

**TOWNSHIP OF ANDOVER
NEWTON, NJ
ANDOVER TOWNSHIP TOWN HALL
ENERGY ASSESSMENT**

for

**NEW JERSEY
BUREAU OF PUBLIC UTILITIES**

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CHA PROJECT NO. 20997

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TABLE OF CONTENTS

	<u>Page</u>
1.0 INTRODUCTION & BACKGROUND.....	1
2.0 EXECUTIVE SUMMARY.....	2
3.0 EXISTING CONDITIONS.....	4
3.1 Building General	
3.2 Utility Usage	
3.3 HVAC Systems	
3.4 Lighting/Electrical Systems	
3.5 Control Systems	
3.6 Plumbing Systems	
4.0 ENERGY CONSERVATION MEASURES.....	8
4.1 ECM-1 Lighting Fixture Modifications	
4.2 ECM-2 Lighting Control Modifications	
4.3 ECM-3 Demand Ventilation (Zone 1)	
4.4 ECM-4 Modify HVAC Unit Control (Zone 1)	
4.5 ECM-5 Modify HVAC Unit Control (Zone 2)	
4.6 ECM-6 Modify HVAC Unit Control (Zone 3)	
4.7 ECM-7 Modify HVAC Unit Control (Zone 4)	
4.8 ECM-8 Replace HVAC Unit with Higher Efficiency Unit (Zone 1)	
4.9 ECM-9 Replace HVAC Unit with Higher Efficiency Unit (Zone 2)	
4.10 ECM-10 Replace HVAC Unit with Higher Efficiency Unit (Zone 3)	
4.11 ECM-11 Replace HVAC Unit with Higher Efficiency Unit (Zone 4)	
4.12 ECM-12 Reduce Water Use	
5.0 PROJECT INCENTIVES.....	18
5.1 Incentives Overview	
5.2 Building Incentives	
6.0 ALTERNATIVE ENERGY SCREENING EVALUATION.....	21
6.1 Geothermal	
6.2 Solar	
6.3 Wind	
6.4 Combined Heat and Power Generation (CHP)	
6.5 Biomass Power Generation	
6.6 Demand Response Curtailment	
7.0 EPA PORTFOLIO MANAGER.....	27
8.0 CONCLUSIONS & RECOMMENDATIONS.....	28

APPENDICES

A	Utility Usage Analysis
B	HVAC Equipment List
C	Separate Cooling Unit for Server Room
D	ECM-1 Lighting Fixture Modifications
E	ECM-2 Lighting Control Modifications
F	ECM-3 Demand Ventilation (Zone 1)
G	ECM-4 Modify HVAC Unit Control (Zone 1)
H	ECM-5 Modify HVAC Unit Control (Zone 2)
I	ECM-6 Modify HVAC Unit Control (Zone 3)
J	ECM-7 Modify HVAC Unit Control (Zone 4)
K	ECM-8 Replace HVAC Unit with Higher Efficiency Unit (Zone 1)
L	ECM-9 Replace HVAC Unit with Higher Efficiency Unit (Zone 2)
M	ECM-10 Replace HVAC Unit with Higher Efficiency Unit (Zone 3)
N	ECM-11 Replace HVAC Unit with Higher Efficiency Unit (Zone 4)
O	ECM-12 Reduce Water Use
P	Photovoltaic (PV) Rooftop Solar Power Generation
Q	Solar Thermal Domestic Hot Water Plant
R	Wind
S	EPA Portfolio Manager
T	Carrier Hourly Analysis Program Base Building Data
U	Site Aerial Image

1.0 INTRODUCTION & BACKGROUND

This report summarizes the energy audit performed at the Andover Township Town Hall building, in the Township of Andover located at 134 Newton Sparta Road in Newton, NJ. The original building had major renovations in 1992 with a new wing added, making the building an 8,807 square foot, two-story structure. The building houses township officials' offices, a meeting/court room, storage, 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 Town Hall.

2.0 EXECUTIVE SUMMARY

This report details the results of the Andover Township Town Hall, in the Township of Andover. The 8,807 square foot, two-story structure houses township officials' offices, a meeting/court room, storage, and auxiliary spaces. The following areas were evaluated for energy conservation measures:

- Lighting upgrades with occupancy sensors
- HVAC system control
- Balance HVAC system
- Water use reduction
- Solar photovoltaic power

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 \$2,570 for the recommended ECMs may be realized with a payback of 1.0 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

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
\$	kW	kWh	Therms	\$		\$	Years	Years
1,300	0	5,400	0	900	9.4	60	1.4	1.4

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

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
\$	kW	kWh	Therms	\$		\$	Years	Years
600	0	700	0	100	1.5	120	6	4.8

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

ECM-4 Modify HVAC Unit Control (Zone 1)

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
\$	kW	kWh	Therms	\$		\$	Years	Years
160	-	500	500	850	79.0	NA	0.2	NA

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

ECM-5 Modify HVAC Unit Control (Zone 2)

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
\$	kW	kWh	Therms	\$		\$	Years	Years
160	-	300	75	200	17.8	NA	0.8	NA

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

ECM-6 Modify HVAC Unit Control (Zone 3)

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
\$	kW	kWh	Therms	\$		\$	Years	Years
160	-	500	50	200	17.8	NA	0.8	NA

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

ECM-7 Modify HVAC Unit Control (Zone 4)

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
\$	kW	kWh	Therms	\$		\$	Years	Years
160	-	600	50	200	17.8	NA	0.8	NA

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

ECM-12 Reduced Water Use

Budgetary Cost	Annual Utility Savings			ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Water	Electricity	Total				
\$	Gallons	kWh	\$		\$	Years	Years
15	6,630	260	120	79	NA	0.1	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 Andover Township Town Hall is an 8,807 square foot, two-story structure. The original building underwent major renovations in 1992 with the addition of a new wing. The building houses township officials' offices, a meeting/court room, storage, and auxiliary spaces.

Andover Township has a full service Town Hall that houses the offices of township officials and a court/meeting room. As such, the typical use of the building primarily follows a 40-hour workweek. Court is in session 15 times per month, always at night.

The original building was renovated in 1992 with a two story, 60'x35' wing added, increasing the size of the facility to 8,807 square feet. At that time, the original exterior shell was repaired. The exterior shell is in good condition. There are different exterior wall constructions. These consist of: 2"x6" studs with 6" (R-19) insulation with ½" exterior plywood, 15# felt, vinyl siding and painted drywall on the exterior; acrylic stucco with fiberglass mesh on 2 ½" rigid insulation board, ½" gypsum sheathing, with either an existing wall behind or a 2"x6" insulated stud wall behind. Below grade walls are 12" reinforced poured concrete with 3" metal furring channels and 1" (R-8) insulation board and 5/8" gypsum board on the interior. The second story front of the new wing has a 4" brick veneer wall with 2" air space and 2"x6" stud wall behind. The roof is an "A" frame, wood truss system with 5/8" exterior plywood, 15# felt and fiberglass shingles. At the bottom cord of the truss is 9" (R-30) batt insulation and suspended acoustical tile ceiling below.

The windows are wood, double hung with insulated glass. The main entrance has two 3'-0"x7'-0" insulated glass panels in an aluminum frame with an entry vestibule and a second set of glass doors. Second floor entry doors both on the side and rear of the building are also insulated glass doors with aluminum frames. One set consists of two 3'-0"x7'-0" doors, the other of 3'-0"x7'-0" door with full height 2'-0" wide side lites. Other side entrance doors are insulated wood with vision panels.

All doors and windows appeared to have good weather stripping.

3.2 Utility Usage

Utilities include electricity, natural gas, and potable water. Electricity is purchased from Jersey Central Power & Light Company (JCP&L), natural gas is purchased from Elizabethtown Gas Company, and potable water is provided by the Newton Water and Sewer Utility.

During the period of December 2008 to November 2009, electric usage was approximately 71,360 kWh at a total cost of about \$12,416. 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 \$3.93 per kW, and blended unit cost of \$0.1740 per kWh. Electricity usage was highest in the summer months when cooling equipment is in use. During the same 2009 timeframe, the building heat and domestic hot water (DHW) produced by natural gas-fired equipment required approximately 1,377 therms. Based on the annual cost of \$2,353, the blended price for natural gas was \$1.71 per therm. Natural gas consumption is highest in the winter months to produce building heat.

This building and the Department of Public Works (DPW) building behind this facility share a water service. Because the water used at the DPW facility is far greater than the Town Hall, the water usage is discussed in the audit report for the DPW building. Both facilities had a total water use from November

2008 through November 2009 of 140,500 gallons at a total cost of \$1,600. The average unit cost is \$11.50 per 1,000 gallons.

Utility data can be found in Appendix A.

Electricity supply and delivery is presently purchased from JCP&L. Natural gas supply and delivery is presently purchased from Elizabethtown Gas. The delivery component will always be the responsibility of the utility that connects the facility to the power grid or gas line; however, the supply can be purchased from a third party. The electricity or natural gas commodity supply entity will require submission of one to three years of past energy bills. Contract terms can vary among suppliers. A list of approved electrical and natural gas energy commodity suppliers can be found in Appendix A.

3.3 HVAC Systems

Heating, ventilation, and air conditioning is provided to the facility in four zones. Zone 1 is the court/meeting room located in the northwest corner of the lower level. Zone 2 is the remainder of the lower level. Zone 3 is the northwest wing and zone 4 is the east wing of the upper level. Zone 1 is a single package unit by Lennox with heating and cooling, economizer operation, and a heat recovery unit. The unit's compressor can provide two-stage operation, high and low. Zones 2, 3, and 4 are served by three split systems utilizing Lennox horizontal, gas-fired, furnaces with a Lennox cooling coil and remote condensing unit by Lennox as well. Each zone also utilizes a Des Champ energy recovery unit. The energy recovery units exhaust air from various spaces (restrooms, kitchenette, conference room) and introduce outside air into the return air stream, tempering the mixed air temperature prior to reaching the furnace and cooling coil. Ductwork located in the ventilated attic space is insulated with duct wrap.

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

Equipment	Cooling Tons	Heating/Cooling Efficiency	Heating MBH Input/Output	Area Served
Packaged Unit	7	78% / 9 EER	135 / 106	Zone 1 (Court Room/Meeting Room)
Furnace/Cooling Coil	3	94% / 11.35 SEER	76 / 71	Zone 2 (Lower Level)
Furnace/Cooling Coil	6	94% / 11.3 SEER	77 / 72	Zone 3 (Northwest Wing, Upper Level)
Furnace/Cooling Coil	5	94% / 11.85 SEER	77 / 72	Zone 4 (East Wing, Upper Level)

Each individual toilet room has an exhaust fan tied into the light switch. The conference room next to the meeting/courtroom has an exhaust fan with manual switch control.

The equipment is original to the renovations and addition work in 1992 (18 years old). Service life is estimated at 15 years for split systems and outdoor unitary equipment. A list of equipment can be found in Appendix B.

The Town Hall facility includes a server room on the second floor that houses two computers and the main telephone system. The only cooling to the room is by a vent in the door, but there is no exhaust fan present to pull cooler air through the room. As a result the room is very hot and could result in computer

or telephone equipment failure. It is recommended that a cooling only, ductless mini-split system dedicated to this room be installed.

This recommendation was analyzed by modeling both the building and the hours of operation in the Carrier Hourly Analysis Program (HAP). Using this model, load calculations were performed to determine the capacity of the unit required to cool this room. A one-ton ductless mini-split system is proposed to provide comfort in the room as well as maintain safe operating temperatures of the electronic equipment. HAP data and load calculations for the server room analysis is located in Appendix C.

The ductless mini-split system equipment has an expected life of 15 years, according to ASHRAE, and total energy costs over the life of the project are estimated at 61,500 kWh, and \$10,500.

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

Separate Cooling Unit for Server Room

Budgetary Cost	Annual Utility Savings			ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas				
\$	kW	kWh	Therms	\$	\$	Years	Years
2,300	-	(4,100)	-	(700)	NA	NA	NA

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

Although this recommendation does not decrease energy consumption, it is suggested to protect the equipment.

3.4 Lighting/Electrical Systems

The majority of lighting fixtures throughout the facility utilize energy efficient T-8 fluorescent lamps or compact fluorescent lamps, although there are mechanical rooms and some restrooms that are equipped with inefficient T-12 fluorescent lamps and fixtures. In addition, there are incandescent lamps located throughout the building. All exit signs within the building use fluorescent lamps.

Exterior building lighting, located at exterior doors, metal halide, include mercury vapor, and A-lamp light fixtures utilizing lamps with various wattages. Site lighting is provided by streetlights that are billed separately by Jersey Central Power and Light at a flat rate.

Emergency lighting is provided by use of self-contained combination light and battery units in all exit corridors. An uninterruptible power source with battery backup is utilized for the computer equipment.

3.5 Control Systems

3.5.1 HVAC Controls

Each HVAC unit is controlled by wall-mounted, non-programmable, standard heating-cooling thermostat. The thermostat for zone 1 is located in the courtroom. The three other thermostats are located in various corridor spaces.

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

Equipment	Heating Occ/Unocc	Cooling Occ/Unocc
Zone 1	72°F / 62°F	76°F / 80°F
Zone 2	72°F / 72°F	76°F / 76°F
Zone 3	72°F / 72°F	76°F / 76°F
Zone 4	72°F / 72°F	76°F / 76°F

Changeover from occupied to unoccupied is by manual reset of thermostat set point.

Toilet room exhaust fans are interlocked with toilet room lights. Conference room exhaust fan is manually controlled by use of a wall switch.

3.5.2 Lighting Controls

Manual wall switches, except for exit lights and emergency lighting, control all lighting in the Town Hall. Exterior lighting is controlled by a combination of switches and photocells with a manual override.

3.6 Plumbing Systems

Domestic hot water for the facility is produced by a 40 gallon, 42 MBH, gas-fired, A.O. Smith water heater with power exhaust. The heater is located on the lower level in a mechanical space. A hot water return loop is not currently installed. Plumbing fixtures in the original building utilize the central hot water system. Restroom and kitchenette fixtures in the building addition utilize electric instantaneous water heaters.

Plumbing fixtures include 1.6 gallon per flush tank-type water closets; urinal; countertop and wall hung restroom sinks; kitchen sink; service sink; and exterior non-freeze wall hydrants. 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 facility has 31 fixtures, which utilize incandescent lamps, and 17 fixtures, which utilize T-12 fluorescent lamps. The incandescent lamps are located throughout the building in corridors and various office spaces. The T-12 fluorescent fixtures are located in restrooms, storage spaces, and mechanical rooms. Overall energy consumption can be reduced by utilizing more efficient compact fluorescent lamps and T-8 fluorescent lamps. The building also has 11 exit signs that currently have 16-watt fluorescent lamps. Exit sign energy consumption can be greatly reduced by replacing these lamps with energy efficient LED lamps.

Energy savings for this measure were calculated by applying the existing and proposed fixture wattages to the estimated time of operation. The difference resulted in an annual savings of 5,440 kWh per year, or \$947 per year. Supporting calculations, including all assumptions for lighting hours, and the annual energy usage for each fixture can be found in Appendix D.

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 81,600 kWh and \$14,205.

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

ECM-1 Lighting Fixture Modifications

Budgetary Cost	Annual Utility Savings			ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas				
\$	kW	kWh	Therms	\$	\$	Years	Years
1,300	0	5,400	0	900	9.4	60	1.4

* 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.

This measure is recommended.

4.2 ECM-2 Lighting Control Modifications

Manual wall switches currently control lighting throughout the facility. By equipping individual offices, restrooms, storage rooms, and mechanical areas with motion sensors, unoccupied energy use can be greatly reduced. This ECM proposes the addition of six wall-mounted occupancy sensors in these areas.

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 694 kWh per year, or \$121 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 10,410 kWh and \$1,815.

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 E. The implementation cost and savings related to this ECM are summarized below:

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		Natural Gas					Total
\$	kW	kWh	Therms	\$		\$	Years	Years
600	0	700	0	100	1.5	120	6	4.8

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

This measure is recommended.

4.3 ECM-3 Demand Ventilation (Zone 1)

An outdoor, packaged HVAC unit with a heat recovery unit in the ceiling serves Zone 1. The heat recovery unit draws fresh air in through an OA intake, tempers the air before blending it with return air, and then passes the mixed air through the HVAC unit and is discharged into the room. The existing system constantly ventilates the space for maximum occupancy. If the space is occupied at less than the design level, the space is still ventilated at the maximum level. Because there is no control on the fresh air intake, the same amount of OA is treated regardless of the ventilation demand determined by space occupancy. Utilizing a demand control ventilation (DCV) system would regulate the amount of OA induced into the space based on the CO₂ levels detected within the room or return air duct. A DCV system is based on the principle that the number of people within the space is proportional to the concentration of CO₂. Controlling the outdoor air amount based on CO₂, the DCV system offers the possibility of reducing the energy consumption by reducing the over-ventilation periods during low occupancy. This ECM evaluates providing only the required fresh air to the space, decreasing the amount of OA to be treated, and reducing the annual heating and cooling loads.

Based on the capacity of the unit and the existing HVAC drawings, it was determined that the required amount of OA needed to serve Zone 1 is approximately 1,125 CFM. Utilizing a DCV system, the required OA in the zone can be reduced to 170 CFM during unoccupied times and a percentage of 1,125 CFM during partial occupancy, yielding an annual savings of approximately 125 therms and an increase of approximately 900 kWh. The savings are small because the energy recovery unit is already tempering the OA and reducing the energy required to heat the air. In this case, reductions in outside air do not lead to large reductions in energy consumption.

Implementation of this measure requires installation of OA controls on the outdoor unit serving Zone 1. This includes installing a CO₂ sensor within the return air duct, wiring and connections between the sensors and the unit, and reprogramming the unit's logic controller so that the unit can control the OA damper positions based on the CO₂ readings. The existing dampers are considered to be in good condition and will be retrofitted with a modulating motor for more precise damper control.

This ECM was analyzed by modeling both the building and the hours of operation in the Carrier Hourly Analysis Program (HAP). Using this model, a percent reduction in outside air was applied to the unit. According to ASHRAE, a typical DCV system will reduce the amount of outside air by 15% on average. HAP data for the zone is located in Appendix F. Base building data is located in Appendix T.

The DCV equipment has an expected life of 15 years, according to ASHRAE, and total energy savings over the life of the project are estimated at 1,875 therms and \$600.

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

ECM-3 Demand Ventilation (Zone 1)

Budgetary Cost	Annual Utility Savings				ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas	Total				
\$	kW	kWh	Therms	\$		\$	Years	Years
2,000	-	(900)	125	40	0.7	NA	>25	NA

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

This measure is not recommended.

4.4 ECM-4 Modify HVAC Unit Control (Zone 1)

Heating and cooling in Zone 1 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 Zone 1, a potential annual savings of approximately 500 therms and 500 kWh, or \$850 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 7,500 therms and 7,500 kWh, or \$12,750.

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 hours of occupancy for this zone were determined based on conversations with building occupants. The room is occupied 15 times a month from 4 pm to 12 am. It is unoccupied at all other times. For the base building analysis of this zone it was assumed that manual setbacks do not occur regularly because of the need for someone to physically adjust the thermostat. HAP data for this ECM is located in Appendix G. Base building data is located in Appendix T.

The following is the proposed setback temperatures for this zone:

Equipment	Heating Occ/Unocc	Cooling Occ/Unocc
Zone 1	72°F / 62°F	76°F / 80°F

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

ECM-4 Modify HVAC Unit Control (Zone 1)

Budgetary Cost	Annual Utility Savings			ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)	
	Electricity		Natural Gas					Total
\$	kW	kWh	Therms	\$		\$	Years	Years
160	-	500	500	850	79.0	NA	0.2	NA

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

This measure is recommended.

4.5 ECM-5 Modify HVAC Unit Control (Zone 2)

Heating and cooling in Zone 2 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 Zone 2, a potential annual savings of approximately 75 therms and 300 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 1,125 therms and 4,500 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. The hours of occupancy for this zone were determined based on typical office hours. The building is occupied 5 days a week from 6 am to 9 pm with partial occupancy over weekends for cleaning crew. It is unoccupied at all other times. HAP data for this ECM is located in Appendix H. Base building data is located in Appendix T.

The following is the proposed setback temperatures for this zone:

Equipment	Heating Occ/Unocc	Cooling Occ/Unocc
Zone 2	72°F / 62°F	76°F / 80°F

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

ECM-5 Modify HVAC Unit Control (Zone 2)

Budgetary Cost	Annual Utility Savings			ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)	
	Electricity		Natural Gas					Total
\$	kW	kWh	Therms	\$	\$	Years	Years	
160	-	300	75	200	17.8	NA	0.8	NA

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

This measure is recommended.

4.6 ECM-6 Modify HVAC Unit Control (Zone 3)

Heating and cooling in Zone 3 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 Zone 3, a potential annual savings of approximately 50 therms and 500 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 750 therms and 7,500 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. The hours of occupancy for this zone were determined based on typical office hours. The building is occupied 5 days a week from 6 am to 9 pm with partial occupancy over weekends for cleaning crew. HAP data for this ECM is located in Appendix I. Base building data is located in Appendix T.

The following is the proposed setback temperatures for this zone:

Equipment	Heating Occ/Unocc	Cooling Occ/Unocc
Zone 3	72°F / 62°F	76°F / 80°F

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

ECM-6 Modify HVAC Unit Control (Zone 3)

Budgetary Cost	Annual Utility Savings			ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)	
	Electricity		Natural Gas					Total
\$	kW	kWh	Therms	\$		\$	Years	Years
160	-	500	50	200	17.8	NA	0.8	NA

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

This measure is recommended.

4.7 ECM-7 Modify HVAC Unit Control (Zone 4)

Heating and cooling in Zone 4 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 Zone 4, a potential annual savings of approximately 50 therms and 600 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 750 therms and 9,000 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. The hours of occupancy for this zone were determined based on typical office hours. The building is occupied 5 days a week from 6 am to 9 pm with partial occupancy over weekends for cleaning crew. HAP data for this ECM is located in Appendix J. Base building data is located in Appendix T.

The following is the proposed setback temperatures for this zone:

Equipment	Heating Occ/Unocc	Cooling Occ/Unocc
Zone 4	72°F / 62°F	76°F / 80°F

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

ECM-7 Modify HVAC Unit Control (Zone 4)

Budgetary Cost	Annual Utility Savings			ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas				
\$	kW	kWh	Therms	\$	\$	Years	Years
160	-	600	50	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.

4.8 ECM-8 Replace HVAC Unit with Higher Efficiency Unit (Zone 1)

Energy efficiency rating (EER) is the value used to determine an air conditioner's energy efficiency. EER is a ratio of the typical cooling output and the electrical input. The larger the EER value, the more energy efficient the unit. The existing packaged unit serving Zone 1 is 15 years old, at the end of its life expectancy, and has an EER rating of 9. By replacing the existing unit with a unit that has an EER rating

of 12.5, the energy consumption of the unit will be reduced by approximately 18%. The existing unit size is 6-tons.

Implementation of this ECM requires the removal of the packaged unit. In addition, a new packaged unit with an economizer and programmable thermostat must be installed in place of the removed unit. 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 under equal conditions. HAP data for this ECM is located in Appendix K. Base building data is located in Appendix T.

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

ECM-8 Replace HVAC Unit with Higher Efficiency Unit (Zone 1)

Budgetary Cost	Annual Utility Savings			ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas				
\$	kW	kWh	Therms	\$	\$	Years	Years
11,200	0	1,000	50	250	(0.7)	550	>25

* Incentive shown is per the New Jersey Smart Start Program, 2010 Electric Unitary HVAC Application. Incentive is based on the use of 6-ton, 16 SEER unit.

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

4.9 ECM-9 Replace HVAC Unit with Higher Efficiency Unit (Zone 2)

The existing condensing unit serving Zone 2 is 15 years old, at the end of its life expectancy, and has a SEER rating of 11.35. 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 29%. The existing unit size is 3-tons.

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 under equal conditions. HAP data for this ECM is located in Appendix L. Base building data is located in Appendix T.

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

ECM-9 Replace HVAC Unit with Higher Efficiency Unit (Zone 2)

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	300	-	50	(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.

4.10 ECM-10 Replace HVAC Unit with Higher Efficiency Unit (Zone 3)

The existing condensing unit serving Zone 3 is 15 years old, at the end of its life expectancy, and has a SEER rating of 11.3. 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 29%. The existing unit size is 6-tons.

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 under equal conditions. HAP data for this ECM is located in Appendix M. Base building data is located in Appendix T.

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

ECM-10 Replace HVAC Unit with Higher Efficiency Unit (Zone 3)

Budgetary Cost	Annual Utility Savings			ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas				
\$	kW	kWh	Therms	\$	\$	Years	Years
9,800	0	600	-	100	(0.8)	550	>25

* Incentive shown is per the New Jersey Smart Start Program, 2010 Electric Unitary HVAC Application. Incentive is based on the use of 6-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.

4.11 ECM-11 Replace HVAC Unit with Higher Efficiency Unit (Zone 4)

The existing condensing unit serving Zone 4 is 15 years old, at the end of its life expectancy, and has a SEER rating of 11.85. 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 26%. The existing unit size is 5-tons.

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 under equal conditions. HAP data for this ECM is located in Appendix N. Base building data is located in Appendix T.

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

ECM-11 Replace HVAC Unit with Higher Efficiency Unit (Zone 4)

Budgetary Cost	Annual Utility Savings			ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas				
\$	kW	kWh	Therms	\$	\$	Years	Years
9,600	0	700	-	100	(0.8)	460	>25

* Incentive shown is per the New Jersey Smart Start Program, 2010 Electric Unitary HVAC Application. Incentive is based on the use of 5-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.

4.12 ECM-12 Reduce Water Use

The facility's lounge has a kitchen sink with a faucet flow rate of 2.2 gallons per minute. Overall water consumption can be reduced by replacing the 2.2 gallon per minute aerator on the faucet with one that restricts the flow to 0.5 gallons per minute. The average annual operation of the faucet was determined by taking into account typical traffic patterns of the lounge area and the number of employees. The reduction in water consumption will reduce the total gallons used as well as the electricity required to heat the water through the instantaneous water heater.

Annual savings of 6,630 gallons of water and 260 kWh in electricity consumption can be realized by installing the low flow aerator.

Aerators have an expected life of 10 years, according to the manufacturer, and the total energy savings over the life of the project is estimated at 66,300 gallons and \$1,200.

The implementation and savings related to this ECM are presented in Appendix O and summarized on the following page:

ECM-12 Reduced Water Use

Budgetary Cost	Annual Utility Savings			ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Water	Electricity	Total				
\$	Gallons	kWh	\$		\$	Years	Years
15	6,630	260	120	79	NA	0.1	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 not eligible for the three incentives available from the New Jersey P4P program as it does not meet the 15% energy reduction required.

5.2.2 New Jersey Smart Start Program

The Andover Township town hall building is eligible for multiple incentives from the New Jersey Smart Start Program.

The lighting replacement measure is eligible for \$60 in savings if proposed fixtures are replaced. There would also be \$120 available for the installation of occupancy sensors. Totaling all these incentives would produce a savings of about \$180.

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 administration building, the building pays for the societal benefits charge. The town hall building 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 split system, gas-fired furnaces with cooling coils. 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 Town Hall to be analyzed. A fixed tilt array type was utilized to calculate energy production. The PVWATTS solar power generation model is provided in Appendix P. Additionally, further financial analysis was provided by www.solar-estimate.org. The result of this analysis is also located in Appendix P.

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 30.7kW and a minimum of 19.5 kW over the previous 12 months. The monthly average over the observed 12-month period was 23.5 kW. Because the most frequent monthly demand is approximately 20 kW, a 20 kW system size was selected for the calculations. 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. This has increased in the past few years due to the rise in national demand for PV power generator systems. Other cost considerations will also need to be considered. PV panels have an approximate 20 year life span; however, the inverter device that converts DC electricity to AC has a life span of 10 to 12 years and will need to be replaced multiple times during the useful life of the PV system.

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

Photovoltaic (PV) Rooftop Solar Power Generation – 20 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
160,000	0	22,300	0	3,900	3,900	20,000	9,740	>25	~5

*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

American Energy Technologies provided Andover Township a solar analysis for both the Town Hall and Department of Public Works (DPW) combined. This analysis utilized a 32 kW system to be located on the DPW roof. The analysis is included in Appendix P. We would suggest that based on the electric use and demand of both the Town Hall and DPW that these calculations be updated.

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 Town Hall 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. DHW is presently produced by a natural gas fired water heater and, therefore, this measure would not save site electricity.

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 Q 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
9,305	0	0	130	220	NA	>25	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, which converts kinetic energy of the wind into rotary motion to drive a generator, which usually is designed specifically for the wind turbine. The rotor consists of two or three blades, usually made from wood or fiberglass. These materials give the turbine the needed strength and flexibility, and have the added advantage of not interfering with television signals. The structural backbone of the wind turbine is the mainframe, and

includes the slip-rings that connect the wind turbine, which rotates as it points into changing wind directions, and the fixed tower wiring. The tail aligns the rotor into the wind.

To avoid turbulence and capture greater wind energy, turbines are mounted on towers. Turbines should be mounted at least 30 feet above any structure or natural feature within 300 feet of the installation. Smaller turbines can utilize shorter towers. For example, a 250-watt turbine may be mounted on a 30-50 foot tower, while a 10 kW turbine will usually need a tower of 80-120 feet. Tower designs include tubular or latticed, guyed or self-supporting. Wind turbine manufacturers also provide towers.

The New Jersey Clean Energy Program for small wind installations has designated numerous pre-approved wind turbines for installation in the State of New Jersey. Incentives for wind turbine installations are based on kilowatt hours saved in the first year. Systems sized under 16,000 kWh per year of production will receive a \$3.20 per kWh incentive. Systems producing over 16,000 kWh will receive \$51,200 for the first 16,000 kWh of production with an additional \$0.50 per kWh up to a maximum cap of 750,000 kWh per year. Federal tax credits are also available for renewable energy projects up to 30% of installation cost for systems less than 100 kW. However, as noted previously, municipalities do not pay federal taxes and is, therefore, not eligible for the tax credit incentive.

The most important part of any small wind generation project is the mean annual wind speed at the height of which the turbine will be installed. In the 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 R.

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 town hall had a monthly average kW demand of 7.9 kW and a maximum demand of 13.8 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 town hall is considered a moderate energy consumer per the Portfolio Manager with a Site Energy Usage Index (EUI) of 85 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 69 kBtu/ft²/year and the national average site EUI is 93 kBtu/ft²/year. The energy consumption of the building is slightly lower than the national average for buildings of similar occupancy.

