component Costs

Month	Air System Fans (\$)	Cooling (\$)	Heating (\$)	Pumps (\$)	Cooling Towers (\$)	HVAC Total (\$)
January	41	0	263	0	0	304
February	37	0	196	0	0	233
March	40	2	131	0	0	173
April	39	8	64	0	0	111
May	40	25	5	0	0	70
June	39	45	0	0	0	84
July	40	79	0	0	0	119
August	40	75	0	0	0	115
September	39	35	0	0	0	74
October	40	19	13	0	0	72
November	39	5	94	0	0	138
December	40	1	196	0	0	237
Total	475	295	963	0	0	1,733

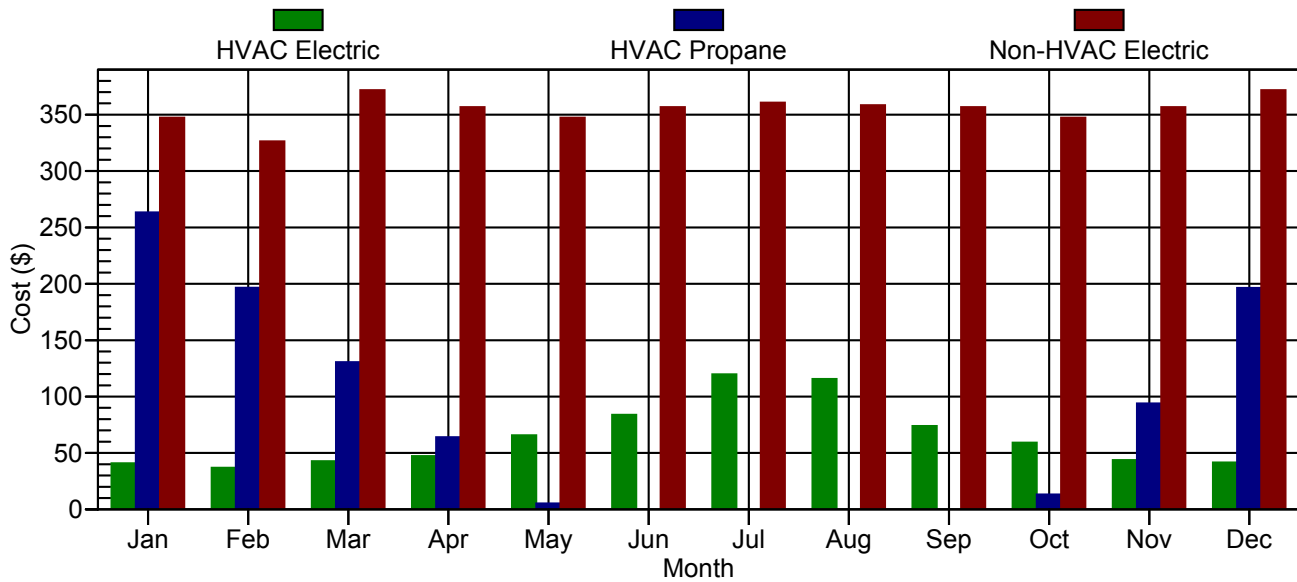
2. Non-HVAC Component Costs

Month	Lights (\$)	Electric Equipment (\$)	Misc. Electric (\$)	Misc. Fuel Use (\$)	Non-HVAC Total (\$)	Grand Total (\$)
January	298	50	0	0	347	651
February	280	47	0	0	326	559
March	319	53	0	0	372	545
April	306	51	0	0	357	468
May	298	50	0	0	347	417
June	306	51	0	0	357	441
July	309	52	0	0	361	480
August	307	51	0	0	358	473
September	306	51	0	0	357	431
October	298	50	0	0	347	419
November	306	51	0	0	357	495
December	319	53	0	0	372	609
Total	3,649	608	0	0	4,257	5,991

Monthly Energy Costs - ECM_2_16SEER

Hillside Barn
Kitchen and Associates

05/27/2010
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1. HVAC Costs

Month	Electric (\$)	Natural Gas (\$)	Fuel Oil (\$)	Propane (\$)	Remote Hot Water (\$)	Remote Steam (\$)	Remote Chilled Water (\$)
January	41	0	0	263	0	0	0
February	37	0	0	196	0	0	0
March	43	0	0	131	0	0	0
April	47	0	0	64	0	0	0
May	66	0	0	5	0	0	0
June	84	0	0	0	0	0	0
July	120	0	0	0	0	0	0
August	116	0	0	0	0	0	0
September	74	0	0	0	0	0	0
October	59	0	0	13	0	0	0
November	44	0	0	94	0	0	0
December	41	0	0	196	0	0	0
Total	770	0	0	963	0	0	0

2. Non-HVAC Costs

Month	Electric (\$)	Natural Gas (\$)	Fuel Oil (\$)	Propane (\$)	Remote Hot Water (\$)	Remote Steam (\$)
January	347	0	0	0	0	0
February	326	0	0	0	0	0
March	372	0	0	0	0	0
April	357	0	0	0	0	0
May	347	0	0	0	0	0
June	357	0	0	0	0	0
July	361	0	0	0	0	0
August	358	0	0	0	0	0
September	357	0	0	0	0	0
October	347	0	0	0	0	0
November	357	0	0	0	0	0
December	372	0	0	0	0	0
Total	4,257	0	0	0	0	0

Monthly Energy Use by Energy Type - ECM_2_16SEER

Hillside Barn
Kitchen and Associates

05/27/2010
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1. HVAC Energy Use

Month	Electric (kWh)	Natural Gas (na)	Fuel Oil (na)	Propane (gal)	Remote HW (na)	Remote Steam (na)	Remote CW (na)
Jan	190	0	0	159	0	0	0
Feb	171	0	0	118	0	0	0
Mar	198	0	0	79	0	0	0
Apr	219	0	0	39	0	0	0
May	305	0	0	3	0	0	0
Jun	390	0	0	0	0	0	0
Jul	557	0	0	0	0	0	0
Aug	538	0	0	0	0	0	0
Sep	343	0	0	0	0	0	0
Oct	275	0	0	8	0	0	0
Nov	203	0	0	57	0	0	0
Dec	193	0	0	118	0	0	0
Totals	3,582	0	0	580	0	0	0

2. Non-HVAC Energy Use

Month	Electric (kWh)	Natural Gas (na)	Fuel Oil (na)	Propane (gal)	Remote HW (na)	Remote Steam (na)
Jan	1,615	0	0	0	0	0
Feb	1,517	0	0	0	0	0
Mar	1,728	0	0	0	0	0
Apr	1,658	0	0	0	0	0
May	1,615	0	0	0	0	0
Jun	1,658	0	0	0	0	0
Jul	1,677	0	0	0	0	0
Aug	1,666	0	0	0	0	0
Sep	1,658	0	0	0	0	0
Oct	1,615	0	0	0	0	0
Nov	1,658	0	0	0	0	0
Dec	1,728	0	0	0	0	0
Totals	19,792	0	0	0	0	0

Monthly Energy Use by Component - ECM_2_16SEER

Hillside Barn
Kitchen and Associates

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1. Monthly Energy Use by System Component

Component	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Air System Fans (kWh)	190	171	188	182	187	182	187	187	182	187	182	188
<i>Cooling</i>												
Electric (kWh)	0	1	10	38	118	208	369	350	162	88	22	5
Natural Gas (na)	0	0	0	0	0	0	0	0	0	0	0	0
Fuel Oil (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (gal)	0	0	0	0	0	0	0	0	0	0	0	0
Remote HW (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote CW (na)	0	0	0	0	0	0	0	0	0	0	0	0
<i>Heating</i>												
Electric (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
Natural Gas (na)	0	0	0	0	0	0	0	0	0	0	0	0
Fuel Oil (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (gal)	159	118	79	39	3	0	0	0	0	8	57	118
Remote HW (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0	0	0	0	0	0	0	0
Pumps (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
Clg. Tower Fans (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
Lighting (kWh)	1384	1300	1481	1421	1384	1421	1437	1428	1421	1384	1421	1481
Electric Eqpt. (kWh)	231	217	247	237	231	237	240	238	237	231	237	247
Misc. Electric (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
<i>Misc. Fuel</i>												
Natural Gas (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (gal)	0	0	0	0	0	0	0	0	0	0	0	0
Remote HW (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0	0	0	0	0	0	0	0

Annual Cost Summary

Hillside Barn
Kitchen and Associates

05/27/2010
07:04PM

Table 1. Annual Costs

Component	ECM_2_16SEER (\$)
Air System Fans	475
Cooling	295
Heating	963
Pumps	0
Cooling Tower Fans	0
HVAC Sub-Total	1,733
Lights	3,649
Electric Equipment	608
Misc. Electric	0
Misc. Fuel Use	0
Non-HVAC Sub-Total	4,257
Grand Total	5,991

Table 2. Annual Cost per Unit Floor Area

Component	ECM_2_16SEER (\$/ft²)
Air System Fans	0.123
Cooling	0.076
Heating	0.249
Pumps	0.000
Cooling Tower Fans	0.000
HVAC Sub-Total	0.448
Lights	0.943
Electric Equipment	0.157
Misc. Electric	0.000
Misc. Fuel Use	0.000
Non-HVAC Sub-Total	1.100
Grand Total	1.548
Gross Floor Area (ft²)	3870.0
Conditioned Floor Area (ft²)	3870.0

Note: Values in this table are calculated using the Gross Floor Area.

Table 3. Component Cost as a Percentage of Total Cost

Component	ECM_2_16SEER (%)
Air System Fans	7.9
Cooling	4.9
Heating	16.1
Pumps	0.0
Cooling Tower Fans	0.0
HVAC Sub-Total	28.9
Lights	60.9
Electric Equipment	10.2
Misc. Electric	0.0
Misc. Fuel Use	0.0
Non-HVAC Sub-Total	71.1
Grand Total	100.0

Annual Energy and Emissions Summary

Hillside Barn
Kitchen and Associates

05/27/2010
07:04PM

Table 1. Annual Costs

Component	ECM_2_16SEER (\$)
HVAC Components	
Electric	770
Natural Gas	0
Fuel Oil	0
Propane	963
Remote HW	0
Remote Steam	0
Remote CW	0
HVAC Sub-Total	1,733
Non-HVAC Components	
Electric	4,257
Natural Gas	0
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Non-HVAC Sub-Total	4,257
Grand Total	5,991

Table 2. Annual Energy Consumption

Component	ECM_2_16SEER
HVAC Components	
Electric (kWh)	3,582
Natural Gas (na)	0
Fuel Oil (na)	0
Propane (gal)	580
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0
Non-HVAC Components	
Electric (kWh)	19,792
Natural Gas (na)	0
Fuel Oil (na)	0
Propane (gal)	0
Remote HW (na)	0
Remote Steam (na)	0
Totals	
Electric (kWh)	23,374
Natural Gas (na)	0
Fuel Oil (na)	0
Propane (gal)	580
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0

Annual Energy and Emissions Summary

Hillside Barn
Kitchen and Associates

05/27/2010
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Table 3. Annual Emissions

Component	ECM_2_16SEER
CO2 Equivalent (lb)	0

Table 4. Annual Cost per Unit Floor Area

Component	ECM_2_16SEER (\$/ft²)
HVAC Components	
Electric	0.199
Natural Gas	0.000
Fuel Oil	0.000
Propane	0.249
Remote HW	0.000
Remote Steam	0.000
Remote CW	0.000
HVAC Sub-Total	0.448
Non-HVAC Components	
Electric	1.100
Natural Gas	0.000
Fuel Oil	0.000
Propane	0.000
Remote HW	0.000
Remote Steam	0.000
Non-HVAC Sub-Total	1.100
Grand Total	1.548
Gross Floor Area (ft²)	3870.0
Conditioned Floor Area (ft²)	3870.0

Note: Values in this table are calculated using the Gross Floor Area.

Table 5. Component Cost as a Percentage of Total Cost

Component	ECM_2_16SEER (%)
HVAC Components	
Electric	12.9
Natural Gas	0.0
Fuel Oil	0.0
Propane	16.1
Remote HW	0.0
Remote Steam	0.0
Remote CW	0.0
HVAC Sub-Total	28.9
Non-HVAC Components	
Electric	71.1
Natural Gas	0.0
Fuel Oil	0.0
Propane	0.0
Remote HW	0.0
Remote Steam	0.0
Non-HVAC Sub-Total	71.1
Grand Total	100.0

APPENDIX H

ECM-6 Convert Gas Range Pilot Lights To Electronic Ignition

BPU ENERGY AUDIT PROGRAM
Andover Township Hillside Barn
CHA Project #20997

ECM-6 Convert Gas Range Pilot Lights to Electronic Ignition

Multipliers	
Material	0.98
Labor	1.21
Equipment	1.07

Installation Costs										
	Qty	Unit	Unit Costs			Subtotal Costs			Total Cost	Remarks
			Material	Labor	Equipment	Material	Labor	Equipment		
New 12-Burner Electronic Ignition Range	1	ea	\$ 5,500.00	\$ 500.00		\$ 5,390.00	\$ 605.00	\$ -	\$ 5,995.00	

New Range Subtotal	\$ 5,995.00
10% Contingency	\$ 599.50
Total	\$ 6,594.50

BPU ENERGY AUDIT PROGRAM
Andover Township Town Hall
CHA Project #20997

ECM-6 Convert Gas Range Pilot Lights to Electronic Ignition

Annual Energy Use Comparison			
	Electricity kWh	Propane Gallons	Cost \$
12 Standing Pilot Lights	0	360	\$ 600
Electronic Ignition	0	0	\$ -
Difference	0	-	\$ 600

APPENDIX I

ECM-7 New Weather Stripping on Exterior Doors

BPU ENERGY AUDIT PROGRAM
Andover Township Hillside Barn
CHA Project #20997

ECM-7 New Weather Stripping on Exterior Doors

Multipliers	
Material	0.98
Labor	1.21
Equipment	1.07

Installation Costs										
	Qty	Unit	Unit Costs			Subtotal Costs			Total Cost	Remarks
			Material	Labor	Equipment	Material	Labor	Equipment		
Install weather stripping on 3'x7' door	1	ea	\$ 25	\$ -		\$ 25	\$ -	\$ -	\$ 25	
Install weather stripping on 6'x7' door	1	ea	\$ 34	\$ -		\$ 33	\$ -	\$ -	\$ 33	

Subtotal	\$58
10% OH, 10% Profit	\$6
10% Contingency	\$6
Total	\$69

BPU ENERGY AUDIT PROGRAM
Andover Township Hillside Barn
CHA Project #20997

ECM-7 New Weather Stripping on Exterior Doors

Annual Energy Use Comparison			
	Electricity kWh	Propane Gallons	Cost \$
Losses due to damaged/missing weather stripping	0	30	\$ 50.00

Energy consumption is based on the modified degree day procedure, per ASHRAE:

$$E = [(H_L * D * 24) / (\text{DeltT} * n * V)] (C_D) (C_F)$$

$$E = [(1381 * 4589 * 24) / (70 * 0.78 * 91,330)] (0.64) (1.65) = 32$$

E = fuel or energy consumption for the estimate period

H_L = design heat loss, including infiltration, Btu per hour

D = number of 65 F degree days for the estimate period

DeltT = design temperature difference, Fahrenheit

n = rated full load efficiency, decimal

V = heating value of fuel, consistent with HL and E

C_D = interim correction factor for heating effect vs degree days

C_F = interim part-load correction factor for fueled systems only; equals 1.0 for electric resistance heating