The EPA Portfolio Manager was able to calculate an energy performance rating for this building because it primarily operates as an office space. The town hall energy performance rating is 54.

If the recommended measures are implemented, ECM-1, ECM-2, ECM-4, ECM-5, ECM-6, ECM-7, and ECM-12, the facility's EUI will be reduced from 85 kBtu/ft²/year to 74 kBtu/ft²/year and the energy performance rating would increase from 54 to 69.

We are able to compare the building's performance with a building rated 75 and the national average for all buildings designated as office space as follows:

Energy Performance Comparison

Performance Metrics	Evaluation Period	Comparisons	
	Baseline (Ending date 12/31/2009)	Rating of 75	National Average
Energy Intensity			
Site (kBtu/ft ²)	85	69	93
Source (kBtu/ft ²)	152	123	167
Energy Cost			
\$/year	\$20,204.18	\$16,408.58	\$22,185.64
\$/ft ² /year	\$2.29	\$1.86	\$2.51
Greenhouse Gas Emissions			
MtCO ₂ e/year	64	52	70
kgCO ₂ e/ft ² /year	7	6	8

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

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 Town Hall, in the Township of Andover, New Jersey identified potential ECMs for lighting fixture upgrades, lighting fixture control modifications, and installation of programmable thermostats, and water use reduction. Potential annual savings of \$2,570 may be realized for the recommended ECMs, with a summary of the costs, savings, and paybacks as follows:

ECM-1 Lighting Fixture Modifications

Budgetary Cost	Annual Utility Savings			ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas				
\$	kW	kWh	Therms	\$	\$	Years	Years
1,300	0	5,400	0	900	9.4	60	1.4

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

Budgetary Cost	Annual Utility Savings			ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas				
\$	kW	kWh	Therms	\$	\$	Years	Years
600	0	700	0	100	1.5	120	4.8

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

ECM-4 Modify HVAC Unit Control (Zone 1)

Budgetary Cost	Annual Utility Savings			ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas				
\$	kW	kWh	Therms	\$	\$	Years	Years
160	-	500	500	850	79.0	NA	0.2

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

ECM-5 Modify HVAC Unit Control (Zone 2)

Budgetary Cost	Annual Utility Savings			ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Electricity		Natural Gas				
\$	kW	kWh	Therms	\$	\$	Years	Years
160	-	300	75	200	17.8	NA	0.8

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

ECM-6 Modify HVAC Unit Control (Zone 3)

Budgetary Cost	Annual Utility Savings			ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)	
	Electricity		Natural Gas					Total
\$	kW	kWh	Therms	\$		\$	Years	Years
160	-	500	50	200	17.8	NA	0.8	NA

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

ECM-7 Modify HVAC Unit Control (Zone 4)

Budgetary Cost	Annual Utility Savings			ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)	
	Electricity		Natural Gas					Total
\$	kW	kWh	Therms	\$		\$	Years	Years
160	-	600	50	200	17.8	NA	0.8	NA

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

ECM-12 Reduced Water Use

Budgetary Cost	Annual Utility Savings			ROI	Potential Incentive*	Payback (without incentive)	Payback (with incentive)
	Water	Electricity	Total				
\$	Gallons	kWh	\$		\$	Years	Years
15	6,630	260	120	79	NA	0.1	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 Town Hall General Service

CHA Project Number

Electricity Cost Summary: Meter #G28260421												
Period	Customer 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	\$ 65.35		\$ 90.58	\$ 31.19	\$ 0.38	\$ 199.15	\$ 533.85	\$ 82.09		\$ 615.94	\$ 815.09
January	\$ 11.65	\$ 62.11		\$ 98.15	\$ 37.38	\$ 0.46	\$ 209.75	\$ 658.05	\$ 98.37		\$ 756.42	\$ 966.17
February	\$ 11.65	\$ 71.17		\$ 96.58	\$ 36.09	\$ 0.44	\$ 215.93	\$ 637.63	\$ 94.98		\$ 732.61	\$ 948.54
March	\$ 11.65	\$ 61.62		\$ 99.09	\$ 38.15	\$ 0.47	\$ 210.98	\$ 657.96	\$ 100.40		\$ 758.36	\$ 969.34
April	\$ 11.65	\$ 61.62		\$ 91.52	\$ 31.96	\$ 0.39	\$ 197.14	\$ 545.55	\$ 84.12		\$ 629.67	\$ 826.81
May	\$ 11.65	\$ 117.11	\$ 0.31	\$ 104.77	\$ 42.79	\$ 0.52	\$ 277.15	\$ 730.33	\$ 112.61		\$ 842.94	\$ 1,120.09
June	\$ 11.65	\$ 111.04	\$ 0.41	\$ 108.14	\$ 41.76	\$ 0.51	\$ 273.51	\$ 819.27	\$ 109.90		\$ 929.17	\$ 1,202.68
July	\$ 11.65	\$ 131.86	\$ 0.44	\$ 110.98	\$ 44.08	\$ 0.54	\$ 299.55	\$ 859.49	\$ 116.01		\$ 975.50	\$ 1,275.05
August	\$ 11.65	\$ 143.66	\$ 0.57	\$ 126.75	\$ 56.96	\$ 0.70	\$ 340.29	\$ 1,110.80	\$ 149.93		\$ 1,260.73	\$ 1,601.02
September	\$ 11.65	\$ 110.35	\$ 0.37	\$ 102.78	\$ 37.38	\$ 0.46	\$ 262.99	\$ 705.00	\$ 98.37		\$ 803.37	\$ 1,066.36
October	\$ 11.65	\$ 78.93	\$ 0.07	\$ 93.73	\$ 33.47	\$ 0.41	\$ 218.26	\$ 571.09	\$ 88.87		\$ 659.96	\$ 878.22
November	\$ 11.65	\$ 65.41		\$ 87.11	\$ 27.82	\$ 0.35	\$ 192.34	\$ 479.54	\$ 74.62		\$ 554.16	\$ 746.50
											\$ -	\$ -
Totals	\$ 139.80	\$ 1,080.23	\$ 2.17	\$ 1,210.18	\$ 459.03	\$ 5.63	\$ 2,897.04	\$ 8,308.56	\$ 1,210.27	\$ -	\$ 9,518.83	\$ 12,415.87

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

BPU ENERGY AUDIT PROGRAM

Andover Town Hall General Service

CHA Project Number

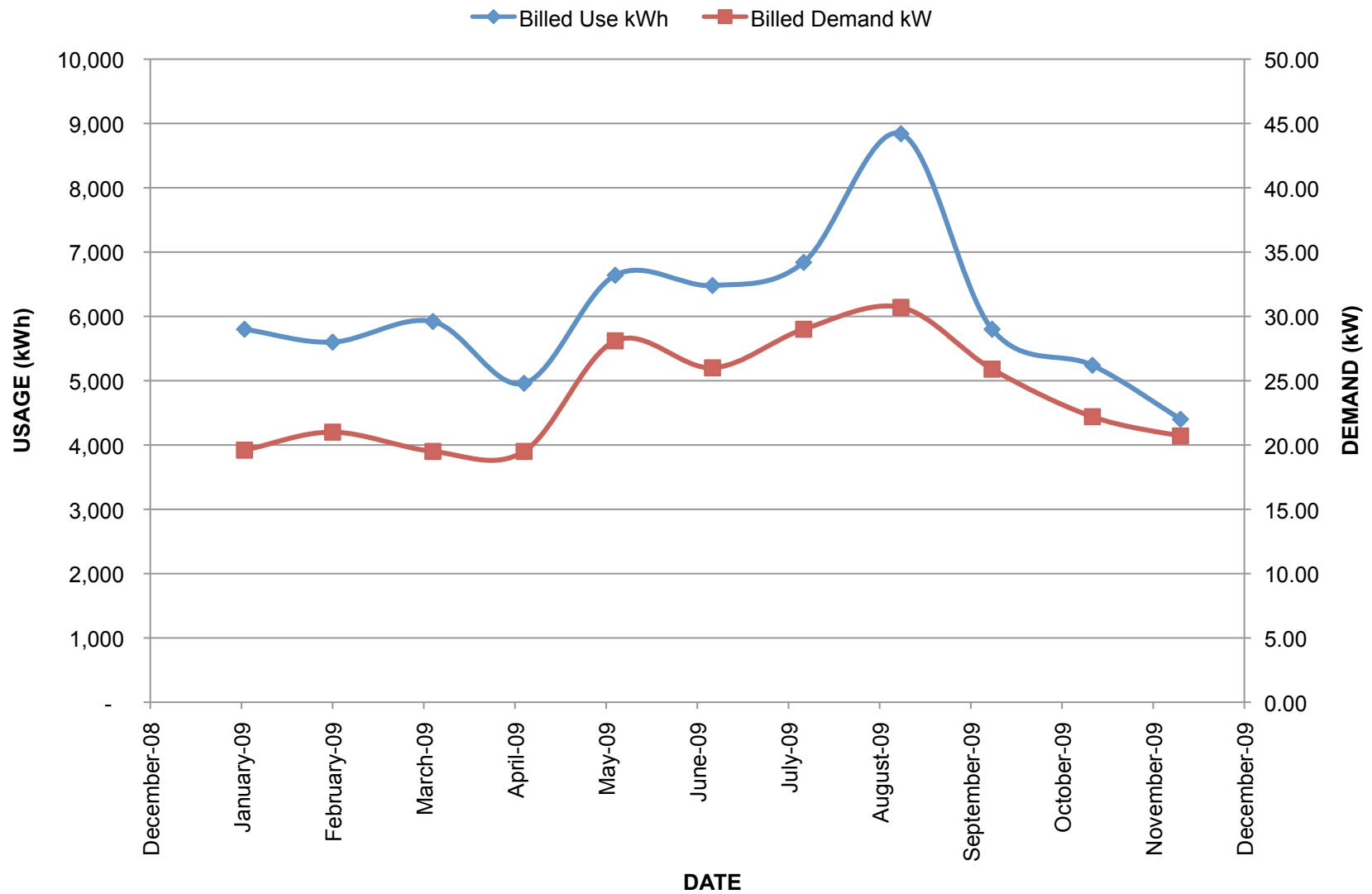
Electricity Cost Summary: Meter #G28260421						
Period	Billed Use	Billed Demand	Total Cost	Demand Unit Cost	Supply Unit Cost	Blended Cost
	kWh	kW	\$	\$/kW	\$/kWh	\$/kWh
December-08	4,840	20.10	\$ 815.09	\$ 3.25	\$ 0.15	\$ 0.1684
January-09	5,800	19.60	\$ 966.17	\$ 3.17	\$ 0.15	\$ 0.1666
February-09	5,600	21.00	\$ 948.54	\$ 3.39	\$ 0.15	\$ 0.1694
March-09	5,920	19.50	\$ 969.34	\$ 3.18	\$ 0.15	\$ 0.1637
April-09	4,960	19.50	\$ 826.81	\$ 3.83	\$ 0.15	\$ 0.1667
May-09	6,640	28.10	\$ 1,120.09	\$ 4.17	\$ 0.15	\$ 0.1687
June-09	6,480	26.00	\$ 1,202.68	\$ 4.27	\$ 0.17	\$ 0.1856
July-09	6,840	29.00	\$ 1,275.05	\$ 4.55	\$ 0.17	\$ 0.1864
August-09	8,840	30.70	\$ 1,601.02	\$ 4.68	\$ 0.16	\$ 0.1811
September-09	5,800	25.90	\$ 1,066.36	\$ 4.26	\$ 0.16	\$ 0.1839
October-09	5,240	22.20	\$ 878.22	\$ 3.56	\$ 0.15	\$ 0.1676
November-09	4,400	20.70	\$ 746.50	\$ 3.89	\$ 0.15	\$ 0.1697
Totals	71,360	282.30	\$ 12,415.87			\$ 0.1740
Monthly Ave.	5,947	23.53	\$ 1,034.66	\$ 3.93	\$ 0.16	
Max. Demand		30.70				

Account Number: 10 00 02 6778 94
 Meter Number: G28260421
 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 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 incled 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 Town Hall General Service



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 Town Hall

CHA Project #20997

Gas Cost Summary: Meter # 0P643637										
Period	Service Charge	Therms	Distribution (Therms)	Demand	Basic Charge	CAC	Total Supply	Gas Cost Refund	Total Cost	Blended Cost \$/Therm
December	\$ 16.15	182.6	\$ 54.38		\$ 233.75	\$ 10.25	\$ 314.52		\$ 314.52	\$ 1.72
January	\$ 16.15	362.3	\$ 107.89		\$ 374.58	\$ 19.38	\$ 518.00		\$ 518.00	\$ 1.43
February	\$ 16.15	259.2	\$ 77.19		\$ 267.99	\$ 13.87	\$ 375.20		\$ 375.20	\$ 1.45
March	\$ 16.15	341.7	\$ 101.76		\$ 353.28	\$ 18.29	\$ 489.48		\$ 489.48	\$ 1.43
April	\$ 16.15	186.7	\$ 55.60		\$ 193.03	\$ 9.98	\$ 274.76		\$ 274.76	\$ 1.47
May	\$ 16.15	23.7	\$ 7.06		\$ 30.34	\$ 1.33	\$ 54.81		\$ 54.81	\$ 2.31
June	\$ 16.15	24.2	\$ 7.21		\$ 30.98	\$ 1.36	\$ 55.65		\$ 55.65	\$ 2.30
July	\$ 16.15	1	\$ 0.30		\$ 1.03	\$ 0.06	\$ 17.54		\$ 17.54	\$ 17.54
August	\$ 16.15	2.1	\$ 0.63		\$ 2.17	\$ 0.09	\$ 19.04		\$ 19.04	\$ 9.07
September	\$ 16.15	2.1	\$ 0.63		\$ 2.17	\$ 0.09	\$ 19.04		\$ 19.04	\$ 9.07
October	\$ 16.15	77.3	\$ 23.02		\$ 98.95	\$ 4.34	\$ 142.49		\$ 142.49	\$ 1.84
November	\$ 16.15	151.4	\$ 45.09		\$ 193.81	\$ 8.50	\$ 263.55		\$ 263.55	\$ 1.74
Totals	\$ 193.80	1614.3	\$ 480.76	\$ -	\$ 1,782.08	\$ 87.54	\$ 2,544.08	\$ -	\$ 2,544.08	\$ 1.58

Account: 8683023581

Billing Type: Small General Serv - Heat

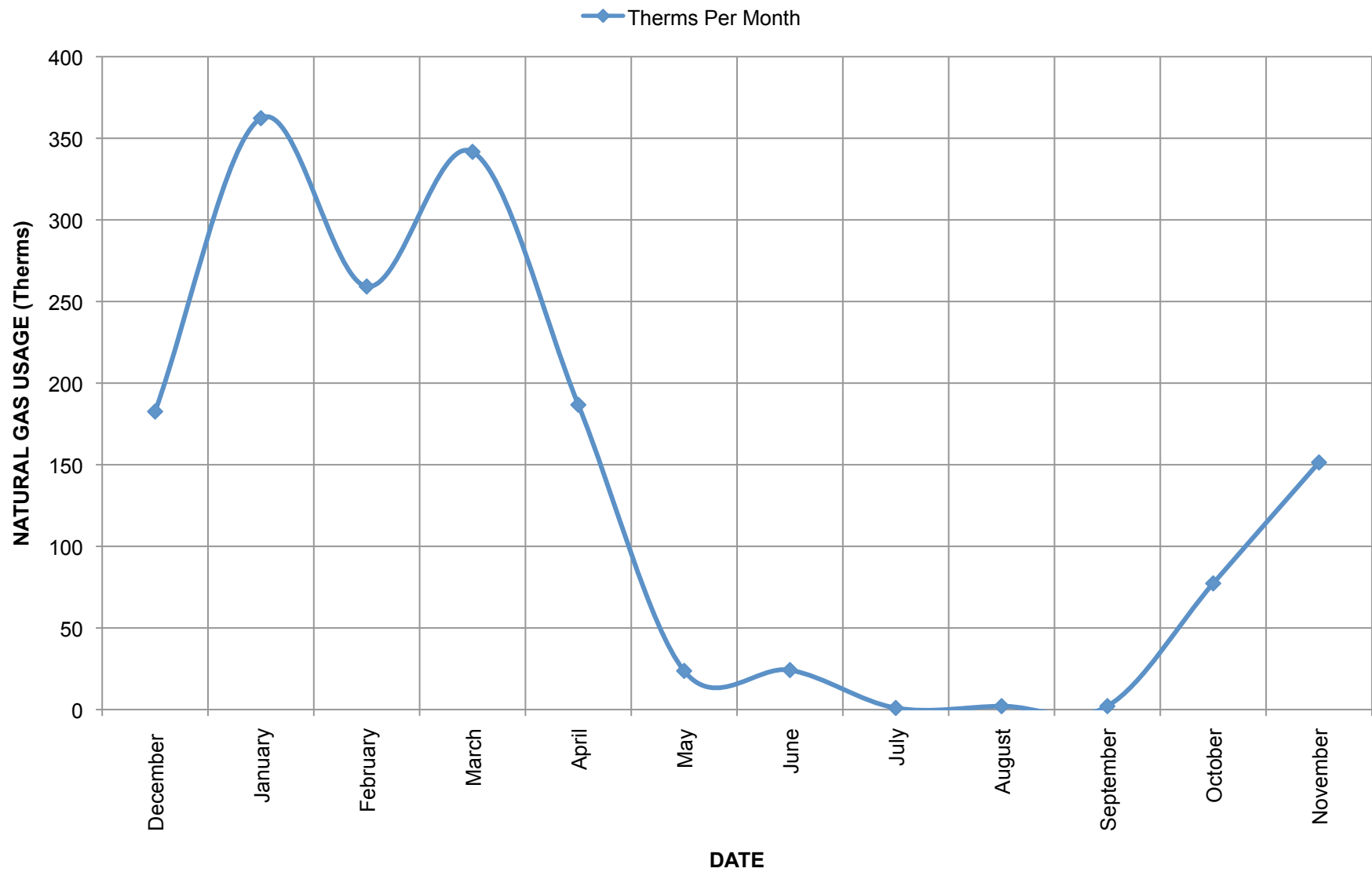
Notes: Chart 4 Gas Cost Summary

This chart provides gas cost breakdowns and sums totals. Sum totals are "Total Demand", 1st, 3rd, 4th, 5th, 6th columns and Total Cost = Total Demand + Total Supply".

Blended Cost = Total divided by Therms.

All numbers are in \$ except Therms.

Andover Township Townhall



ELIZABETHTOWN GAS CO. SERVICE TERRITORY

Last Updated: 05/19/10

***CUSTOMER CLASS - R – RESIDENTIAL C – COMMERCIAL I – INDUSTRIAL**

Supplier	Telephone & Web Site	*Customer Class
Colonial Energy, Inc. 3975 Fair Ridge Drive Suite T 10 N Fairfax, Va. 22033	845-429-3229 www.colonialgroupinc.com	C/I ACTIVE
Cooperative Industries 412-420 Washington Avenue Belleville, NJ 07109	800-6-BUYGAS (6-289427) www.cooperativenet.com	C/I ACTIVE
Direct Energy Services, LLP 120 Wood Avenue, Suite 611 Iselin, NJ 08830	866-547-2722 www.directenergy.com	R/C/I INACTIVE
Gateway Energy Services Corporation 44 Whispering Pines Lane Lakewood, NJ 08701	800-805-8586 www.gesc.com	R/C/I ACTIVE
UGI Energy Services, Inc. d/b/a GASMARK 224 Strawbridge Drive, Suite 107 Moorestown, NJ 08057	856-273-9995 www.ugienergyservices.com	C/I ACTIVE
Great Eastern Energy 116 Village Riva, Suite 200 Princeton, NJ 08540	888-651-4121 www.greateastern.com	C/I ACTIVE
Glacial Energy of New Jersey, Inc. 207 LaRoche Avenue Harrington Park, NJ 07640	1-877-569-2841 www.glacialenergy.com	C/I ACTIVE
Hess Energy, Inc. One Hess Plaza Woodbridge, NJ 07095	800-437-7872 www.hess.com	C/I ACTIVE
Intelligent Energy 2050 Center Avenue, Suite 500 Fort Lee, NJ 07024	800-724-1880 www.intelligentenergy.org	R/C/I ACTIVE
Metromedia Energy, Inc. 6 Industrial Way Eatontown, NJ 07724	877-750-7046 www.metromediaenergy.com	C ACTIVE

MxEnergy, Inc. 510 Thornall Street, Suite 270 Edison, NJ 08837	800-375-1277 www.mxenergy.com	R/C ACTIVE
NATGASCO (Mitchell Supreme) 532 Freeman Street Orange, NJ 07050	800-840-4GAS www.natgasco.com	C ACTIVE
Palmco Energy NJ, LLC One Greentree Centre 10000 Lincoln Drive East, Suite 201 Marlton, NJ 08053	877-726-5862 www.PalmcoEnergy.com	C/I ACTIVE
Pepco Energy Services, Inc. 112 Main Street Lebanon, NJ 08833	800-363-7499 www.pepco-services.com	C/I ACTIVE
PPL EnergyPlus, LLC 811 Church Road - Office 105 Cherry Hill, NJ 08002	800-281-2000 www.pplenergyplus.com	C/I ACTIVE
South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037	800-756-3749 www.sjindustries.com/sje.htm	R/C/I ACTIVE
Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 07928	800-225-1560 www.spragueenergy.com	C/I ACTIVE
Woodruff Energy 73 Water Street Bridgeton, NJ 08302	800- 557-1121 www.woodruffenergy.com	R/C/I ACTIVE

[Back to main supplier information page](#)

BPU ENERGY AUDIT PROGRAM

Andover Township - Department of Public Works Garage and Town Hall

CHA Project # xxxxx

Water Cost Summary: Account Number #460*072			
Period	Consumption Gallons	Total Cost	Water cost per 1000 gallons
2/28/09	37410	\$ 430.92	\$ 11.52
5/31/09	49120	\$ 571.44	\$ 11.63
8/31/09	24010	\$ 270.12	\$ 11.25
11/30/09	29930	\$ 341.16	\$ 11.40
Totals	140470	\$ 1,613.64	\$ 11.48

Newton Water & Sewer Authority

Notes: Water Cost Summary

This chart provides water cost breakdowns and sums totals.

All numbers are in \$ except gallons.

A single water meter is utilized for both the Town Hall and DPW Garage buildings.

APPENDIX B

HVAC Equipment List

BPU ENERGY AUDIT PROGRAM

Andover Town Hall

CHA Project #20997[illegible]

APPENDIX C

Separate Cooling Unit for Server Room

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

Separate Cooling Unit for Server Room

Budgetary Costs	Annual Utility Savings			ROI	Potential Incentive	Payback (Without Incentive)	Payback (With Incentive)
	Water	Electricity	Total				
\$	\$	\$	\$		\$	Years	Years
\$ 2,500.00	\$ -	\$ (700.00)	\$ (700.00)	NA	0	NA	-

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

Separate Cooling Unit for Server Room

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 Electrical Circuit and Connections	1	ea	\$300	\$200		\$294	\$242	\$0	\$536	
1-Ton Ductless Mini Split System	1	ea	\$1,000	\$500		\$980	\$605	\$0	\$1,585	

Subtotal	\$2,121
10% OH, 10% Profit	\$212
10% Contingency	\$212
Total	\$2,545

ALT5 - Floor 1 Server Room Input Data

Project Name: Andover - Town Hall
Prepared by: Kitchen and Associates

06/08/2010
02:26PM

1. General Details:

Air System Name ALT5 - Floor 1 Server Room
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

Supply Fan Data:

Fan Type Forward Curved
Configuration Draw-thru
Fan Performance 0.25 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 Ducted Return

3. Zone Components:

Space Assignments:

Zone 1: Server Room	
Server Room	x1

Thermostats and Zone Data:

Zone All
Cooling T-stat: Occ. 70.0 °F
Cooling T-stat: Unocc. 70.0 °F
Heating T-stat: Occ. 69.0 °F
Heating T-stat: Unocc. 69.0 °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 Health 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

4. Sizing Data (Computer-Generated):

System Sizing Data:

Cooling Supply Temperature 58.0 °F
Supply Fan Airflow 795.3 CFM

ALT5 - Floor 1 Server Room Input Data

Project Name: Andover - Town Hall
Prepared by: Kitchen and Associates

06/08/2010
02:26PM

Ventilation Airflow 0.0 CFM

Hydronic Sizing Specifications:

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

Safety Factors:

Cooling Sensible 15 %
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	795.3	-	-	

5. Equipment Data

Central Cooling Unit - Air-Cooled DX

Design OAT 95.0 °F
Equipment Sizing (Auto-Sized) 12.0 MBH
Capacity Oversizing Factor 15 %
ARI Performance Rating 12.00 SEER
Conventional Cutoff OAT 55.0 °F
Low Temperature Operation Used
Low Temperature Cutoff OAT 15.0 °F

Air System Sizing Summary for ALT5 - Floor 1 Server Room

Project Name: Andover - Town Hall
Prepared by: Kitchen and Associates

06/08/2010
02:27PM

Air System Information

Air System Name **ALT5 - Floor 1 Server Room**
Equipment Class **SPLT AHU**
Air System Type **SZCAV**

Number of zones **1**
Floor Area **50.0** ft²
Location **Newark, New Jersey**

Sizing Calculation Information

Zone and Space Sizing Method:

Zone CFM **Sum of space airflow rates**
Space CFM **Individual peak space loads**

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Central Cooling Coil Sizing Data

Total coil load **0.8** Tons
Total coil load **9.5** MBH
Sensible coil load **9.5** MBH
Coil CFM at Aug 1500 **727** CFM
Max block CFM **727** CFM
Sum of peak zone CFM **727** CFM
Sensible heat ratio **1.000**
ft²/Ton **63.0**
BTU/(hr-ft²) **190.4**
Water flow @ 10.0 °F rise **N/A**

Load occurs at **Aug 1500**
OA DB / WB **92.5 / 73.9** °F
Entering DB / WB **70.9 / 43.9** °F
Leaving DB / WB **58.8 / 37.6** °F
Coil ADP **57.4** °F
Bypass Factor **0.100**
Resulting RH **0** %
Design supply temp. **58.0** °F
Zone T-stat Check **1 of 1** OK
Max zone temperature deviation **0.0** °F

Supply Fan Sizing Data

Actual max CFM **727** CFM
Standard CFM **726** CFM
Actual max CFM/ft² **14.54** CFM/ft²

Fan motor BHP **0.05** BHP
Fan motor kW **0.04** kW
Fan static **0.25** in wg

Outdoor Ventilation Air Data

Design airflow CFM **0** CFM
CFM/ft² **0.00** CFM/ft²

CFM/person **0.00** CFM/person

Zone Sizing Summary for ALT5 - Floor 1 Server Room

Project Name: Andover - Town Hall
Prepared by: Kitchen and Associates

06/08/2010
02:27PM

Air System Information

Air System Name **ALT5 - Floor 1 Server Room**
Equipment Class **SPLT AHU**
Air System Type **SZCAV**

Number of zones **1**
Floor Area **50.0** ft²
Location **Newark, New Jersey**

Sizing Calculation Information

Zone and Space Sizing Method:

Zone CFM **Sum of space airflow rates**
Space CFM **Individual peak space loads**

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone Sizing Data

Zone Name	Maximum Cooling Sensible (MBH)	Design Air Flow (CFM)	Minimum Air Flow (CFM)	Time of Peak Load	Maximum Heating Load (MBH)	Zone Floor Area (ft ²)	Zone CFM/ft ²
Server Room	9.4	727	727	Aug 1600	1.0	50.0	14.54

Zone Terminal Sizing Data

No Zone Terminal Sizing Data required for this system.