APPENDIX J

ECM-8 Replace Refrigerators and Freezers in Kitchen

BPU ENERGY AUDIT PROGRAM
Andover Township Hillside Barn
CHA Project #20997

ECM-8 Replace Refrigerators and Freezers in Kitchen

Multipliers	
Material	0.98
Labor	1.21
Equipment	1.07

Installation Costs										
	Qty	Unit	Unit Costs			Subtotal Costs			Total Cost	Remarks
			Material	Labor	Equipment	Material	Labor	Equipment		
Purchase New Commercial 35 Cu. Ft. Refrigerator	2	ea	\$ 3,000	\$ -		\$ 5,880	\$ -	\$ -	\$ 5,880	

Subtotal	\$5,880
10% Contingency	\$588
Total	\$6,468

BPU ENERGY AUDIT PROGRAM
Andover Township Hillside Barn
CHA Project #20997

ECM-8 Replace Refrigerators and Freezers in Kitchen

Annual Energy Use Comparison			
	Electricity kWh	Propane Gallons	Cost \$
Existing Refrigerator #1	5,000	0	\$ 1,100.00
Existing Refrigerator #2	3,000	0	\$ 600.00
Existing Refrigerated Display Case	3,300	0	\$ 700.00
Existing Chest Freezer	400	0	\$ 90.00
(2) New 35 Cu. Ft. Commercial Refrigerators	6,400	0	\$ 1,400.00
(1) New 8.5 Cu. Ft. Chest Freezer	400	0	\$ 90.00
Operating Cost Difference (Refrigerators)	4,900	0	\$ 1,000.00
Operating Cost Difference (Freezer)	0	0	\$ -

Assumptions (Based on Survey Observations):

Existing Refrigerator #1: Compressor runs continuously at 0.575 kW (5 Amps at 115V)

Existing Refrigerator #2: Compressor runs continuously at 0.345 kW (3 Amps at 115V)

Existing Refrigerated Display Case: Compressor runs 50% of the time at 0.746 kW (1 HP compressor)

Existing Chest Freezer: Compressor runs 50% of the time at 0.095 kW

New 35 Cu. Ft. Commercial Refrigerator: Compressor runs 35% of the time at 1.058 kW (9.2 Amps at 115V)

New 8.5 Cu. Ft. Chest Freezer: Yearly kWh consumption based on manufacturer data

APPENDIX K

Photovoltaic (PV) Rooftop Solar Power Generation



AC ENERGY & COST SAVINGS



(Type comments here to appear on printout; maximum 1 row of 90 characters.)

Station Identification	
Cell ID:	0267370
State:	New Jersey
Latitude:	40.9 ° N
Longitude:	74.7 ° W
PV System Specifications	
DC Rating:	30.0 kW
DC to AC Derate Factor:	0.770
AC Rating:	23.1 kW
Array Type:	Fixed Tilt
Array Tilt:	40.9 °
Array Azimuth:	180.0 °
Energy Specifications	
Cost of Electricity:	21.5 ¢/kWh

Results			
Month	Solar Radiation (kWh/m ² /day)	AC Energy (kWh)	Energy Value (\$)
1	3.13	2331	501.40
2	3.93	2629	565.50
3	5.04	3571	768.12
4	5.30	3498	752.42
5	5.57	3714	798.88
6	5.80	3647	784.47
7	5.48	3487	750.05
8	5.46	3508	754.57
9	5.29	3372	725.32
10	4.74	3243	697.57
11	3.43	2332	501.61
12	2.98	2175	467.84
Year	4.68	37507	8067.76

Output Results as Text

[SAVING TEXT FROM A BROWSER](#)

RUN **PVWATTS v.2** FOR ANOTHER LOCATION

RUN **PVWATTS v.1**

Please send questions and comments to [Webmaster](#)
[Disclaimer and copyright notice.](#)



RReDC home page (<http://rredc.nrel.gov>)

Your Solar Electric Estimate

YOUR SOLAR RATING ?



The solar rating of your area is **Great** for adopting a solar system. (4.68 kWh/m² per day).
You may want to change some of the information to better match your situation.

Customize Your Assumptions

Price Installed \$ 8 per watt DC.

This is a user-entered cost. Enter 0 to return to default.

Provide 94 % of my electricity, on average, over the course of a year.

Electric Rate: \$ 0.2151/kWh [More](#)

Monthly Electric Usage: 3,340 kWh/Month [More](#)

Utility Annual Inflation Rate: 3.78%

Utility Savings Method: Net Metering (common)

Federal ITC Based Upon: Gross Cost

Federal Income Tax Rate: 28%

State Income Tax Rate: 7.8% (Low: 1.40% - High: 8.97%) [help](#)

Loan Modeling: Borrow 0 % of \$137,310 estimated cost
at 6.5 % interest (apr) re-paid over 30 years

If you agree **this is a smart investment**, we encourage
you to work with a [Professional](#) to help you install
your very own system.

[http://www.solar-estimate.org/index.php?page=solar-
installer&subpage=show&wantsolar=1&zipcode=07821](http://www.solar-estimate.org/index.php?page=solar-installer&subpage=show&wantsolar=1&zipcode=07821)

Click on the [notes](#) buttons to learn about our assumptions and other important information used to generate your estimate. Also, please review the

help us improve. We rely on feedback from our users to help keep our service accurate and useful:
[Send us your Feedback](#)

Your Solar Electric Estimate by the Numbers

Building Type:

Commercial/Business

State & County:

NJ - Sussex

Utility:

Jersey Central Power & Lt Co

Utility Type: Investor-Owned Utility

Your Average Monthly Electricity Bill: \$ 718 / Month
(Assumed rate x average monthly useage)

Tiered Rates Apply: No

Time-of-Use Metering Offered: No

Net-Metering Available: Yes - See [Notes](#), below!

ESTIMATED SYSTEM SIZE

The system size best for your situation will vary based upon product, building, geographic and other variables. We encourage you to work with a [Solar Pro](#) who can better estimate the system size best for your situation. We estimate your building will need a system sized between 23.88 kW and 35.82 kW of peak power. This estimate assumes the mid-point of this range.

Solar Rating: **Good**
4.68 kWh/sq-m/day

Solar System Capacity Required: 29.85 kW of peak power
(DC watts)

Roof Area Needed: 2,985 sq-ft

Equivalent Annual Production: 37,671 kWh electricity

ESTIMATED SYSTEM COST

This is only an estimate based upon many assumptions. Installation costs can vary considerably. We encourage you to work with a [Solar Pro](#) who can provide you with a more detailed cost estimate. We estimate that a 30 kW peak DC power system will cost between \$191,040 and \$286,560. This estimate assumes the mid-point of this cost range.

Assumed Installation Gross Cost: \$238,800
"Gross Cost" is the cost before any rebates, incentives, tax credits, etc. are applied. See the [Cost Notes](#), below! assuming \$8 per watt DC

FINANCIAL INCENTIVES

Financial incentives shown are totals across all years. So, if an incentive spans multiple years then the value shown is the total of all years. For details, please refer to the table below "Cash Flow by Year and Cumulative Across Years"

NJ: Solar Renewable Energy Certificates (SREC) [» link](#) \$ 290,147

NJ Renewable Energy Incentive (Commercial) [» link](#) \$ 29,850

Federal Tax Credit (30% of Gross Cost at Installation) » link	\$ 71,640
Modified Accelerated Cost Recovery System (MACRS) Depreciation (5 yr) » link	YES
ESTIMATED NET COST:	\$ -152,837
ESTIMATED NET COST AT INSTALLATION:	\$ 137,310
Cash & Loan Amounts:	\$ 137,310 Cash \$ 0 Borrowed
Loan Monthly Payment (6.5% apr, 30 years):	\$ 0

CASH FLOW

Cash Flow Breakeven is where the chart crosses the \$ zero point - this is when your investment has paid itself back in cash.

The chart above is a summary of the net cash flow you can expect over time. Net Cash Flow is the total cash after all costs (out-flows of cash) are reduced by financial incentives, annual utility savings and tax effects (in-flows of cash).

Average values are used together with your assumed income tax rate (36%). Any property appreciation has not been included, as this is generally not a cash flow (it's an investment). The loan modeled, if any, is included. Because this is a business, we have assumed utility savings result in loss of some expense write offs against income, but Modified Accelerated Cost Recovery System (MACRS) Depreciation applies (an income tax benefit). Because individual tax situations vary, we have not included Federal income tax liabilities that may result from having received non-federal incentives, if any (e.g. state rebate programs) as they are usually not taxed as earned income.

SAVINGS & BENEFITS

First-year Utility Savings:	\$8,104
Average Monthly Utility Savings: <i>over 25-year expected life of system</i>	\$1,133
Average Annual Utility Savings: <i>over 25-year expected life of system</i>	\$13,602
25-year Utility Savings:	\$340,046
Internal Rate of Return (IRR):	26.2 %
Net Present Value (NPV):	\$222,429
Profitability Index:	2.6
Greenhouse Gas (CO2) Saved: <i>over 25-year system life</i>	772 tons 1,544,000 auto miles

Cash Flow by Year and Cumulative Across Years

This cash flow table includes tax effects applied to utility savings and loan interest payments (if any). For commercial (business) situations we assume utility savings result in loss of some expense write offs against income: Utility Savings = (\$'s saved on utility bill) x (1 - Income Tax Rate). "Tax Savings from MACRS depreciation" (below) is the net cash saved on income taxes after the depreciation expense is written off. So the

amount that was depreciated would be the cash value shown divided by the Income Tax Rate ([more info.](#)). Because individual tax situations vary, we have not included Federal income tax liabilities that may result from having received non-federal incentives, if any (e.g. state rebate programs) as they are usually not taxed as earned income. Any income from your system (e.g. performance-based incentives and "SREC's") may be taxed as income (also not shown).

Year of Operation:	at Install	1	2	3	4	5
Gross Cost (\$238,800)						
NJ: Solar Renewable Energy Certificates (SREC)	\$0	\$23,749	\$23,034	\$22,341	\$21,669	\$21,017
NJ Renewable Energy Incentive (Commercial)	\$29,850	\$0	\$0	\$0	\$0	\$0
Federal Tax Credit (30% of Gross Cost at Installation)	\$71,640	\$0	\$0	\$0	\$0	\$0
Tax savings from MACRS Depreciation	\$0	\$12,396	\$19,834	\$11,900	\$7,140	\$7,140
Utility Savings	\$0	\$5,399	\$5,603	\$5,815	\$6,035	\$6,263
ANNUAL CASH FLOW	\$-137,310	\$41,544	\$48,471	\$40,056	\$34,844	\$34,420
Cumulative Cash Flow	\$-137,310	\$-95,766	\$-47,295	\$-7,239	\$27,605	\$62,025
				Breakeven		

Year of Operation:	6	7	8	9	10	11
Gross Cost						
NJ: Solar Renewable Energy Certificates (SREC)	\$20,384	\$19,771	\$19,176	\$18,598	\$18,039	\$17,496
NJ Renewable Energy Incentive (Commercial)	\$0	\$0	\$0	\$0	\$0	\$0
Federal Tax Credit (30% of Gross Cost at Installation)	\$0	\$0	\$0	\$0	\$0	\$0
Tax savings from MACRS Depreciation	\$3,570	\$0	\$0	\$0	\$0	\$0
Utility Savings	\$6,500	\$6,746	\$7,001	\$7,265	\$7,540	\$7,825
ANNUAL CASH FLOW	\$30,454	\$26,517	\$26,177	\$25,863	\$25,579	\$25,321

Cumulative Cash Flow \$92,479 \$118,996 \$145,173 \$171,036 \$196,615 \$221,936

Year of Operation:	12	13	14	15	16	17		
				(\$26,865)				
Gross Cost				Inverter Replaced				
NJ: Solar Renewable Energy Certificates (SREC)	\$16,969	\$16,458	\$15,963	\$15,483	\$0	\$0		
NJ Renewable Energy Incentive (Commercial)	\$0	\$0	\$0	\$0	\$0	\$0		
Federal Tax Credit (30% of Gross Cost at Installation)	\$0	\$0	\$0	\$0	\$0	\$0		
Tax savings from MACRS Depreciation	\$0	\$0	\$0	\$0	\$0	\$0		
Utility Savings	\$8,121	\$8,427	\$8,746	\$9,077	\$9,420	\$9,776		
ANNUAL CASH FLOW	\$25,090	\$24,885	\$24,709	\$-2,305	\$9,420	\$9,776		
Cumulative Cash Flow	\$247,026	\$271,911	\$296,620	\$294,315	\$303,735	\$313,511		
Year of Operation:	18	19	20	21	22	23	24	25
Gross Cost								
NJ: Solar Renewable Energy Certificates (SREC)	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
NJ Renewable Energy Incentive (Commercial)	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Federal Tax Credit (30% of Gross	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0

Cost at Installation)								
Tax savings from MACRS Depreciation	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Utility Savings	\$10,145	\$10,529	\$10,927	\$11,340	\$11,769	\$12,213	\$12,675	\$13,154
ANNUAL CASH FLOW	\$10,145	\$10,529	\$10,927	\$11,340	\$11,769	\$12,213	\$12,675	\$13,154
Cumulative Cash Flow	\$323,656	\$334,185	\$345,112	\$356,452	\$368,221	\$380,434	\$393,109	\$406,263

FAQ's: Frequently Asked Questions for NJ:

- [Are renewable energy systems exempt from sales tax in New Jersey?](#)
- [Can I sell Solar Renewable Energy Certificates \(SREC\) in New Jersey?](#)
- [Where can I find more information about New Jersey Renewable energy programs and incentives?](#)

Notes & Assumptions: Solar Electric (PV) Systems

* HOW TO REDUCE THE SYSTEM SIZE NEEDED & INCREASE SAVINGS

The estimate provided above assumes "base" electric rates apply. Other taxes and surcharges may be applied to your utility bill. We suggest you review a recent utility bill and change the "Assumed Electric Rate", above, as needed to better match your situation.

You may have other metered-rate options with your utility. Options such as Tiered billing rates, Time-Of-Use (TOU) metering, and Net-Metering, if available, can help reduce the system size you need to provide a "net-zero" energy bill. Sometimes people also reduce the size of their solar system to accommodate planned improvements in their building's energy efficiency, or to match a budget and/or the available space for installing a solar system.

Energy production from a solar electric (PV) system is a function of several factors, including the following. Our assumptions are:

Factor	Assumption
Solar resources	Assumed solar availability: As per Solar Radiance chart
Soiling or contamination of the PV panels	Clean, washed frequently: 100% design sunlight transmission
Temperature	25C, calm wind
System configuration (battery or non-battery)	Non-battery
Orientation to the sun	tilted at your latitude, full sun

Shading	None
PV Energy delivered as % of manufacturer's rating	95%
Soiling, wiring & power point tracking losses	9% (91% delivered)
Inverter Efficiency	90%
<u>Total Energy Delivered</u>	<u>95% x 91% x 90% = 78%</u>

Energy Efficiency: [Improving your building's energy efficiency](#) will reduce the system size you need to attain a "net-zero" energy bill.

Tiered Rates: Often people are paying a "Tiered" rate for their electricity. This is a higher rate (higher than the "Base" rate) for electricity charged when a home or building uses more than a "Base" amount allocated for the building. Installing a solar system will reduce your electrical demand from the utility. This can result in a lower utility rate because you stay within the "Base" rate level. In this case, the more expensive "Tiered" rate electricity is eliminated, reducing your average electricity rate.

TOU Metering: Many utilities offer Time-of-Use (TOU) meters. This allows the price of electricity to vary by time of day (called "Peak" or "Off-Peak" periods) and by season (usually "Winter" versus "Summer" rates). If TOU metering is offered by your utility, a solar system may result in additional savings. This is because peak (more expensive electricity) rates often occur during the daytime. This is usually when a solar system is producing the most output, thus reducing your demand for peak-rate electricity from the utility.