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft ²)	Space CFM/ft ²
<i>Server Room</i>							
Server Room	1	9.4	Aug 1600	727	1.0	50.0	14.54

Air System Design Load Summary for ALT5 - Floor 1 Server Room

Project Name: Andover - Town Hall
Prepared by: Kitchen and Associates

06/08/2010
02:27PM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1500 COOLING OA DB / WB 92.5 °F / 73.9 °F			HEATING DATA AT DES HTG HEATING OA DB / WB 10.0 °F / 7.7 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	96 ft²	258	-	96 ft²	297	-
Roof Transmission	50 ft²	147	-	50 ft²	129	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	290 ft²	597	-	290 ft²	552	-
Overhead Lighting	100 W	341	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	2000 W	6824	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	15% / 0%	1225	0	0%	0	0
>> Total Zone Loads	-	9392	0	-	978	0
Zone Conditioning	-	9388	0	-	100	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Return Fan Load	727 CFM	0	-	727 CFM	0	-
Ventilation Load	0 CFM	0	0	0 CFM	0	0
Supply Fan Load	727 CFM	135	-	727 CFM	-135	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	-	9522	0	-	-35	0
Central Cooling Coil	-	9522	0	-	0	0
>> Total Conditioning	-	9522	0	-	0	0
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

System Psychrometrics for ALT5 - Floor 1 Server Room

Project Name: Andover - Town Hall
Prepared by: Kitchen and Associates

06/08/2010
02:27PM

August DESIGN COOLING DAY, 1500

TABLE 1: SYSTEM DATA

Component	Location	Dry-Bulb Temp (°F)	Specific Humidity (lb/lb)	Airflow (CFM)	CO2 Level (ppm)	Sensible Heat (BTU/hr)	Latent Heat (BTU/hr)
Ventilation Air	Inlet	92.5	0.01368	0	400	0	0
Vent - Return Mixing	Outlet	70.9	0.00000	727	800	-	-
Central Cooling Coil	Outlet	58.8	0.00000	727	800	9522	0
Supply Fan	Outlet	58.9	0.00000	727	800	135	-
Cold Supply Duct	Outlet	58.9	0.00000	727	800	-	-
Zone Air	-	70.9	0.00000	727	800	9388	0
Return Plenum	Outlet	70.9	0.00000	727	800	0	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1.080; At site altitude = 1.079 BTU/(hr-CFM-F)

Air Density x Heat of Vaporization x Conversion Factor: At sea level = 4746.6; At site altitude = 4741.5 BTU/(hr-CFM)

Site Altitude = 30.0 ft

TABLE 2: ZONE DATA

Zone Name	Zone Sensible Load (BTU/hr)	T-stat Mode	Zone Cond (BTU/hr)	Zone Temp (°F)	Zone Airflow (CFM)	CO2 Level (ppm)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
Server Room	9392	Cooling	9388	70.9	727	800	0	0

System Psychrometrics for ALT5 - Floor 1 Server Room

Project Name: Andover - Town Hall
Prepared by: Kitchen and Associates

06/08/2010
02:27PM

WINTER DESIGN HEATING

TABLE 1: SYSTEM DATA

Component	Location	Dry-Bulb Temp (°F)	Specific Humidity (lb/lb)	Airflow (CFM)	CO2 Level (ppm)	Sensible Heat (BTU/hr)	Latent Heat (BTU/hr)
Ventilation Air	Inlet	10.0	0.00066	0	400	0	0
Vent - Return Mixing	Outlet	54.7	0.00000	727	800	-	-
Central Cooling Coil	Outlet	54.7	0.00000	727	800	0	0
Supply Fan	Outlet	54.8	0.00000	727	800	135	-
Cold Supply Duct	Outlet	54.8	0.00000	727	800	-	-
Zone Air	-	54.7	0.00000	727	800	-100	0
Return Plenum	Outlet	54.7	0.00000	727	800	0	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1.080; At site altitude = 1.079 BTU/(hr-CFM-F)

Air Density x Heat of Vaporization x Conversion Factor: At sea level = 4746.6; At site altitude = 4741.5 BTU/(hr-CFM)

Site Altitude = 30.0 ft

TABLE 2: ZONE DATA

Zone Name	Zone Sensible Load (BTU/hr)	T-stat Mode	Zone Cond (BTU/hr)	Zone Temp (°F)	Zone Airflow (CFM)	CO2 Level (ppm)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
Server Room	-978	Deadband	-100	54.7	727	800	0	0

Psychrometric Analysis for ALT5 - Floor 1 Server Room

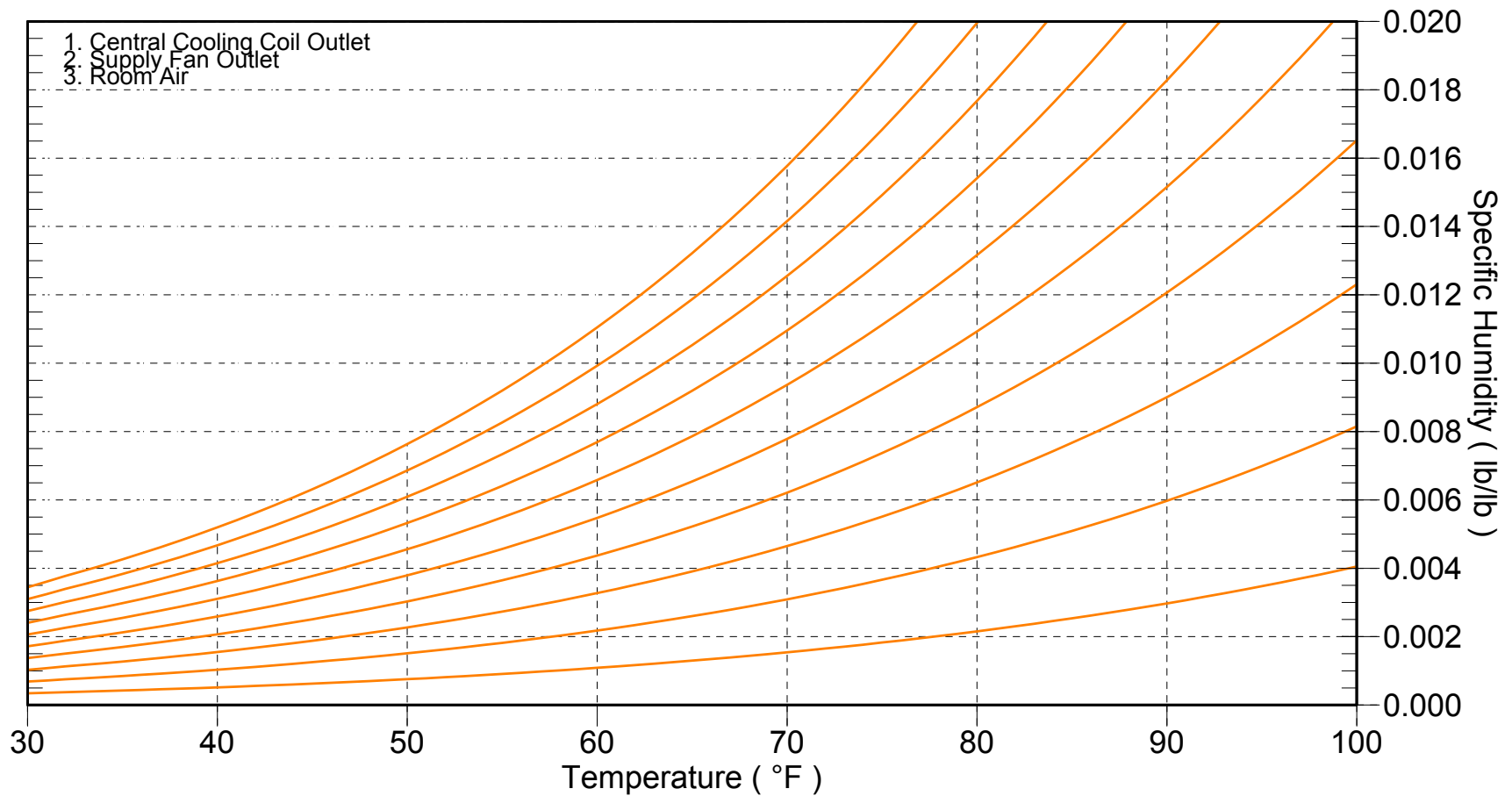
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06/08/2010
02:27PM

Location: Newark, New Jersey

Altitude: 30.0 ft.

Data for: August DESIGN COOLING DAY, 1500



Space Input Data

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06/08/2010
02:27PM

Server Room

1. General Details:

Floor Area 50.0 ft²
Avg. Ceiling Height 9.0 ft
Building Weight 70.0 lb/ft²

1.1. OA Ventilation Requirements:

Space Usage User-Defined
OA Requirement 1 0.0 CFM/person
OA Requirement 2 0.00 CFM/ft²
Space Usage Defaults ASHRAE Std 62.1-2004

2. Internals:

2.1. Overhead Lighting:

Fixture Type Recessed (Unvented)
Wattage 1.00 W/ft²
Ballast Multiplier 2.00
Schedule Server Room

2.4. People:

Occupancy 0.0 Person
Activity Level Office Work
Sensible 245.0 BTU/hr/person
Latent 205.0 BTU/hr/person
Schedule None

2.2. Task Lighting:

Wattage 0.00 W/ft²
Schedule None

2.5. Miscellaneous Loads:

Sensible 0 BTU/hr
Schedule None
Latent 0 BTU/hr
Schedule None

2.3. Electrical Equipment:

Wattage 40.00 W/ft²
Schedule Server Room

3. Walls, Windows, Doors:

Exp.	Wall Gross Area (ft ²)	Window 1 Qty.	Window 2 Qty.	Door 1 Qty.
S	96.0	0	0	0

3.1. Construction Types for Exposure S

Wall Type Light Weight Wall

4. Roofs, Skylights:

Exp.	Roof Gross Area (ft ²)	Roof Slope (deg.)	Skylight Qty.
S	50.0	30	0

4.1. Construction Types for Exposure S

Roof Type Asphalt Shingle + Plywood + R-22 Batt

5. Infiltration:

Design Cooling 0.00 CFM
Design Heating 0.00 CFM
Energy Analysis 0.00 CFM
Infiltration occurs only when the fan is off.

6. Floors:

Type Floor Above Conditioned Space
(No additional input required for this floor type).

7. Partitions:

7.1. 1st Partition Details:

Partition Type Ceiling Partition
Area 50.0 ft²
U-Value 0.150 BTU/(hr-ft²-°F)
Uncondit. Space Max Temp 130.0 °F
Ambient at Space Max Temp 95.0 °F
Uncondit. Space Min Temp 30.0 °F
Ambient at Space Min Temp 0.0 °F

7.2. 2nd Partition Details:

Partition Type Ceiling Partition
Area 240.0 ft²
U-Value 0.190 BTU/(hr-ft²-°F)
Uncondit. Space Max Temp 75.0 °F
Ambient at Space Max Temp 95.0 °F
Uncondit. Space Min Temp 60.0 °F
Ambient at Space Min Temp 0.0 °F

Billing Details - Electric - ALT5 - Server Room AC

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06/08/2010
02:28PM

1. Component Charges

Billing Period	Energy Charges (\$)	Demand Charges (\$)	Customer Charges (\$)	Taxes (\$)	Total Charge (\$)
Jan	320	0	0	0	320
Feb	293	0	0	0	293
Mar	326	0	0	0	326
Apr	318	0	0	0	318
May	336	0	0	0	336
Jun	332	0	0	0	332
Jul	349	0	0	0	349
Aug	349	0	0	0	349
Sep	329	0	0	0	329
Oct	333	0	0	0	333
Nov	316	0	0	0	316
Dec	325	0	0	0	325
Totals	3,929	0	0	0	3,929

2. Totals

Billing Period	Total Charges (\$)	Total Consumption (kWh)	Avg Price (\$/kWh)
Jan	320	1,839	0.1740
Feb	293	1,683	0.1740
Mar	326	1,876	0.1740
Apr	318	1,830	0.1740
May	336	1,933	0.1740
Jun	332	1,911	0.1740
Jul	349	2,005	0.1740
Aug	349	2,006	0.1740
Sep	329	1,893	0.1740
Oct	333	1,913	0.1740
Nov	316	1,819	0.1740
Dec	325	1,870	0.1740
Totals	3,929	22,578	0.1740

3. Consumption Totals

Billing Period	Peak (kWh)	Mid-Peak (kWh)	Normal Peak (kWh)	Off-Peak (kWh)	Overall (kWh)
Jan	0	0	0	0	1,839
Feb	0	0	0	0	1,683
Mar	0	0	0	0	1,876
Apr	0	0	0	0	1,830
May	0	0	0	0	1,933
Jun	0	0	0	0	1,911
Jul	0	0	0	0	2,005
Aug	0	0	0	0	2,006
Sep	0	0	0	0	1,893
Oct	0	0	0	0	1,913
Nov	0	0	0	0	1,819
Dec	0	0	0	0	1,870
Totals	0	0	0	0	22,578

Billing Details - Electric - ALT5 - Server Room AC

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06/08/2010
02:28PM

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	2.5
Feb	0.0	0.0	0.0	0.0	2.5
Mar	0.0	0.0	0.0	0.0	2.7
Apr	0.0	0.0	0.0	0.0	2.8
May	0.0	0.0	0.0	0.0	2.9
Jun	0.0	0.0	0.0	0.0	2.9
Jul	0.0	0.0	0.0	0.0	2.9
Aug	0.0	0.0	0.0	0.0	2.8
Sep	0.0	0.0	0.0	0.0	2.8
Oct	0.0	0.0	0.0	0.0	2.8
Nov	0.0	0.0	0.0	0.0	2.6
Dec	0.0	0.0	0.0	0.0	2.6

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	2.5
Feb	0.0	0.0	0.0	0.0	2.5
Mar	0.0	0.0	0.0	0.0	2.7
Apr	0.0	0.0	0.0	0.0	2.8
May	0.0	0.0	0.0	0.0	2.9
Jun	0.0	0.0	0.0	0.0	2.9
Jul	0.0	0.0	0.0	0.0	2.9
Aug	0.0	0.0	0.0	0.0	2.8
Sep	0.0	0.0	0.0	0.0	2.8
Oct	0.0	0.0	0.0	0.0	2.8
Nov	0.0	0.0	0.0	0.0	2.6
Dec	0.0	0.0	0.0	0.0	2.6

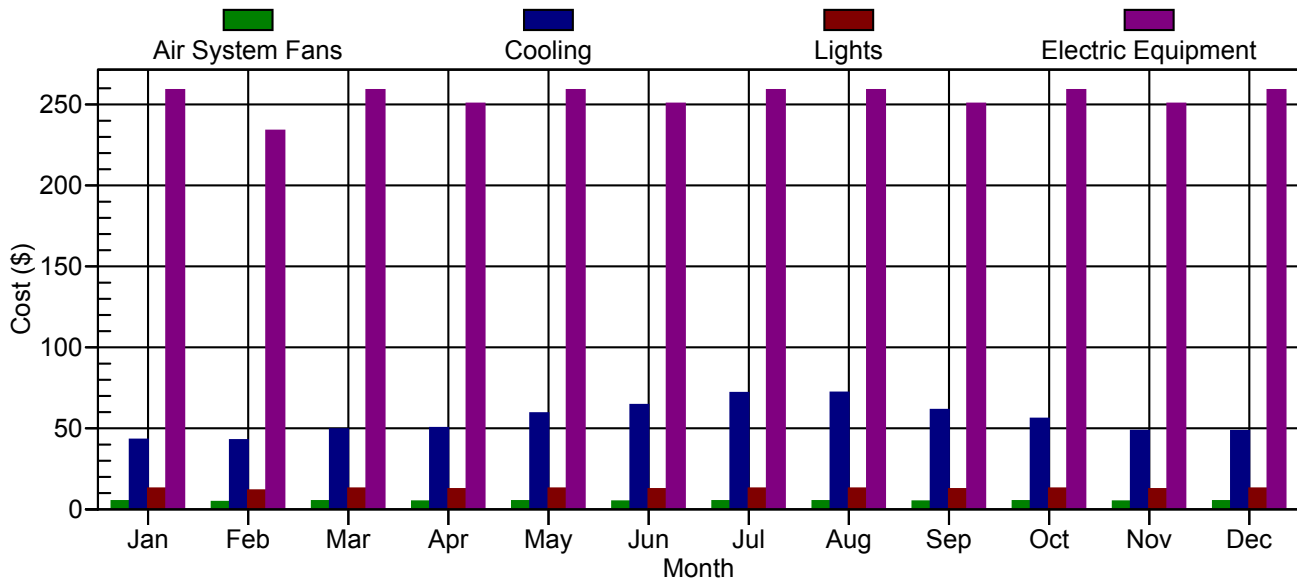
6. Time Of Maximum Demands

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	1/10/1600
Feb	n/a	n/a	n/a	n/a	2/12/1400
Mar	n/a	n/a	n/a	n/a	3/5/1700
Apr	n/a	n/a	n/a	n/a	4/19/1700
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	7/1/1600
Aug	n/a	n/a	n/a	n/a	8/4/1600
Sep	n/a	n/a	n/a	n/a	9/19/1500
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	12/2/1400

Monthly Component Costs - ALT5 - Server Room AC

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06/08/2010
02:28PM



1. HVAC Component Costs

Month	Air System Fans (\$)	Cooling (\$)	Heating (\$)	Pumps (\$)	Cooling Towers (\$)	HVAC Total (\$)
January	5	43	0	0	0	48
February	5	43	0	0	0	48
March	5	50	0	0	0	55
April	5	50	0	0	0	55
May	5	59	0	0	0	64
June	5	64	0	0	0	69
July	5	72	0	0	0	77
August	5	72	0	0	0	77
September	5	61	0	0	0	66
October	5	56	0	0	0	61
November	5	48	0	0	0	53
December	5	48	0	0	0	53
Total	60	667	0	0	0	728

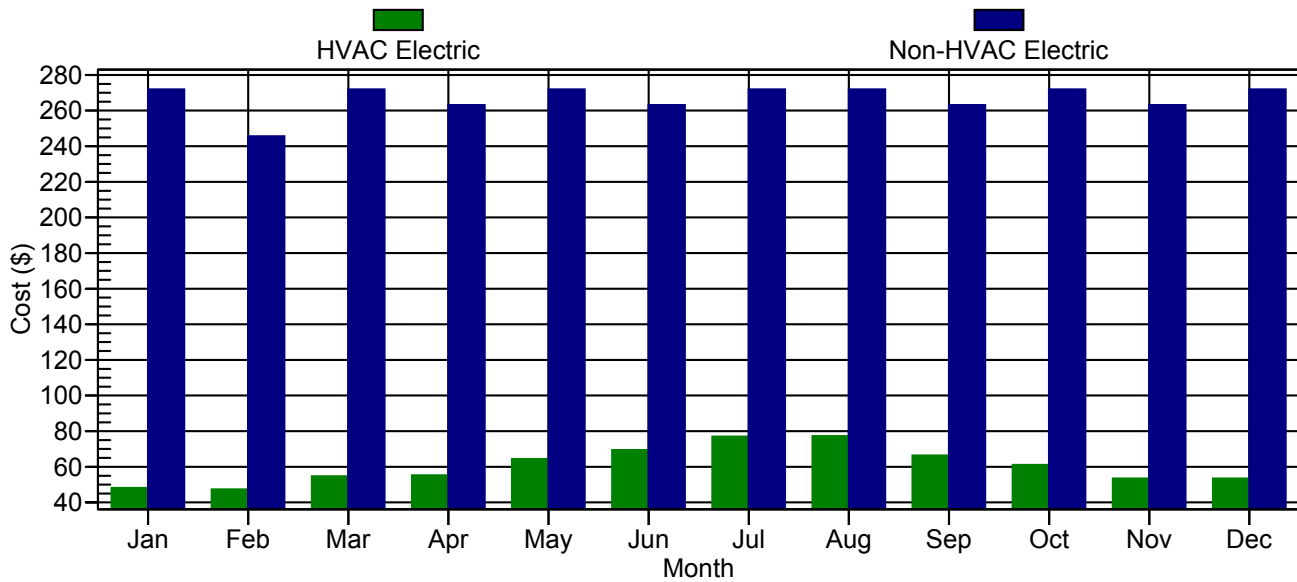
2. Non-HVAC Component Costs

Month	Lights (\$)	Electric Equipment (\$)	Misc. Electric (\$)	Misc. Fuel Use (\$)	Non-HVAC Total (\$)	Grand Total (\$)
January	13	259	0	0	272	320
February	12	234	0	0	246	294
March	13	259	0	0	272	327
April	13	251	0	0	263	318
May	13	259	0	0	272	336
June	13	251	0	0	263	332
July	13	259	0	0	272	349
August	13	259	0	0	272	349
September	13	251	0	0	263	329
October	13	259	0	0	272	333
November	13	251	0	0	263	316
December	13	259	0	0	272	325
Total	152	3,048	0	0	3,201	3,929

Monthly Energy Costs - ALT5 - Server Room AC

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06/08/2010
02:28PM



1. HVAC Costs

Month	Electric (\$)	Natural Gas (\$)	Fuel Oil (\$)	Propane (\$)	Remote Hot Water (\$)	Remote Steam (\$)	Remote Chilled Water (\$)
January	48	0	0	0	0	0	0
February	47	0	0	0	0	0	0
March	55	0	0	0	0	0	0
April	55	0	0	0	0	0	0
May	64	0	0	0	0	0	0
June	69	0	0	0	0	0	0
July	77	0	0	0	0	0	0
August	77	0	0	0	0	0	0
September	66	0	0	0	0	0	0
October	61	0	0	0	0	0	0
November	53	0	0	0	0	0	0
December	53	0	0	0	0	0	0
Total	728	0	0	0	0	0	0

2. Non-HVAC Costs

Month	Electric (\$)	Natural Gas (\$)	Fuel Oil (\$)	Propane (\$)	Remote Hot Water (\$)	Remote Steam (\$)
January	272	0	0	0	0	0
February	246	0	0	0	0	0
March	272	0	0	0	0	0
April	263	0	0	0	0	0
May	272	0	0	0	0	0
June	263	0	0	0	0	0
July	272	0	0	0	0	0
August	272	0	0	0	0	0
September	263	0	0	0	0	0
October	272	0	0	0	0	0
November	263	0	0	0	0	0
December	272	0	0	0	0	0
Total	3,201	0	0	0	0	0

Monthly Energy Use by Energy Type - ALT5 - Server Room AC

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06/08/2010
02:28PM

1. HVAC Energy Use

Month	Electric (kWh)	Natural Gas (na)	Fuel Oil (na)	Propane (na)	Remote HW (na)	Remote Steam (na)	Remote CW (na)
Jan	277	0	0	0	0	0	0
Feb	272	0	0	0	0	0	0
Mar	314	0	0	0	0	0	0
Apr	318	0	0	0	0	0	0
May	370	0	0	0	0	0	0
Jun	399	0	0	0	0	0	0
Jul	442	0	0	0	0	0	0
Aug	444	0	0	0	0	0	0
Sep	381	0	0	0	0	0	0
Oct	351	0	0	0	0	0	0
Nov	307	0	0	0	0	0	0
Dec	307	0	0	0	0	0	0
Totals	4,182	0	0	0	0	0	0

2. Non-HVAC Energy Use

Month	Electric (kWh)	Natural Gas (na)	Fuel Oil (na)	Propane (na)	Remote HW (na)	Remote Steam (na)
Jan	1,562	0	0	0	0	0
Feb	1,411	0	0	0	0	0
Mar	1,562	0	0	0	0	0
Apr	1,512	0	0	0	0	0
May	1,562	0	0	0	0	0
Jun	1,512	0	0	0	0	0
Jul	1,562	0	0	0	0	0
Aug	1,562	0	0	0	0	0
Sep	1,512	0	0	0	0	0
Oct	1,562	0	0	0	0	0
Nov	1,512	0	0	0	0	0
Dec	1,562	0	0	0	0	0
Totals	18,396	0	0	0	0	0

Monthly Energy Use by Component - ALT5 - Server Room AC

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06/08/2010
02:28PM

1. Monthly Energy Use by System Component

Component	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Air System Fans (kWh)	29	27	29	28	29	28	29	29	28	29	28	29
<i>Cooling</i>												
Electric (kWh)	247	246	285	289	341	370	413	414	353	321	278	278
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 (na)	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 (na)	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
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)	74	67	74	72	74	72	74	74	72	74	72	74
Electric Eqpt. (kWh)	1488	1344	1488	1440	1488	1440	1488	1488	1440	1488	1440	1488
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 (na)	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

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06/08/2010
02:28PM

Table 1. Annual Costs

Component	ALT5 - Server Room AC (\$)
Air System Fans	60
Cooling	667
Heating	0
Pumps	0
Cooling Tower Fans	0
HVAC Sub-Total	728
Lights	152
Electric Equipment	3,048
Misc. Electric	0
Misc. Fuel Use	0
Non-HVAC Sub-Total	3,201
Grand Total	3,929

Table 2. Annual Cost per Unit Floor Area

Component	ALT5 - Server Room AC (\$/ft²)
Air System Fans	1.204
Cooling	13.348
Heating	0.000
Pumps	0.000
Cooling Tower Fans	0.000
HVAC Sub-Total	14.552
Lights	3.049
Electric Equipment	60.970
Misc. Electric	0.000
Misc. Fuel Use	0.000
Non-HVAC Sub-Total	64.018
Grand Total	78.570
Gross Floor Area (ft²)	50.0
Conditioned Floor Area (ft²)	50.0

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

Table 3. Component Cost as a Percentage of Total Cost

Component	ALT5 - Server Room AC (%)
Air System Fans	1.5
Cooling	17.0
Heating	0.0
Pumps	0.0
Cooling Tower Fans	0.0
HVAC Sub-Total	18.5
Lights	3.9
Electric Equipment	77.6
Misc. Electric	0.0
Misc. Fuel Use	0.0
Non-HVAC Sub-Total	81.5
Grand Total	100.0

Annual Energy and Emissions Summary

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:28PM

Table 1. Annual Costs

Component	ALT5 - Server Room AC (\$)
HVAC Components	
Electric	728
Natural Gas	0
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Remote CW	0
HVAC Sub-Total	728
Non-HVAC Components	
Electric	3,201
Natural Gas	0
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Non-HVAC Sub-Total	3,201
Grand Total	3,929

Table 2. Annual Energy Consumption

Component	ALT5 - Server Room AC
HVAC Components	
Electric (kWh)	4,182
Natural Gas (na)	0
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0
Non-HVAC Components	
Electric (kWh)	18,396
Natural Gas (na)	0
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Totals	
Electric (kWh)	22,578
Natural Gas (na)	0
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0

Annual Energy and Emissions Summary

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:28PM

Table 3. Annual Emissions

Component	ALT5 - Server Room AC
CO2 Equivalent (lb)	0

Table 4. Annual Cost per Unit Floor Area

Component	ALT5 - Server Room AC (\$/ft²)
HVAC Components	
Electric	14.552
Natural Gas	0.000
Fuel Oil	0.000
Propane	0.000
Remote HW	0.000
Remote Steam	0.000
Remote CW	0.000
HVAC Sub-Total	14.552
Non-HVAC Components	
Electric	64.018
Natural Gas	0.000
Fuel Oil	0.000
Propane	0.000
Remote HW	0.000
Remote Steam	0.000
Non-HVAC Sub-Total	64.018
Grand Total	78.570
Gross Floor Area (ft²)	50.0
Conditioned Floor Area (ft²)	50.0

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

Table 5. Component Cost as a Percentage of Total Cost

Component	ALT5 - Server Room AC (%)
HVAC Components	
Electric	18.5
Natural Gas	0.0
Fuel Oil	0.0
Propane	0.0
Remote HW	0.0
Remote Steam	0.0
Remote CW	0.0
HVAC Sub-Total	18.5
Non-HVAC Components	
Electric	81.5
Natural Gas	0.0
Fuel Oil	0.0
Propane	0.0
Remote HW	0.0
Remote Steam	0.0
Non-HVAC Sub-Total	81.5
Grand Total	100.0

APPENDIX D

ECM-1 Lighting Fixture Modifications

BPU ENERGY AUDIT PROGRAM
Andover Township Town Hall
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			
	\$	\$	\$	\$	\$	Years	Years
Exit Sign Upgrades	\$979	\$248	\$0	\$248	\$0	3.9	3.9
A-Lamp to CFLs	\$184	\$676	\$0	\$676	\$0	0.3	0.3
T12 Fixtures to T8 Fixtures	\$1,573	\$63	\$0	\$63	\$510	24.9	16.8
Combined	\$2,736	\$987		\$987	\$510	2.8	2.3

*Budgetary costs include \$30 per fixture incentive for replacing T12 fixtures and lamps with T8 fixtures and lamps