Most utilities do charge for the purchase and installation of a time-of-use meter (normally a few hundred dollars). We have assumed the cost for this is part of the "Estimated Installation cost" shown above.

Net-Metering: With [Net-Metering](#), surplus electricity generated by your renewable energy system will be credited back to your utility account. So if your solar system makes more electricity than you are using, the "meter spins backwards". You are not actually "selling" electricity, since in most states the utility will not reimburse you for excess electricity. But, if your utility offers "Net-Metering" you may be able to get credit for electricity provided back to the grid during peak periods. Combined with TOU metering, Net-Metering can result in multiplied savings since your electricity account may be gaining electricity credits during the time of peak utility rates -- Think of a hot, sunny summer day ... your solar system is producing power, spinning your electric meter backwards, and supplying the grid with electricity to run other people's air conditioners -- you're "spinning back" cost at peak rates! That's the savings power of Net-metering, combined with TOU rates.

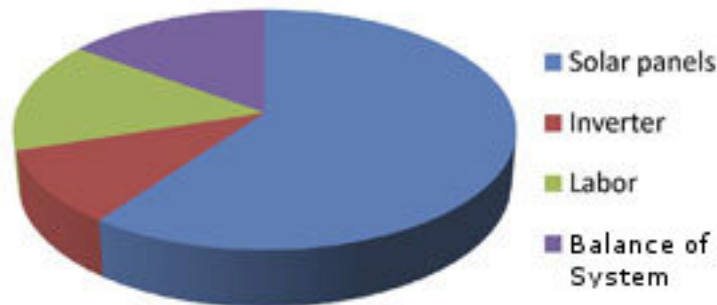
Solar Power "Fixes" Energy Costs: The cost of sunshine is free. While the sun rises every morning, the cost of sunshine does not. Utility rates, on the other hand, tend to rise steadily in cost. So, the value of your savings from a solar system are likely to increase as time goes on. If you are on a fixed income (e.g. nearing or in retirement) this may be of particular interest to you.

THE COST TO GO SOLAR

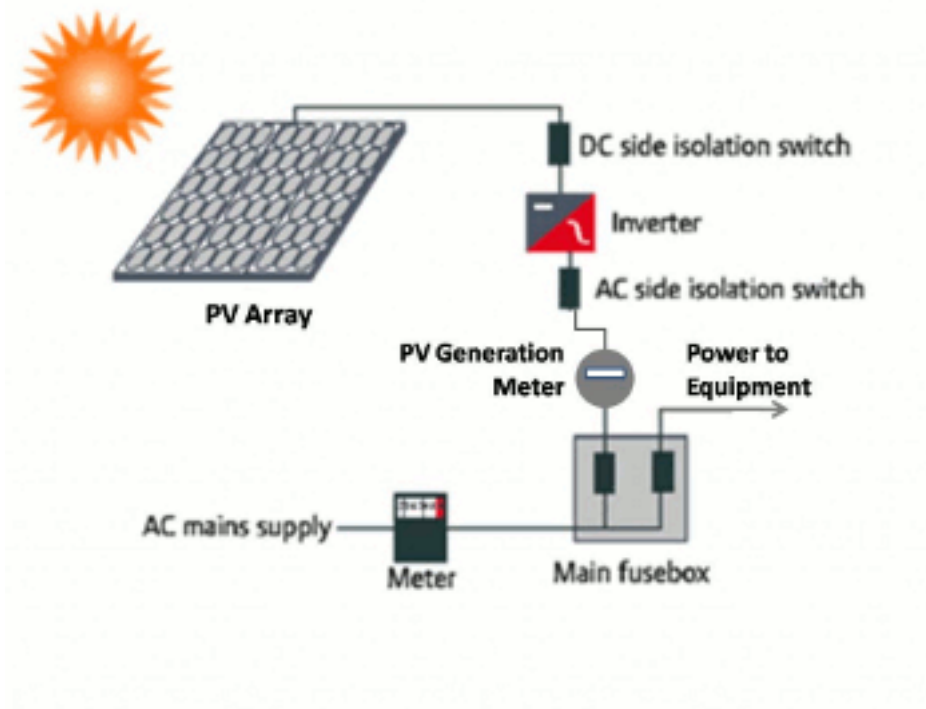
This is only an estimate based upon many assumptions and limited data entered by you: Installation costs can vary considerably. The cost to purchase and install a complete grid-tied solar photovoltaic (PV) system on a residential home is typically as further defined in the table, below. This includes the PV array, inverter and associated balance of system costs. It does not include the cost of options you may select, such as battery backup power storage, or the costs of building preparation work, like new shingles. Costs can also be higher if you add other features or have special installation needs (such as application over tile roofing) or you choose to use special mounting systems (such as sun tracking systems). Other factors may also affect price, including, but not limited to, your location, the building condition, type and location, its wiring, and warranties offered.

Assumed Cost, per Watt DC

Item	System Size < 2kW	System Size ≥ 2kW
Assumed Total	\$10 per watt DC (+/- 20%)	\$9 per watt DC (+/- 20%)



About 60% of the cost to install a solar-electric (PV) system goes to the solar photovoltaic (PV) panels, 10% to an inverter, 15% to direct labor, and 15% to the "balance of system" (BOS) costs.



OTHER ASSUMPTIONS

This summary is based upon many [assumptions](#) and the limited data you entered. An actual site assessment by a qualified solar system retailer or contractor will be needed to determine the actual costs and benefits of installing a solar electric system.

HELPFUL PDF's & Links



[Report on Solar-Estimate.org Estimator: Comparisons, Methods & Assumpti](#)



[Payback & Other Financial Test for Solar on Your Home](#)

The Dept. of Energy's: [PVWatts Online PV Calculator](#)

Natural Resources Canada's: [RETScreen Renewable Energy Calculators](#)

A Free Public Service of the Solar & Wind Communities since 2000



Contractor verification assisted by »
[ContractorCheck.com](#)



Pre-screened, Customer-recommended Solar Pros
See: » [How it Works](#)



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[SOLAR-ESTIMATE.ORG](#) is a free, public service. We believe the efficient use of energy and renewable energy systems makes for comfortable living and a more secure future. So we want to help you reduce your energy demands, increase your energy efficiency and help you utilize more energy from renewable energy systems and sources -- like solar electric (PV - photovoltaics), solar space (air), water & pool heating, wind turbines, biomass furnaces and ground-source heat pumps. Our [mission](#) is to serve as a convenient, user-friendly means for home and small commercial building owners to make preliminary evaluations of renewable and solar energy options for their location, run financial analysis and help find and verify the experience, quality and business status of certified solar contractors, and other professionals who can design, install and service renewable and solar energy and energy efficient power systems. (See [How It Works](#)). As a business verification service, we maintain the largest directory of current local solar installer and solar contractor profiles including extensive customer reviews and ratings of these professionals. Profiles are not limited to solar energy professionals, but include many other renewable energy, design, engineering and support [professional services](#). We also serve as a consolidator of national and region-specific solar and energy efficiency programs, and utility information about renewable energy, solar energy and energy efficient measures. Our software tools and content include: Online [solar estimator](#) (solar calculator, analysis) to help you determine the costs and benefits of a renewable or solar energy system for your particular location and building needs, including financial analysis tools. We also provide a trusted means by which you, as a consumer, can [review and access solar panel installers, solar contractors, solar pros](#) and other solar, renewable energy and energy efficiency [professional services](#). And we offer answers to [frequently asked questions](#) about renewable and solar power, [links and resources](#) to current information about solar power, solar energy, renewable energy, energy bill savings, energy efficiency data, solar incentives, tax credits, rebates and other programs and [helpful information](#) so you can learn about solar energy, help us promote renewable and solar power adoption and, hopefully, install a solar system for your home, building, company or community

and/or improve your energy efficiency and use. [Site Map](#)

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APPENDIX L

Solar Thermal Domestic Hot Water Plant



[Home](#)

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[Electric Choice](#)

[Home Energy](#)

[FAQs](#)

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Interactive Energy Calculators

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?](#)

RENEWABLE ENERGY
THE INFINITE POWER
OF TEXAS

Solar Water Heating Calculator

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

Water Heater Characteristics			
Physical		Thermal	
2.2 Diameter (feet)	2.2	50 Water Inlet Temperature (Degrees F)	50
100 Capacity (gallons)	100	70 Ambient Temperature (Degrees F)	70
31.91 Surface Area (calculated - sq ft)	31.91	140 Hot Water Temperature (Degrees F)	140
16 Effective R-value	16	60 Hot Water Usage (Gallons per Day)	60
Energy Use			
1847		1847 Heat Delivered in Hot Water (BTU/hr)	
139.6		139.6 Heat loss through insulation (BTU/hr)	

Gas vs. Electric Water Heating		
Gas		Electric
0	0.9111 Overall Efficiency	0.9111
0	0.98 Conversion Efficiency	0.98

NaN BTU/hr	2027 BTU/hr
Cost	
\$ 0.40 /Therm	\$ 0.2151 /kWh
\$ NaN	\$ 1118.61
How Does Solar Compare?	
9305 Solar Water Heater Cost: \$	70 Percentage Solar:
NaN years for gas	11.8833 years for electric

More information on solar water heating:

- Fact sheet - [Solar Water Heaters](#)
- Fact sheet - [Solar Water Heaters for Swimming Pools](#)
- Kids fact sheet - [Heat from the Sun](#)

[Return to Top of Page](#)

Send comments, questions, and suggestions to [website manager](#).

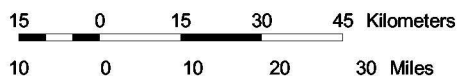
APPENDIX M

Wind

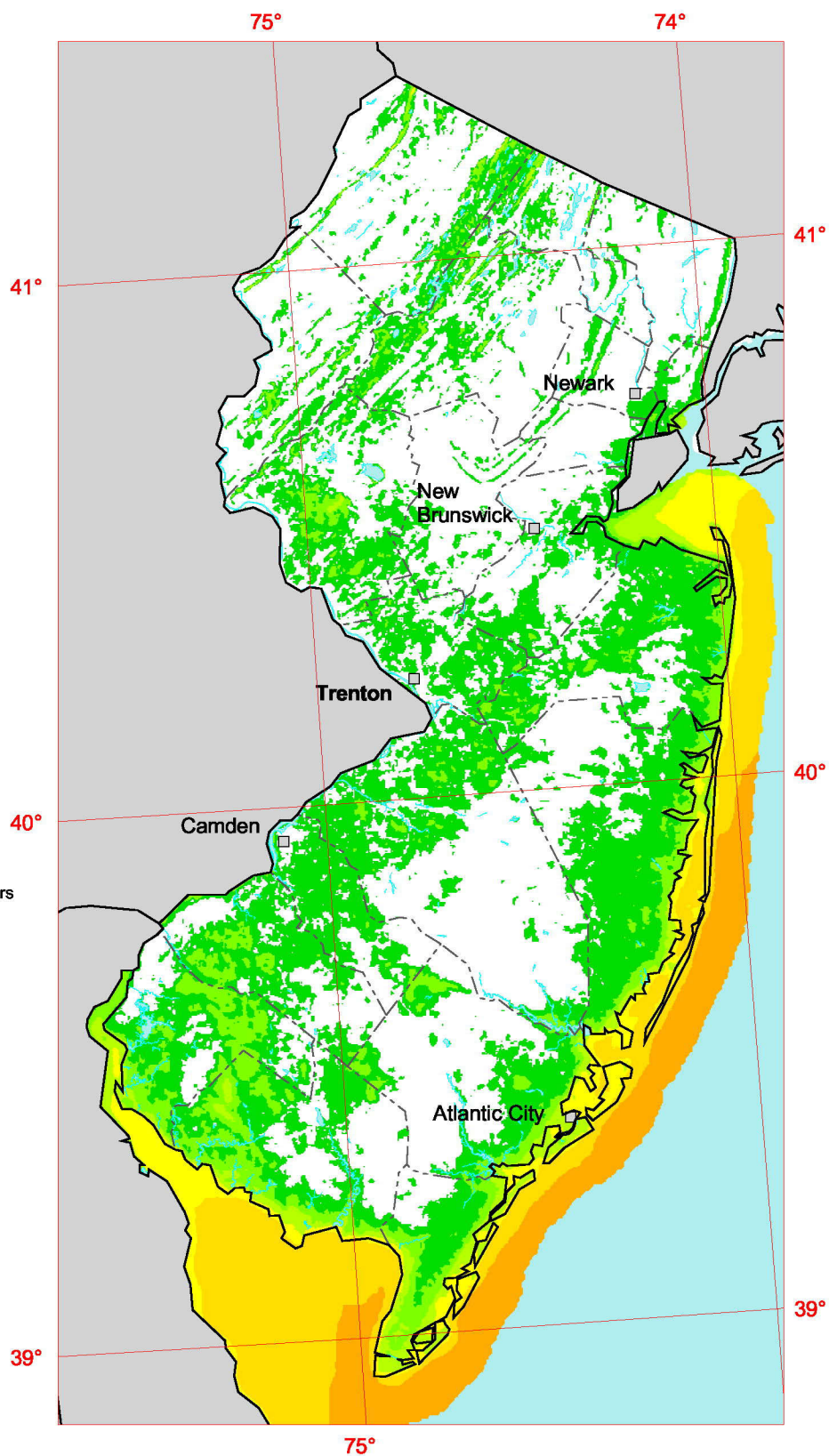
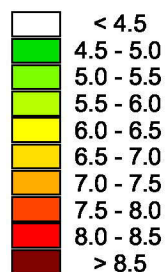
New Jersey

30 m Wind Speed Map

The annual wind speed estimates for this map were produced by TrueWind Solutions using their Mesomap system and historical weather data. It has been validated with available surface data by NREL and wind energy meteorological consultants.