BPU ENERGY AUDIT PROGRAM
Andover Township Town Hall
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
101 - Lobby	A - 2'x2' Fluorescent	1	(2) 32W T8U	(1) Electronic	62	62	8760	Breaker	543.12	\$94.50
101 - Lobby	A - 2'x2' Fluorescent	10	(2) 32W T8U	(1) Electronic	62	620	2080	Switch	1289.60	\$224.39
101 - Lobby	I - Recessed Step Baffle	2	(1) 100W A19	-	100	200	2080	Switch	416.00	\$72.38
101 - Lobby	Exit Sign, 16W	1	(2) 7W PL	(1) Electronic	16	16	9760	Breaker	156.16	\$27.17
102 Meeting and Court Room	A - 2'x2' Fluorescent	4	(2) 32W T8U	(1) Electronic	62	248	1440	Switch	357.12	\$62.14
102 Meeting and Court Room	B - 2'x4' Fluorescent	4	(4) 32W T8	(1) Electronic	114	456	1440	Switch	656.64	\$114.26
102 Meeting and Court Room	B - 2'x4' Fluorescent	10	(4) 32W T8	(1) Electronic	114	1140	1440	Switch	1641.60	\$285.64
102 Meeting and Court Room	E - Wall Mounted Globe	8	(1) 100W A19	-	100	800	1440	Switch	1152.00	\$200.45
102 Meeting and Court Room	Compact Fluorescent Flood Lights	7	14W CFL	-	14	98	1440	Switch	141.12	\$24.55
102 Meeting and Court Room	Exit Sign, 16W	2	(2) 7W PL	(1) Electronic	16	32	8760	Breaker	280.32	\$48.78
103 - Conference	B - 2'x4' Fluorescent	4	(4) 32W T8	(1) Electronic	114	456	2080	Switch	948.48	\$165.04
104 - Court Clerk	C - 2'x4' Fluorescent	4	(4) 32W T8	(1) Electronic	114	456	2080	Switch	948.48	\$165.04
104 - Court Clerk	I - Recessed Step Baffle	2	(1) 100W A19	-	100	200	2080	Switch	416.00	\$72.38
105 - Men	D - 2'x4' Fluorescent	2	(2) 32W T8	(1) Electronic	62	124	2080	Switch	257.92	\$44.88
105 - Men	F - 4' Wall Mounted Luminaire	1	(2) 34W T12	(1) Magnetic	82	82	2080	Switch	170.56	\$29.68
106 - Women	D - 2'x4' Fluorescent	2	(2) 32W T8	(1) Electronic	62	124	2080	Switch	257.92	\$44.88
106 - Women	F - 4' Wall Mounted Luminaire	1	(2) 34W T12	(1) Magnetic	82	82	2080	Switch	170.56	\$29.68
107 - Entry Lock	A - 2'x2' Fluorescent	2	(2) 32W T8U	(1) Electronic	62	124	2080	Switch	257.92	\$44.88
108 - Utility Closet	A - 2'x2' Fluorescent	1	(2) 32W T8U	(1) Electronic	62	62	130	Switch	8.06	\$1.40
109 - Entry Lock	D - 2'x4' Fluorescent	1	(2) 32W T8	(1) Electronic	62	62	2080	Switch	128.96	\$22.44
110 - Public Defender	C - 2'x4' Fluorescent	2	(4) 32W T8	(1) Electronic	114	228	2080	Switch	474.24	\$82.52
111 - Prosecutor	C - 2'x4' Fluorescent	4	(4) 32W T8	(1) Electronic	114	456	2080	Switch	948.48	\$165.04
113 - Electrical and Telephone Room	"A" Light, 100W	1	(1) 100W A-Lamp	-	100	100	130	Switch	13.00	\$2.26
113 - Electrical and Telephone Room	F - 4' Wall Mounted Luminaire	1	(2) 34W T12	(1) Magnetic	82	82	130	Switch	10.66	\$1.85
115 - Storage	F - 4' Wall Mounted Luminaire	5	(2) 34W T12	(1) Magnetic	82	410	130	Switch	53.30	\$9.27
118 - Corridor	F - 4' Wall Mounted Luminaire	1	(2) 34W T12	(1) Magnetic	82	82	2080	Switch	170.56	\$29.68
118 - Corridor	F - 4' Wall Mounted Luminaire	2	(2) 34W T12	(1) Magnetic	82	164	2080	Switch	341.12	\$59.35
118 - Corridor	Exit Sign, 16W	1	(2) 7W PL	(1) Electronic	16	16	8760	Breaker	140.16	\$24.39
119 - Storage	F - 4' Wall Mounted Luminaire	4	(2) 34W T12	(1) Magnetic	82	328	130	Switch	42.64	\$7.42
Water Room	"A" Light, 60W	1	(1) 60 W A-Lamp	-	60	60	130	Switch	7.80	\$1.36
Elevator Machine Room	"A" Light, 100W	1	(1) 100W A-Lamp	-	100	100	130	Switch	13.00	\$2.26
201 - Entry Lock	A - 2'x2' Fluorescent	1	(2) 32W T8U	(1) Electronic	62	62	2080	Switch	128.96	\$22.44
202 - Corridor	A - 2'x2' Fluorescent	2	(2) 32W T8U	(1) Electronic	62	124	8760	Breaker	1086.24	\$189.01
202 - Corridor	A - 2'x2' Fluorescent	30	(2) 32W T8U	(1) Electronic	62	1860	2080	Switch	3868.80	\$673.17
202 - Corridor	I - Recessed Step Baffle	2	(1) 100W A19	-	100	200	2080	Switch	416.00	\$72.38
202 - Corridor	P - Candelabra	1	(6) 20W A-Lamp	-	120	120	2080	Switch	249.60	\$43.43
202 - Corridor	Exit Sign, 16W	6	(2) 7W PL	(1) Electronic	16	96	8760	Breaker	840.96	\$146.33
203 - Tax Collector	C - 2'x4' Fluorescent	7	(4) 32W T8	(1) Electronic	114	798	2080	Switch	1659.84	\$288.81
203 - Tax Collector	I - Recessed Step Baffle	1	(1) 100W A19	-	100	100	2080	Switch	208.00	\$36.19
204 - Tax Assessor	C - 2'x4' Fluorescent	3	(4) 32W T8	(1) Electronic	114	342	2080	Switch	711.36	\$123.78
204 - Tax Assessor	I - Recessed Step Baffle	1	(1) 100W A19	-	100	100	2080	Switch	208.00	\$36.19
204 - Tax Assessor	Exit Sign, 16W	1	(2) 7W PL	(1) Electronic	16	16	8760	Breaker	140.16	\$24.39
205 - Men	D - 2'x4' Fluorescent	1	(2) 32W T8	(1) Electronic	62	62	2080	Switch	128.96	\$22.44
206 - Women	D - 2'x4' Fluorescent	1	(2) 32W T8	(1) Electronic	62	62	2080	Switch	128.96	\$22.44
207 - Reception	B - 2'x4' Fluorescent	1	(4) 32W T8	(1) Electronic	114	114	2080	Switch	237.12	\$41.26
207 - Reception	C - 2'x4' Fluorescent	3	(4) 32W T8	(1) Electronic	114	342	2080	Switch	711.36	\$123.78
207 - Reception	I - Recessed Step Baffle	3	(1) 100W A19	-	100	300	2080	Switch	624.00	\$108.58
208 - Municipal Clerks	C - 2'x4' Fluorescent	4	(4) 32W T8	(1) Electronic	114	456	2080	Switch	948.48	\$165.04
208 - Municipal Clerks	I - Recessed Step Baffle	1	(1) 100W A19	-	100	100	2080	Switch	208.00	\$36.19
209 - Conference	B - 2'x4' Fluorescent	4	(4) 32W T8	(1) Electronic	114	456	2080	Switch	948.48	\$165.04
209 - Conference	Flood, 65W	10	(1) 65W A-Lamp	-	65	650	2080	Switch	1352.00	\$235.25
210 - Administrator	B - 2'x4' Fluorescent	4	(4) 32W T8	(1) Electronic	114	456	2080	Switch	948.48	\$165.04
211 - Lounge	C - 2'x4' Fluorescent	4	(4) 32W T8	(1) Electronic	114	456	2080	Switch	948.48	\$165.04
212 - Finance	C - 2'x4' Fluorescent	4	(4) 32W T8	(1) Electronic	114	456	2080	Switch	948.48	\$165.04
212 - Finance	I - Recessed Step Baffle	2	(1) 100W A19	-	100	200	2080	Switch	416.00	\$72.38
213 - Court Clerk	C - 2'x4' Fluorescent	4	(4) 32W T8	(1) Electronic	114	456	2080	Switch	948.48	\$165.04
213 - Court Clerk	I - Recessed Step Baffle	2	(1) 100W A19	-	100	200	2080	Switch	416.00	\$72.38
214 - Health, Rec. & Social Services	C - 2'x4' Fluorescent	3	(4) 32W T8	(1) Electronic	114	342	2080	Switch	711.36	\$123.78
214 - Health, Rec. & Social Services	I - Recessed Step Baffle	2	(1) 100W A19	-	100	200	2080	Switch	416.00	\$72.38
215 - Building Department	C - 2'x4' Fluorescent	6	(4) 32W T8	(1) Electronic	114	684	2080	Switch	1422.72	\$247.55
216 - Planning and Zoning	C - 2'x4' Fluorescent	5	(4) 32W T8	(1) Electronic	114	570	2080	Switch	1185.60	\$206.29
217 - Supply Room	C - 2'x4' Fluorescent	1	(4) 32W T8	(1) Electronic	114	114	2080	Switch	237.12	\$41.26
218 - Copier Alcove	A - 2'x2' Fluorescent	2	(2) 32W T8U	(1) Electronic	62	124	2080	Switch	257.92	\$44.88
219 - Janitor Closet	A - 2'x2' Fluorescent	1	(2) 32W T8U	(1) Electronic	62	62	130	Switch	8.06	\$1.40
220 - Women	G - 3' Wall Mounted Luminaire	1	(2) 30W T12	(1) Magnetic	79	79	2080	Switch	164.32	\$28.59
221 - Men	G - 3' Wall Mounted Luminaire	1	(2) 30W T12	(1) Magnetic	79	79	2080	Switch	164.32	\$28.59
Exterior	K - Recessed	12	1) 100 W Metal Halid	(1) Electronic	110	1320	2080	Switch	2745.60	\$477.73
Exterior	L - Flood Light	2	1) 100W Mercury Vap	(1) Magnetic	119	238	4380	Photocell	1042.44	\$181.38
Exterior	M - Exterior wall Mounted Globe	2	(1) 100W A-Lamp	-	100	200	2080	Switch	416.00	\$72.38
Exterior	Q - Pendant Mounted Fixture	1	1) 100 W Metal Halid	(1) Electronic	110	110	4380	Photocell	481.80	\$83.83
Exterior	Low "A", 60 W	2	(1) 60 W A-Lamp	-	60	120	2080	Switch	249.60	\$43.43
Exterior	"Big Light"	1	1) 200 W Metal Halid	(1) Magnetic	232	232	4380	Photocell	1016.16	\$176.81
TOTAL									42363.72	\$7,371.29

Energy Cost: \$0.1740

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 Town Hall
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
101 - Lobby	A - 2'x2' Fluorescent, (2) T8U, 62W	Breaker	543	\$94.50		1		8760								
101 - Lobby	A - 2'x2' Fluorescent, (2) T8U, 62W	Switch	1290	\$224.39		10		2080								
101 - Lobby	F - Recessed Step Baffle, (11)A19, 100W	Switch	416	\$72.38	Compact Fluorescent	2	25	50	2080	104	\$18.10	\$5.95	\$11.90	312	\$54.29	0.22
101 - Lobby	Exit Sign, 16W	Breaker	140	\$24.39	LED Exit Sign	1	1.2	1	8760	11	\$1.83	\$89.00	\$89.00	130	\$22.56	3.95
102 Meeting and Court Room	A - 2'x2' Fluorescent, (2) T8U, 62W	Switch	357	\$62.14		4		1440								
102 Meeting and Court Room	B - 2'x4' Fluorescent, (4) T8, 114W	Switch	657	\$114.26		4		1440								
102 Meeting and Court Room	B - 2'x4' Fluorescent, (4) T8, 114W	Switch	1642	\$285.64		10		1440								
102 Meeting and Court Room	B - Wall Mounted Globe, (1)A19, 100W	Switch	1132	\$200.45	Compact Fluorescent	8	25	200	1440	288	\$50.11	\$5.95	\$47.60	864	\$150.34	0.32
102 Meeting and Court Room	Compact Fluorescent Flood Lights, 14 W	Switch	141	\$24.55		7		1440								
102 Meeting and Court Room	Exit Sign, 16W	Breaker	280	\$48.78	LED Exit Sign	2	1.2	2	8760	21	\$3.66	\$89.00	\$178.00	259	\$45.12	3.95
103 - Conference	B - 2'x4' Fluorescent, (4) T8, 114W	Switch	948	\$165.04		4		2080								
104 - Court Clerk	C - 2'x4' Fluorescent, (4) T8, 114W	Switch	948	\$165.04		4		2080								
104 - Court Clerk	F - Recessed Step Baffle, (11)A19, 100W	Switch	416	\$72.38	Compact Fluorescent	2	25	50	2080	104	\$18.10	\$5.95	\$11.90	312	\$54.29	0.22
105 - Men	D - 2'x4' Fluorescent, (2) T8, 62W	Switch	258	\$44.88		2		2080								
105 - Men	F - 4' Wall Mounted Luminaire, (2) T12, 82W	Switch	171	\$29.68	4' Fluorescent, (2) T8, Elec Ballast, 62W	1	62	62	2080	129	\$22.44	\$119.00	\$119.00	42	\$7.24	16.44
106 - Women	D - 2'x4' Fluorescent, (2) T8, 62W	Switch	258	\$44.88		2		2080								
106 - Women	F - 4' Wall Mounted Luminaire, (2) T12, 82W	Switch	171	\$29.68	4' Fluorescent, (2) T8, Elec Ballast, 62W	1	62	62	2080	129	\$22.44	\$119.00	\$119.00	42	\$7.24	16.44
107 - Entry Lock	A - 2'x2' Fluorescent, (2) T8U, 62W	Switch	258	\$44.88		2		2080								
108 - Utility Closet	A - 2'x2' Fluorescent, (2) T8U, 62W	Switch	8	\$1.40		1		130								
109 - Entry Lock	D - 2'x4' Fluorescent, (2) T8, 62W	Switch	129	\$22.44		1		2080								
110 - Public Defender	C - 2'x4' Fluorescent, (4) T8, 114W	Switch	474	\$82.52		2		2080								
111 - Prosecutor	C - 2'x4' Fluorescent, (4) T8, 114W	Switch	948	\$165.04		4		2080								
113 - Electrical and Telephone Room	A* Light, 100W	Switch	13	\$2.26	Compact Fluorescent	1	25	25	130	3	\$0.57	\$5.95	\$5.95	10	\$1.70	3.51
113 - Electrical and Telephone Room	F - 4' Wall Mounted Luminaire, (2) T12, 82W	Switch	171	\$185.47	4' Fluorescent, (2) T8, Elec Ballast, 62W	1	62	62	130	6	\$1.40	\$89.00	\$89.00	3	\$0.45	196.73
113 - Storage	F - 4' Wall Mounted Luminaire, (2) T12, 82W	Switch	53	\$9.27	4' Fluorescent, (2) T8, Elec Ballast, 62W	5	62	310	130	40	\$7.01	\$89.00	\$445.00	13	\$2.26	196.73
118 - Corridor	F - 4' Wall Mounted Luminaire, (2) T12, 82W	Switch	171	\$29.68	4' Fluorescent, (2) T8, Elec Ballast, 62W	1	62	62	2080	129	\$22.44	\$89.00	\$89.00	42	\$7.24	12.30
118 - Corridor	F - 4' Wall Mounted Luminaire, (2) T12, 82W	Switch	341	\$59.35	4' Fluorescent, (2) T8, Elec Ballast, 62W	2	62	124	2080	258	\$44.88	\$89.00	\$178.00	83	\$14.48	12.30
118 - Corridor	Exit Sign, 16W	Breaker	140	\$24.39	LED Exit Sign	1	1.2	1	8760	11	\$1.83	\$89.00	\$89.00	130	\$22.56	3.95
119 - Storage	F - 4' Wall Mounted Luminaire, (2) T12, 82W	Switch	43	\$7.42	4' Fluorescent, (2) T8, Elec Ballast, 62W	4	62	248	130	32	\$5.61	\$89.00	\$356.00	10	\$1.81	196.73
Water Room	A* Light, 60W	Switch	8	\$1.34	Compact Fluorescent	1	15	15	130	3	\$0.34	\$5.95	\$5.95	6	\$1.02	5.86
Elevator Machine Room	A* Light, 100W	Switch	13	\$2.26	Compact Fluorescent	1	25	25	130	3	\$0.57	\$5.95	\$5.95	10	\$1.70	3.51
201 - Entry Lock	A - 2'x2' Fluorescent, (2) T8U, 62W	Switch	129	\$22.44		1		2080								
202 - Corridor	A - 2'x2' Fluorescent, (2) T8U, 62W	Breaker	1086	\$189.01		2		8760								
202 - Corridor	A - 2'x2' Fluorescent, (2) T8U, 62W	Switch	3869	\$673.17		30		2080								
202 - Corridor	F - Recessed Step Baffle, (11)A19, 100W	Switch	416	\$72.38	Compact Fluorescent	2	25	50	2080	104	\$18.10	\$5.95	\$11.90	312	\$54.29	0.22
202 - Corridor	P - Candelabra, (6) Lamps, 120W	Switch	250	\$43.43		1		2080								
202 - Corridor	Exit Sign, 16W	Breaker	841	\$146.33	LED Exit Sign	6	1.2	7	8760	63	\$10.97	\$89.00	\$534.00	778	\$135.35	3.95
203 - Tax Collector	C - 2'x4' Fluorescent, (4) T8, 114W	Switch	1660	\$288.81		7		2080								
203 - Tax Collector	F - Recessed Step Baffle, (11)A19, 100W	Switch	208	\$36.19	Compact Fluorescent	1	25	25	2080	52	\$9.05	\$5.95	\$5.95	156	\$27.14	0.22
204 - Tax Assessor	C - 2'x4' Fluorescent, (4) T8, 114W	Switch	711	\$123.78		3		2080								
204 - Tax Assessor	F - Recessed Step Baffle, (11)A19, 100W	Switch	208	\$36.19	Compact Fluorescent	1	25	25	2080	52	\$9.05	\$5.95	\$5.95	156	\$27.14	0.22
204 - Tax Assessor	Exit Sign, 16W	Breaker	140	\$24.39	LED Exit Sign	1	1.2	1	8760	11	\$1.83	\$89.00	\$89.00	130	\$22.56	3.95
205 - Men	D - 2'x4' Fluorescent, (2) T8, 62W	Switch	129	\$22.44		1		2080								
206 - Women	D - 2'x4' Fluorescent, (2) T8, 62W	Switch	129	\$22.44		1		2080								
207 - Reception	B - 2'x4' Fluorescent, (4) T8, 114W	Switch	237	\$41.26		1		2080								
207 - Reception	C - 2'x4' Fluorescent, (4) T8, 114W	Switch	711	\$123.78		3		2080								
207 - Reception	F - Recessed Step Baffle, (11)A19, 100W	Switch	624	\$108.58	Compact Fluorescent	3	25	75	2080	156	\$27.14	\$5.95	\$17.85	468	\$81.43	0.22
208 - Municipal Clerks	C - 2'x4' Fluorescent, (4) T8, 114W	Switch	948	\$165.04		4		2080								
208 - Municipal Clerks	F - Recessed Step Baffle, (11)A19, 100W	Switch	208	\$36.19	Compact Fluorescent	1	25	25	2080	52	\$9.05	\$5.95	\$5.95	156	\$27.14	0.22
209 - Conference	B - 2'x4' Fluorescent, (4) T8, 114W	Switch	948	\$165.04		4		2080								
209 - Conference	Flood, 65W	Switch	1352	\$235.25		10		2080								
210 - Administrator	B - 2'x4' Fluorescent, (4) T8, 114W	Switch	948	\$165.04		4		2080								
211 - Lounge	C - 2'x4' Fluorescent, (4) T8, 114W	Switch	948	\$165.04		4		2080								
212 - Finance	C - 2'x4' Fluorescent, (4) T8, 114W	Switch	948	\$165.04		4		2080								
212 - Finance	F - Recessed Step Baffle, (11)A19, 100W	Switch	416	\$72.38	Compact Fluorescent	2	25	50	2080	104	\$18.10	\$5.95	\$11.90	312	\$54.29	0.22
213 - Court Clerk	C - 2'x4' Fluorescent, (4) T8, 114W	Switch	948	\$165.04		4		2080								
213 - Court Clerk	F - Recessed Step Baffle, (11)A19, 100W	Switch	416	\$72.38	Compact Fluorescent	2	25	50	2080	104	\$18.10	\$5.95	\$11.90	312	\$54.29	0.22
214 - Health, Rec. & Social Services	C - 2'x4' Fluorescent, (4) T8, 114W	Switch	711	\$123.78		3		2080								
214 - Health, Rec. & Social Services	F - Recessed Step Baffle, (11)A19, 100W	Switch	416	\$72.38	Compact Fluorescent	2	25	50	2080	104	\$18.10	\$5.95	\$11.90	312	\$54.29	0.22
215 - Building Department	C - 2'x4' Fluorescent, (4) T8, 114W	Switch	1423	\$247.55		6		2080								
216 - Planning and Zoning	C - 2'x4' Fluorescent, (4) T8, 114W	Switch	1186	\$206.29		5		2080								
217 - Supply Room	C - 2'x4' Fluorescent, (4) T8, 114W	Switch	237	\$41.26		1		2080								
218 - Cloier Alcove	A - 2'x2' Fluorescent, (2) T8U, 62W	Switch	258	\$44.88		2		2080								
219 - Junior Closet	A - 2'x2' Fluorescent, (2) T8U, 62W	Switch	8	\$1.40		1		130								
220 - Women	G - 3' Wall Mounted Luminaire, (2) T12, 79W	Switch	164	\$28.59	3' Fluorescent, (2) T8, Elec Ballast,	1	48	48	2080	100	\$17.37	\$89.00	\$89.00	64	\$11.22	7.91
221 - Men	G - 3' Wall Mounted Luminaire, (2) T12, 79W	Switch	164	\$28.59	3' Fluorescent, (2) T8, Elec Ballast,	1	48	48	2080	100	\$17.37	\$89.00	\$89.00	64	\$11.22	7.91
Exterior	K - Recessed Metal Halide, 110W	Switch	2746	\$477.73		12		2080								
Exterior	L - Flood Light, Mercury Vapor, 119W	Photocell	1042	\$181.38		2		4380								
Exterior	M - Exterior wall Mounted Globe, (1)A19, 100W	Switch	416	\$72.38		2		2080								
Exterior	O - Pendant Mounted Fixture, Metal Halide, 110 W	Photocell	482	\$83.83		1		4380								
Exterior	Low "A", 60 W	Switch	250	\$43.43	Compact Fluorescent	2	15	30	2080	62	\$10.86	\$5.95	\$11.90	187	\$32.57	0.37
Exterior	"Big Light", Metal Halide, 232 W	Photocell	1016	\$176.81		1		4380								

Energy Cost: \$0.1740

*Installed cost for T12 to T8 fixtures includes a \$30 per fixtur 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 Town Hall
CHA Project #20997

ECM-1 Lighting Fixture Modifications
 EXIT SIGNS

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			
Exit Sign Lamps Replacement	5	ea	\$15	\$50		\$74	\$303	\$0	\$376	\$0	
and rewiring.						\$0	\$0	\$0	\$0		

Subtotal	\$376
10% Contingency	\$38
10% OH	\$41
10% Profit	\$45
Total	\$500
Incentive	\$0
Total Cost with Incentive	\$500

BPU ENERGY AUDIT PROGRAM
Andover Township Town Hall
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			
3', 2 Lamp, T-12 to T-8 Fixture	2	ea	\$70	\$49	\$0	\$140	\$119	\$0	\$259	\$60	

Subtotal	\$259
10% Contingency	\$0
10% OH	\$0
10% Profit	\$0
Total	\$259
Incentive	\$60
Total Cost with Incentive	\$199

APPENDIX E

ECM-2 Lighting Control Modifications

BPU ENERGY AUDIT PROGRAM
Andover Township Town Hall
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	558	694	0	121	2.3	120	4.6	3.6

BPU ENERGY AUDIT PROGRAM
Andover Township Town Hall
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	
101 - Lobby	A - 2'x2' Fluorescent	1	(2) 32W T8U	(1) Electronic	62	62	8760	Breaker	543.12	\$94.50	
101 - Lobby	A - 2'x2' Fluorescent	10	(2) 32W T8U	(1) Electronic	62	620	2080	Switch	1289.60	\$224.39	
101 - Lobby	I - Recessed Step Baffle	2	(1) 100W A19	-	100	200	2080	Switch	416.00	\$72.38	
101 - Lobby	Exit Sign, 16W	1	(2) 7W PL	(1) Electronic	16	16	9760	Breaker	156.16	\$27.17	
102 Meeting and Court Room	A - 2'x2' Fluorescent	4	(2) 32W T8U	(1) Electronic	62	248	1440	Switch	357.12	\$62.14	
102 Meeting and Court Room	B - 2'x4' Fluorescent	4	(4) 32W T8	(1) Electronic	114	456	1440	Switch	656.64	\$114.26	
102 Meeting and Court Room	B - 2'x4' Fluorescent	10	(4) 32W T8	(1) Electronic	114	1140	1440	Switch	1641.60	\$285.64	
102 Meeting and Court Room	E - Wall Mounted Globe	8	(1) 100W A19	-	100	800	1440	Switch	1152.00	\$200.45	
102 Meeting and Court Room	Compact Fluorescent Flood Lights	7	14W CFL	-	14	98	1440	Switch	141.12	\$24.55	
102 Meeting and Court Room	Exit Sign, 16W	2	(2) 7W PL	(1) Electronic	16	32	8760	Breaker	280.32	\$48.78	
103 - Conference	B - 2'x4' Fluorescent	4	(4) 32W T8	(1) Electronic	114	456	2080	Switch	948.48	\$165.04	
104 - Court Clerk	C - 2'x4' Fluorescent	4	(4) 32W T8	(1) Electronic	114	456	2080	Switch	948.48	\$165.04	
104 - Court Clerk	I - Recessed Step Baffle	2	(1) 100W A19	-	100	200	2080	Switch	416.00	\$72.38	
105 - Men	D - 2'x4' Fluorescent	2	(2) 32W T8	(1) Electronic	62	124	2080	Switch	257.92	\$44.88	
105 - Men	F - 4' Wall Mounted Luminaire	1	(2) 34W T12	(1) Magnetic	82	82	2080	Switch	170.56	\$29.68	
106 - Women	D - 2'x4' Fluorescent	2	(2) 32W T8	(1) Electronic	62	124	2080	Switch	257.92	\$44.88	
106 - Women	F - 4' Wall Mounted Luminaire	1	(2) 34W T12	(1) Magnetic	82	82	2080	Switch	170.56	\$29.68	
107 - Entry Lock	A - 2'x2' Fluorescent	2	(2) 32W T8U	(1) Electronic	62	124	2080	Switch	257.92	\$44.88	
108 - Utility Closet	A - 2'x2' Fluorescent	1	(2) 32W T8U	(1) Electronic	62	62	130	Switch	8.06	\$1.40	
109 - Entry Lock	D - 2'x4' Fluorescent	1	(2) 32W T8	(1) Electronic	62	62	2080	Switch	128.96	\$22.44	
110 - Public Defender	C - 2'x4' Fluorescent	2	(4) 32W T8	(1) Electronic	114	228	2080	Switch	474.24	\$82.52	
111 - Prosecutor	C - 2'x4' Fluorescent	4	(4) 32W T8	(1) Electronic	114	456	2080	Switch	948.48	\$165.04	
113 - Electrical and Telephone Room	"A" Light, 100W	1	(1) 100W A-Lamp	-	100	100	130	Switch	13.00	\$2.26	
113 - Electrical and Telephone Room	F - 4' Wall Mounted Luminaire	1	(2) 34W T12	(1) Magnetic	82	82	130	Switch	10.66	\$1.85	
115 - Storage	F - 4' Wall Mounted Luminaire	5	(2) 34W T12	(1) Magnetic	82	410	130	Switch	53.30	\$9.27	
118 - Corridor	F - 4' Wall Mounted Luminaire	1	(2) 34W T12	(1) Magnetic	82	82	2080	Switch	170.56	\$29.68	
118 - Corridor	F - 4' Wall Mounted Luminaire	2	(2) 34W T12	(1) Magnetic	82	164	2080	Switch	341.12	\$59.35	
118 - Corridor	Exit Sign, 16W	1	(2) 7W PL	(1) Electronic	16	16	8760	Breaker	140.16	\$24.39	
119 - Storage	F - 4' Wall Mounted Luminaire	4	(2) 34W T12	(1) Magnetic	82	328	130	Switch	42.64	\$7.42	
Water Room	"A" Light, 60W	1	(1) 60 W A-Lamp	-	60	60	130	Switch	7.80	\$1.36	
Elevator Machine Room	"A" Light, 100W	1	(1) 100W A-Lamp	-	100	100	130	Switch	13.00	\$2.26	
201 - Entry Lock	A - 2'x2' Fluorescent	1	(2) 32W T8U	(1) Electronic	62	62	2080	Switch	128.96	\$22.44	
202 - Corridor	A - 2'x2' Fluorescent	2	(2) 32W T8U	(1) Electronic	62	124	8760	Breaker	1086.24	\$189.01	
202 - Corridor	A - 2'x2' Fluorescent	30	(2) 32W T8U	(1) Electronic	62	1860	2080	Switch	3868.80	\$673.17	
202 - Corridor	I - Recessed Step Baffle	2	(1) 100W A19	-	100	200	2080	Switch	416.00	\$72.38	
202 - Corridor	P - Candelabra	1	(6) 20W A-Lamp	-	120	120	2080	Switch	249.60	\$43.43	
202 - Corridor	Exit Sign, 16W	6	(2) 7W PL	(1) Electronic	16	96	8760	Breaker	840.96	\$146.33	
203 - Tax Collector	C - 2'x4' Fluorescent	7	(4) 32W T8	(1) Electronic	114	798	2080	Switch	1659.84	\$288.81	
203 - Tax Collector	I - Recessed Step Baffle	1	(1) 100W A19	-	100	100	2080	Switch	208.00	\$36.19	
204 - Tax Assessor	C - 2'x4' Fluorescent	3	(4) 32W T8	(1) Electronic	114	342	2080	Switch	711.36	\$123.78	
204 - Tax Assessor	I - Recessed Step Baffle	1	(1) 100W A19	-	100	100	2080	Switch	208.00	\$36.19	
204 - Tax Assessor	Exit Sign, 16W	1	(2) 7W PL	(1) Electronic	16	16	8760	Breaker	140.16	\$24.39	
205 - Men	D - 2'x4' Fluorescent	1	(2) 32W T8	(1) Electronic	62	62	2080	Switch	128.96	\$22.44	
206 - Women	D - 2'x4' Fluorescent	1	(2) 32W T8	(1) Electronic	62	62	2080	Switch	128.96	\$22.44	
207 - Reception	B - 2'x4' Fluorescent	1	(4) 32W T8	(1) Electronic	114	114	2080	Switch	237.12	\$41.26	
207 - Reception	C - 2'x4' Fluorescent	3	(4) 32W T8	(1) Electronic	114	342	2080	Switch	711.36	\$123.78	
207 - Reception	I - Recessed Step Baffle	3	(1) 100W A19	-	100	300	2080	Switch	624.00	\$108.58	
208 - Municipal Clerks	C - 2'x4' Fluorescent	4	(4) 32W T8	(1) Electronic	114	456	2080	Switch	948.48	\$165.04	
208 - Municipal Clerks	I - Recessed Step Baffle	1	(1) 100W A19	-	100	100	2080	Switch	208.00	\$36.19	
209 - Conference	B - 2'x4' Fluorescent	4	(4) 32W T8	(1) Electronic	114	456	2080	Switch	948.48	\$165.04	
209 - Conference	Flood, 65W	10	(1) 65W A-Lamp	-	65	650	2080	Switch	1352.00	\$235.25	
210 - Administrator	B - 2'x4' Fluorescent	4	(4) 32W T8	(1) Electronic	114	456	2080	Switch	948.48	\$165.04	
211 - Lounge	C - 2'x4' Fluorescent	4	(4) 32W T8	(1) Electronic	114	456	2080	Switch	948.48	\$165.04	
212 - Finance	C - 2'x4' Fluorescent	4	(4) 32W T8	(1) Electronic	114	456	2080	Switch	948.48	\$165.04	
212 - Finance	I - Recessed Step Baffle	2	(1) 100W A19	-	100	200	2080	Switch	416.00	\$72.38	
213 - Court Clerk	C - 2'x4' Fluorescent	4	(4) 32W T8	(1) Electronic	114	456	2080	Switch	948.48	\$165.04	
213 - Court Clerk	I - Recessed Step Baffle	2	(1) 100W A19	-	100	200	2080	Switch	416.00	\$72.38	
214 - Health, Rec. & Social Services	C - 2'x4' Fluorescent	3	(4) 32W T8	(1) Electronic	114	342	2080	Switch	711.36	\$123.78	
214 - Health, Rec. & Social Services	I - Recessed Step Baffle	2	(1) 100W A19	-	100	200	2080	Switch	416.00	\$72.38	
215 - Building Department	C - 2'x4' Fluorescent	6	(4) 32W T8	(1) Electronic	114	684	2080	Switch	1422.72	\$247.55	
216 - Planning and Zoning	C - 2'x4' Fluorescent	5	(4) 32W T8	(1) Electronic	114	570	2080	Switch	1185.60	\$206.29	
217 - Supply Room	C - 2'x4' Fluorescent	1	(4) 32W T8	(1) Electronic	114	114	2080	Switch	237.12	\$41.26	
218 - Copier Alcove	A - 2'x2' Fluorescent	2	(2) 32W T8U	(1) Electronic	62	124	2080	Switch	257.92	\$44.88	
219 - Janitor Closet	A - 2'x2' Fluorescent	1	(2) 32W T8U	(1) Electronic	62	62	130	Switch	8.06	\$1.40	
220 - Women	G - 3' Wall Mounted Luminaire	1	(2) 30W T12	(1) Magnetic	79	79	2080	Switch	164.32	\$28.59	
221 - Men	G - 3' Wall Mounted Luminaire	1	(2) 30W T12	(1) Magnetic	79	79	2080	Switch	164.32	\$28.59	
Exterior	K - Recessed	12	(1) 100 W Metal Halide	(1) Electronic	110	1320	2080	Switch	2745.60	\$477.73	
Exterior	L - Flood Light	2	(1) 100W Mercury Vapor	(1) Magnetic	119	238	4380	Photocell	1042.44	\$181.38	
Exterior	M - Exterior wall Mounted Globe	2	(1) 100W A-Lamp	-	100	200	2080	Switch	416.00	\$72.38	
Exterior	Q - Pendant Mounted Fixture	1	(1) 100 W Metal Halide	(1) Electronic	110	110	4380	Photocell	481.80	\$83.83	
Exterior	Low "A" W, 60 W	2	(1) 60 W A-Lamp	-	60	120	2080	Switch	249.60	\$43.43	
Exterior	"Big Light"	1	(1) 200 W Metal Halide	(1) Magnetic	232	232	4380	Photocell	1016.16	\$176.81	