Wind Speed at 30 Meters m/s



U.S. Department of Energy
National Renewable Energy Laboratory



10-JAN-2003 1.1.8

APPENDIX N

EPA Portfolio Manager

STATEMENT OF ENERGY PERFORMANCE

Andover Township Hillside Barn

Building ID: 2272136

For 12-month Period Ending: November 30, 2009¹

Date SEP becomes ineligible: N/A

Date SEP Generated: May 24, 2010

Facility	Facility Owner	Primary Contact for this Facility
Andover Township Hillside Barn 146 Lake Iliff Rd. Andover, NJ 07821	N/A	N/A

Year Built: 1933

Gross Floor Area (ft²): 7,000Energy Performance Rating² (1-100) N/A**Site Energy Use Summary³**

Electricity - Grid Purchase(kBtu)	136,753
Propane (kBtu)	300,041
Natural Gas - (kBtu) ⁴	0
Total Energy (kBtu)	436,794

Energy Intensity⁵

Site (kBtu/ft ² /yr)	62
Source (kBtu/ft ² /yr)	109

Emissions (based on site energy use)

Greenhouse Gas Emissions (MtCO ₂ e/year)	40
---	----

Electric Distribution Utility

FirstEnergy - Jersey Central Power & Lt Co

National Average Comparison

National Average Site EUI	77
National Average Source EUI	182
% Difference from National Average Source EUI	-40%
Building Type	Office

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	
Building Name	Andover Township Hillside Barn	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	Office	Is this an accurate description of the space in question?		☐
Location	146 Lake Iliff Rd., Andover, NJ 07821	Is this address accurate and complete? Correct weather normalization requires an accurate zip code.		☐
Single Structure	Single Facility	Does this SEP represent a single structure? SEPs cannot be submitted for multiple-building campuses (with the exception of acute care or children's hospitals) nor can they be submitted as representing only a portion of a building		☐

Offices (Office)

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	
Gross Floor Area	3,550 Sq. Ft.	Does this square footage include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, atria, vent shafts, etc. Also note that existing atriums should only include the base floor area that it occupies. Interstitial (plenum) space between floors should not be included in the total. Finally gross floor area is not the same as leasable space. Leasable space is a subset of gross floor area.		☐
Weekly operating hours	40 Hours	Is this the total number of hours per week that the Office space is 75% occupied? This number should exclude hours when the facility is occupied only by maintenance, security, or other support personnel. For facilities with a schedule that varies during the year, "operating hours/week" refers to the total weekly hours for the schedule most often followed.		☐
Workers on Main Shift	6	Is this the number of employees present during the main shift? Note this is not the total number of employees or visitors who are in a building during an entire 24 hour period. For example, if there are two daily 8 hour shifts of 100 workers each, the Workers on Main Shift value is 100. The normal worker density ranges between 0.3 and 10 workers per 1000 square feet (92.8 square meters)		☐
Number of PCs	6	Is this the number of personal computers in the Office?		☐
Percent Cooled	50% or more	Is this the percentage of the total floor space within the facility that is served by mechanical cooling equipment?		☐
Percent Heated	50% or more	Is this the percentage of the total floor space within the facility that is served by mechanical heating equipment?		☐

Recreation Space (Other)

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	
-----------	---------------------------------------	------------------------	-------	--

Gross Floor Area	3,450 Sq. Ft.	Does this square footage include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, atria, vent shafts, etc. Also note that existing atriums should only include the base floor area that it occupies. Interstitial (plenum) space between floors should not be included in the total. Finally gross floor area is not the same as leasable space. Leasable space is a subset of gross floor area.	☐
Number of PCs	N/A(Optional)	Is this the number of personal computers in the space?	☐
Weekly operating hours	N/A(Optional)	Is this the total number of hours per week that the space is 75% occupied? This number should exclude hours when the facility is occupied only by maintenance, security, or other support personnel. For facilities with a schedule that varies during the year, "operating hours/week" refers to the total weekly hours for the schedule most often followed.	☐
Workers on Main Shift	N/A(Optional)	Is this the number of employees present during the main shift? Note this is not the total number of employees or visitors who are in a building during an entire 24 hour period. For example, if there are two daily 8 hour shifts of 100 workers each, the Workers on Main Shift value is 100.	☐

ENERGY STAR® Data Checklist for Commercial Buildings

Energy Consumption

Power Generation Plant or Distribution Utility: FirstEnergy - Jersey Central Power & Lt Co

Fuel Type: Electricity		
Meter: Electric Meter (kWh (thousand Watt-hours)) Space(s): Entire Facility Generation Method: Grid Purchase		
Start Date	End Date	Energy Use (kWh (thousand Watt-hours))
11/01/2009	11/30/2009	2,640.00
10/01/2009	10/31/2009	2,000.00
09/01/2009	09/30/2009	2,640.00
08/01/2009	08/31/2009	4,640.00
07/01/2009	07/31/2009	3,440.00
06/01/2009	06/30/2009	3,120.00
05/01/2009	05/31/2009	2,560.00
04/01/2009	04/30/2009	2,560.00
03/01/2009	03/31/2009	3,120.00
02/01/2009	02/28/2009	3,920.00
01/01/2009	01/31/2009	5,280.00
12/01/2008	12/31/2008	4,160.00
Electric Meter Consumption (kWh (thousand Watt-hours))		40,080.00
Electric Meter Consumption (kBtu (thousand Btu))		136,752.96
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		136,752.96
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?		☐
Fuel Type: Propane		
Meter: Propane Use (Gallons) Space(s): Entire Facility		
Start Date	End Date	Energy Use (Gallons)
11/01/2009	11/30/2009	378.10
10/01/2009	10/31/2009	0.00
09/01/2009	09/30/2009	579.30
08/01/2009	08/31/2009	0.00
07/01/2009	07/31/2009	0.00
06/01/2009	06/30/2009	0.00
05/01/2009	05/31/2009	0.00
04/01/2009	04/30/2009	0.00
03/01/2009	03/31/2009	955.30
02/01/2009	02/28/2009	356.10

01/01/2009	01/31/2009	727.00
Propane Use Consumption (Gallons)		2,995.80
Propane Use Consumption (kBtu (thousand Btu))		274,557.88
Total Propane Consumption (kBtu (thousand Btu))		274,557.88
Is this the total Propane consumption at this building including all Propane meters?		☐

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

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

Certifying Professional

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

Name: _____ Date: _____

Signature: _____

Signature is required when applying for the ENERGY STAR.

FOR YOUR RECORDS ONLY. DO NOT SUBMIT TO EPA.

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

Facility

Andover Township Hillside Barn
146 Lake Iliff Rd.
Andover, NJ 07821

Facility Owner

N/A

Primary Contact for this Facility

N/A

General Information

Andover Township Hillside Barn	
Gross Floor Area Excluding Parking: (ft ²)	7,000
Year Built	1933
For 12-month Evaluation Period Ending Date:	November 30, 2009

Facility Space Use Summary

Offices		Recreation Space	
Space Type	Office	Space Type	Other - Recreation
Gross Floor Area(ft ²)	3,550	Gross Floor Area(ft ²)	3,450
Weekly operating hours	40	Number of PCs ^o	N/A
Workers on Main Shift	6	Weekly operating hours ^o	N/A
Number of PCs	6	Workers on Main Shift ^o	N/A
Percent Cooled	50% or more		
Percent Heated	50% or more		

Energy Performance Comparison

Performance Metrics	Evaluation Periods		Comparisons		
	Current (Ending Date 11/30/2009)	Baseline (Ending Date 11/30/2009)	Rating of 75	Target	National Average
Energy Performance Rating	N/A	N/A	75	N/A	N/A
Energy Intensity					
Site (kBtu/ft ²)	62	62	46	N/A	77
Source (kBtu/ft ²)	109	109	81	N/A	182
Energy Cost					
\$/year	\$ 13,562.99	\$ 13,562.99	\$ 10,059.22	N/A	\$ 16,736.38
\$/ft ² /year	\$ 1.94	\$ 1.94	\$ 1.44	N/A	\$ 2.39
Greenhouse Gas Emissions					
MtCO ₂ e/year	40	40	30	N/A	49
kgCO ₂ e/ft ² /year	6	6	4	N/A	7

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

Notes:

o - This attribute is optional.

d - A default value has been supplied by Portfolio Manager.

APPENDIX O

Carrier Hourly Analysis Program – Downstairs Office Base Building

ALT2 - Floor 1 BLD1-Basement Input Data

Project Name: Hillside Barn
Prepared by: Kitchen and Associates

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1. General Details:

Air System Name ALT2 - Floor 1 BLD1-Basement
Equipment Type Split AHU
Air System Type Single Zone CAV
Number of zones 1

2. System Components:

Ventilation Air Data:

Airflow Control Constant Ventilation Airflow
Ventilation Sizing Method Sum of Space OA Airflows
Unocc. Damper Position Closed
Damper Leak Rate 0 %
Outdoor Air CO2 Level 400 ppm

Central Cooling Data:

Supply Air Temperature 58.0 °F
Coil Bypass Factor 0.100
Cooling Source Air-Cooled DX
Schedule JFMAMJJASOND
Capacity Control Cycled or Staged Capacity - Fan On

Central Heating Data:

Supply Temperature 100.0 °F
Heating Source Combustion - Propane
Schedule JFMAMJJASOND
Capacity Control Cycled or Staged Capacity - Fan On

Supply Fan Data:

Fan Type Forward Curved
Configuration Blow-thru
Fan Performance 1.00 in wg
Overall Efficiency 54 %

Duct System Data:

Supply Duct Data:

Duct Heat Gain 0 %
Duct Leakage 0 %

Return Duct or Plenum Data:

Return Air Via Return Air Plenum
Wall Heat Gain to Plenum 0 %
Roof Heat Gain to Plenum 70 %
Lighting Heat Gain to Plenum 30 %

3. Zone Components:

Space Assignments:

Zone 1: BLD1-F002-Z01	
BLD1-F002-Z01	x1

Thermostats and Zone Data:

Zone All
Cooling T-stat: Occ. 75.0 °F
Cooling T-stat: Unocc. 75.0 °F
Heating T-stat: Occ. 70.0 °F
Heating T-stat: Unocc. 70.0 °F
T-stat Throttling Range 1.50 °F
Diversity Factor 100 %
Direct Exhaust Airflow 0.0 CFM
Direct Exhaust Fan kW 0.0 kW

Thermostat Schedule 90.1 Assembly HVAC
Unoccupied Cooling is Available

Supply Terminals Data:

Zone All
Terminal Type Diffuser
Minimum Airflow 0.00 CFM/person

Zone Heating Units:

Zone All

ALT2 - Floor 1 BLD1-Basement Input Data

Project Name: Hillside Barn
Prepared by: Kitchen and Associates

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Zone Heating Unit Type **None**

Zone Unit Heat Source **Electric Resistance**

Zone Heating Unit Schedule **JFMAMJJASOND**

4. Sizing Data (Computer-Generated):

System Sizing Data:

Cooling Supply Temperature **58.0** °F
Supply Fan Airflow **1570.3** CFM
Ventilation Airflow **0.0** CFM
Heating Supply Temperature **100.0** °F

Hydronic Sizing Specifications:

Chilled Water Delta-T **10.0** °F
Hot Water Delta-T **20.0** °F

Safety Factors:

Cooling Sensible **0** %
Cooling Latent **0** %
Heating **0** %

Zone Sizing Data:

Zone Airflow Sizing Method **Sum of space airflow rates**
Space Airflow Sizing Method **Individual peak space loads**

Zone	Supply Airflow (CFM)	Zone Htg Unit (MBH)	Reheat Coil (MBH)	- (CFM)
1	1570.3	-	-	

5. Equipment Data

Central Cooling Unit - Air-Cooled DX

Estimated Maximum Load **37.6** MBH
Design OAT **95.0** °F
Equipment Sizing **User-Defined**
Gross Cooling Capacity **36.0** MBH
ARI Performance Rating **10.00** SEER
Conventional Cutoff OAT **55.0** °F
Low Temperature Operation **Used**
Low Temperature Cutoff OAT **15.0** °F

Central Heating Unit - Combustion

Estimated Maximum Load **46.5** MBH
Equipment Sizing **User-Defined**
Gross Heating Capacity **75.0** MBH
Average Efficiency **92.2** %
Misc. Electric **0.000** kW

Billing Details - Electric - ALT2 - Split-System

Hillside Barn
Kitchen and Associates

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1. Component Charges

Billing Period	Energy Charges (\$)	Demand Charges (\$)	Customer Charges (\$)	Taxes (\$)	Total Charge (\$)
Jan	395	0	0	0	395
Feb	369	0	0	0	369
Mar	421	0	0	0	421
Apr	412	0	0	0	412
May	421	0	0	0	421
Jun	453	0	0	0	453
Jul	508	0	0	0	508
Aug	498	0	0	0	498
Sep	440	0	0	0	440
Oct	414	0	0	0	414
Nov	408	0	0	0	408
Dec	420	0	0	0	420
Totals	5,159	0	0	0	5,159

2. Totals

Billing Period	Total Charges (\$)	Total Consumption (kWh)	Avg Price (\$/kWh)
Jan	395	1,836	0.2151
Feb	369	1,716	0.2151
Mar	421	1,957	0.2151
Apr	412	1,913	0.2151
May	421	1,957	0.2151
Jun	453	2,107	0.2151
Jul	508	2,362	0.2151
Aug	498	2,314	0.2151
Sep	440	2,045	0.2151
Oct	414	1,923	0.2151
Nov	408	1,898	0.2151
Dec	420	1,952	0.2151
Totals	5,159	23,982	0.2151

3. Consumption Totals

Billing Period	Peak (kWh)	Mid-Peak (kWh)	Normal Peak (kWh)	Off-Peak (kWh)	Overall (kWh)
Jan	0	0	0	0	1,836
Feb	0	0	0	0	1,716
Mar	0	0	0	0	1,957
Apr	0	0	0	0	1,913
May	0	0	0	0	1,957
Jun	0	0	0	0	2,107
Jul	0	0	0	0	2,362
Aug	0	0	0	0	2,314
Sep	0	0	0	0	2,045
Oct	0	0	0	0	1,923
Nov	0	0	0	0	1,898
Dec	0	0	0	0	1,952
Totals	0	0	0	0	23,982

Billing Details - Electric - ALT2 - Split-System

Hillside Barn
Kitchen and Associates

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4. Billing Demands

Billing Period	Peak (kW)	Mid-Peak (kW)	Normal Peak (kW)	Off-Peak (kW)	Overall (kW)
Jan	0.0	0.0	0.0	0.0	6.4
Feb	0.0	0.0	0.0	0.0	6.8
Mar	0.0	0.0	0.0	0.0	6.9
Apr	0.0	0.0	0.0	0.0	7.1
May	0.0	0.0	0.0	0.0	8.8
Jun	0.0	0.0	0.0	0.0	8.7
Jul	0.0	0.0	0.0	0.0	9.2
Aug	0.0	0.0	0.0	0.0	8.8
Sep	0.0	0.0	0.0	0.0	8.1
Oct	0.0	0.0	0.0	0.0	7.9
Nov	0.0	0.0	0.0	0.0	6.9
Dec	0.0	0.0	0.0	0.0	6.9

5. Maximum Demands

Billing Period	Peak (kW)	Mid-Peak (kW)	Normal Peak (kW)	Off-Peak (kW)	Overall (kW)
Jan	0.0	0.0	0.0	0.0	6.4
Feb	0.0	0.0	0.0	0.0	6.8
Mar	0.0	0.0	0.0	0.0	6.9
Apr	0.0	0.0	0.0	0.0	7.1
May	0.0	0.0	0.0	0.0	8.8
Jun	0.0	0.0	0.0	0.0	8.7
Jul	0.0	0.0	0.0	0.0	9.2
Aug	0.0	0.0	0.0	0.0	8.8
Sep	0.0	0.0	0.0	0.0	8.1
Oct	0.0	0.0	0.0	0.0	7.9
Nov	0.0	0.0	0.0	0.0	6.9
Dec	0.0	0.0	0.0	0.0	6.9

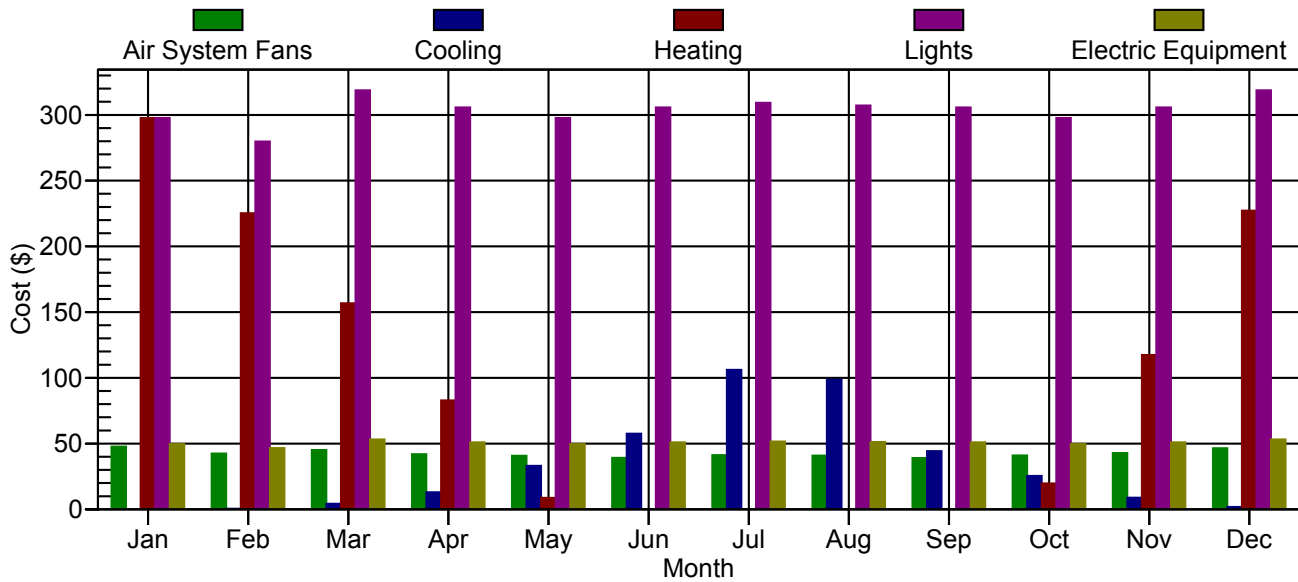
6. Time Of Maximum Demands

Billing Period	Peak (m/d/h)	Mid-Peak (m/d/h)	Normal Peak (m/d/h)	Off-Peak (m/d/h)	Overall (m/d/h)
Jan	n/a	n/a	n/a	n/a	1/1/0800
Feb	n/a	n/a	n/a	n/a	2/12/1400
Mar	n/a	n/a	n/a	n/a	3/5/1600
Apr	n/a	n/a	n/a	n/a	4/19/1600
May	n/a	n/a	n/a	n/a	5/17/1600
Jun	n/a	n/a	n/a	n/a	6/11/1600
Jul	n/a	n/a	n/a	n/a	7/29/1600
Aug	n/a	n/a	n/a	n/a	8/4/1600
Sep	n/a	n/a	n/a	n/a	9/10/1500
Oct	n/a	n/a	n/a	n/a	10/1/1500
Nov	n/a	n/a	n/a	n/a	11/3/1300
Dec	n/a	n/a	n/a	n/a	12/2/1300

Monthly Component Costs - ALT2 - Split-System

Hillside Barn
Kitchen and Associates

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1. HVAC Component Costs

Month	Air System Fans (\$)	Cooling (\$)	Heating (\$)	Pumps (\$)	Cooling Towers (\$)	HVAC Total (\$)
January	48	0	298	0	0	346
February	42	0	225	0	0	267
March	45	4	157	0	0	206
April	42	13	83	0	0	138
May	41	33	9	0	0	83
June	39	58	0	0	0	97
July	41	106	0	0	0	147
August	41	99	0	0	0	140
September	39	44	0	0	0	83
October	41	25	20	0	0	86
November	43	9	117	0	0	169
December	46	2	227	0	0	275
Total	508	393	1,136	0	0	2,037

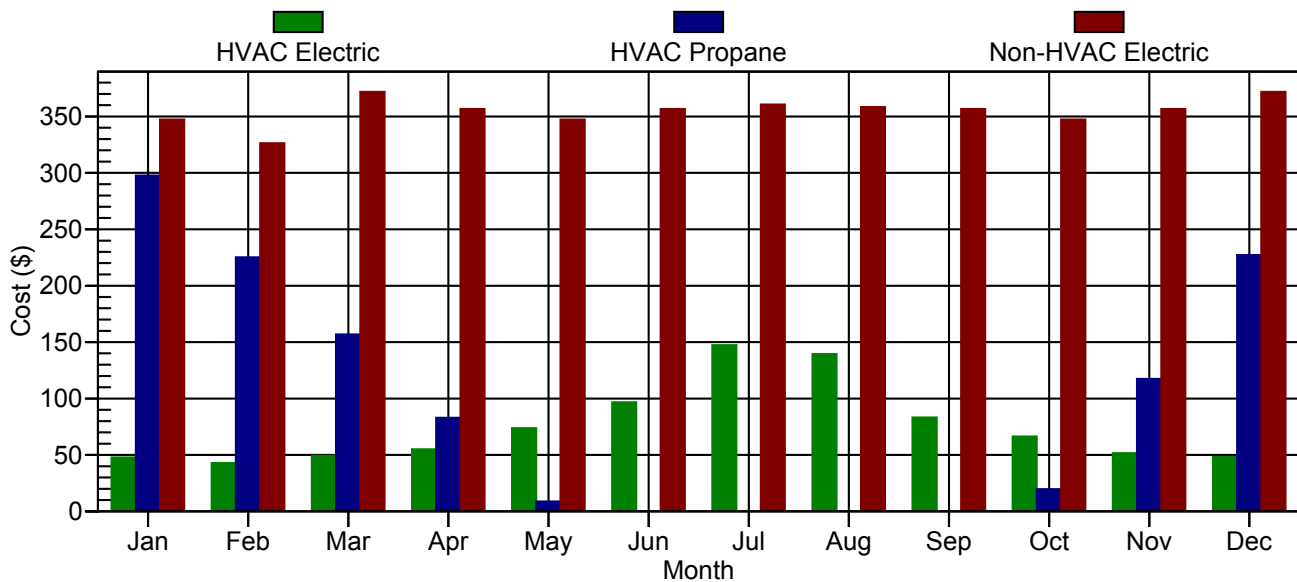
2. Non-HVAC Component Costs

Month	Lights (\$)	Electric Equipment (\$)	Misc. Electric (\$)	Misc. Fuel Use (\$)	Non-HVAC Total (\$)	Grand Total (\$)
January	298	50	0	0	347	693
February	280	47	0	0	326	593
March	319	53	0	0	372	578
April	306	51	0	0	357	495
May	298	50	0	0	347	430
June	306	51	0	0	357	454
July	309	52	0	0	361	508
August	307	51	0	0	358	498
September	306	51	0	0	357	440
October	298	50	0	0	347	433
November	306	51	0	0	357	526
December	319	53	0	0	372	647
Total	3,649	608	0	0	4,257	6,294

Monthly Energy Costs - ALT2 - Split-System

Hillside Barn
Kitchen and Associates

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1. HVAC Costs

Month	Electric (\$)	Natural Gas (\$)	Fuel Oil (\$)	Propane (\$)	Remote Hot Water (\$)	Remote Steam (\$)	Remote Chilled Water (\$)
January	48	0	0	298	0	0	0
February	43	0	0	225	0	0	0
March	49	0	0	157	0	0	0
April	55	0	0	83	0	0	0
May	74	0	0	9	0	0	0
June	97	0	0	0	0	0	0
July	147	0	0	0	0	0	0
August	139	0	0	0	0	0	0
September	83	0	0	0	0	0	0
October	66	0	0	20	0	0	0
November	52	0	0	117	0	0	0
December	48	0	0	227	0	0	0
Total	901	0	0	1,136	0	0	0

2. Non-HVAC Costs

Month	Electric (\$)	Natural Gas (\$)	Fuel Oil (\$)	Propane (\$)	Remote Hot Water (\$)	Remote Steam (\$)
January	347	0	0	0	0	0
February	326	0	0	0	0	0
March	372	0	0	0	0	0
April	357	0	0	0	0	0
May	347	0	0	0	0	0
June	357	0	0	0	0	0
July	361	0	0	0	0	0
August	358	0	0	0	0	0
September	357	0	0	0	0	0
October	347	0	0	0	0	0
November	357	0	0	0	0	0
December	372	0	0	0	0	0
Total	4,257	0	0	0	0	0

Monthly Energy Use by Energy Type - ALT2 - Split-System

Hillside Barn
Kitchen and Associates

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1. HVAC Energy Use

Month	Electric (kWh)	Natural Gas (na)	Fuel Oil (na)	Propane (gal)	Remote HW (na)	Remote Steam (na)	Remote CW (na)
Jan	222	0	0	179	0	0	0
Feb	199	0	0	136	0	0	0
Mar	229	0	0	94	0	0	0
Apr	255	0	0	50	0	0	0
May	343	0	0	5	0	0	0
Jun	449	0	0	0	0	0	0
Jul	685	0	0	0	0	0	0
Aug	648	0	0	0	0	0	0
Sep	387	0	0	0	0	0	0
Oct	308	0	0	12	0	0	0
Nov	240	0	0	71	0	0	0
Dec	224	0	0	137	0	0	0
Totals	4,190	0	0	684	0	0	0

2. Non-HVAC Energy Use

Month	Electric (kWh)	Natural Gas (na)	Fuel Oil (na)	Propane (gal)	Remote HW (na)	Remote Steam (na)
Jan	1,615	0	0	0	0	0
Feb	1,517	0	0	0	0	0
Mar	1,728	0	0	0	0	0
Apr	1,658	0	0	0	0	0
May	1,615	0	0	0	0	0
Jun	1,658	0	0	0	0	0
Jul	1,677	0	0	0	0	0
Aug	1,666	0	0	0	0	0
Sep	1,658	0	0	0	0	0
Oct	1,615	0	0	0	0	0
Nov	1,658	0	0	0	0	0
Dec	1,728	0	0	0	0	0
Totals	19,792	0	0	0	0	0

Monthly Energy Use by Component - ALT2 - Split-System

Hillside Barn
Kitchen and Associates

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1. Monthly Energy Use by System Component

Component	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Air System Fans (kWh)	222	197	210	195	189	182	191	190	182	190	199	216
<i>Cooling</i>												
Electric (kWh)	0	2	19	60	154	267	493	458	206	118	41	8
Natural Gas (na)	0	0	0	0	0	0	0	0	0	0	0	0
Fuel Oil (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (gal)	0	0	0	0	0	0	0	0	0	0	0	0
Remote HW (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote CW (na)	0	0	0	0	0	0	0	0	0	0	0	0
<i>Heating</i>												
Electric (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
Natural Gas (na)	0	0	0	0	0	0	0	0	0	0	0	0
Fuel Oil (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (gal)	179	136	94	50	5	0	0	0	0	12	71	137
Remote HW (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0	0	0	0	0	0	0	0
Pumps (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
Clg. Tower Fans (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
Lighting (kWh)	1384	1300	1481	1421	1384	1421	1437	1428	1421	1384	1421	1481
Electric Eqpt. (kWh)	231	217	247	237	231	237	240	238	237	231	237	247
Misc. Electric (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
<i>Misc. Fuel</i>												
Natural Gas (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (gal)	0	0	0	0	0	0	0	0	0	0	0	0
Remote HW (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0	0	0	0	0	0	0	0

Annual Cost Summary

Hillside Barn
Kitchen and Associates

06/02/2010
06:43PM

Table 1. Annual Costs

Component	ALT2 - Split-System (\$)
Air System Fans	508
Cooling	393
Heating	1,136
Pumps	0
Cooling Tower Fans	0
HVAC Sub-Total	2,037
Lights	3,649
Electric Equipment	608
Misc. Electric	0
Misc. Fuel Use	0
Non-HVAC Sub-Total	4,257
Grand Total	6,294

Table 2. Annual Cost per Unit Floor Area

Component	ALT2 - Split-System (\$/ft²)
Air System Fans	0.131
Cooling	0.102
Heating	0.293
Pumps	0.000
Cooling Tower Fans	0.000
HVAC Sub-Total	0.526
Lights	0.943
Electric Equipment	0.157
Misc. Electric	0.000
Misc. Fuel Use	0.000
Non-HVAC Sub-Total	1.100
Grand Total	1.626
Gross Floor Area (ft²)	3870.0
Conditioned Floor Area (ft²)	3870.0

Note: Values in this table are calculated using the Gross Floor Area.

Table 3. Component Cost as a Percentage of Total Cost

Component	ALT2 - Split-System (%)
Air System Fans	8.1
Cooling	6.2
Heating	18.0
Pumps	0.0
Cooling Tower Fans	0.0
HVAC Sub-Total	32.4
Lights	58.0
Electric Equipment	9.7
Misc. Electric	0.0
Misc. Fuel Use	0.0
Non-HVAC Sub-Total	67.6
Grand Total	100.0

Annual Energy and Emissions Summary

Hillside Barn
Kitchen and Associates

06/02/2010
06:43PM

Table 1. Annual Costs

Component	ALT2 - Split-System (\$)
HVAC Components	
Electric	901
Natural Gas	0
Fuel Oil	0
Propane	1,136
Remote HW	0
Remote Steam	0
Remote CW	0
HVAC Sub-Total	2,037
Non-HVAC Components	
Electric	4,257
Natural Gas	0
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Non-HVAC Sub-Total	4,257
Grand Total	6,294

Table 2. Annual Energy Consumption

Component	ALT2 - Split-System
HVAC Components	
Electric (kWh)	4,190
Natural Gas (na)	0
Fuel Oil (na)	0
Propane (gal)	684
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0
Non-HVAC Components	
Electric (kWh)	19,792
Natural Gas (na)	0
Fuel Oil (na)	0
Propane (gal)	0
Remote HW (na)	0
Remote Steam (na)	0
Totals	
Electric (kWh)	23,982
Natural Gas (na)	0
Fuel Oil (na)	0
Propane (gal)	684
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0

Annual Energy and Emissions Summary

Hillside Barn
Kitchen and Associates

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Table 3. Annual Emissions

Component	ALT2 - Split-System
CO2 Equivalent (lb)	0

Table 4. Annual Cost per Unit Floor Area

Component	ALT2 - Split-System (\$/ft²)
HVAC Components	
Electric	0.233
Natural Gas	0.000
Fuel Oil	0.000
Propane	0.293
Remote HW	0.000
Remote Steam	0.000
Remote CW	0.000
HVAC Sub-Total	0.526
Non-HVAC Components	
Electric	1.100
Natural Gas	0.000
Fuel Oil	0.000
Propane	0.000
Remote HW	0.000
Remote Steam	0.000
Non-HVAC Sub-Total	1.100
Grand Total	1.626
Gross Floor Area (ft²)	3870.0
Conditioned Floor Area (ft²)	3870.0

Note: Values in this table are calculated using the Gross Floor Area.