Energy Cost: \$0.1740

Notes:

Existing Lighting Fixture Schedule

$$\text{Total Watts} = \text{No. of Fixture} \times \text{Fixture Watts}$$
$$\text{kwh/Year} = \text{Total Watts}/1000 \times \text{Hours of Operation}$$
$$\text{Operational Cost/Year} = \text{kwh/Year} \times \text{Energy Cost}$$

BPU ENERGY AUDIT PROGRAM
Andover Township Town Hall
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)	6	ea	\$ 25.00	\$ 50.00		\$ 147.00	\$ 363.00	\$ -	\$ 510.00	\$ 120.00	

Subtotal	\$510
10% Contingency	\$51
10% OH	\$56
10% Profit	\$62
Total	\$679
Incentive	\$120
Total Cost with Incentive	\$559

BPU ENERGY AUDIT PROGRAM

Andover Township Town Hall
CHA Project #20997

ECM-2 Lighting Control Modifications (Existing Fixtures)

Lighting Fixture Replacement Savings														Savings			
Existing Fixtures	Location	Fixture Description with System Watts	No. of Fixtures	Lamp Type & No.	Total Watts	Hours of Operation	Controls	kwh/Year	Operational Cost/Year	Modified Control	New Hours of	kwh/Year	Operational Cost/Year	Installation Cost	kwh/Year	Cost Savings/Year	Payback in Years
101 - Lobby	A - 2x2' Fluorescent, (2) TRU, 62W	1	(2) 32W TRU	62	8760	Breaker	543	\$94.50			6570	407	\$71				
101 - Lobby	A - 2x2' Fluorescent, (2) TRU, 62W	10	(2) 32W TRU	620	2080	Switch	1200	\$224.39			1560	907	\$168				
101 - Lobby	I - Recessed Step Baffle, (1)A19, 100W	2	(1) 100W A19	200	2080	Switch	416	\$72.38			1560	312	\$54				
101 - Lobby	Exit Sign, 16W	1	(2) 7W PL	16	8760	Breaker	140	\$24.39			6570	105	\$18				
102 Meeting and Court Room	A - 2x2' Fluorescent, (2) TRU, 62W	4	(2) 32W TRU	248	1440	Switch	357	\$62.14			1080	268	\$47				
102 Meeting and Court Room	B - 2x4' Fluorescent, (4) TS, 114W	4	(4) 32W T8	456	1440	Switch	657	\$114.26			1080	492	\$86				
102 Meeting and Court Room	B - 2x4' Fluorescent, (4) TS, 114W	10	(4) 32W T8	1140	1440	Switch	1642	\$285.64			1080	1221	\$214				
102 Meeting and Court Room	E - Wall Mounted Globe, (1)A19, 100W	8	(1) 100W A19	800	1440	Switch	1152	\$200.45			1080	864	\$150				
102 Meeting and Court Room	Compact Fluorescent Flood Lights, 14 W	7	14W CFL	98	1440	Switch	141	\$24.55			1080	106	\$18				
102 Meeting and Court Room	Exit Sign, 16W	2	(2) 7W PL	32	8760	Breaker	280	\$48.78			6570	210	\$37				
103 - Conference	B - 2x4' Fluorescent, (4) TS, 114W	4	(4) 32W T8	456	2080	Switch	948	\$165.04			1560	711	\$124				
104 - Court Clerk	C - 2x4' Fluorescent, (4) TS, 114W	4	(4) 32W T8	456	2080	Switch	948	\$165.04			1560	711	\$124				
104 - Court Clerk	I - Recessed Step Baffle, (1)A19, 100W	2	(1) 100W A19	200	2080	Switch	416	\$72.38			1560	312	\$54				
105 - Men	D - 2x4' Fluorescent, (2) TS, 62W	2	(2) 32W T8	124	2080	Switch	258	\$44.88	Motion Sensor		1560	193	\$34	\$47	64	\$11	4.15
105 - Men	F - 4' Wall Mounted Luminaire, (2) T12, 82W	1	(2) 34W T12	82	2080	Switch	171	\$29.68	Motion Sensor		1560	128	\$22	\$47	43	\$7	6.28
106 - Women	D - 2x4' Fluorescent, (2) TS, 62W	2	(2) 32W T8	124	2080	Switch	258	\$44.88	Motion Sensor		1560	193	\$34	\$47	64	\$11	4.15
106 - Women	F - 4' Wall Mounted Luminaire, (2) T12, 82W	1	(2) 34W T12	82	2080	Switch	171	\$29.68	Motion Sensor		1560	128	\$22	\$47	43	\$7	6.28
107 - Entry Lock	A - 2x2' Fluorescent, (2) TRU, 62W	2	(2) 32W TRU	124	2080	Switch	258	\$44.88			1560	193	\$34				
108 - Utility Closet	A - 2x2' Fluorescent, (2) TRU, 62W	1	(2) 32W TRU	62	130	Switch	8	\$1.40			98	6	\$1				
109 - Entry Lock	D - 2x4' Fluorescent, (2) TS, 62W	2	(2) 32W T8	62	2080	Switch	129	\$22.44			1560	97	\$17				
110 - Public Defender	C - 2x4' Fluorescent, (4) TS, 114W	2	(4) 32W T8	228	2080	Switch	474	\$82.52	Motion Sensor		1560	356	\$62	\$93	119	\$21	4.51
111 - Prosecutor	C - 2x4' Fluorescent, (4) TS, 114W	4	(4) 32W T8	456	2080	Switch	948	\$165.04	Motion Sensor		1560	711	\$124	\$93	227	\$41	2.26
113 - Electrical and Telephone Room	"A" Light, 100W	1	(1) 100W A-Lamp	100	130	Switch	13	\$2.26	Motion Sensor		98	10	\$2	\$47	3	\$1	82.35
113 - Electrical and Telephone Room	F - 4' Wall Mounted Luminaire, (2) T12, 82W	1	(2) 34W T12	82	130	Switch	11	\$1.85	Motion Sensor		98	8	\$1	\$47	3	\$0	100.43
115 - Storage	F - 4' Wall Mounted Luminaire, (2) T12, 82W	5	(2) 34W T12	410	130	Switch	53	\$9.27	Motion Sensor		98	40	\$7	\$93	13	\$2	40.17
118 - Corridor	F - 4' Wall Mounted Luminaire, (2) T12, 82W	1	(2) 34W T12	82	2080	Switch	171	\$29.68			1560	128	\$22				
118 - Corridor	F - 4' Wall Mounted Luminaire, (2) T12, 82W	2	(2) 34W T12	164	2080	Switch	341	\$59.35			1560	256	\$45				
118 - Corridor	Exit Sign, 16W	1	(2) 7W PL	16	8760	Breaker	140	\$24.39			6570	105	\$18				
119 - Storage	F - 4' Wall Mounted Luminaire, (2) T12, 82W	4	(2) 34W T12	328	130	Switch	43	\$7.42	Motion Sensor		98	32	\$6	\$93	11	\$2	50.21
Water Room	"A" Light, 60W	1	(1) 60 W A-Lamp	60	130	Switch	8	\$1.36	Motion Sensor		98	6	\$1	\$93	2	\$0	274.51
Elevator Machine Room	"A" Light, 100W	1	(1) 100W A-Lamp	100	130	Switch	13	\$2.26	Motion Sensor		98	10	\$2	\$93	3	\$1	164.70
201 - Entry Lock	A - 2x2' Fluorescent, (2) TRU, 62W	1	(2) 32W TRU	62	2080	Switch	129	\$22.44			1560	97	\$17				
202 - Corridor	A - 2x2' Fluorescent, (2) TRU, 62W	30	(2) 32W TRU	124	8760	Breaker	1086	\$189.01			6570	815	\$142				
202 - Corridor	A - 2x2' Fluorescent, (2) TRU, 62W	30	(2) 32W TRU	1860	2080	Switch	3869	\$673.17			1560	2902	\$505				
202 - Corridor	I - Recessed Step Baffle, (1)A19, 100W	2	(1) 100W A19	200	2080	Switch	416	\$72.38			1560	312	\$54				
202 - Corridor	P - Candelabra, (6) Lamps, 120W	1	(6) 20W A-Lamp	120	2080	Switch	250	\$43.43			1560	187	\$33				
202 - Corridor	Exit Sign, 16W	6	(2) 7W PL	96	8760	Breaker	841	\$146.33			6570	631	\$109				
203 - Tax Collector	C - 2x4' Fluorescent, (4) TS, 114W	7	(4) 32W T8	798	2080	Switch	1660	\$288.81			1560	1245	\$217				
203 - Tax Collector	I - Recessed Step Baffle, (1)A19, 100W	1	(1) 100W A19	100	2080	Switch	208	\$36.19			1560	156	\$27				
204 - Tax Assessor	C - 2x4' Fluorescent, (4) TS, 114W	3	(4) 32W T8	342	2080	Switch	711	\$123.78			1560	534	\$93				
204 - Tax Assessor	I - Recessed Step Baffle, (1)A19, 100W	1	(1) 100W A19	100	2080	Switch	208	\$36.19			1560	156	\$27				
204 - Tax Assessor	Exit Sign, 16W	1	(2) 7W PL	16	8760	Breaker	140	\$24.39			6570	105	\$18				
205 - Men	D - 2x4' Fluorescent, (2) TS, 62W	1	(2) 32W T8	62	2080	Switch	129	\$22.44	Motion Sensor		1560	97	\$17	\$47	32	\$6	8.30
205 - Women	D - 2x4' Fluorescent, (2) TS, 62W	1	(2) 32W T8	62	2080	Switch	129	\$22.44	Motion Sensor		1560	97	\$17	\$47	32	\$6	8.30
207 - Reception	B - 2x4' Fluorescent, (4) TS, 114W	1	(4) 32W T8	114	2080	Switch	237	\$41.26			1560	178	\$31				
207 - Reception	C - 2x4' Fluorescent, (4) TS, 114W	3	(4) 32W T8	342	2080	Switch	711	\$123.78			1560	534	\$93				
207 - Reception	I - Recessed Step Baffle, (1)A19, 100W	3	(1) 100W A19	300	2080	Switch	624	\$108.58			1560	468	\$81				
208 - Municipal Clerks	C - 2x4' Fluorescent, (4) TS, 114W	4	(4) 32W T8	456	2080	Switch	948	\$165.04			1560	711	\$124				
208 - Municipal Clerks	I - Recessed Step Baffle, (1)A19, 100W	1	(1) 100W A19	100	2080	Switch	208	\$36.19			1560	156	\$27				
209 - Conference	B - 2x4' Fluorescent, (4) TS, 114W	4	(4) 32W T8	456	2080	Switch	948	\$165.04			1560	711	\$124				
209 - Conference	Flood, 65W	10	(1) 65W A-Lamp	650	2080	Switch	1352	\$235.25			1560	1014	\$176				
210 - Administrator	B - 2x4' Fluorescent, (4) TS, 114W	4	(4) 32W T8	456	2080	Switch	948	\$165.04			1560	711	\$124				
211 - Lounge	C - 2x4' Fluorescent, (4) TS, 114W	4	(4) 32W T8	456	2080	Switch	948	\$165.04			1560	711	\$124				
212 - Finance	C - 2x4' Fluorescent, (4) TS, 114W	4	(4) 32W T8	456	2080	Switch	948	\$165.04			1560	711	\$124				
212 - Finance	I - Recessed Step Baffle, (1)A19, 100W	2	(1) 100W A19	200	2080	Switch	416	\$72.38			1560	312	\$54				
213 - Court Clerk	C - 2x4' Fluorescent, (4) TS, 114W	4	(4) 32W T8	456	2080	Switch	948	\$165.04			1560	711	\$124				
213 - Court Clerk	I - Recessed Step Baffle, (1)A19, 100W	2	(1) 100W A19	200	2080	Switch	416	\$72.38			1560	312	\$54				
214 - Health, Rec. & Social Services	C - 2x4' Fluorescent, (4) TS, 114W	3	(4) 32W T8	342	2080	Switch	711	\$123.78			1560	534	\$93				
214 - Health, Rec. & Social Services	I - Recessed Step Baffle, (1)A19, 100W	2	(1) 100W A19	200	2080	Switch	416	\$72.38			1560	312	\$54				
215 - Building Department	C - 2x4' Fluorescent, (4) TS, 114W	6	(4) 32W T8	684	2080	Switch	1423	\$247.55			1560	1067	\$186				
216 - Planning and Zoning	C - 2x4' Fluorescent, (4) TS, 114W	5	(4) 32W T8	570	2080	Switch	1186	\$206.29			1560	889	\$155				
217 - Supply Room	C - 2x4' Fluorescent, (4) TS, 114W	1	(4) 32W T8	114	2080	Switch	237	\$41.26	Motion Sensor		1560	178	\$31	\$93	59	\$10	9.03
218 - Capitol Atrium	A - 2x2' Fluorescent, (2) TRU, 62W	2	(2) 32W TRU	124	2080	Switch	258	\$44.88			1560	193	\$34				
219 - Janitor Closet	A - 2x2' Fluorescent, (2) TRU, 62W	1	(2) 32W TRU	62	130	Switch	8	\$1.40	Motion Sensor		98	6	\$1	\$93	2	\$0	265.65
220 - Women	G - 3' Wall Mounted Luminaire, (2) T12, 79W	1	(2) 30W T12	79	2080	Switch	164	\$28.59	Motion Sensor		1560	123	\$21	\$93	41	\$7	13.03
221 - Men	G - 3' Wall Mounted Luminaire, (2) T12, 79W	1	(2) 30W T12	79	2080	Switch	164	\$28.59	Motion Sensor		1560	123	\$21	\$93	41	\$7	13.03
Exterior	K - Recessed Metal Halide, 110W	12	(1) 100 W Metal Halide	120	2080	Switch	2746	\$477.73			3285	2059	\$358				
Exterior	L - Flood Light, Mercury Vapor, 110W	2	(1) 100W Mercury Vapor	238	4380	Photocell	1042	\$181.38			3285	782	\$136				
Exterior	M - Exterior wall Mounted Globe, (1)A19, 100W	2	(1) 100W A-Lamp	200	2080	Switch	416	\$72.38			1560	312	\$54				
Exterior	Q - Pendant Mounted Fixture, Metal Halide, 110 W	1	(1) 100 W Metal Halide	110	4380	Photocell	482	\$83.83			3285	361	\$63				
Exterior	Low "A", 60 W	2	(1) 60 W A-Lamp	120	2080	Switch	250	\$43.43			1560	187	\$33				
Exterior	"Big Light", Metal Halide, 232 W	1	(1) 200 W Metal Halide	232	4380	Photocell	1016	\$176.81			3285	762	\$133				

Energy Cost: \$0.1740

*Installation Cost Does Not Include Potential Incentives.

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
Payback in Years = Total Installed Cost/Yearly \$ Savings
Installed cost of compact fluorescent fixtures is only cost of lamp (bulb). Life of compact fluorescent lamp is twice as long as incandescent "A" lamp, offsetting installation cost.

BPU ENERGY AUDIT PROGRAM

Andover Township Town Hall
CHA Project #20997

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

Lighting Fixture Replacement Savings													
Existing Fixtures	Location	Fixture Description with System Watts	No. of Fixtures	Lamp Type & No.	Total Watts	Hours of Operation	Controls	kwh/Year	Operational Cost/Year	Proposed Lighting Fixture Controls	Modified Control	New Hours of	Savings
													Cost Savings/Year
													Payback in Years
101 - Lobby	A - 2x2' Fluorescent, (2) TRU, 62W	1	(2) 32W TRU	62	8760	Breaker	543	\$94.50				6570	\$71
101 - Lobby	A - 2x2' Fluorescent, (2) TRU, 62W	10	(2) 32W TRU	620	2080	Switch	1200	\$224.39				1560	\$168
101 - Lobby	Compact Fluorescent	2	(1) 25 W CFL	50	2080	Switch	104	\$18.10				1560	\$14
101 - Lobby	LED Exit Sign	1	1.2 W LED	1.2	8760	Breaker	11	\$1.83				6570	\$1
102 Meeting and Court Room	A - 2x2' Fluorescent, (2) TRU, 62W	4	(2) 32W TRU	248	1440	Switch	357	\$62.14				1080	\$47
102 Meeting and Court Room	B - 2x4' Fluorescent, (4) TR, 114W	4	(4) 32W TR	456	1440	Switch	657	\$114.26				1080	\$86
102 Meeting and Court Room	B - 2x4' Fluorescent, (4) TR, 114W	10	(4) 32W TR	1140	1440	Switch	1642	\$285.64				1080	\$121
102 Meeting and Court Room	Compact Fluorescent	8	(1) 25 W CFL	200	1440	Switch	288	\$50.11				1080	\$38
102 Meeting and Court Room	Compact Fluorescent Flood Lights, 14 W	7	14W CFL	98	1440	Switch	141	\$24.55				1080	\$18
102 Meeting and Court Room	LED Exit Sign	2	1.2 W LED	2.4	8760	Breaker	21	\$3.66				6570	\$3
103 - Conference	B - 2x4' Fluorescent, (4) TR, 114W	4	(4) 32W TR	456	2080	Switch	948	\$165.04				1560	\$124
104 - Court Clerk	C - 2x4' Fluorescent, (4) TR, 114W	4	(4) 32W TR	456	2080	Switch	948	\$165.04				1560	\$124
104 - Court Clerk	Compact Fluorescent	2	(1) 25 W CFL	50	2080	Switch	104	\$18.10				1560	\$14
105 - Men	D - 2x4' Fluorescent, (2) TR, 62W	2	(2) 32W TR	124	2080	Switch	258	\$44.88	Motion Sensor			1560	\$34
105 - Men	F - 4' Wall Mounted Luminaire, (2) T12, 82W	1	(2) 34W T12	82	2080	Switch	171	\$29.68	Motion Sensor			1560	\$22
106 - Women	D - 2x4' Fluorescent, (2) TR, 62W	2	(2) 32W TR	124	2080	Switch	258	\$44.88	Motion Sensor			1560	\$34
106 - Women	F - 4' Wall Mounted Luminaire, (2) T12, 82W	1	(2) 34W T12	82	2080	Switch	171	\$29.68	Motion Sensor			1560	\$22
107 - Entry Lock	A - 2x2' Fluorescent, (2) TRU, 62W	2	(2) 32W TRU	124	2080	Switch	258	\$44.88				1560	\$34
108 - Utility Closet	A - 2x2' Fluorescent, (2) TRU, 62W	1	(2) 32W TRU	62	130	Switch	8	\$1.40				98	\$1
109 - Entry Lock	D - 2x4' Fluorescent, (2) TR, 62W	2	(2) 32W TR	124	2080	Switch	129	\$22.44				1560	\$17
110 - Public Defender	C - 2x4' Fluorescent, (4) TR, 114W	2	(4) 32W TR	228	2080	Switch	474	\$82.52	Motion Sensor			1560	\$62
111 - Prosecutor	C - 2x4' Fluorescent, (4) TR, 114W	4	(4) 32W TR	456	2080	Switch	948	\$165.04	Motion Sensor			1560	\$124
113 - Electrical and Telephone Room	Compact Fluorescent	1	(1) 25 W CFL	25	130	Switch	3	\$0.57	Motion Sensor			98	\$0
113 - Electrical and Telephone Room	F - 4' Wall Mounted Luminaire, (2) T12, 82W	1	(2) 34W T12	82	130	Switch	11	\$1.85	Motion Sensor			98	\$1
115 - Storage	F - 4' Wall Mounted Luminaire, (2) T12, 82W	5	(2) 34W T12	410	130	Switch	53	\$9.27	Motion Sensor			98	\$7
118 - Corridor	F - 4' Wall Mounted Luminaire, (2) T12, 82W	1	(2) 34W T12	82	2080	Switch	171	\$29.68				1560	\$22
118 - Corridor	F - 4' Wall Mounted Luminaire, (2) T12, 82W	2	(2) 34W T12	164	2080	Switch	341	\$59.35				1560	\$45
118 - Corridor	LED Exit Sign	1	1.2 W LED	1.2	8760	Breaker	11	\$1.83				6570	\$1
119 - Storage	F - 4' Wall Mounted Luminaire, (2) T12, 82W	4	(2) 34W T12	328	130	Switch	43	\$7.42	Motion Sensor			98	\$6
Water Room	Compact Fluorescent	1	(1) 15 W CFL	15	130	Switch	2	\$0.34	Motion Sensor			98	\$0
Elevator Machine Room	Compact Fluorescent	1	(1) 25 W CFL	25	130	Switch	3	\$0.57	Motion Sensor			98	\$0
201 - Entry Lock	A - 2x2' Fluorescent, (2) TRU, 62W	1	(2) 32W TRU	62	2080	Switch	129	\$22.44				1560	\$17
202 - Corridor	A - 2x2' Fluorescent, (2) TRU, 62W	2	(2) 32W TRU	124	8760	Breaker	1086	\$189.01				6570	\$142
202 - Corridor	A - 2x2' Fluorescent, (2) TRU, 62W	30	(2) 32W TRU	1860	2080	Switch	3869	\$673.17				1560	\$202
202 - Corridor	Compact Fluorescent	2	(1) 25 W CFL	50	2080	Switch	104	\$18.10				1560	\$14
202 - Corridor	P - Candelabra, (6) Lamps, 120W	1	(6) 20W A-Lamp	120	2080	Switch	250	\$43.43				1560	\$187
202 - Corridor	LED Exit Sign	6	1.2 W LED	7.2	8760	Breaker	63	\$10.97				6570	\$7
203 - Tax Collector	C - 2x4' Fluorescent, (4) TR, 114W	7	(4) 32W TR	798	2080	Switch	1660	\$288.81				1560	\$1245
203 - Tax Collector	Compact Fluorescent	1	(1) 25 W CFL	25	2080	Switch	52	\$9.05				1560	\$9
204 - Tax Assessor	C - 2x4' Fluorescent, (4) TR, 114W	3	(4) 32W TR	342	2080	Switch	711	\$123.78				1560	\$93
204 - Tax Assessor	Compact Fluorescent	1	(1) 25 W CFL	25	2080	Switch	52	\$9.05				1560	\$9
204 - Tax Assessor	LED Exit Sign	1	1.2 W LED	1.2	8760	Breaker	11	\$1.83				6570	\$1
205 - Men	D - 2x4' Fluorescent, (2) TR, 62W	1	(2) 32W TR	62	2080	Switch	129	\$22.44	Motion Sensor			1560	\$17
206 - Women	D - 2x4' Fluorescent, (2) TR, 62W	1	(2) 32W TR	62	2080	Switch	129	\$22.44	Motion Sensor			1560	\$17
207 - Reception	B - 2x4' Fluorescent, (4) TR, 114W	1	(4) 32W TR	114	2080	Switch	237	\$41.26				1560	\$178
207 - Reception	C - 2x4' Fluorescent, (4) TR, 114W	3	(4) 32W TR	342	2080	Switch	711	\$123.78				1560	\$93
207 - Reception	Compact Fluorescent	3	(1) 25 W CFL	75	2080	Switch	156	\$27.14				1560	\$17
208 - Municipal Clerks	C - 2x4' Fluorescent, (4) TR, 114W	4	(4) 32W TR	456	2080	Switch	948	\$165.04				1560	\$124
208 - Municipal Clerks	Compact Fluorescent	1	(1) 25 W CFL	25	2080	Switch	52	\$9.05				1560	\$9
209 - Conference	B - 2x4' Fluorescent, (4) TR, 114W	4	(4) 32W TR	456	2080	Switch	948	\$165.04				1560	\$124
209 - Conference	Flood, 65W	10	(1) 65W A-Lamp	650	2080	Switch	1352	\$235.25				1560	\$1014
210 - Administrator	B - 2x4' Fluorescent, (4) TR, 114W	4	(4) 32W TR	456	2080	Switch	948	\$165.04				1560	\$124
211 - Lounge	C - 2x4' Fluorescent, (4) TR, 114W	4	(4) 32W TR	456	2080	Switch	948	\$165.04				1560	\$124
212 - Finance	C - 2x4' Fluorescent, (4) TR, 114W	4	(4) 32W TR	456	2080	Switch	948	\$165.04				1560	\$124
212 - Finance	Compact Fluorescent	2	(1) 25 W CFL	50	2080	Switch	104	\$18.10				1560	\$14
213 - Court Clerk	C - 2x4' Fluorescent, (4) TR, 114W	4	(4) 32W TR	456	2080	Switch	948	\$165.04				1560	\$124
213 - Court Clerk	Compact Fluorescent	2	(1) 25 W CFL	50	2080	Switch	104	\$18.10				1560	\$14
214 - Health, Rec. & Social Services	C - 2x4' Fluorescent, (4) TR, 114W	3	(4) 32W TR	342	2080	Switch	711	\$123.78				1560	\$93
214 - Health, Rec. & Social Services	Compact Fluorescent	2	(1) 25 W CFL	50	2080	Switch	104	\$18.10				1560	\$14
215 - Building Department	C - 2x4' Fluorescent, (4) TR, 114W	6	(4) 32W TR	684	2080	Switch	1423	\$247.55				1560	\$1067
216 - Planning and Zoning	C - 2x4' Fluorescent, (4) TR, 114W	5	(4) 32W TR	570	2080	Switch	1186	\$206.29				1560	\$899
217 - Supply Room	C - 2x4' Fluorescent, (4) TR, 114W	1	(4) 32W TR	114	2080	Switch	237	\$41.26	Motion Sensor			1560	\$178
218 - Capitol Atrium	A - 2x2' Fluorescent, (2) TRU, 62W	2	(2) 32W TRU	124	2080	Switch	258	\$44.88				1560	\$34
219 - Janitor Closet	A - 2x2' Fluorescent, (2) TRU, 62W	1	(2) 32W TRU	62	130	Switch	8	\$1.40	Motion Sensor			98	\$1
220 - Women	3' Fluorescent (2) TR, Elec Ballast	1	(2) 32W TR	48	2080	Switch	100	\$17.37	Motion Sensor			1560	\$75
221 - Men	3' Fluorescent (2) TR, Elec Ballast	1	(2) 32W TR	48	2080	Switch	100	\$17.37	Motion Sensor			1560	\$75
Exterior	K - Recessed Metal Halide, 110W	12	(1) 100 W Metal Halide	1200	2080	Switch	2746	\$477.73				1560	\$2090
Exterior	L - Flood Light, Mercury Vapor, 110W	2	(1) 100W Mercury Vapor	238	4380	Photocell	1042	\$181.38				3285	\$782
Exterior	M - Exterior wall Mounted Globe, (1) A19, 100W	2	(1) 100W A-Lamp	200	2080	Switch	416	\$72.38				1560	\$124
Exterior	Q - Pendant Mounted Fixture, Metal Halide, 110 W	1	(1) 100 W Metal Halide	110	4380	Photocell	482	\$83.83				3285	\$61
Exterior	Compact Fluorescent	2	(1) 15 W CFL	30	2080	Switch	62	\$10.86				1560	\$7
Exterior	"Big Light", Metal Halide, 232 W	1	(1) 200 W Metal Halide	232	4380	Photocell	1016	\$176.81				3285	\$762

Energy Cost: \$0.1740
Installation Cost Does Not Include Potential Incentives.

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
Payback in Years = Total Installed Cost/Yearly \$ Savings
Installed cost of compact fluorescent fixtures is only cost of lamp (bulb). Life of compact fluorescent lamp is twice as long as incandescent "A" lamp, offsetting installation cost.