Table 5. Component Cost as a Percentage of Total Cost

Component	ALT2 - Split-System (%)
HVAC Components	
Electric	14.3
Natural Gas	0.0
Fuel Oil	0.0
Propane	18.0
Remote HW	0.0
Remote Steam	0.0
Remote CW	0.0
HVAC Sub-Total	32.4
Non-HVAC Components	
Electric	67.6
Natural Gas	0.0
Fuel Oil	0.0
Propane	0.0
Remote HW	0.0
Remote Steam	0.0
Non-HVAC Sub-Total	67.6
Grand Total	100.0

APPENDIX P

Carrier Hourly Analysis Program – Upstairs Recreation Area Base Building

ALT1 - Floor 1 BLD1-F001-Z01 Input Data

Project Name: Hillside Barn
Prepared by: Kitchen and Associates

05/27/2010
06:57PM

1. General Details:

Air System Name ALT1 - Floor 1 BLD1-F001-Z01
Equipment Type Packaged Rooftop Units
Air System Type Single Zone CAV
Number of zones 1

2. System Components:

Ventilation Air Data:

Airflow Control Constant Ventilation Airflow
Ventilation Sizing Method Sum of Space OA Airflows
Unocc. Damper Position Closed
Damper Leak Rate 0 %
Outdoor Air CO2 Level 400 ppm

Central Cooling Data:

Supply Air Temperature 58.0 °F
Coil Bypass Factor 0.100
Cooling Source Air-Cooled DX
Schedule JFMAMJJASOND
Capacity Control Cycled or Staged Capacity - Fan On

Central Heating Data:

Supply Temperature 100.0 °F
Heating Source Combustion - Propane
Schedule JFMAMJJASOND
Capacity Control Cycled or Staged Capacity - Fan On

Supply Fan Data:

Fan Type Forward Curved
Configuration Draw-thru
Fan Performance 2.5 BHP

Duct System Data:

Supply Duct Data:

Duct Heat Gain 0 %
Duct Leakage 0 %

Return Duct or Plenum Data:

Return Air Via Ducted Return

3. Zone Components:

Space Assignments:

Zone 1: BLD1-F001-Z01	
BLD1-F001-Z01	x1

Thermostats and Zone Data:

Zone All
Cooling T-stat: Occ. 75.0 °F
Cooling T-stat: Unocc. 75.0 °F
Heating T-stat: Occ. 70.0 °F
Heating T-stat: Unocc. 70.0 °F
T-stat Throttling Range 1.50 °F
Diversity Factor 100 %
Direct Exhaust Airflow 0.0 CFM
Direct Exhaust Fan kW 0.0 kW

Thermostat Schedule 90.1 Assembly HVAC
Unoccupied Cooling is Available

Supply Terminals Data:

Zone All
Terminal Type Diffuser
Minimum Airflow 0.00 CFM/person

Zone Heating Units:

Zone All
Zone Heating Unit Type None

Zone Unit Heat Source Electric Resistance
Zone Heating Unit Schedule JFMAMJJASOND

ALT1 - Floor 1 BLD1-F001-Z01 Input Data

Project Name: Hillside Barn
Prepared by: Kitchen and Associates

05/27/2010
06:57PM

4. Sizing Data (Computer-Generated):

System Sizing Data:

Hydronic Sizing Specifications:

Chilled Water Delta-T 10.0 °F
Hot Water Delta-T 20.0 °F

Safety Factors:

Cooling Sensible 0 %
Cooling Latent 0 %
Heating 0 %

Zone Sizing Data:

Zone Airflow Sizing Method Sum of space airflow rates
Space Airflow Sizing Method Individual peak space loads

5. Equipment Data

Central Cooling Unit - Air-Cooled DX

Design OAT 95.0 °F
Equipment Sizing User-Defined
Gross Cooling Capacity 208.0 MBH
ARI Performance Rating 11.00 EER
Conventional Cutoff OAT 55.0 °F
Low Temperature Operation Used
Low Temperature Cutoff OAT 15.0 °F

Central Heating Unit - Combustion

Equipment Sizing User-Defined
Gross Heating Capacity 350.0 MBH
Average Efficiency 80.1 %
Misc. Electric 0.000 kW

Billing Details - Electric - ALT1 - RTU-1

Hillside Barn
Kitchen and Associates

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07:01PM

1. Component Charges

Billing Period	Energy Charges (\$)	Demand Charges (\$)	Customer Charges (\$)	Taxes (\$)	Total Charge (\$)
Jan	831	0	0	0	831
Feb	773	0	0	0	773
Mar	891	0	0	0	891
Apr	914	0	0	0	914
May	1,135	0	0	0	1,135
Jun	1,424	0	0	0	1,424
Jul	1,697	0	0	0	1,697
Aug	1,650	0	0	0	1,650
Sep	1,281	0	0	0	1,281
Oct	1,028	0	0	0	1,028
Nov	864	0	0	0	864
Dec	880	0	0	0	880
Totals	13,366	0	0	0	13,366

2. Totals

Billing Period	Total Charges (\$)	Total Consumption (kWh)	Avg Price (\$/kWh)
Jan	831	3,862	0.2151
Feb	773	3,595	0.2151
Mar	891	4,141	0.2151
Apr	914	4,250	0.2151
May	1,135	5,276	0.2151
Jun	1,424	6,619	0.2151
Jul	1,697	7,890	0.2151
Aug	1,650	7,669	0.2151
Sep	1,281	5,953	0.2151
Oct	1,028	4,779	0.2151
Nov	864	4,018	0.2151
Dec	880	4,089	0.2151
Totals	13,366	62,140	0.2151

3. Consumption Totals

Billing Period	Peak (kWh)	Mid-Peak (kWh)	Normal Peak (kWh)	Off-Peak (kWh)	Overall (kWh)
Jan	0	0	0	0	3,862
Feb	0	0	0	0	3,595
Mar	0	0	0	0	4,141
Apr	0	0	0	0	4,250
May	0	0	0	0	5,276
Jun	0	0	0	0	6,619
Jul	0	0	0	0	7,890
Aug	0	0	0	0	7,669
Sep	0	0	0	0	5,953
Oct	0	0	0	0	4,779
Nov	0	0	0	0	4,018
Dec	0	0	0	0	4,089
Totals	0	0	0	0	62,140

Billing Details - Electric - ALT1 - RTU-1

Hillside Barn
Kitchen and Associates

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4. Billing Demands

Billing Period	Peak (kW)	Mid-Peak (kW)	Normal Peak (kW)	Off-Peak (kW)	Overall (kW)
Jan	0.0	0.0	0.0	0.0	12.6
Feb	0.0	0.0	0.0	0.0	13.7
Mar	0.0	0.0	0.0	0.0	17.5
Apr	0.0	0.0	0.0	0.0	22.0
May	0.0	0.0	0.0	0.0	29.0
Jun	0.0	0.0	0.0	0.0	28.4
Jul	0.0	0.0	0.0	0.0	29.5
Aug	0.0	0.0	0.0	0.0	27.9
Sep	0.0	0.0	0.0	0.0	25.7
Oct	0.0	0.0	0.0	0.0	24.9
Nov	0.0	0.0	0.0	0.0	17.1
Dec	0.0	0.0	0.0	0.0	15.4

5. Maximum Demands

Billing Period	Peak (kW)	Mid-Peak (kW)	Normal Peak (kW)	Off-Peak (kW)	Overall (kW)
Jan	0.0	0.0	0.0	0.0	12.6
Feb	0.0	0.0	0.0	0.0	13.7
Mar	0.0	0.0	0.0	0.0	17.5
Apr	0.0	0.0	0.0	0.0	22.0
May	0.0	0.0	0.0	0.0	29.0
Jun	0.0	0.0	0.0	0.0	28.4
Jul	0.0	0.0	0.0	0.0	29.5
Aug	0.0	0.0	0.0	0.0	27.9
Sep	0.0	0.0	0.0	0.0	25.7
Oct	0.0	0.0	0.0	0.0	24.9
Nov	0.0	0.0	0.0	0.0	17.1
Dec	0.0	0.0	0.0	0.0	15.4

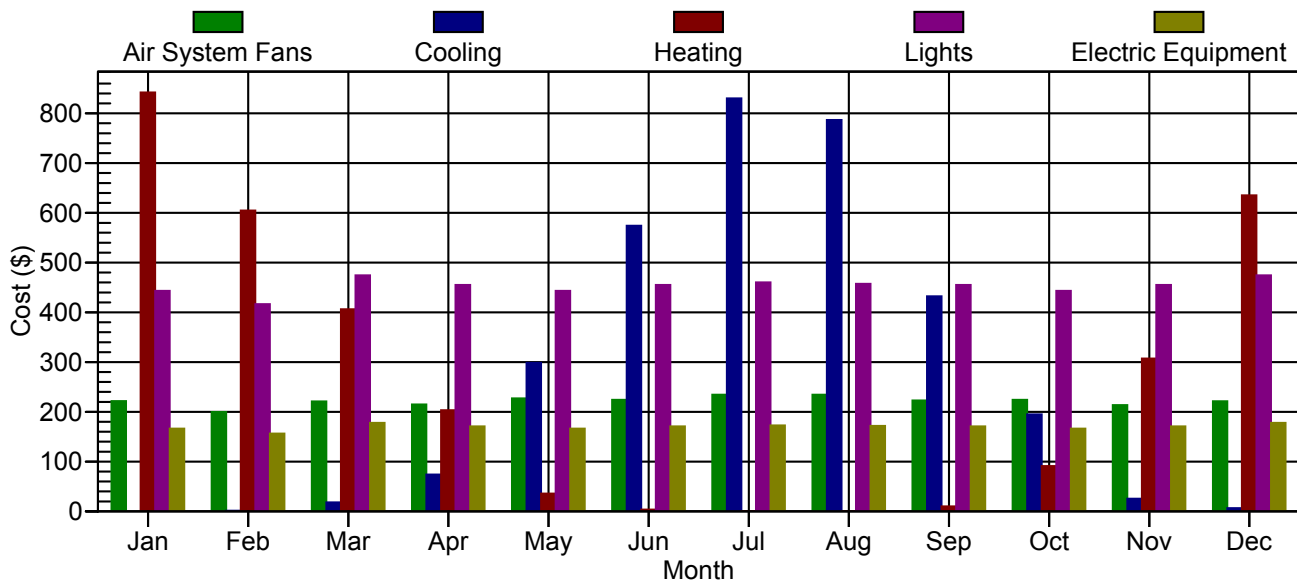
6. Time Of Maximum Demands

Billing Period	Peak (m/d/h)	Mid-Peak (m/d/h)	Normal Peak (m/d/h)	Off-Peak (m/d/h)	Overall (m/d/h)
Jan	n/a	n/a	n/a	n/a	1/1/0800
Feb	n/a	n/a	n/a	n/a	2/12/1500
Mar	n/a	n/a	n/a	n/a	3/5/1600
Apr	n/a	n/a	n/a	n/a	4/19/1600
May	n/a	n/a	n/a	n/a	5/17/1500
Jun	n/a	n/a	n/a	n/a	6/11/1600
Jul	n/a	n/a	n/a	n/a	7/1/1600
Aug	n/a	n/a	n/a	n/a	8/30/1400
Sep	n/a	n/a	n/a	n/a	9/13/1600
Oct	n/a	n/a	n/a	n/a	10/1/1500
Nov	n/a	n/a	n/a	n/a	11/3/1600
Dec	n/a	n/a	n/a	n/a	12/2/1500

Monthly Component Costs - ALT1 - RTU-1

Hillside Barn
Kitchen and Associates

05/27/2010
07:01PM



1. HVAC Component Costs

Month	Air System Fans (\$)	Cooling (\$)	Heating (\$)	Pumps (\$)	Cooling Towers (\$)	HVAC Total (\$)
January	221	0	842	0	0	1,063
February	200	1	605	0	0	806
March	221	18	406	0	0	645
April	215	74	203	0	0	492
May	227	299	36	0	0	562
June	224	574	3	0	0	801
July	234	830	0	0	0	1,064
August	234	787	0	0	0	1,021
September	223	432	10	0	0	665
October	224	195	91	0	0	510
November	214	25	307	0	0	546
December	221	6	635	0	0	862
Total	2,658	3,240	3,138	0	0	9,036

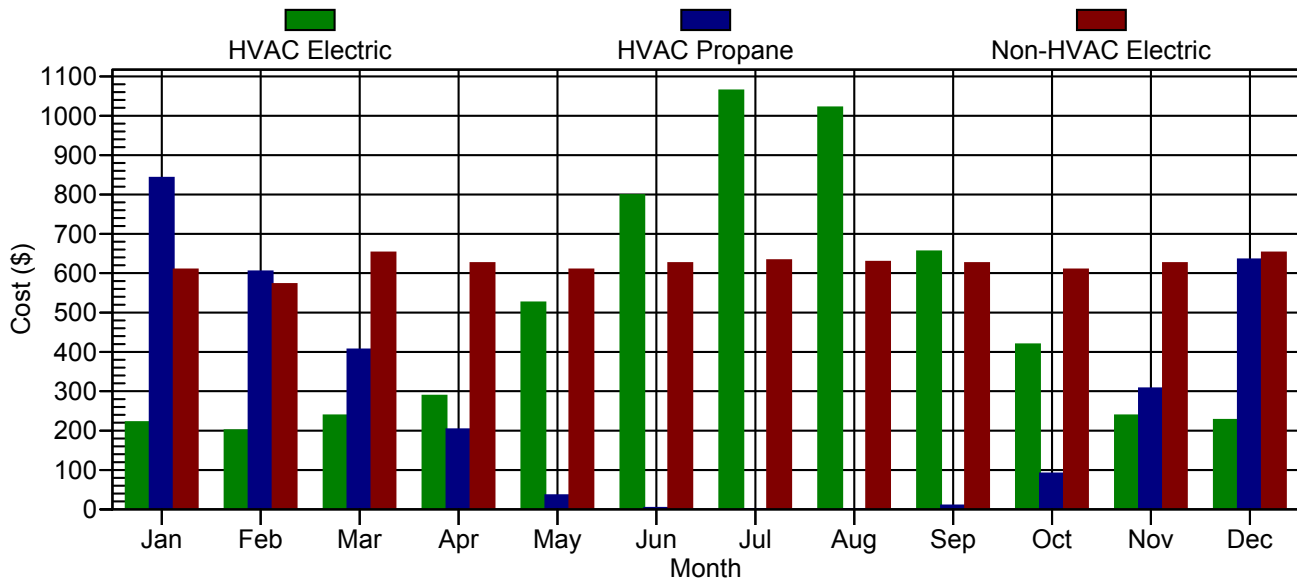
2. Non-HVAC Component Costs

Month	Lights (\$)	Electric Equipment (\$)	Misc. Electric (\$)	Misc. Fuel Use (\$)	Non-HVAC Total (\$)	Grand Total (\$)
January	443	166	0	0	609	1,672
February	416	156	0	0	572	1,378
March	474	178	0	0	652	1,297
April	455	171	0	0	626	1,118
May	443	166	0	0	609	1,171
June	455	171	0	0	626	1,427
July	460	173	0	0	633	1,697
August	457	171	0	0	629	1,650
September	455	171	0	0	626	1,291
October	443	166	0	0	609	1,119
November	455	171	0	0	626	1,172
December	474	178	0	0	652	1,514
Total	5,431	2,037	0	0	7,468	16,504

Monthly Energy Costs - ALT1 - RTU-1

Hillside Barn
Kitchen and Associates

05/27/2010
07:01PM



1. HVAC Costs

Month	Electric (\$)	Natural Gas (\$)	Fuel Oil (\$)	Propane (\$)	Remote Hot Water (\$)	Remote Steam (\$)	Remote Chilled Water (\$)
January	221	0	0	842	0	0	0
February	201	0	0	605	0	0	0
March	239	0	0	406	0	0	0
April	289	0	0	203	0	0	0
May	526	0	0	36	0	0	0
June	798	0	0	3	0	0	0
July	1,064	0	0	0	0	0	0
August	1,021	0	0	0	0	0	0
September	655	0	0	10	0	0	0
October	419	0	0	91	0	0	0
November	239	0	0	307	0	0	0
December	227	0	0	635	0	0	0
Total	5,898	0	0	3,138	0	0	0

2. Non-HVAC Costs

Month	Electric (\$)	Natural Gas (\$)	Fuel Oil (\$)	Propane (\$)	Remote Hot Water (\$)	Remote Steam (\$)
January	609	0	0	0	0	0
February	572	0	0	0	0	0
March	652	0	0	0	0	0
April	626	0	0	0	0	0
May	609	0	0	0	0	0
June	626	0	0	0	0	0
July	633	0	0	0	0	0
August	629	0	0	0	0	0
September	626	0	0	0	0	0
October	609	0	0	0	0	0
November	626	0	0	0	0	0
December	652	0	0	0	0	0
Total	7,468	0	0	0	0	0

Monthly Energy Use by Energy Type - ALT1 - RTU-1

Hillside Barn
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05/27/2010
07:01PM

1. HVAC Energy Use

Month	Electric (kWh)	Natural Gas (na)	Fuel Oil (na)	Propane (gal)	Remote HW (na)	Remote Steam (na)	Remote CW (na)
Jan	1,029	0	0	507	0	0	0
Feb	934	0	0	364	0	0	0
Mar	1,110	0	0	245	0	0	0
Apr	1,342	0	0	122	0	0	0
May	2,444	0	0	21	0	0	0
Jun	3,710	0	0	2	0	0	0
Jul	4,948	0	0	0	0	0	0
Aug	4,746	0	0	0	0	0	0
Sep	3,045	0	0	6	0	0	0
Oct	1,947	0	0	55	0	0	0
Nov	1,109	0	0	185	0	0	0
Dec	1,057	0	0	383	0	0	0
Totals	27,422	0	0	1,890	0	0	0

2. Non-HVAC Energy Use

Month	Electric (kWh)	Natural Gas (na)	Fuel Oil (na)	Propane (gal)	Remote HW (na)	Remote Steam (na)
Jan	2,832	0	0	0	0	0
Feb	2,661	0	0	0	0	0
Mar	3,032	0	0	0	0	0
Apr	2,908	0	0	0	0	0
May	2,832	0	0	0	0	0
Jun	2,908	0	0	0	0	0
Jul	2,942	0	0	0	0	0
Aug	2,923	0	0	0	0	0
Sep	2,908	0	0	0	0	0
Oct	2,832	0	0	0	0	0
Nov	2,908	0	0	0	0	0
Dec	3,032	0	0	0	0	0
Totals	34,719	0	0	0	0	0

Monthly Energy Use by Component - ALT1 - RTU-1

Hillside Barn
Kitchen and Associates

05/27/2010
07:01PM

1. Monthly Energy Use by System Component

Component	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Air System Fans (kWh)	1029	929	1027	998	1056	1043	1089	1089	1036	1041	993	1027
<i>Cooling</i>												
Electric (kWh)	0	5	83	343	1388	2668	3859	3657	2009	906	117	30
Natural Gas (na)	0	0	0	0	0	0	0	0	0	0	0	0
Fuel Oil (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (gal)	0	0	0	0	0	0	0	0	0	0	0	0
Remote HW (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote CW (na)	0	0	0	0	0	0	0	0	0	0	0	0
<i>Heating</i>												
Electric (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
Natural Gas (na)	0	0	0	0	0	0	0	0	0	0	0	0
Fuel Oil (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (gal)	507	364	245	122	21	2	0	0	6	55	185	383
Remote HW (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0	0	0	0	0	0	0	0
Pumps (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
Clg. Tower Fans (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
Lighting (kWh)	2060	1935	2205	2115	2060	2115	2139	2125	2115	2060	2115	2205
Electric Eqpt. (kWh)	772	726	827	793	772	793	802	797	793	772	793	827
Misc. Electric (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
<i>Misc. Fuel</i>												
Natural Gas (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (gal)	0	0	0	0	0	0	0	0	0	0	0	0
Remote HW (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0	0	0	0	0	0	0	0

Annual Cost Summary

Hillside Barn
Kitchen and Associates

05/27/2010
07:01PM

Table 1. Annual Costs

Component	ALT1 - RTU-1 (\$)
Air System Fans	2,658
Cooling	3,240
Heating	3,138
Pumps	0
Cooling Tower Fans	0
HVAC Sub-Total	9,036
Lights	5,431
Electric Equipment	2,037
Misc. Electric	0
Misc. Fuel Use	0
Non-HVAC Sub-Total	7,468
Grand Total	16,504

Table 2. Annual Cost per Unit Floor Area

Component	ALT1 - RTU-1 (\$/ft²)
Air System Fans	0.615
Cooling	0.750
Heating	0.726
Pumps	0.000
Cooling Tower Fans	0.000
HVAC Sub-Total	2.092
Lights	1.257
Electric Equipment	0.472
Misc. Electric	0.000
Misc. Fuel Use	0.000
Non-HVAC Sub-Total	1.729
Grand Total	3.820
Gross Floor Area (ft²)	4320.0
Conditioned Floor Area (ft²)	4320.0

Note: Values in this table are calculated using the Gross Floor Area.

Table 3. Component Cost as a Percentage of Total Cost

Component	ALT1 - RTU-1 (%)
Air System Fans	16.1
Cooling	19.6
Heating	19.0
Pumps	0.0
Cooling Tower Fans	0.0
HVAC Sub-Total	54.8
Lights	32.9
Electric Equipment	12.3
Misc. Electric	0.0
Misc. Fuel Use	0.0
Non-HVAC Sub-Total	45.2
Grand Total	100.0

Annual Energy and Emissions Summary

Hillside Barn
Kitchen and Associates

05/27/2010
07:01PM

Table 1. Annual Costs

Component	ALT1 - RTU-1 (\$)
HVAC Components	
Electric	5,898
Natural Gas	0
Fuel Oil	0
Propane	3,138
Remote HW	0
Remote Steam	0
Remote CW	0
HVAC Sub-Total	9,036
Non-HVAC Components	
Electric	7,468
Natural Gas	0
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Non-HVAC Sub-Total	7,468
Grand Total	16,504

Table 2. Annual Energy Consumption

Component	ALT1 - RTU-1
HVAC Components	
Electric (kWh)	27,422
Natural Gas (na)	0
Fuel Oil (na)	0
Propane (gal)	1,890
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0
Non-HVAC Components	
Electric (kWh)	34,719
Natural Gas (na)	0
Fuel Oil (na)	0
Propane (gal)	0
Remote HW (na)	0
Remote Steam (na)	0
Totals	
Electric (kWh)	62,140
Natural Gas (na)	0
Fuel Oil (na)	0
Propane (gal)	1,890
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0

Annual Energy and Emissions Summary

Hillside Barn
Kitchen and Associates

05/27/2010
07:01PM

Table 3. Annual Emissions

Component	ALT1 - RTU-1
CO2 Equivalent (lb)	0

Table 4. Annual Cost per Unit Floor Area

Component	ALT1 - RTU-1 (\$/ft²)
HVAC Components	
Electric	1.365
Natural Gas	0.000
Fuel Oil	0.000
Propane	0.726
Remote HW	0.000
Remote Steam	0.000
Remote CW	0.000
HVAC Sub-Total	2.092
Non-HVAC Components	
Electric	1.729
Natural Gas	0.000
Fuel Oil	0.000
Propane	0.000
Remote HW	0.000
Remote Steam	0.000
Non-HVAC Sub-Total	1.729
Grand Total	3.821
Gross Floor Area (ft²)	4320.0
Conditioned Floor Area (ft²)	4320.0

Note: Values in this table are calculated using the Gross Floor Area.

Table 5. Component Cost as a Percentage of Total Cost

Component	ALT1 - RTU-1 (%)
HVAC Components	
Electric	35.7
Natural Gas	0.0
Fuel Oil	0.0
Propane	19.0
Remote HW	0.0
Remote Steam	0.0
Remote CW	0.0
HVAC Sub-Total	54.8
Non-HVAC Components	
Electric	45.2
Natural Gas	0.0
Fuel Oil	0.0
Propane	0.0
Remote HW	0.0
Remote Steam	0.0
Non-HVAC Sub-Total	45.2
Grand Total	100.0

APPENDIX Q

Carrier Hourly Analysis Program – Rooftop Units with Economizer

ECM_3_NightSB_ECONO Input Data

Project Name: Hillside Barn
Prepared by: Kitchen and Associates

05/28/2010
09:30AM

1. General Details:

Air System Name ECM_3_NightSB_ECONO
Equipment Type Packaged Rooftop Units
Air System Type Single Zone CAV
Number of zones 1

2. System Components:

Ventilation Air Data:

Airflow Control Constant Ventilation Airflow
Ventilation Sizing Method Sum of Space OA Airflows
Unocc. Damper Position Closed
Damper Leak Rate 0 %
Outdoor Air CO2 Level 400 ppm

Economizer Data:

Control Integrated enthalpy control
Upper Cutoff 73.0 °F
Lower Cutoff -60.0 °F

Central Cooling Data:

Supply Air Temperature 58.0 °F
Coil Bypass Factor 0.100
Cooling Source Air-Cooled DX
Schedule JFMAMJJASOND
Capacity Control Cycled or Staged Capacity - Fan On

Central Heating Data:

Supply Temperature 100.0 °F
Heating Source Combustion - Propane
Schedule JFMAMJJASOND
Capacity Control Cycled or Staged Capacity - Fan On

Supply Fan Data:

Fan Type Forward Curved
Configuration Draw-thru
Fan Performance 2.5 BHP

Duct System Data:

Supply Duct Data:

Duct Heat Gain 0 %
Duct Leakage 0 %

Return Duct or Plenum Data:

Return Air Via Ducted Return

3. Zone Components:

Space Assignments:

Zone 1: BLD1-F001-Z01	
ECM_3_NightSB_ECONO_FL1	x1

Thermostats and Zone Data:

Zone All
Cooling T-stat: Occ. 75.0 °F
Cooling T-stat: Unocc. 85.0 °F
Heating T-stat: Occ. 70.0 °F
Heating T-stat: Unocc. 60.0 °F
T-stat Throttling Range 1.50 °F
Diversity Factor 100 %
Direct Exhaust Airflow 0.0 CFM
Direct Exhaust Fan kW 0.0 kW

Thermostat Schedule 90.1 Assembly HVAC
Unoccupied Cooling is Available

Supply Terminals Data:

Zone All
Terminal Type Diffuser
Minimum Airflow 0.00 CFM/person

Zone Heating Units:

ECM_3_NightSB_ECONO Input Data

Project Name: Hillside Barn
Prepared by: Kitchen and Associates

05/28/2010
09:30AM

Zone **All**
Zone Heating Unit Type **None**

Zone Unit Heat Source **Electric Resistance**
Zone Heating Unit Schedule **JFMAMJJASOND**

4. Sizing Data (Computer-Generated):

System Sizing Data:

Cooling Supply Temperature **58.0** °F
Supply Fan Airflow **7112.1** CFM
Ventilation Airflow **1800.0** CFM
Heating Supply Temperature **100.0** °F

Hydronic Sizing Specifications:

Chilled Water Delta-T **10.0** °F
Hot Water Delta-T **20.0** °F

Safety Factors:

Cooling Sensible **0** %
Cooling Latent **0** %
Heating **0** %

Zone Sizing Data:

Zone Airflow Sizing Method **Sum of space airflow rates**
Space Airflow Sizing Method **Individual peak space loads**

Zone	Supply Airflow (CFM)	Zone Htg Unit (MBH)	Reheat Coil (MBH)	- (CFM)
1	7112.1	-	-	

5. Equipment Data

Central Cooling Unit - Air-Cooled DX

Estimated Maximum Load **291.1** MBH
Design OAT **95.0** °F
Equipment Sizing **User-Defined**
Gross Cooling Capacity **208.0** MBH
ARI Performance Rating **11.00** EER
Conventional Cutoff OAT **55.0** °F
Low Temperature Operation **Used**
Low Temperature Cutoff OAT **15.0** °F

Central Heating Unit - Combustion

Estimated Maximum Load **162.6** MBH
Equipment Sizing **User-Defined**
Gross Heating Capacity **350.0** MBH
Average Efficiency **80.1** %
Misc. Electric **0.000** kW

Billing Details - Electric - ECM_3_NightSB_ECONO

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1. Component Charges

Billing Period	Energy Charges (\$)	Demand Charges (\$)	Customer Charges (\$)	Taxes (\$)	Total Charge (\$)
Jan	829	0	0	0	829
Feb	771	0	0	0	771
Mar	875	0	0	0	875
Apr	865	0	0	0	865
May	978	0	0	0	978
Jun	1,269	0	0	0	1,269
Jul	1,579	0	0	0	1,579
Aug	1,570	0	0	0	1,570
Sep	1,123	0	0	0	1,123
Oct	914	0	0	0	914
Nov	839	0	0	0	839
Dec	873	0	0	0	873
Totals	12,485	0	0	0	12,485

2. Totals

Billing Period	Total Charges (\$)	Total Consumption (kWh)	Avg Price (\$/kWh)
Jan	829	3,854	0.2151
Feb	771	3,586	0.2151
Mar	875	4,066	0.2151
Apr	865	4,022	0.2151
May	978	4,547	0.2151
Jun	1,269	5,901	0.2151
Jul	1,579	7,341	0.2151
Aug	1,570	7,298	0.2151
Sep	1,123	5,219	0.2151
Oct	914	4,250	0.2151
Nov	839	3,900	0.2151
Dec	873	4,057	0.2151
Totals	12,485	58,042	0.2151

3. Consumption Totals

Billing Period	Peak (kWh)	Mid-Peak (kWh)	Normal Peak (kWh)	Off-Peak (kWh)	Overall (kWh)
Jan	0	0	0	0	3,854
Feb	0	0	0	0	3,586
Mar	0	0	0	0	4,066
Apr	0	0	0	0	4,022
May	0	0	0	0	4,547
Jun	0	0	0	0	5,901
Jul	0	0	0	0	7,341
Aug	0	0	0	0	7,298
Sep	0	0	0	0	5,219
Oct	0	0	0	0	4,250
Nov	0	0	0	0	3,900
Dec	0	0	0	0	4,057
Totals	0	0	0	0	58,042

Billing Details - Electric - ECM_3_NightSB_ECONO

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4. Billing Demands

Billing Period	Peak (kW)	Mid-Peak (kW)	Normal Peak (kW)	Off-Peak (kW)	Overall (kW)
Jan	0.0	0.0	0.0	0.0	12.6
Feb	0.0	0.0	0.0	0.0	12.6
Mar	0.0	0.0	0.0	0.0	15.6
Apr	0.0	0.0	0.0	0.0	22.2
May	0.0	0.0	0.0	0.0	29.0
Jun	0.0	0.0	0.0	0.0	28.3
Jul	0.0	0.0	0.0	0.0	29.5
Aug	0.0	0.0	0.0	0.0	28.3
Sep	0.0	0.0	0.0	0.0	25.9
Oct	0.0	0.0	0.0	0.0	25.1
Nov	0.0	0.0	0.0	0.0	12.8
Dec	0.0	0.0	0.0	0.0	12.6

5. Maximum Demands

Billing Period	Peak (kW)	Mid-Peak (kW)	Normal Peak (kW)	Off-Peak (kW)	Overall (kW)
Jan	0.0	0.0	0.0	0.0	12.6
Feb	0.0	0.0	0.0	0.0	12.6
Mar	0.0	0.0	0.0	0.0	15.6
Apr	0.0	0.0	0.0	0.0	22.2
May	0.0	0.0	0.0	0.0	29.0
Jun	0.0	0.0	0.0	0.0	28.3
Jul	0.0	0.0	0.0	0.0	29.5
Aug	0.0	0.0	0.0	0.0	28.3
Sep	0.0	0.0	0.0	0.0	25.9
Oct	0.0	0.0	0.0	0.0	25.1
Nov	0.0	0.0	0.0	0.0	12.8
Dec	0.0	0.0	0.0	0.0	12.6