APPENDIX F

ECM-3 Demand Ventilation (Zone 1)

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

ECM-3 Demand Ventilation (Zone 1)

Item	Budgetary Costs	Annual Utility Savings			ROI	Potential Incentive	Payback (Without Incentive)	Payback (With Incentive)
		Electricity	Natural Gas	Total				
	\$	KWH	Therms	\$		\$	Years	Years
Zone 1 Unit	\$2,000	(900)	125	\$40		0	50.0	50.0

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

ECM-3 Demand Ventilation (Zone 1)

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		
Carbon Dioxide Sensors	1	ea	\$250	\$100		\$245	\$121	\$0	\$366	
Wiring and Connections	1	ea	\$50	\$150		\$49	\$182	\$0	\$231	
Control Programming	1	ea	\$0	\$500		\$0	\$605	\$0	\$605	
Modulating Motor Damper	1	ea	\$135	\$150		\$132	\$182	\$0	\$314	
New Controller	1	ea	\$200	\$100		\$196	\$121	\$0	\$317	

Subtotal	\$1,519
10% Contingency	\$152
10% OH	\$167
10% Profit	\$184
Total	\$2,021

Zone_1_DCV Input Data

Project Name: Andover - Town Hall
Prepared by: Kitchen and Associates

06/08/2010
02:29PM

1. General Details:

Air System Name **Zone_1_DCV**
Equipment Type **Packaged Rooftop Units**
Air System Type **Single Zone CAV**
Number of zones **1**

2. System Components:

Ventilation Air Data:

Airflow Control **Demand Controlled Ventilation**
Ventilation Sizing Method **Sum of Space OA Airflows**
Minimum Airflow **10** %
Damper Leak Rate **5** %
Minimum CO2 Differential **100** ppm
Maximum CO2 Differential **700** ppm
Outdoor Air CO2 Level **400** ppm

Economizer Data:

Control **Integrated dry-bulb control**
Upper Cutoff **75.0** °F
Lower Cutoff **-60.0** °F

Ventilation Reclaim Data:

Reclaim Type **Sensible Heat**
Thermal Efficiency **80** %
Input kW **0.200** kW
Schedule **JFMAMJJASOND**

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 - Natural Gas**
Schedule **JFMAMJJASOND**
Capacity Control **Cycled or Staged Capacity - Fan On**

Supply Fan Data:

Fan Type **Forward Curved**
Configuration **Draw-thru**
Fan Performance **1.10** 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 **Ducted Return**

3. Zone Components:

Space Assignments:

Zone 1: BLD1-F001-Z01	
Zone_1_DCV	x1

Thermostats and Zone Data:

Zone **All**
Cooling T-stat: Occ. **76.0** °F
Cooling T-stat: Unocc. **76.0** °F
Heating T-stat: Occ. **72.0** °F
Heating T-stat: Unocc. **72.0** °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**

Zone_1_DCV Input Data

Project Name: Andover - Town Hall
Prepared by: Kitchen and Associates

06/08/2010
02:29PM

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

4. Sizing Data (Computer-Generated):

System Sizing Data:

Cooling Supply Temperature 58.0 °F
Supply Fan Airflow 2970.9 CFM
Ventilation Airflow 1125.0 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	2970.9	-	-	

5. Equipment Data

Central Cooling Unit - Air-Cooled DX

Estimated Maximum Load 94.1 MBH
Design OAT 95.0 °F
Equipment Sizing User-Defined
Gross Cooling Capacity 75.5 MBH
ARI Performance Rating 9.00 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 64.0 MBH
Equipment Sizing User-Defined
Gross Heating Capacity 135.0 MBH
Average Efficiency 78.0 %
Misc. Electric 0.000 kW

Billing Details - Electric - Zone_1_DCV

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:29PM

1. Component Charges

Billing Period	Energy Charges (\$)	Demand Charges (\$)	Customer Charges (\$)	Taxes (\$)	Total Charge (\$)
Jan	169	0	0	0	169
Feb	157	0	0	0	157
Mar	175	0	0	0	175
Apr	172	0	0	0	172
May	196	0	0	0	196
Jun	307	0	0	0	307
Jul	413	0	0	0	413
Aug	387	0	0	0	387
Sep	241	0	0	0	241
Oct	184	0	0	0	184
Nov	167	0	0	0	167
Dec	176	0	0	0	176
Totals	2,742	0	0	0	2,742

2. Totals

Billing Period	Total Charges (\$)	Total Consumption (kWh)	Avg Price (\$/kWh)
Jan	169	971	0.1740
Feb	157	902	0.1740
Mar	175	1,005	0.1740
Apr	172	988	0.1740
May	196	1,126	0.1740
Jun	307	1,762	0.1740
Jul	413	2,375	0.1740
Aug	387	2,223	0.1740
Sep	241	1,383	0.1740
Oct	184	1,055	0.1740
Nov	167	958	0.1740
Dec	176	1,013	0.1740
Totals	2,742	15,761	0.1740

3. Consumption Totals

Billing Period	Peak (kWh)	Mid-Peak (kWh)	Normal Peak (kWh)	Off-Peak (kWh)	Overall (kWh)
Jan	0	0	0	0	971
Feb	0	0	0	0	902
Mar	0	0	0	0	1,005
Apr	0	0	0	0	988
May	0	0	0	0	1,126
Jun	0	0	0	0	1,762
Jul	0	0	0	0	2,375
Aug	0	0	0	0	2,223
Sep	0	0	0	0	1,383
Oct	0	0	0	0	1,055
Nov	0	0	0	0	958
Dec	0	0	0	0	1,013
Totals	0	0	0	0	15,761

Billing Details - Electric - Zone_1_DCV

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06/08/2010
02:29PM

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	3.6
Feb	0.0	0.0	0.0	0.0	3.6
Mar	0.0	0.0	0.0	0.0	4.7
Apr	0.0	0.0	0.0	0.0	7.5
May	0.0	0.0	0.0	0.0	10.6
Jun	0.0	0.0	0.0	0.0	10.7
Jul	0.0	0.0	0.0	0.0	11.0
Aug	0.0	0.0	0.0	0.0	10.7
Sep	0.0	0.0	0.0	0.0	9.3
Oct	0.0	0.0	0.0	0.0	8.7
Nov	0.0	0.0	0.0	0.0	3.6
Dec	0.0	0.0	0.0	0.0	3.6

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	3.6
Feb	0.0	0.0	0.0	0.0	3.6
Mar	0.0	0.0	0.0	0.0	4.7
Apr	0.0	0.0	0.0	0.0	7.5
May	0.0	0.0	0.0	0.0	10.6
Jun	0.0	0.0	0.0	0.0	10.7
Jul	0.0	0.0	0.0	0.0	11.0
Aug	0.0	0.0	0.0	0.0	10.7
Sep	0.0	0.0	0.0	0.0	9.3
Oct	0.0	0.0	0.0	0.0	8.7
Nov	0.0	0.0	0.0	0.0	3.6
Dec	0.0	0.0	0.0	0.0	3.6

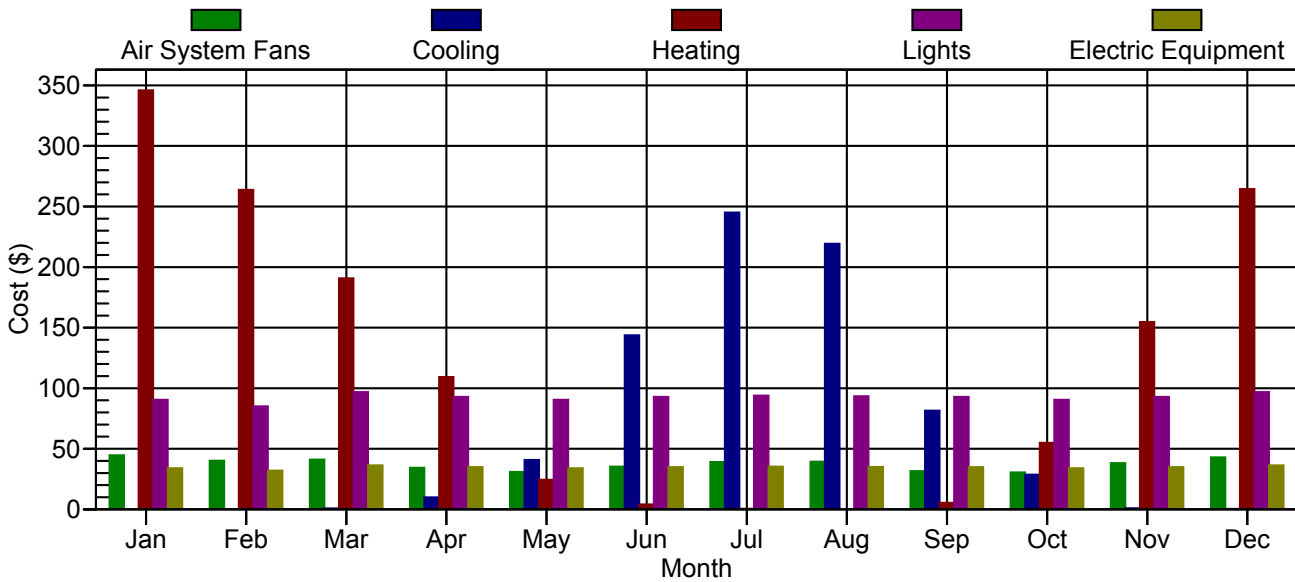
6. Time Of Maximum Demands

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	1/4/1400
Feb	n/a	n/a	n/a	n/a	2/1/1400
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	6/30/1500
Jul	n/a	n/a	n/a	n/a	7/29/1600
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	11/3/1300
Dec	n/a	n/a	n/a	n/a	12/1/1400

Monthly Component Costs - Zone_1_DCV

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06/08/2010
02:29PM



1. HVAC Component Costs

Month	Air System Fans (\$)	Cooling (\$)	Heating (\$)	Pumps (\$)	Cooling Towers (\$)	HVAC Total (\$)
January	45	0	346	0	0	391
February	40	0	264	0	0	304
March	41	1	191	0	0	233
April	34	10	109	0	0	153
May	31	41	24	0	0	96
June	35	144	4	0	0	183
July	39	245	0	0	0	284
August	39	219	0	0	0	258
September	32	81	5	0	0	118
October	31	29	55	0	0	115
November	38	1	155	0	0	194
December	43	0	264	0	0	307
Total	448	771	1,418	0	0	2,636

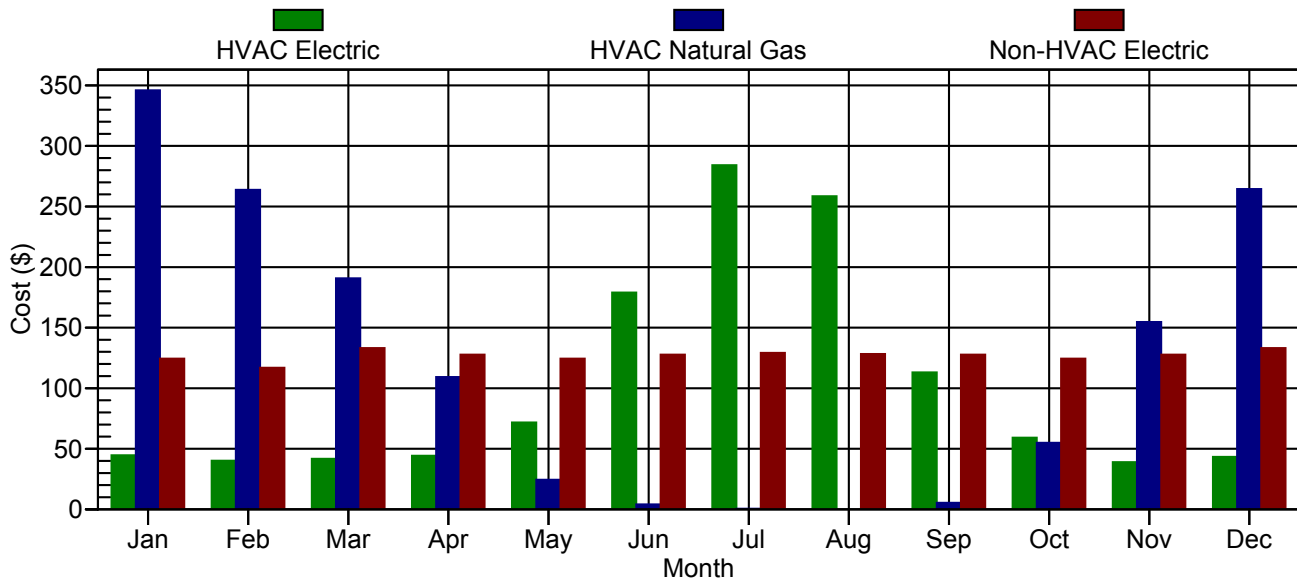
2. Non-HVAC Component Costs

Month	Lights (\$)	Electric Equipment (\$)	Misc. Electric (\$)	Misc. Fuel Use (\$)	Non-HVAC Total (\$)	Grand Total (\$)
January	90	34	0	0	124	515
February	85	32	0	0	117	421
March	97	36	0	0	133	366
April	93	35	0	0	128	281
May	90	34	0	0	124	220
June	93	35	0	0	128	311
July	94	35	0	0	129	413
August	93	35	0	0	128	386
September	93	35	0	0	128	246
October	90	34	0	0	124	239
November	93	35	0	0	128	322
December	97	36	0	0	133	440
Total	1,109	416	0	0	1,524	4,160

Monthly Energy Costs - Zone_1_DCV

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:29PM



1. HVAC Costs

Month	Electric (\$)	Natural Gas (\$)	Fuel Oil (\$)	Propane (\$)	Remote Hot Water (\$)	Remote Steam (\$)	Remote Chilled Water (\$)
January	45	346	0	0	0	0	0
February	40	264	0	0	0	0	0
March	42	191	0	0	0	0	0
April	44	109	0	0	0	0	0
May	72	24	0	0	0	0	0
June	179	4	0	0	0	0	0
July	284	0	0	0	0	0	0
August	258	0	0	0	0	0	0
September	113	5	0	0	0	0	0
October	59	55	0	0	0	0	0
November	39	155	0	0	0	0	0
December	43	264	0	0	0	0	0
Total	1,218	1,418	0	0	0	0	0

2. Non-HVAC Costs

Month	Electric (\$)	Natural Gas (\$)	Fuel Oil (\$)	Propane (\$)	Remote Hot Water (\$)	Remote Steam (\$)
January	124	0	0	0	0	0
February	117	0	0	0	0	0
March	133	0	0	0	0	0
April	128	0	0	0	0	0
May	124	0	0	0	0	0
June	128	0	0	0	0	0
July	129	0	0	0	0	0
August	128	0	0	0	0	0
September	128	0	0	0	0	0
October	124	0	0	0	0	0
November	128	0	0	0	0	0
December	133	0	0	0	0	0
Total	1,524	0	0	0	0	0

Monthly Energy Use by Energy Type - Zone_1_DCV

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Kitchen and Associates

06/08/2010
02:29PM

1. HVAC Energy Use

Month	Electric (kWh)	Natural Gas (Therm)	Fuel Oil (na)	Propane (na)	Remote HW (na)	Remote Steam (na)	Remote CW (na)
Jan	257	219	0	0	0	0	0
Feb	230	167	0	0	0	0	0
Mar	240	121	0	0	0	0	0
Apr	254	69	0	0	0	0	0
May	412	15	0	0	0	0	0
Jun	1,028	3	0	0	0	0	0
Jul	1,633	0	0	0	0	0	0
Aug	1,486	0	0	0	0	0	0
Sep	650	3	0	0	0	0	0
Oct	340	35	0	0	0	0	0
Nov	224	98	0	0	0	0	0
Dec	248	167	0	0	0	0	0
Totals	7,001	897	0	0	0	0	0

2. Non-HVAC Energy Use

Month	Electric (kWh)	Natural Gas (Therm)	Fuel Oil (na)	Propane (na)	Remote HW (na)	Remote Steam (na)
Jan	715	0	0	0	0	0
Feb	671	0	0	0	0	0
Mar	765	0	0	0	0	0
Apr	734	0	0	0	0	0
May	715	0	0	0	0	0
Jun	734	0	0	0	0	0
Jul	742	0	0	0	0	0
Aug	737	0	0	0	0	0
Sep	734	0	0	0	0	0
Oct	715	0	0	0	0	0
Nov	734	0	0	0	0	0
Dec	765	0	0	0	0	0
Totals	8,760	0	0	0	0	0

Monthly Energy Use by Component - Zone_1_DCV

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Kitchen and Associates

06/08/2010
02:29PM

1. Monthly Energy Use by System Component

Component	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Air System Fans (kWh)	257	230	235	197	178	203	225	226	181	175	219	246
<i>Cooling</i>												
Electric (kWh)	0	0	4	57	234	826	1408	1260	468	165	5	2
Natural Gas (Therm)	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 (na)	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 (Therm)	219	167	121	69	15	3	0	0	3	35	98	167
Fuel Oil (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	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
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)	520	488	556	534	520	534	540	536	534	520	534	556
Electric Eqpt. (kWh)	195	183	209	200	195	200	202	201	200	195	200	209
Misc. Electric (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
<i>Misc. Fuel</i>												
Natural Gas (Therm)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	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

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:29PM

Table 1. Annual Costs

Component	Zone_1_DCV (\$)
Air System Fans	448
Cooling	771
Heating	1,418
Pumps	0
Cooling Tower Fans	0
HVAC Sub-Total	2,636
Lights	1,109
Electric Equipment	416
Misc. Electric	0
Misc. Fuel Use	0
Non-HVAC Sub-Total	1,524
Grand Total	4,160

Table 2. Annual Cost per Unit Floor Area

Component	Zone_1_DCV (\$/ft²)
Air System Fans	0.411
Cooling	0.707
Heating	1.301
Pumps	0.000
Cooling Tower Fans	0.000
HVAC Sub-Total	2.418
Lights	1.017
Electric Equipment	0.381
Misc. Electric	0.000
Misc. Fuel Use	0.000
Non-HVAC Sub-Total	1.398
Grand Total	3.817
Gross Floor Area (ft²)	1090.0
Conditioned Floor Area (ft²)	1090.0

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

Table 3. Component Cost as a Percentage of Total Cost

Component	Zone_1_DCV (%)
Air System Fans	10.8
Cooling	18.5
Heating	34.1
Pumps	0.0
Cooling Tower Fans	0.0
HVAC Sub-Total	63.4
Lights	26.6
Electric Equipment	10.0
Misc. Electric	0.0
Misc. Fuel Use	0.0
Non-HVAC Sub-Total	36.6
Grand Total	100.0

Annual Energy and Emissions Summary

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:29PM

Table 1. Annual Costs

Component	Zone_1_DCV (\$)
HVAC Components	
Electric	1,218
Natural Gas	1,418
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Remote CW	0
HVAC Sub-Total	2,636
Non-HVAC Components	
Electric	1,524
Natural Gas	0
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Non-HVAC Sub-Total	1,524
Grand Total	4,160

Table 2. Annual Energy Consumption

Component	Zone_1_DCV
HVAC Components	
Electric (kWh)	7,001
Natural Gas (Therm)	897
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0
Non-HVAC Components	
Electric (kWh)	8,760
Natural Gas (Therm)	0
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Totals	
Electric (kWh)	15,761
Natural Gas (Therm)	897
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0

Annual Energy and Emissions Summary

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:29PM

Table 3. Annual Emissions

Component	Zone_1_DCV
CO2 Equivalent (lb)	0

Table 4. Annual Cost per Unit Floor Area

Component	Zone_1_DCV (\$/ft²)
HVAC Components	
Electric	1.118
Natural Gas	1.301
Fuel Oil	0.000
Propane	0.000
Remote HW	0.000
Remote Steam	0.000
Remote CW	0.000
HVAC Sub-Total	2.418
Non-HVAC Components	
Electric	1.398
Natural Gas	0.000
Fuel Oil	0.000
Propane	0.000
Remote HW	0.000
Remote Steam	0.000
Non-HVAC Sub-Total	1.398
Grand Total	3.817
Gross Floor Area (ft²)	1090.0
Conditioned Floor Area (ft²)	1090.0

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

Table 5. Component Cost as a Percentage of Total Cost

Component	Zone_1_DCV (%)
HVAC Components	
Electric	29.3
Natural Gas	34.1
Fuel Oil	0.0
Propane	0.0
Remote HW	0.0
Remote Steam	0.0
Remote CW	0.0
HVAC Sub-Total	63.4
Non-HVAC Components	
Electric	36.6
Natural Gas	0.0
Fuel Oil	0.0
Propane	0.0
Remote HW	0.0
Remote Steam	0.0
Non-HVAC Sub-Total	36.6
Grand Total	100.0

APPENDIX G

ECM-4 Modify HVAC Unit Control (Zone 1)

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

ECM-4 Modify HVAC Unit Control (Zone 1)

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 Town Hall
CHA Project #20997

ECM-4 Modify HVAC Unit Control (Zone 1)

Annual Energy Use Comparison			
	Electricity kWh	Natural Gas therms	Cost \$
Existing Manual Thermostat Control	6,102	1,021	\$ 2,676.00
Proposed Programmable Thermostat	5,574	545	\$ 1,832.00
Difference	528	476	\$ 844.00

Zone_1_NightSB Input Data

Project Name: Andover - Town Hall
Prepared by: Kitchen and Associates

06/08/2010
02:39PM

1. General Details:

Air System Name **Zone_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 **5** %
Outdoor Air CO2 Level **400** ppm

Economizer Data:

Control **Integrated dry-bulb control**
Upper Cutoff **75.0** °F
Lower Cutoff **-60.0** °F

Ventilation Reclaim Data:

Reclaim Type **Sensible Heat**
Thermal Efficiency **80** %
Input kW **0.200** kW
Schedule **JFMAMJJASOND**

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 - Natural Gas**
Schedule **JFMAMJJASOND**
Capacity Control **Cycled or Staged Capacity - Fan On**

Supply Fan Data:

Fan Type **Forward Curved**
Configuration **Draw-thru**
Fan Performance **1.10** 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 **Ducted Return**

3. Zone Components:

Space Assignments:

Zone 1: BLD1-F001-Z01	
Zone_1_NightSB	x1

Thermostats and Zone Data:

Zone **All**
Cooling T-stat: Occ. **76.0** °F
Cooling T-stat: Unocc. **80.0** °F
Heating T-stat: Occ. **72.0** °F
Heating T-stat: Unocc. **62.0** °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**

Zone_1_NightSB Input Data

Project Name: Andover - Town Hall
Prepared by: Kitchen and Associates

06/08/2010
02:39PM

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

4. Sizing Data (User-Modified):

System Sizing Data:

Cooling Supply Temperature 58.0 °F
Supply Fan Airflow 2580.1 CFM
Ventilation Airflow 1125.0 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	2580.1	-	-	

5. Equipment Data

Central Cooling Unit - Air-Cooled DX

Design OAT 95.0 °F
Equipment Sizing User-Defined
Gross Cooling Capacity 75.5 MBH
ARI Performance Rating 9.00 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 135.0 MBH
Average Efficiency 78.0 %
Misc. Electric 0.000 kW

Billing Details - Electric - Zone_1_NightSB

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:40PM

1. Component Charges

Billing Period	Energy Charges (\$)	Demand Charges (\$)	Customer Charges (\$)	Taxes (\$)	Total Charge (\$)
Jan	155	0	0	0	155
Feb	145	0	0	0	145
Mar	163	0	0	0	163
Apr	159	0	0	0	159
May	178	0	0	0	178
Jun	279	0	0	0	279
Jul	367	0	0	0	367
Aug	341	0	0	0	341
Sep	222	0	0	0	222
Oct	167	0	0	0	167
Nov	156	0	0	0	156
Dec	163	0	0	0	163
Totals	2,494	0	0	0	2,494

2. Totals

Billing Period	Total Charges (\$)	Total Consumption (kWh)	Avg Price (\$/kWh)
Jan	155	890	0.1740
Feb	145	832	0.1740
Mar	163	935	0.1740
Apr	159	914	0.1740
May	178	1,025	0.1740
Jun	279	1,602	0.1740
Jul	367	2,109	0.1740
Aug	341	1,962	0.1740
Sep	222	1,273	0.1740
Oct	167	960	0.1740
Nov	156	894	0.1740
Dec	163	937	0.1740
Totals	2,494	14,333	0.1740

3. Consumption Totals

Billing Period	Peak (kWh)	Mid-Peak (kWh)	Normal Peak (kWh)	Off-Peak (kWh)	Overall (kWh)
Jan	0	0	0	0	890
Feb	0	0	0	0	832
Mar	0	0	0	0	935
Apr	0	0	0	0	914
May	0	0	0	0	1,025
Jun	0	0	0	0	1,602
Jul	0	0	0	0	2,109
Aug	0	0	0	0	1,962
Sep	0	0	0	0	1,273
Oct	0	0	0	0	960
Nov	0	0	0	0	894
Dec	0	0	0	0	937
Totals	0	0	0	0	14,333

Billing Details - Electric - Zone_1_NightSB

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:40PM

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	3.5
Feb	0.0	0.0	0.0	0.0	3.5
Mar	0.0	0.0	0.0	0.0	3.6
Apr	0.0	0.0	0.0	0.0	7.1
May	0.0	0.0	0.0	0.0	11.0
Jun	0.0	0.0	0.0	0.0	10.7
Jul	0.0	0.0	0.0	0.0	11.3
Aug	0.0	0.0	0.0	0.0	10.8
Sep	0.0	0.0	0.0	0.0	9.9
Oct	0.0	0.0	0.0	0.0	8.9
Nov	0.0	0.0	0.0	0.0	3.5
Dec	0.0	0.0	0.0	0.0	3.5

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	3.5
Feb	0.0	0.0	0.0	0.0	3.5
Mar	0.0	0.0	0.0	0.0	3.6
Apr	0.0	0.0	0.0	0.0	7.1
May	0.0	0.0	0.0	0.0	11.0
Jun	0.0	0.0	0.0	0.0	10.7
Jul	0.0	0.0	0.0	0.0	11.3
Aug	0.0	0.0	0.0	0.0	10.8
Sep	0.0	0.0	0.0	0.0	9.9
Oct	0.0	0.0	0.0	0.0	8.9
Nov	0.0	0.0	0.0	0.0	3.5
Dec	0.0	0.0	0.0	0.0	3.5

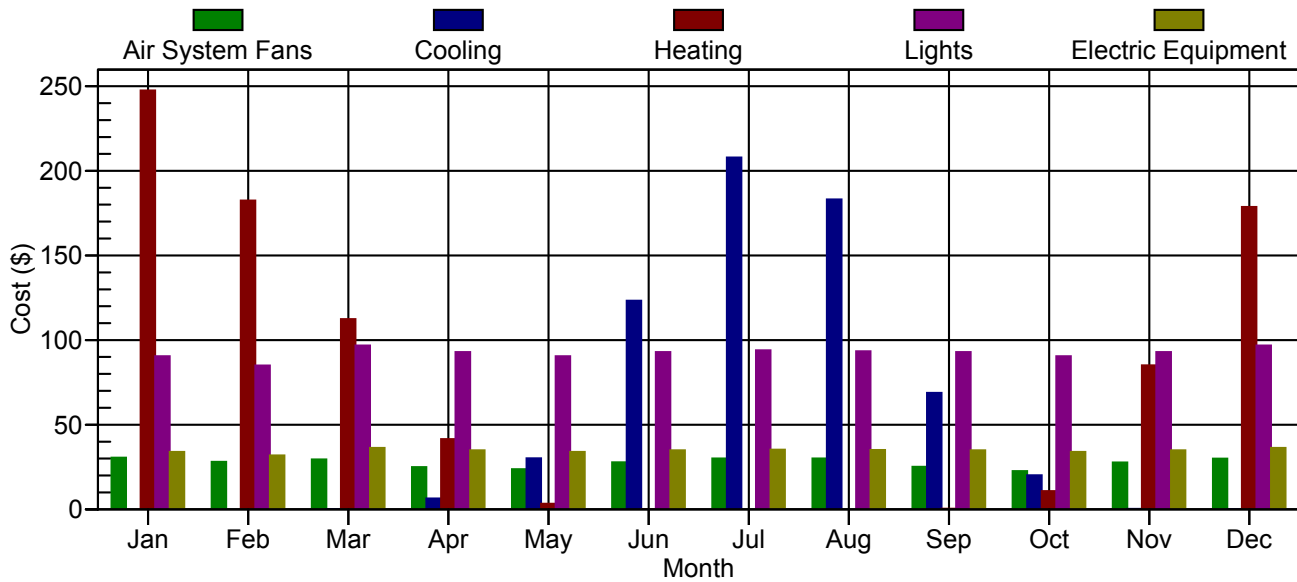
6. Time Of Maximum Demands

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	1/4/1400
Feb	n/a	n/a	n/a	n/a	2/1/1400
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	5/17/1500
Jun	n/a	n/a	n/a	n/a	6/3/1600
Jul	n/a	n/a	n/a	n/a	7/1/1600
Aug	n/a	n/a	n/a	n/a	8/4/1600
Sep	n/a	n/a	n/a	n/a	9/23/1600
Oct	n/a	n/a	n/a	n/a	10/4/1600
Nov	n/a	n/a	n/a	n/a	11/1/1400
Dec	n/a	n/a	n/a	n/a	12/1/1400

Monthly Component Costs - Zone_1_NightSB

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:40PM



1. HVAC Component Costs

Month	Air System Fans (\$)	Cooling (\$)	Heating (\$)	Pumps (\$)	Cooling Towers (\$)	HVAC Total (\$)
January	31	0	248	0	0	279
February	28	0	182	0	0	210
March	29	0	112	0	0	141
April	25	6	42	0	0	73
May	24	30	3	0	0	57
June	28	123	0	0	0	151
July	30	208	0	0	0	238
August	30	183	0	0	0	213
September	25	69	0	0	0	94
October	23	20	11	0	0	54
November	28	0	85	0	0	113
December	30	0	179	0	0	209
Total	330	640	862	0	0	1,832

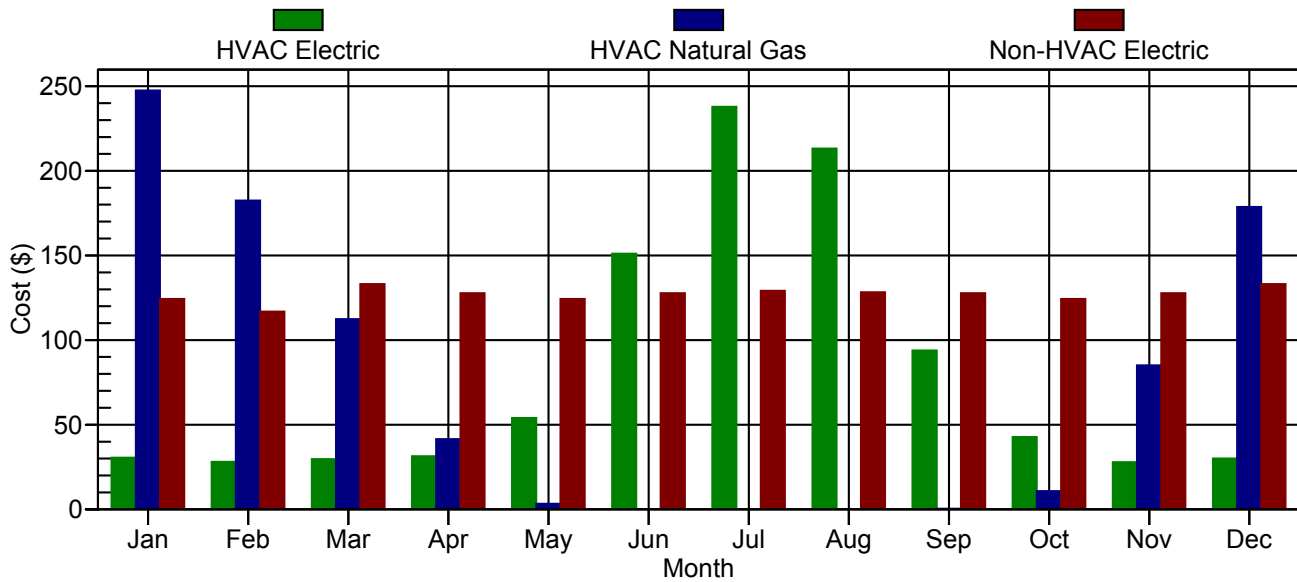
2. Non-HVAC Component Costs

Month	Lights (\$)	Electric Equipment (\$)	Misc. Electric (\$)	Misc. Fuel Use (\$)	Non-HVAC Total (\$)	Grand Total (\$)
January	90	34	0	0	124	403
February	85	32	0	0	117	327
March	97	36	0	0	133	274
April	93	35	0	0	128	201
May	90	34	0	0	124	181
June	93	35	0	0	128	279
July	94	35	0	0	129	367
August	93	35	0	0	128	341
September	93	35	0	0	128	222
October	90	34	0	0	124	178
November	93	35	0	0	128	241
December	97	36	0	0	133	342
Total	1,109	416	0	0	1,524	3,356