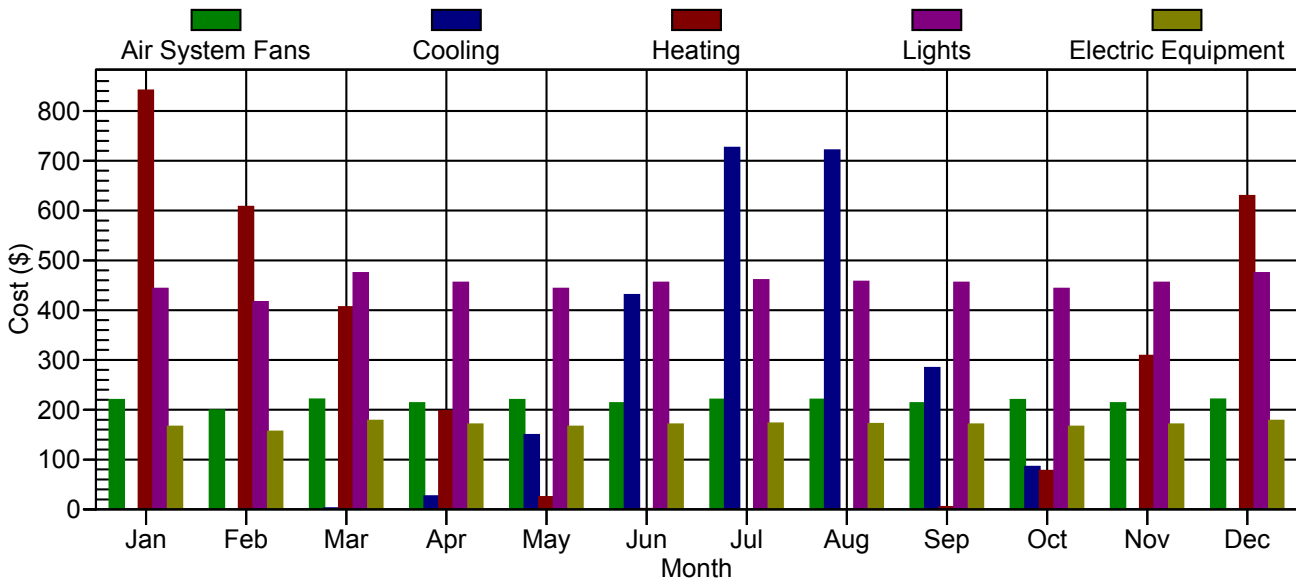
6. Time Of Maximum Demands

Billing Period	Peak (m/d/h)	Mid-Peak (m/d/h)	Normal Peak (m/d/h)	Off-Peak (m/d/h)	Overall (m/d/h)
Jan	n/a	n/a	n/a	n/a	1/1/0800
Feb	n/a	n/a	n/a	n/a	2/1/0800
Mar	n/a	n/a	n/a	n/a	3/5/1600
Apr	n/a	n/a	n/a	n/a	4/19/1600
May	n/a	n/a	n/a	n/a	5/17/1500
Jun	n/a	n/a	n/a	n/a	6/11/1600
Jul	n/a	n/a	n/a	n/a	7/1/1500
Aug	n/a	n/a	n/a	n/a	8/4/1500
Sep	n/a	n/a	n/a	n/a	9/13/1600
Oct	n/a	n/a	n/a	n/a	10/1/1500
Nov	n/a	n/a	n/a	n/a	11/3/1600
Dec	n/a	n/a	n/a	n/a	12/1/0800

Monthly Component Costs - ECM_3_NightSB_ECONO

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1. HVAC Component Costs

Month	Air System Fans (\$)	Cooling (\$)	Heating (\$)	Pumps (\$)	Cooling Towers (\$)	HVAC Total (\$)
January	220	0	841	0	0	1,061
February	199	0	608	0	0	807
March	221	2	406	0	0	629
April	213	26	197	0	0	436
May	220	149	25	0	0	394
June	213	430	1	0	0	644
July	220	726	0	0	0	946
August	220	721	0	0	0	941
September	213	284	5	0	0	502
October	220	85	77	0	0	382
November	213	0	308	0	0	521
December	221	0	629	0	0	850
Total	2,593	2,424	3,097	0	0	8,114

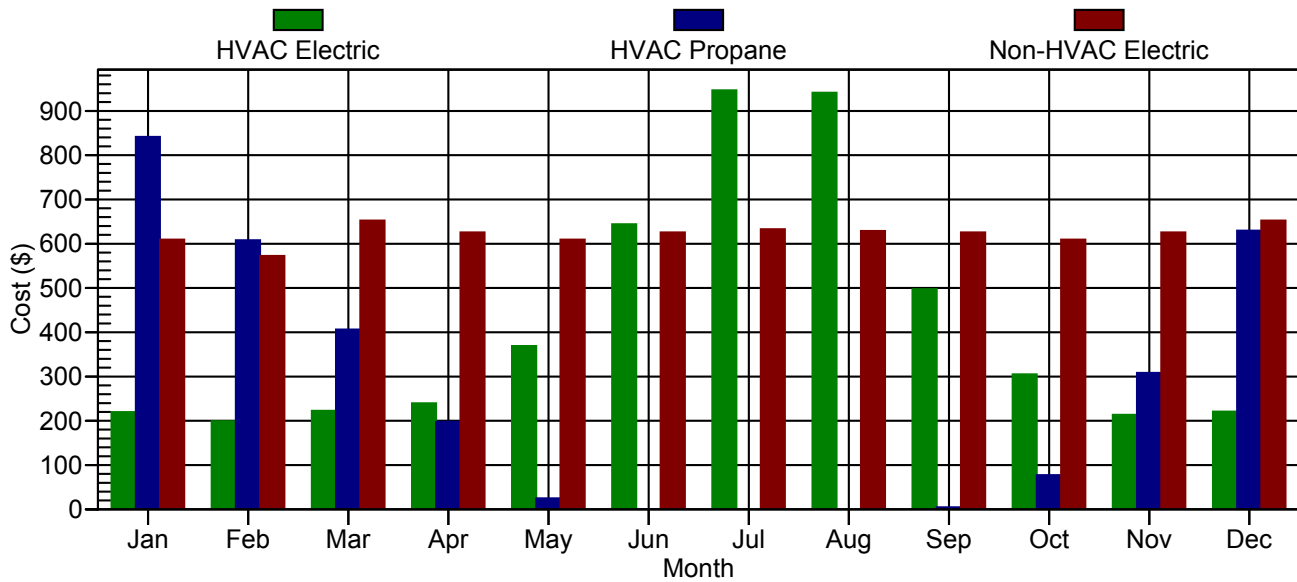
2. Non-HVAC Component Costs

Month	Lights (\$)	Electric Equipment (\$)	Misc. Electric (\$)	Misc. Fuel Use (\$)	Non-HVAC Total (\$)	Grand Total (\$)
January	443	166	0	0	609	1,670
February	416	156	0	0	572	1,379
March	474	178	0	0	652	1,281
April	455	171	0	0	626	1,062
May	443	166	0	0	609	1,003
June	455	171	0	0	626	1,270
July	460	173	0	0	633	1,579
August	457	171	0	0	629	1,570
September	455	171	0	0	626	1,128
October	443	166	0	0	609	991
November	455	171	0	0	626	1,147
December	474	178	0	0	652	1,502
Total	5,431	2,037	0	0	7,468	15,582

Monthly Energy Costs - ECM_3_NightSB_ECONO

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Kitchen and Associates

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1. HVAC Costs

Month	Electric (\$)	Natural Gas (\$)	Fuel Oil (\$)	Propane (\$)	Remote Hot Water (\$)	Remote Steam (\$)	Remote Chilled Water (\$)
January	220	0	0	841	0	0	0
February	199	0	0	608	0	0	0
March	223	0	0	406	0	0	0
April	240	0	0	197	0	0	0
May	369	0	0	25	0	0	0
June	644	0	0	1	0	0	0
July	946	0	0	0	0	0	0
August	941	0	0	0	0	0	0
September	497	0	0	5	0	0	0
October	305	0	0	77	0	0	0
November	213	0	0	308	0	0	0
December	221	0	0	629	0	0	0
Total	5,017	0	0	3,097	0	0	0

2. Non-HVAC Costs

Month	Electric (\$)	Natural Gas (\$)	Fuel Oil (\$)	Propane (\$)	Remote Hot Water (\$)	Remote Steam (\$)
January	609	0	0	0	0	0
February	572	0	0	0	0	0
March	652	0	0	0	0	0
April	626	0	0	0	0	0
May	609	0	0	0	0	0
June	626	0	0	0	0	0
July	633	0	0	0	0	0
August	629	0	0	0	0	0
September	626	0	0	0	0	0
October	609	0	0	0	0	0
November	626	0	0	0	0	0
December	652	0	0	0	0	0
Total	7,468	0	0	0	0	0

Monthly Energy Use by Energy Type - ECM_3_NightSB_ECONO

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1. HVAC Energy Use

Month	Electric (kWh)	Natural Gas (na)	Fuel Oil (na)	Propane (gal)	Remote HW (na)	Remote Steam (na)	Remote CW (na)
Jan	1,022	0	0	507	0	0	0
Feb	925	0	0	366	0	0	0
Mar	1,035	0	0	245	0	0	0
Apr	1,114	0	0	119	0	0	0
May	1,715	0	0	15	0	0	0
Jun	2,993	0	0	1	0	0	0
Jul	4,399	0	0	0	0	0	0
Aug	4,375	0	0	0	0	0	0
Sep	2,311	0	0	3	0	0	0
Oct	1,418	0	0	47	0	0	0
Nov	992	0	0	186	0	0	0
Dec	1,025	0	0	379	0	0	0
Totals	23,324	0	0	1,866	0	0	0

2. Non-HVAC Energy Use

Month	Electric (kWh)	Natural Gas (na)	Fuel Oil (na)	Propane (gal)	Remote HW (na)	Remote Steam (na)
Jan	2,832	0	0	0	0	0
Feb	2,661	0	0	0	0	0
Mar	3,032	0	0	0	0	0
Apr	2,908	0	0	0	0	0
May	2,832	0	0	0	0	0
Jun	2,908	0	0	0	0	0
Jul	2,942	0	0	0	0	0
Aug	2,923	0	0	0	0	0
Sep	2,908	0	0	0	0	0
Oct	2,832	0	0	0	0	0
Nov	2,908	0	0	0	0	0
Dec	3,032	0	0	0	0	0
Totals	34,719	0	0	0	0	0

Monthly Energy Use by Component - ECM_3_NightSB_ECONO

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1. Monthly Energy Use by System Component

Component	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Air System Fans (kWh)	1022	925	1025	992	1022	992	1023	1023	992	1022	992	1025
<i>Cooling</i>												
Electric (kWh)	0	0	9	122	693	2001	3376	3352	1319	396	0	0
Natural Gas (na)	0	0	0	0	0	0	0	0	0	0	0	0
Fuel Oil (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (gal)	0	0	0	0	0	0	0	0	0	0	0	0
Remote HW (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote CW (na)	0	0	0	0	0	0	0	0	0	0	0	0
<i>Heating</i>												
Electric (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
Natural Gas (na)	0	0	0	0	0	0	0	0	0	0	0	0
Fuel Oil (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (gal)	507	366	245	119	15	1	0	0	3	47	186	379
Remote HW (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0	0	0	0	0	0	0	0
Pumps (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
Clg. Tower Fans (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
Lighting (kWh)	2060	1935	2205	2115	2060	2115	2139	2125	2115	2060	2115	2205
Electric Eqpt. (kWh)	772	726	827	793	772	793	802	797	793	772	793	827
Misc. Electric (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
<i>Misc. Fuel</i>												
Natural Gas (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (gal)	0	0	0	0	0	0	0	0	0	0	0	0
Remote HW (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0	0	0	0	0	0	0	0

Annual Cost Summary

Hillside Barn
Kitchen and Associates

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Table 1. Annual Costs

Component	ECM_3_NightSB_ ECONO (\$)
Air System Fans	2,593
Cooling	2,424
Heating	3,097
Pumps	0
Cooling Tower Fans	0
HVAC Sub-Total	8,114
Lights	5,431
Electric Equipment	2,037
Misc. Electric	0
Misc. Fuel Use	0
Non-HVAC Sub-Total	7,468
Grand Total	15,582

Table 2. Annual Cost per Unit Floor Area

Component	ECM_3_NightSB_ ECONO (\$/ft²)
Air System Fans	0.600
Cooling	0.561
Heating	0.717
Pumps	0.000
Cooling Tower Fans	0.000
HVAC Sub-Total	1.878
Lights	1.257
Electric Equipment	0.472
Misc. Electric	0.000
Misc. Fuel Use	0.000
Non-HVAC Sub-Total	1.729
Grand Total	3.607
Gross Floor Area (ft²)	4320.0
Conditioned Floor Area (ft²)	4320.0

Note: Values in this table are calculated using the Gross Floor Area.

Table 3. Component Cost as a Percentage of Total Cost

Component	ECM_3_NightSB_ ECONO (%)
Air System Fans	16.6
Cooling	15.6
Heating	19.9
Pumps	0.0
Cooling Tower Fans	0.0
HVAC Sub-Total	52.1
Lights	34.9
Electric Equipment	13.1
Misc. Electric	0.0
Misc. Fuel Use	0.0
Non-HVAC Sub-Total	47.9
Grand Total	100.0

Annual Energy and Emissions Summary

Hillside Barn
Kitchen and Associates

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Table 1. Annual Costs

Component	ECM_3_NightSB ECONO (\$)
HVAC Components	
Electric	5,017
Natural Gas	0
Fuel Oil	0
Propane	3,097
Remote HW	0
Remote Steam	0
Remote CW	0
HVAC Sub-Total	8,114
Non-HVAC Components	
Electric	7,468
Natural Gas	0
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Non-HVAC Sub-Total	7,468
Grand Total	15,582

Table 2. Annual Energy Consumption

Component	ECM_3_NightSB ECONO
HVAC Components	
Electric (kWh)	23,324
Natural Gas (na)	0
Fuel Oil (na)	0
Propane (gal)	1,866
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0
Non-HVAC Components	
Electric (kWh)	34,719
Natural Gas (na)	0
Fuel Oil (na)	0
Propane (gal)	0
Remote HW (na)	0
Remote Steam (na)	0
Totals	
Electric (kWh)	58,043
Natural Gas (na)	0
Fuel Oil (na)	0
Propane (gal)	1,866
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0

Annual Energy and Emissions Summary

Hillside Barn
Kitchen and Associates

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Table 3. Annual Emissions

Component	ECM_3_NightSB_ ECONO
CO2 Equivalent (lb)	0

Table 4. Annual Cost per Unit Floor Area

Component	ECM_3_NightSB_ ECONO (\$/ft²)
HVAC Components	
Electric	1.161
Natural Gas	0.000
Fuel Oil	0.000
Propane	0.717
Remote HW	0.000
Remote Steam	0.000
Remote CW	0.000
HVAC Sub-Total	1.878
Non-HVAC Components	
Electric	1.729
Natural Gas	0.000
Fuel Oil	0.000
Propane	0.000
Remote HW	0.000
Remote Steam	0.000
Non-HVAC Sub-Total	1.729
Grand Total	3.607
Gross Floor Area (ft²)	4320.0
Conditioned Floor Area (ft²)	4320.0

Note: Values in this table are calculated using the Gross Floor Area.

Table 5. Component Cost as a Percentage of Total Cost

Component	ECM_3_NightSB_ ECONO (%)
HVAC Components	
Electric	32.2
Natural Gas	0.0
Fuel Oil	0.0
Propane	19.9
Remote HW	0.0
Remote Steam	0.0
Remote CW	0.0
HVAC Sub-Total	52.1
Non-HVAC Components	
Electric	47.9
Natural Gas	0.0
Fuel Oil	0.0
Propane	0.0
Remote HW	0.0
Remote Steam	0.0
Non-HVAC Sub-Total	47.9
Grand Total	100.0

APPENDIX R

Site Aerial Image





Lake Iliff Rd

Lake Iliff Rd

bing™

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