Monthly Energy Costs - Zone_1_NightSB

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:40PM



1. HVAC Costs

Month	Electric (\$)	Natural Gas (\$)	Fuel Oil (\$)	Propane (\$)	Remote Hot Water (\$)	Remote Steam (\$)	Remote Chilled Water (\$)
January	31	248	0	0	0	0	0
February	28	182	0	0	0	0	0
March	30	112	0	0	0	0	0
April	31	42	0	0	0	0	0
May	54	3	0	0	0	0	0
June	151	0	0	0	0	0	0
July	238	0	0	0	0	0	0
August	213	0	0	0	0	0	0
September	94	0	0	0	0	0	0
October	43	11	0	0	0	0	0
November	28	85	0	0	0	0	0
December	30	179	0	0	0	0	0
Total	970	862	0	0	0	0	0

2. Non-HVAC Costs

Month	Electric (\$)	Natural Gas (\$)	Fuel Oil (\$)	Propane (\$)	Remote Hot Water (\$)	Remote Steam (\$)
January	124	0	0	0	0	0
February	117	0	0	0	0	0
March	133	0	0	0	0	0
April	128	0	0	0	0	0
May	124	0	0	0	0	0
June	128	0	0	0	0	0
July	129	0	0	0	0	0
August	128	0	0	0	0	0
September	128	0	0	0	0	0
October	124	0	0	0	0	0
November	128	0	0	0	0	0
December	133	0	0	0	0	0
Total	1,524	0	0	0	0	0

Monthly Energy Use by Energy Type - Zone_1_NightSB

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Kitchen and Associates

06/08/2010
02:40PM

1. HVAC Energy Use

Month	Electric (kWh)	Natural Gas (Therm)	Fuel Oil (na)	Propane (na)	Remote HW (na)	Remote Steam (na)	Remote CW (na)
Jan	175	157	0	0	0	0	0
Feb	161	115	0	0	0	0	0
Mar	170	71	0	0	0	0	0
Apr	180	26	0	0	0	0	0
May	310	2	0	0	0	0	0
Jun	868	0	0	0	0	0	0
Jul	1,367	0	0	0	0	0	0
Aug	1,225	0	0	0	0	0	0
Sep	539	0	0	0	0	0	0
Oct	245	7	0	0	0	0	0
Nov	160	54	0	0	0	0	0
Dec	172	113	0	0	0	0	0
Totals	5,574	545	0	0	0	0	0

2. Non-HVAC Energy Use

Month	Electric (kWh)	Natural Gas (Therm)	Fuel Oil (na)	Propane (na)	Remote HW (na)	Remote Steam (na)
Jan	715	0	0	0	0	0
Feb	671	0	0	0	0	0
Mar	765	0	0	0	0	0
Apr	734	0	0	0	0	0
May	715	0	0	0	0	0
Jun	734	0	0	0	0	0
Jul	742	0	0	0	0	0
Aug	737	0	0	0	0	0
Sep	734	0	0	0	0	0
Oct	715	0	0	0	0	0
Nov	734	0	0	0	0	0
Dec	765	0	0	0	0	0
Totals	8,760	0	0	0	0	0

Monthly Energy Use by Component - Zone_1_NightSB

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Kitchen and Associates

06/08/2010
02:40PM

1. Monthly Energy Use by System Component

Component	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Air System Fans (kWh)	175	161	169	143	137	160	172	173	144	130	159	172
<i>Cooling</i>												
Electric (kWh)	0	0	1	37	173	708	1194	1052	395	116	2	0
Natural Gas (Therm)	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 (na)	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 (Therm)	157	115	71	26	2	0	0	0	0	7	54	113
Fuel Oil (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	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
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)	520	488	556	534	520	534	540	536	534	520	534	556
Electric Eqpt. (kWh)	195	183	209	200	195	200	202	201	200	195	200	209
Misc. Electric (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
<i>Misc. Fuel</i>												
Natural Gas (Therm)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	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

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:40PM

Table 1. Annual Costs

Component	Zone_1_NightSB (\$)
Air System Fans	330
Cooling	640
Heating	862
Pumps	0
Cooling Tower Fans	0
HVAC Sub-Total	1,832
Lights	1,109
Electric Equipment	416
Misc. Electric	0
Misc. Fuel Use	0
Non-HVAC Sub-Total	1,524
Grand Total	3,356

Table 2. Annual Cost per Unit Floor Area

Component	Zone_1_NightSB (\$/ft²)
Air System Fans	0.302
Cooling	0.587
Heating	0.791
Pumps	0.000
Cooling Tower Fans	0.000
HVAC Sub-Total	1.680
Lights	1.017
Electric Equipment	0.381
Misc. Electric	0.000
Misc. Fuel Use	0.000
Non-HVAC Sub-Total	1.398
Grand Total	3.079
Gross Floor Area (ft²)	1090.0
Conditioned Floor Area (ft²)	1090.0

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

Table 3. Component Cost as a Percentage of Total Cost

Component	Zone_1_NightSB (%)
Air System Fans	9.8
Cooling	19.1
Heating	25.7
Pumps	0.0
Cooling Tower Fans	0.0
HVAC Sub-Total	54.6
Lights	33.0
Electric Equipment	12.4
Misc. Electric	0.0
Misc. Fuel Use	0.0
Non-HVAC Sub-Total	45.4
Grand Total	100.0

Annual Energy and Emissions Summary

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:40PM

Table 1. Annual Costs

Component	Zone_1_NightSB (\$)
HVAC Components	
Electric	970
Natural Gas	862
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Remote CW	0
HVAC Sub-Total	1,832
Non-HVAC Components	
Electric	1,524
Natural Gas	0
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Non-HVAC Sub-Total	1,524
Grand Total	3,356

Table 2. Annual Energy Consumption

Component	Zone_1_NightSB
HVAC Components	
Electric (kWh)	5,574
Natural Gas (Therm)	545
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0
Non-HVAC Components	
Electric (kWh)	8,760
Natural Gas (Therm)	0
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Totals	
Electric (kWh)	14,334
Natural Gas (Therm)	545
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0

Annual Energy and Emissions Summary

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:40PM

Table 3. Annual Emissions

Component	Zone_1_NightSB
CO2 Equivalent (lb)	0

Table 4. Annual Cost per Unit Floor Area

Component	Zone_1_NightSB (\$/ft²)
HVAC Components	
Electric	0.890
Natural Gas	0.791
Fuel Oil	0.000
Propane	0.000
Remote HW	0.000
Remote Steam	0.000
Remote CW	0.000
HVAC Sub-Total	1.680
Non-HVAC Components	
Electric	1.398
Natural Gas	0.000
Fuel Oil	0.000
Propane	0.000
Remote HW	0.000
Remote Steam	0.000
Non-HVAC Sub-Total	1.398
Grand Total	3.079
Gross Floor Area (ft²)	1090.0
Conditioned Floor Area (ft²)	1090.0

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

Table 5. Component Cost as a Percentage of Total Cost

Component	Zone_1_NightSB (%)
HVAC Components	
Electric	28.9
Natural Gas	25.7
Fuel Oil	0.0
Propane	0.0
Remote HW	0.0
Remote Steam	0.0
Remote CW	0.0
HVAC Sub-Total	54.6
Non-HVAC Components	
Electric	45.4
Natural Gas	0.0
Fuel Oil	0.0
Propane	0.0
Remote HW	0.0
Remote Steam	0.0
Non-HVAC Sub-Total	45.4
Grand Total	100.0

APPENDIX H

ECM-5 Modify HVAC Unit Control (Zone 2)

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

ECM-5 Modify HVAC Unit Control (Zone 2)

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 Town Hall
CHA Project #20997

ECM-5 Modify HVAC Unit Control (Zone 2)

Annual Energy Use Comparison			
	Electricity kWh	Natural Gas therms	Cost \$
Existing Manual Thermostat Control	3,855	164	\$ 930.00
Proposed Programmable Thermostat	3,592	90	\$ 767.00
Difference	263	74	\$ 163.00

Zone_2_NightSB Input Data

Project Name: Andover - Town Hall
Prepared by: Kitchen and Associates

06/08/2010
02:41PM

1. General Details:

Air System Name **Zone_2_NightSB**
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

Ventilation Reclaim Data:

Reclaim Type **Sensible Heat**
Thermal Efficiency **80** %
Input kW **0.200** kW
Schedule **JFMAMJJASOND**

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 - Natural Gas**
Schedule **JFMAMJJASOND**
Capacity Control **Cycled or Staged Capacity - Fan On**

Supply Fan Data:

Fan Type **Forward Curved**
Configuration **Draw-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-F001-Z02	
Zone_2_NightSB	x1

Thermostats and Zone Data:

Zone **All**
Cooling T-stat: Occ. **76.0** °F
Cooling T-stat: Unocc. **80.0** °F
Heating T-stat: Occ. **72.0** °F
Heating T-stat: Unocc. **62.0** °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 Office HVAC**
Unoccupied Cooling is **Available**

Supply Terminals Data:

Zone **All**

Zone_2_NightSB Input Data

Project Name: Andover - Town Hall
Prepared by: Kitchen and Associates

06/08/2010
02:41PM

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**

4. Sizing Data (Computer-Generated):

System Sizing Data:

Cooling Supply Temperature **58.0** °F
Supply Fan Airflow **1313.4** CFM
Ventilation Airflow **210.0** 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	1313.4	-	-	

5. Equipment Data

Central Cooling Unit - Air-Cooled DX

Design OAT **95.0** °F
Equipment Sizing **User-Defined**
Gross Cooling Capacity **33.0** MBH
ARI Performance Rating **11.35** SEER
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 **75.5** MBH
Average Efficiency **94.0** %
Misc. Electric **0.000** kW

Billing Details - Electric - Zone_2_NightSB

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:41PM

1. Component Charges

Billing Period	Energy Charges (\$)	Demand Charges (\$)	Customer Charges (\$)	Taxes (\$)	Total Charge (\$)
Jan	324	0	0	0	324
Feb	304	0	0	0	304
Mar	345	0	0	0	345
Apr	335	0	0	0	335
May	347	0	0	0	347
Jun	391	0	0	0	391
Jul	418	0	0	0	418
Aug	411	0	0	0	411
Sep	373	0	0	0	373
Oct	335	0	0	0	335
Nov	331	0	0	0	331
Dec	346	0	0	0	346
Totals	4,261	0	0	0	4,261

2. Totals

Billing Period	Total Charges (\$)	Total Consumption (kWh)	Avg Price (\$/kWh)
Jan	324	1,862	0.1740
Feb	304	1,746	0.1740
Mar	345	1,982	0.1740
Apr	335	1,927	0.1740
May	347	1,993	0.1740
Jun	391	2,248	0.1740
Jul	418	2,404	0.1740
Aug	411	2,363	0.1740
Sep	373	2,145	0.1740
Oct	335	1,924	0.1740
Nov	331	1,900	0.1740
Dec	346	1,991	0.1740
Totals	4,261	24,487	0.1740

3. Consumption Totals

Billing Period	Peak (kWh)	Mid-Peak (kWh)	Normal Peak (kWh)	Off-Peak (kWh)	Overall (kWh)
Jan	0	0	0	0	1,862
Feb	0	0	0	0	1,746
Mar	0	0	0	0	1,982
Apr	0	0	0	0	1,927
May	0	0	0	0	1,993
Jun	0	0	0	0	2,248
Jul	0	0	0	0	2,404
Aug	0	0	0	0	2,363
Sep	0	0	0	0	2,145
Oct	0	0	0	0	1,924
Nov	0	0	0	0	1,900
Dec	0	0	0	0	1,991
Totals	0	0	0	0	24,487

Billing Details - Electric - Zone_2_NightSB

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:41PM

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	6.9
Feb	0.0	0.0	0.0	0.0	6.9
Mar	0.0	0.0	0.0	0.0	7.4
Apr	0.0	0.0	0.0	0.0	8.3
May	0.0	0.0	0.0	0.0	9.6
Jun	0.0	0.0	0.0	0.0	9.4
Jul	0.0	0.0	0.0	0.0	9.7
Aug	0.0	0.0	0.0	0.0	9.5
Sep	0.0	0.0	0.0	0.0	8.9
Oct	0.0	0.0	0.0	0.0	8.9
Nov	0.0	0.0	0.0	0.0	7.5
Dec	0.0	0.0	0.0	0.0	7.1

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	6.9
Feb	0.0	0.0	0.0	0.0	6.9
Mar	0.0	0.0	0.0	0.0	7.4
Apr	0.0	0.0	0.0	0.0	8.3
May	0.0	0.0	0.0	0.0	9.6
Jun	0.0	0.0	0.0	0.0	9.4
Jul	0.0	0.0	0.0	0.0	9.7
Aug	0.0	0.0	0.0	0.0	9.5
Sep	0.0	0.0	0.0	0.0	8.9
Oct	0.0	0.0	0.0	0.0	8.9
Nov	0.0	0.0	0.0	0.0	7.5
Dec	0.0	0.0	0.0	0.0	7.1

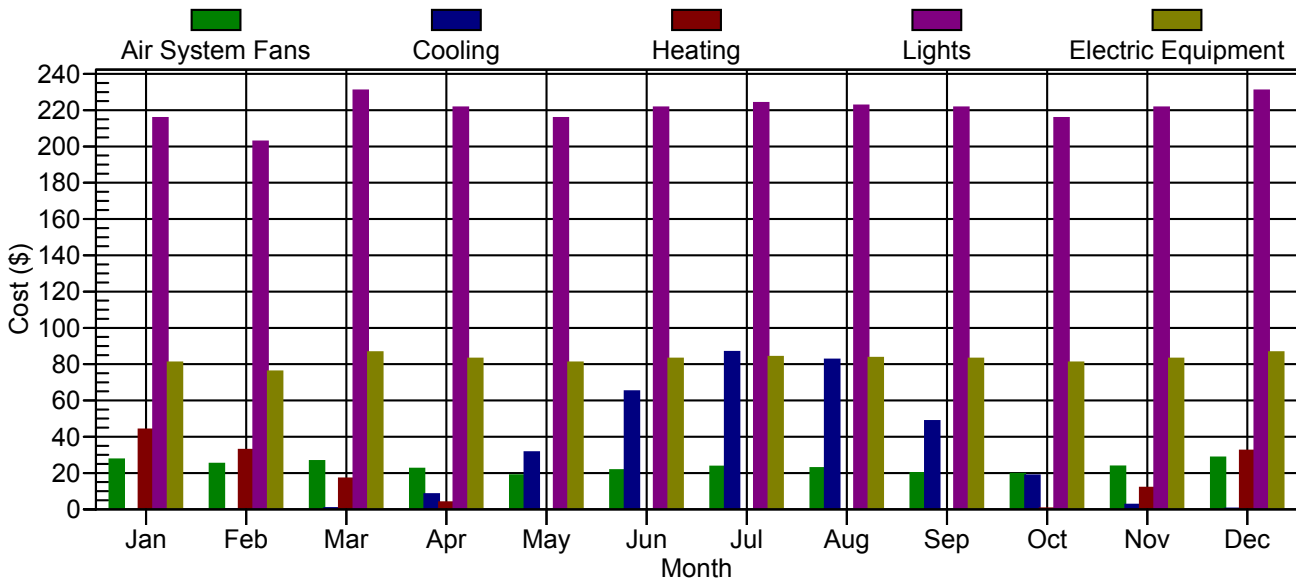
6. Time Of Maximum Demands

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	7/1/1600
Aug	n/a	n/a	n/a	n/a	8/30/1400
Sep	n/a	n/a	n/a	n/a	9/23/1600
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	12/3/1600

Monthly Component Costs - Zone_2_NightSB

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:41PM



1. HVAC Component Costs

Month	Air System Fans (\$)	Cooling (\$)	Heating (\$)	Pumps (\$)	Cooling Towers (\$)	HVAC Total (\$)
January	27	0	44	0	0	71
February	25	0	33	0	0	58
March	27	1	17	0	0	45
April	22	8	4	0	0	34
May	19	31	0	0	0	50
June	22	65	0	0	0	87
July	23	87	0	0	0	110
August	23	82	0	0	0	105
September	20	49	0	0	0	69
October	20	19	1	0	0	40
November	24	3	12	0	0	39
December	29	0	32	0	0	61
Total	280	345	142	0	0	767

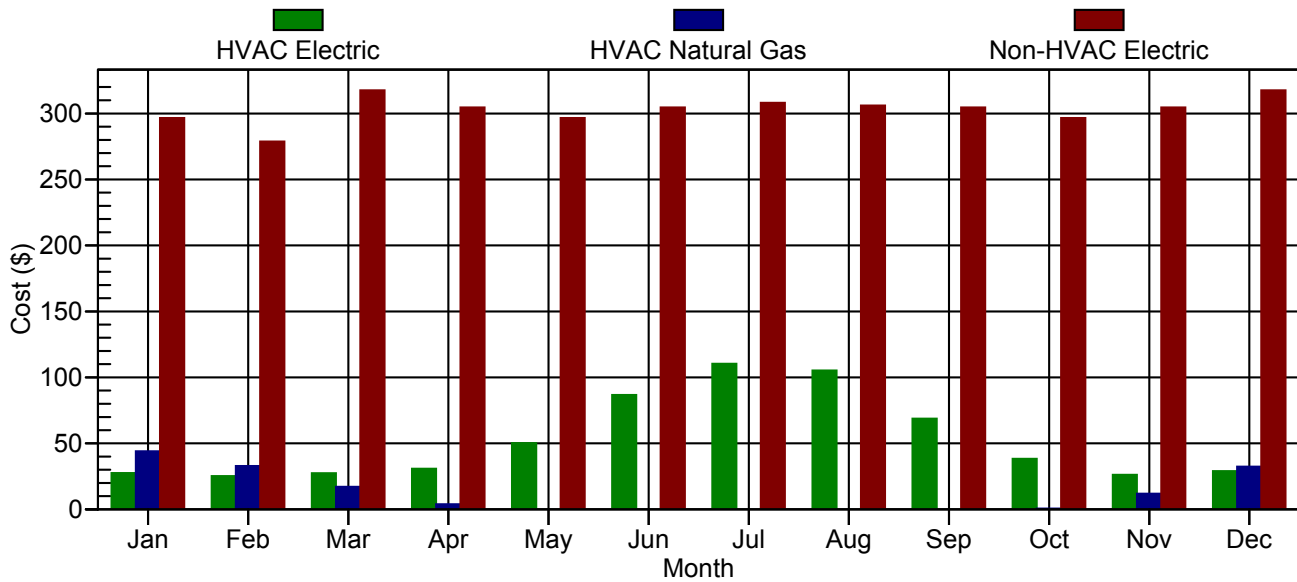
2. Non-HVAC Component Costs

Month	Lights (\$)	Electric Equipment (\$)	Misc. Electric (\$)	Misc. Fuel Use (\$)	Non-HVAC Total (\$)	Grand Total (\$)
January	216	81	0	0	297	368
February	203	76	0	0	279	337
March	231	87	0	0	317	362
April	221	83	0	0	305	339
May	216	81	0	0	297	347
June	221	83	0	0	305	392
July	224	84	0	0	308	418
August	223	83	0	0	306	411
September	221	83	0	0	305	374
October	216	81	0	0	297	337
November	221	83	0	0	305	344
December	231	87	0	0	317	378
Total	2,644	992	0	0	3,636	4,403

Monthly Energy Costs - Zone_2_NightSB

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:41PM



1. HVAC Costs

Month	Electric (\$)	Natural Gas (\$)	Fuel Oil (\$)	Propane (\$)	Remote Hot Water (\$)	Remote Steam (\$)	Remote Chilled Water (\$)
January	27	44	0	0	0	0	0
February	25	33	0	0	0	0	0
March	27	17	0	0	0	0	0
April	31	4	0	0	0	0	0
May	50	0	0	0	0	0	0
June	87	0	0	0	0	0	0
July	110	0	0	0	0	0	0
August	105	0	0	0	0	0	0
September	69	0	0	0	0	0	0
October	38	1	0	0	0	0	0
November	26	12	0	0	0	0	0
December	29	32	0	0	0	0	0
Total	625	142	0	0	0	0	0

2. Non-HVAC Costs

Month	Electric (\$)	Natural Gas (\$)	Fuel Oil (\$)	Propane (\$)	Remote Hot Water (\$)	Remote Steam (\$)
January	297	0	0	0	0	0
February	279	0	0	0	0	0
March	317	0	0	0	0	0
April	305	0	0	0	0	0
May	297	0	0	0	0	0
June	305	0	0	0	0	0
July	308	0	0	0	0	0
August	306	0	0	0	0	0
September	305	0	0	0	0	0
October	297	0	0	0	0	0
November	305	0	0	0	0	0
December	317	0	0	0	0	0
Total	3,636	0	0	0	0	0

Monthly Energy Use by Energy Type - Zone_2_NightSB

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:41PM

1. HVAC Energy Use

Month	Electric (kWh)	Natural Gas (Therm)	Fuel Oil (na)	Propane (na)	Remote HW (na)	Remote Steam (na)	Remote CW (na)
Jan	158	28	0	0	0	0	0
Feb	145	21	0	0	0	0	0
Mar	157	11	0	0	0	0	0
Apr	177	2	0	0	0	0	0
May	289	0	0	0	0	0	0
Jun	498	0	0	0	0	0	0
Jul	634	0	0	0	0	0	0
Aug	604	0	0	0	0	0	0
Sep	395	0	0	0	0	0	0
Oct	220	0	0	0	0	0	0
Nov	150	7	0	0	0	0	0
Dec	167	20	0	0	0	0	0
Totals	3,592	90	0	0	0	0	0

2. Non-HVAC Energy Use

Month	Electric (kWh)	Natural Gas (Therm)	Fuel Oil (na)	Propane (na)	Remote HW (na)	Remote Steam (na)
Jan	1,705	0	0	0	0	0
Feb	1,602	0	0	0	0	0
Mar	1,825	0	0	0	0	0
Apr	1,750	0	0	0	0	0
May	1,705	0	0	0	0	0
Jun	1,750	0	0	0	0	0
Jul	1,770	0	0	0	0	0
Aug	1,759	0	0	0	0	0
Sep	1,750	0	0	0	0	0
Oct	1,705	0	0	0	0	0
Nov	1,750	0	0	0	0	0
Dec	1,825	0	0	0	0	0
Totals	20,895	0	0	0	0	0

Monthly Energy Use by Component - Zone_2_NightSB

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Kitchen and Associates

06/08/2010
02:41PM

1. Monthly Energy Use by System Component

Component	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Air System Fans (kWh)	158	144	153	129	108	124	135	130	115	112	135	164
<i>Cooling</i>												
Electric (kWh)	0	0	4	48	181	374	499	474	280	107	15	3
Natural Gas (Therm)	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 (na)	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 (Therm)	28	21	11	2	0	0	0	0	0	0	7	20
Fuel Oil (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	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
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)	1240	1165	1327	1273	1240	1273	1288	1279	1273	1240	1273	1327
Electric Eqpt. (kWh)	465	437	498	477	465	477	483	480	477	465	477	498
Misc. Electric (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
<i>Misc. Fuel</i>												
Natural Gas (Therm)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	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

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:41PM

Table 1. Annual Costs

Component	Zone_2_NightSB (\$)
Air System Fans	280
Cooling	345
Heating	142
Pumps	0
Cooling Tower Fans	0
HVAC Sub-Total	767
Lights	2,644
Electric Equipment	992
Misc. Electric	0
Misc. Fuel Use	0
Non-HVAC Sub-Total	3,636
Grand Total	4,403

Table 2. Annual Cost per Unit Floor Area

Component	Zone_2_NightSB (\$/ft²)
Air System Fans	0.108
Cooling	0.133
Heating	0.055
Pumps	0.000
Cooling Tower Fans	0.000
HVAC Sub-Total	0.295
Lights	1.017
Electric Equipment	0.381
Misc. Electric	0.000
Misc. Fuel Use	0.000
Non-HVAC Sub-Total	1.398
Grand Total	1.694
Gross Floor Area (ft²)	2600.0
Conditioned Floor Area (ft²)	2600.0

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

Table 3. Component Cost as a Percentage of Total Cost

Component	Zone_2_NightSB (%)
Air System Fans	6.4
Cooling	7.8
Heating	3.2
Pumps	0.0
Cooling Tower Fans	0.0
HVAC Sub-Total	17.4
Lights	60.1
Electric Equipment	22.5
Misc. Electric	0.0
Misc. Fuel Use	0.0
Non-HVAC Sub-Total	82.6
Grand Total	100.0

Annual Energy and Emissions Summary

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:41PM

Table 1. Annual Costs

Component	Zone_2_NightSB (\$)
HVAC Components	
Electric	625
Natural Gas	142
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Remote CW	0
HVAC Sub-Total	767
Non-HVAC Components	
Electric	3,636
Natural Gas	0
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Non-HVAC Sub-Total	3,636
Grand Total	4,403

Table 2. Annual Energy Consumption

Component	Zone_2_NightSB
HVAC Components	
Electric (kWh)	3,592
Natural Gas (Therm)	90
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0
Non-HVAC Components	
Electric (kWh)	20,895
Natural Gas (Therm)	0
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Totals	
Electric (kWh)	24,487
Natural Gas (Therm)	90
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0

Annual Energy and Emissions Summary

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:41PM

Table 3. Annual Emissions

Component	Zone_2_NightSB
CO2 Equivalent (lb)	0

Table 4. Annual Cost per Unit Floor Area

Component	Zone_2_NightSB (\$/ft²)
HVAC Components	
Electric	0.240
Natural Gas	0.055
Fuel Oil	0.000
Propane	0.000
Remote HW	0.000
Remote Steam	0.000
Remote CW	0.000
HVAC Sub-Total	0.295
Non-HVAC Components	
Electric	1.398
Natural Gas	0.000
Fuel Oil	0.000
Propane	0.000
Remote HW	0.000
Remote Steam	0.000
Non-HVAC Sub-Total	1.398
Grand Total	1.694
Gross Floor Area (ft²)	2600.0
Conditioned Floor Area (ft²)	2600.0

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

Table 5. Component Cost as a Percentage of Total Cost

Component	Zone_2_NightSB (%)
HVAC Components	
Electric	14.2
Natural Gas	3.2
Fuel Oil	0.0
Propane	0.0
Remote HW	0.0
Remote Steam	0.0
Remote CW	0.0
HVAC Sub-Total	17.4
Non-HVAC Components	
Electric	82.6
Natural Gas	0.0
Fuel Oil	0.0
Propane	0.0
Remote HW	0.0
Remote Steam	0.0
Non-HVAC Sub-Total	82.6
Grand Total	100.0

APPENDIX I

ECM-6 Modify HVAC Unit Control (Zone 3)

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

ECM-6 Modify HVAC Unit Control (Zone 3)

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 Town Hall
CHA Project #20997

ECM-6 Modify HVAC Unit Control (Zone 3)

Annual Energy Use Comparison			
	Electricity kWh	Natural Gas therms	Cost \$
Existing Manual Thermostat Control	6,444	153	\$ 1,362.00
Proposed Programmable Thermostat	5,923	104	\$ 1,194.00
Difference	521	49	\$ 168.00

Zone_3_NightSB Input Data

Project Name: Andover - Town Hall
Prepared by: Kitchen and Associates

06/08/2010
02:42PM

1. General Details:

Air System Name **Zone_3_NightSB**
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

Ventilation Reclaim Data:

Reclaim Type **Sensible Heat**
Thermal Efficiency **80** %
Input kW **0.200** kW
Schedule **JFMAMJJASOND**

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 - Natural Gas**
Schedule **JFMAMJJASOND**
Capacity Control **Cycled or Staged Capacity - Fan On**

Supply Fan Data:

Fan Type **Forward Curved**
Configuration **Draw-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	
Zone_3_NightSB	x1

Thermostats and Zone Data:

Zone **All**
Cooling T-stat: Occ. **76.0** °F
Cooling T-stat: Unocc. **80.0** °F
Heating T-stat: Occ. **72.0** °F
Heating T-stat: Unocc. **62.0** °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 Office HVAC**
Unoccupied Cooling is **Available**

Supply Terminals Data:

Zone **All**

Zone_3_NightSB Input Data

Project Name: Andover - Town Hall
Prepared by: Kitchen and Associates

06/08/2010
02:42PM

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**

4. Sizing Data (Computer-Generated):

System Sizing Data:

Cooling Supply Temperature **58.0** °F
Supply Fan Airflow **1957.3** CFM
Ventilation Airflow **315.0** 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	1957.3	-	-	

5. Equipment Data

Central Cooling Unit - Air-Cooled DX

Design OAT **95.0** °F
Equipment Sizing **User-Defined**
Gross Cooling Capacity **65.7** MBH
ARI Performance Rating **11.30** SEER
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 **76.6** MBH
Average Efficiency **94.0** %
Misc. Electric **0.000** kW

Billing Details - Electric - Zone_3_NightSB

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:42PM

1. Component Charges

Billing Period	Energy Charges (\$)	Demand Charges (\$)	Customer Charges (\$)	Taxes (\$)	Total Charge (\$)
Jan	282	0	0	0	282
Feb	264	0	0	0	264
Mar	302	0	0	0	302
Apr	301	0	0	0	301
May	338	0	0	0	338
Jun	402	0	0	0	402
Jul	450	0	0	0	450
Aug	441	0	0	0	441
Sep	369	0	0	0	369
Oct	309	0	0	0	309
Nov	289	0	0	0	289
Dec	302	0	0	0	302
Totals	4,051	0	0	0	4,051

2. Totals

Billing Period	Total Charges (\$)	Total Consumption (kWh)	Avg Price (\$/kWh)
Jan	282	1,618	0.1740
Feb	264	1,520	0.1740
Mar	302	1,737	0.1740
Apr	301	1,728	0.1740
May	338	1,945	0.1740
Jun	402	2,310	0.1740
Jul	450	2,587	0.1740
Aug	441	2,535	0.1740
Sep	369	2,122	0.1740
Oct	309	1,779	0.1740
Nov	289	1,664	0.1740
Dec	302	1,737	0.1740
Totals	4,051	23,282	0.1740

3. Consumption Totals

Billing Period	Peak (kWh)	Mid-Peak (kWh)	Normal Peak (kWh)	Off-Peak (kWh)	Overall (kWh)
Jan	0	0	0	0	1,618
Feb	0	0	0	0	1,520
Mar	0	0	0	0	1,737
Apr	0	0	0	0	1,728
May	0	0	0	0	1,945
Jun	0	0	0	0	2,310
Jul	0	0	0	0	2,587
Aug	0	0	0	0	2,535
Sep	0	0	0	0	2,122
Oct	0	0	0	0	1,779
Nov	0	0	0	0	1,664
Dec	0	0	0	0	1,737
Totals	0	0	0	0	23,282

Billing Details - Electric - Zone_3_NightSB

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:42PM

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	5.9
Feb	0.0	0.0	0.0	0.0	6.0
Mar	0.0	0.0	0.0	0.0	7.1
Apr	0.0	0.0	0.0	0.0	8.7
May	0.0	0.0	0.0	0.0	10.2
Jun	0.0	0.0	0.0	0.0	9.8
Jul	0.0	0.0	0.0	0.0	10.8
Aug	0.0	0.0	0.0	0.0	9.8
Sep	0.0	0.0	0.0	0.0	9.0
Oct	0.0	0.0	0.0	0.0	8.9
Nov	0.0	0.0	0.0	0.0	6.9
Dec	0.0	0.0	0.0	0.0	6.6

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	5.9
Feb	0.0	0.0	0.0	0.0	6.0
Mar	0.0	0.0	0.0	0.0	7.1
Apr	0.0	0.0	0.0	0.0	8.7
May	0.0	0.0	0.0	0.0	10.2
Jun	0.0	0.0	0.0	0.0	9.8
Jul	0.0	0.0	0.0	0.0	10.8
Aug	0.0	0.0	0.0	0.0	9.8
Sep	0.0	0.0	0.0	0.0	9.0
Oct	0.0	0.0	0.0	0.0	8.9
Nov	0.0	0.0	0.0	0.0	6.9
Dec	0.0	0.0	0.0	0.0	6.6

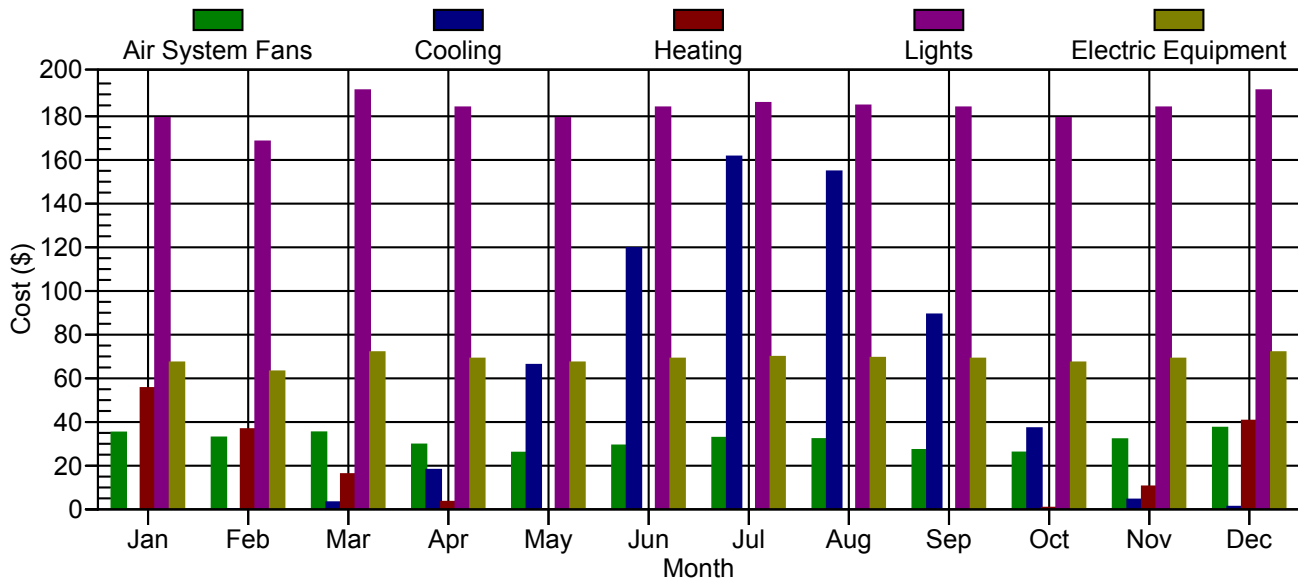
6. Time Of Maximum Demands

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	2/12/1500
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	7/29/1600
Aug	n/a	n/a	n/a	n/a	8/4/1400
Sep	n/a	n/a	n/a	n/a	9/20/1300
Oct	n/a	n/a	n/a	n/a	10/1/1600
Nov	n/a	n/a	n/a	n/a	11/4/1300
Dec	n/a	n/a	n/a	n/a	12/3/1400

Monthly Component Costs - Zone_3_NightSB

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:42PM



1. HVAC Component Costs

Month	Air System Fans (\$)	Cooling (\$)	Heating (\$)	Pumps (\$)	Cooling Towers (\$)	HVAC Total (\$)
January	35	0	56	0	0	91
February	33	0	37	0	0	70
March	35	3	16	0	0	54
April	30	18	3	0	0	51
May	26	66	0	0	0	92
June	29	120	0	0	0	149
July	33	161	0	0	0	194
August	32	155	0	0	0	187
September	27	89	0	0	0	116
October	26	37	1	0	0	64
November	32	4	10	0	0	46
December	37	1	41	0	0	79
Total	375	655	164	0	0	1,194

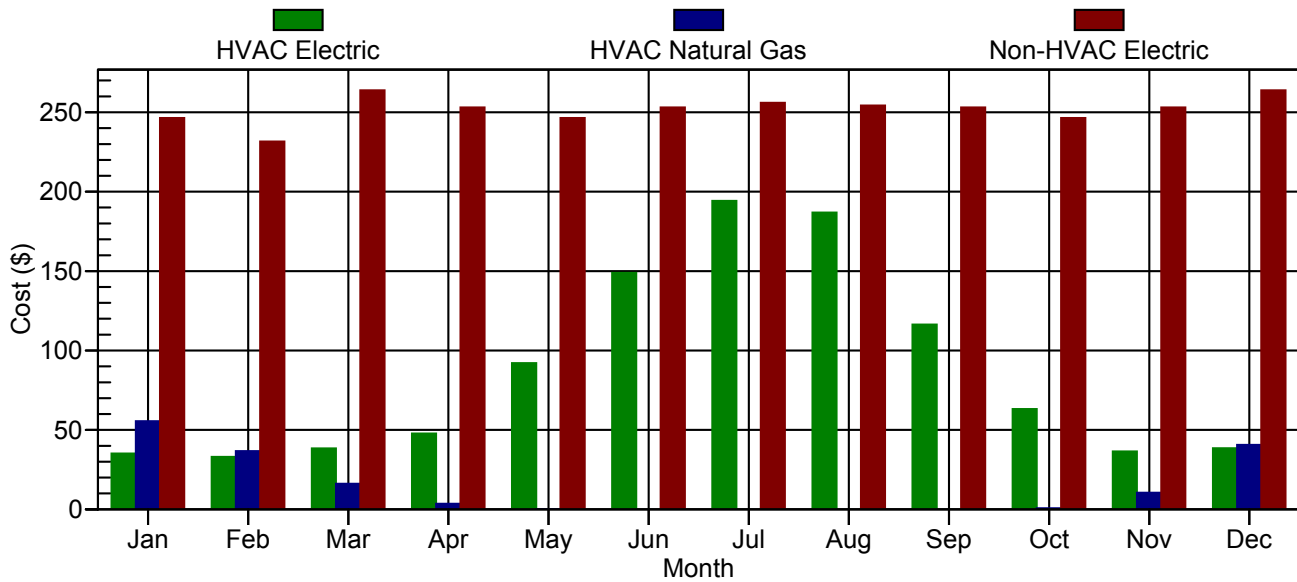
2. Non-HVAC Component Costs

Month	Lights (\$)	Electric Equipment (\$)	Misc. Electric (\$)	Misc. Fuel Use (\$)	Non-HVAC Total (\$)	Grand Total (\$)
January	179	67	0	0	246	337
February	168	63	0	0	232	302
March	192	72	0	0	264	318
April	184	69	0	0	253	304
May	179	67	0	0	246	338
June	184	69	0	0	253	402
July	186	70	0	0	256	450
August	185	69	0	0	254	441
September	184	69	0	0	253	369
October	179	67	0	0	246	310
November	184	69	0	0	253	299
December	192	72	0	0	264	343
Total	2,197	824	0	0	3,020	4,215

Monthly Energy Costs - Zone_3_NightSB

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:42PM



1. HVAC Costs

Month	Electric (\$)	Natural Gas (\$)	Fuel Oil (\$)	Propane (\$)	Remote Hot Water (\$)	Remote Steam (\$)	Remote Chilled Water (\$)
January	35	56	0	0	0	0	0
February	33	37	0	0	0	0	0
March	38	16	0	0	0	0	0
April	48	3	0	0	0	0	0
May	92	0	0	0	0	0	0
June	149	0	0	0	0	0	0
July	194	0	0	0	0	0	0
August	187	0	0	0	0	0	0
September	116	0	0	0	0	0	0
October	63	1	0	0	0	0	0
November	36	10	0	0	0	0	0
December	39	41	0	0	0	0	0
Total	1,031	164	0	0	0	0	0

2. Non-HVAC Costs

Month	Electric (\$)	Natural Gas (\$)	Fuel Oil (\$)	Propane (\$)	Remote Hot Water (\$)	Remote Steam (\$)
January	246	0	0	0	0	0
February	232	0	0	0	0	0
March	264	0	0	0	0	0
April	253	0	0	0	0	0
May	246	0	0	0	0	0
June	253	0	0	0	0	0
July	256	0	0	0	0	0
August	254	0	0	0	0	0
September	253	0	0	0	0	0
October	246	0	0	0	0	0
November	253	0	0	0	0	0
December	264	0	0	0	0	0
Total	3,021	0	0	0	0	0

Monthly Energy Use by Energy Type - Zone_3_NightSB

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Kitchen and Associates

06/08/2010
02:42PM

1. HVAC Energy Use

Month	Electric (kWh)	Natural Gas (Therm)	Fuel Oil (na)	Propane (na)	Remote HW (na)	Remote Steam (na)	Remote CW (na)
Jan	202	35	0	0	0	0	0
Feb	189	23	0	0	0	0	0
Mar	221	10	0	0	0	0	0
Apr	274	2	0	0	0	0	0
May	529	0	0	0	0	0	0
Jun	856	0	0	0	0	0	0
Jul	1,116	0	0	0	0	0	0
Aug	1,074	0	0	0	0	0	0
Sep	668	0	0	0	0	0	0
Oct	363	0	0	0	0	0	0
Nov	210	7	0	0	0	0	0
Dec	221	26	0	0	0	0	0
Totals	5,923	104	0	0	0	0	0

2. Non-HVAC Energy Use

Month	Electric (kWh)	Natural Gas (Therm)	Fuel Oil (na)	Propane (na)	Remote HW (na)	Remote Steam (na)
Jan	1,416	0	0	0	0	0
Feb	1,331	0	0	0	0	0
Mar	1,516	0	0	0	0	0
Apr	1,454	0	0	0	0	0
May	1,416	0	0	0	0	0
Jun	1,454	0	0	0	0	0
Jul	1,471	0	0	0	0	0
Aug	1,461	0	0	0	0	0
Sep	1,454	0	0	0	0	0
Oct	1,416	0	0	0	0	0
Nov	1,454	0	0	0	0	0
Dec	1,516	0	0	0	0	0
Totals	17,359	0	0	0	0	0

Monthly Energy Use by Component - Zone_3_NightSB

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Kitchen and Associates

06/08/2010
02:42PM

1. Monthly Energy Use by System Component

Component	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Air System Fans (kWh)	202	189	202	170	149	168	188	185	156	149	184	215
<i>Cooling</i>												
Electric (kWh)	0	0	18	104	380	688	928	889	512	213	25	7
Natural Gas (Therm)	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 (na)	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 (Therm)	35	23	10	2	0	0	0	0	0	0	7	26
Fuel Oil (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	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
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)	1030	968	1102	1058	1030	1058	1070	1063	1058	1030	1058	1102
Electric Eqpt. (kWh)	386	363	413	397	386	397	401	399	397	386	397	413
Misc. Electric (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
<i>Misc. Fuel</i>												
Natural Gas (Therm)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	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

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Kitchen and Associates

06/08/2010
02:42PM

Table 1. Annual Costs

Component	Zone_3_NightSB (\$)
Air System Fans	375
Cooling	655
Heating	164
Pumps	0
Cooling Tower Fans	0
HVAC Sub-Total	1,194
Lights	2,197
Electric Equipment	824
Misc. Electric	0
Misc. Fuel Use	0
Non-HVAC Sub-Total	3,020
Grand Total	4,215

Table 2. Annual Cost per Unit Floor Area

Component	Zone_3_NightSB (\$/ft²)
Air System Fans	0.174
Cooling	0.303
Heating	0.076
Pumps	0.000
Cooling Tower Fans	0.000
HVAC Sub-Total	0.553
Lights	1.017
Electric Equipment	0.381
Misc. Electric	0.000
Misc. Fuel Use	0.000
Non-HVAC Sub-Total	1.398
Grand Total	1.951
Gross Floor Area (ft²)	2160.0
Conditioned Floor Area (ft²)	2160.0

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

Table 3. Component Cost as a Percentage of Total Cost

Component	Zone_3_NightSB (%)
Air System Fans	8.9
Cooling	15.5
Heating	3.9
Pumps	0.0
Cooling Tower Fans	0.0
HVAC Sub-Total	28.3
Lights	52.1
Electric Equipment	19.5
Misc. Electric	0.0
Misc. Fuel Use	0.0
Non-HVAC Sub-Total	71.7
Grand Total	100.0

Annual Energy and Emissions Summary

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:42PM

Table 1. Annual Costs

Component	Zone_3_NightSB (\$)
HVAC Components	
Electric	1,031
Natural Gas	164
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Remote CW	0
HVAC Sub-Total	1,194
Non-HVAC Components	
Electric	3,021
Natural Gas	0
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Non-HVAC Sub-Total	3,021
Grand Total	4,215

Table 2. Annual Energy Consumption

Component	Zone_3_NightSB
HVAC Components	
Electric (kWh)	5,923
Natural Gas (Therm)	104
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0
Non-HVAC Components	
Electric (kWh)	17,359
Natural Gas (Therm)	0
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Totals	
Electric (kWh)	23,282
Natural Gas (Therm)	104
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0

Annual Energy and Emissions Summary

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:42PM

Table 3. Annual Emissions

Component	Zone_3_NightSB
CO2 Equivalent (lb)	0

Table 4. Annual Cost per Unit Floor Area

Component	Zone_3_NightSB (\$/ft²)
HVAC Components	
Electric	0.477
Natural Gas	0.076
Fuel Oil	0.000
Propane	0.000
Remote HW	0.000
Remote Steam	0.000
Remote CW	0.000
HVAC Sub-Total	0.553
Non-HVAC Components	
Electric	1.398
Natural Gas	0.000
Fuel Oil	0.000
Propane	0.000
Remote HW	0.000
Remote Steam	0.000
Non-HVAC Sub-Total	1.398
Grand Total	1.951
Gross Floor Area (ft²)	2160.0
Conditioned Floor Area (ft²)	2160.0

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

Table 5. Component Cost as a Percentage of Total Cost

Component	Zone_3_NightSB (%)
HVAC Components	
Electric	24.5
Natural Gas	3.9
Fuel Oil	0.0
Propane	0.0
Remote HW	0.0
Remote Steam	0.0
Remote CW	0.0
HVAC Sub-Total	28.3
Non-HVAC Components	
Electric	71.7
Natural Gas	0.0
Fuel Oil	0.0
Propane	0.0
Remote HW	0.0
Remote Steam	0.0
Non-HVAC Sub-Total	71.7
Grand Total	100.0

APPENDIX J

ECM-7 Modify HVAC Unit Control (Zone 4)

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

ECM-7 Modify HVAC Unit Control (Zone 4)

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 Town Hall
CHA Project #20997

ECM-7 Modify HVAC Unit Control (Zone 4)

Annual Energy Use Comparison			
	Electricity kWh	Natural Gas therms	Cost \$
Existing Manual Thermostat Control	7,662	154	\$ 1,576.00
Proposed Programmable Thermostat	7,023	102	\$ 1,383.00
Difference	639	52	\$ 193.00

Zone_4_NightSB Input Data

Project Name: Andover - Town Hall
Prepared by: Kitchen and Associates

06/08/2010
02:43PM

1. General Details:

Air System Name **Zone_4_NightSB**
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

Ventilation Reclaim Data:

Reclaim Type **Sensible Heat**
Thermal Efficiency **80** %
Input kW **0.200** kW
Schedule **JFMAMJJASOND**

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 - Natural Gas**
Schedule **JFMAMJJASOND**
Capacity Control **Cycled or Staged Capacity - Fan On**

Supply Fan Data:

Fan Type **Forward Curved**
Configuration **Draw-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-Z02	
Zone_4_NightSB	x1

Thermostats and Zone Data:

Zone **All**
Cooling T-stat: Occ. **76.0** °F
Cooling T-stat: Unocc. **80.0** °F
Heating T-stat: Occ. **72.0** °F
Heating T-stat: Unocc. **62.0** °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 Office HVAC**
Unoccupied Cooling is **Available**

Supply Terminals Data:

Zone **All**

Zone_4_NightSB Input Data

Project Name: Andover - Town Hall
Prepared by: Kitchen and Associates

06/08/2010
02:43PM

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**

4. Sizing Data (Computer-Generated):

System Sizing Data:

Cooling Supply Temperature **58.0** °F
Supply Fan Airflow **2375.5** CFM
Ventilation Airflow **360.0** 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	2375.5	-	-	

5. Equipment Data

Central Cooling Unit - Air-Cooled DX

Design OAT **95.0** °F
Equipment Sizing **User-Defined**
Gross Cooling Capacity **50.7** MBH
ARI Performance Rating **11.85** SEER
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 **76.6** MBH
Average Efficiency **94.0** %
Misc. Electric **0.000** kW

Billing Details - Electric - Zone_4_NightSB

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Kitchen and Associates

06/08/2010
02:43PM

1. Component Charges

Billing Period	Energy Charges (\$)	Demand Charges (\$)	Customer Charges (\$)	Taxes (\$)	Total Charge (\$)
Jan	343	0	0	0	343
Feb	322	0	0	0	322
Mar	369	0	0	0	369
Apr	371	0	0	0	371
May	418	0	0	0	418
Jun	489	0	0	0	489
Jul	537	0	0	0	537
Aug	528	0	0	0	528
Sep	450	0	0	0	450
Oct	379	0	0	0	379
Nov	354	0	0	0	354
Dec	368	0	0	0	368
Totals	4,928	0	0	0	4,928

2. Totals

Billing Period	Total Charges (\$)	Total Consumption (kWh)	Avg Price (\$/kWh)
Jan	343	1,969	0.1740
Feb	322	1,849	0.1740
Mar	369	2,122	0.1740
Apr	371	2,135	0.1740
May	418	2,403	0.1740
Jun	489	2,809	0.1740
Jul	537	3,083	0.1740
Aug	528	3,037	0.1740
Sep	450	2,586	0.1740
Oct	379	2,178	0.1740
Nov	354	2,034	0.1740
Dec	368	2,115	0.1740
Totals	4,928	28,320	0.1740

3. Consumption Totals

Billing Period	Peak (kWh)	Mid-Peak (kWh)	Normal Peak (kWh)	Off-Peak (kWh)	Overall (kWh)
Jan	0	0	0	0	1,969
Feb	0	0	0	0	1,849
Mar	0	0	0	0	2,122
Apr	0	0	0	0	2,135
May	0	0	0	0	2,403
Jun	0	0	0	0	2,809
Jul	0	0	0	0	3,083
Aug	0	0	0	0	3,037
Sep	0	0	0	0	2,586
Oct	0	0	0	0	2,178
Nov	0	0	0	0	2,034
Dec	0	0	0	0	2,115
Totals	0	0	0	0	28,320

Billing Details - Electric - Zone_4_NightSB

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06/08/2010
02:43PM

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	7.2
Feb	0.0	0.0	0.0	0.0	7.4
Mar	0.0	0.0	0.0	0.0	8.5
Apr	0.0	0.0	0.0	0.0	10.4
May	0.0	0.0	0.0	0.0	11.3
Jun	0.0	0.0	0.0	0.0	11.2
Jul	0.0	0.0	0.0	0.0	11.4
Aug	0.0	0.0	0.0	0.0	11.2
Sep	0.0	0.0	0.0	0.0	10.5
Oct	0.0	0.0	0.0	0.0	10.5
Nov	0.0	0.0	0.0	0.0	8.2
Dec	0.0	0.0	0.0	0.0	8.0

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	7.2
Feb	0.0	0.0	0.0	0.0	7.4
Mar	0.0	0.0	0.0	0.0	8.5
Apr	0.0	0.0	0.0	0.0	10.4
May	0.0	0.0	0.0	0.0	11.3
Jun	0.0	0.0	0.0	0.0	11.2
Jul	0.0	0.0	0.0	0.0	11.4
Aug	0.0	0.0	0.0	0.0	11.2
Sep	0.0	0.0	0.0	0.0	10.5
Oct	0.0	0.0	0.0	0.0	10.5
Nov	0.0	0.0	0.0	0.0	8.2
Dec	0.0	0.0	0.0	0.0	8.0

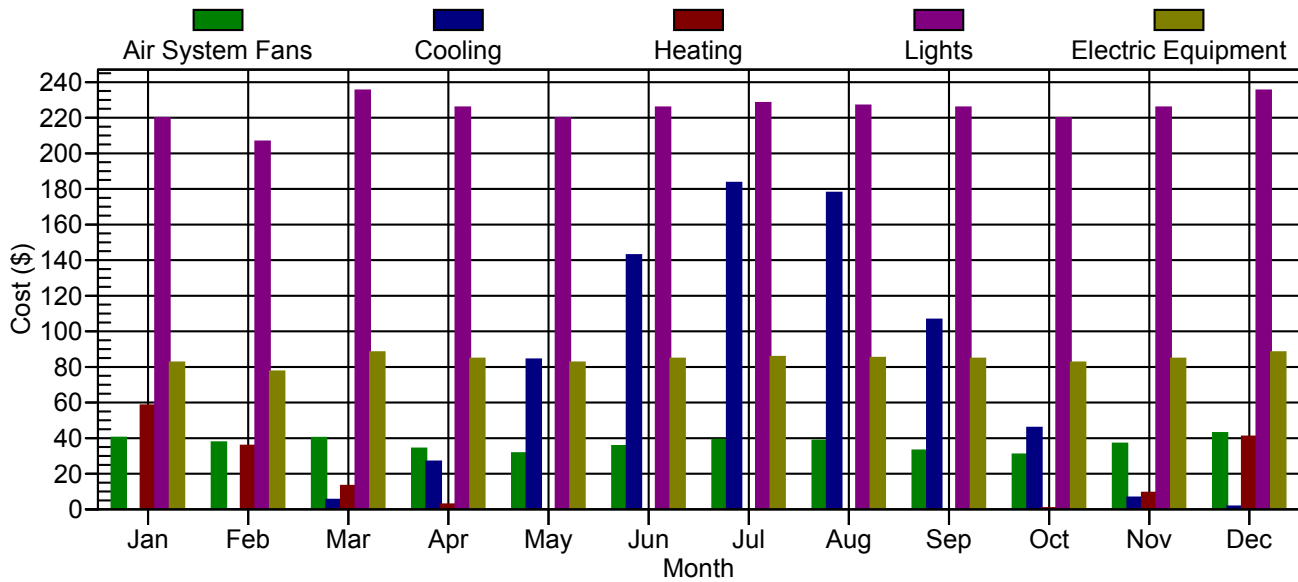
6. Time Of Maximum Demands

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	6/11/1600
Jul	n/a	n/a	n/a	n/a	7/1/1500
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	11/4/1400
Dec	n/a	n/a	n/a	n/a	12/2/1400

Monthly Component Costs - Zone_4_NightSB

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06/08/2010
02:43PM



1. HVAC Component Costs

Month	Air System Fans (\$)	Cooling (\$)	Heating (\$)	Pumps (\$)	Cooling Towers (\$)	HVAC Total (\$)
January	40	0	58	0	0	98
February	38	0	36	0	0	74
March	40	5	13	0	0	58
April	34	27	3	0	0	64
May	32	84	0	0	0	116
June	36	143	0	0	0	179
July	39	183	0	0	0	222
August	39	178	0	0	0	217
September	33	107	0	0	0	140
October	31	46	1	0	0	78
November	37	7	9	0	0	53
December	43	2	41	0	0	86
Total	440	781	161	0	0	1,383

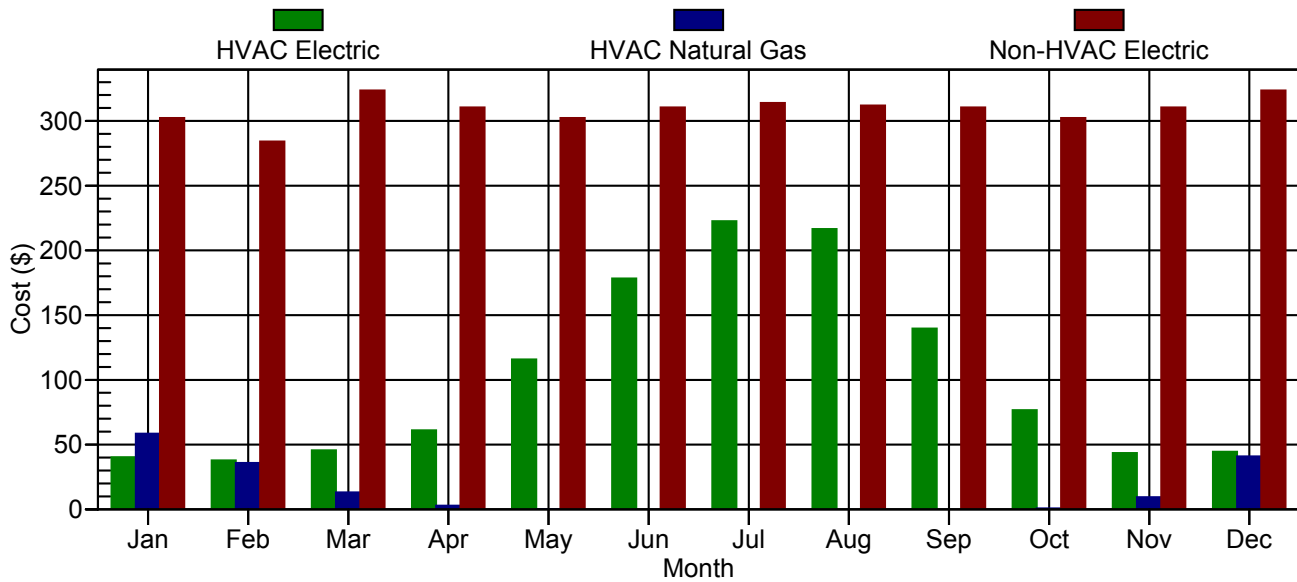
2. Non-HVAC Component Costs

Month	Lights (\$)	Electric Equipment (\$)	Misc. Electric (\$)	Misc. Fuel Use (\$)	Non-HVAC Total (\$)	Grand Total (\$)
January	220	82	0	0	302	400
February	207	77	0	0	284	358
March	235	88	0	0	324	382
April	226	85	0	0	310	374
May	220	82	0	0	302	418
June	226	85	0	0	310	489
July	228	86	0	0	314	536
August	227	85	0	0	312	529
September	226	85	0	0	310	450
October	220	82	0	0	302	380
November	226	85	0	0	310	363
December	235	88	0	0	324	410
Total	2,695	1,011	0	0	3,706	5,089

Monthly Energy Costs - Zone_4_NightSB

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Kitchen and Associates

06/08/2010
02:43PM



1. HVAC Costs

Month	Electric (\$)	Natural Gas (\$)	Fuel Oil (\$)	Propane (\$)	Remote Hot Water (\$)	Remote Steam (\$)	Remote Chilled Water (\$)
January	40	58	0	0	0	0	0
February	38	36	0	0	0	0	0
March	46	13	0	0	0	0	0
April	61	3	0	0	0	0	0
May	116	0	0	0	0	0	0
June	178	0	0	0	0	0	0
July	223	0	0	0	0	0	0
August	216	0	0	0	0	0	0
September	140	0	0	0	0	0	0
October	77	1	0	0	0	0	0
November	43	9	0	0	0	0	0
December	44	41	0	0	0	0	0
Total	1,222	161	0	0	0	0	0

2. Non-HVAC Costs

Month	Electric (\$)	Natural Gas (\$)	Fuel Oil (\$)	Propane (\$)	Remote Hot Water (\$)	Remote Steam (\$)
January	302	0	0	0	0	0
February	284	0	0	0	0	0
March	324	0	0	0	0	0
April	310	0	0	0	0	0
May	302	0	0	0	0	0
June	310	0	0	0	0	0
July	314	0	0	0	0	0
August	312	0	0	0	0	0
September	310	0	0	0	0	0
October	302	0	0	0	0	0
November	310	0	0	0	0	0
December	324	0	0	0	0	0
Total	3,706	0	0	0	0	0

Monthly Energy Use by Energy Type - Zone_4_NightSB

Andover - Town Hall
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06/08/2010
02:43PM

1. HVAC Energy Use

Month	Electric (kWh)	Natural Gas (Therm)	Fuel Oil (na)	Propane (na)	Remote HW (na)	Remote Steam (na)	Remote CW (na)
Jan	231	37	0	0	0	0	0
Feb	217	23	0	0	0	0	0
Mar	262	8	0	0	0	0	0
Apr	351	2	0	0	0	0	0
May	665	0	0	0	0	0	0
Jun	1,025	0	0	0	0	0	0
Jul	1,279	0	0	0	0	0	0
Aug	1,244	0	0	0	0	0	0
Sep	802	0	0	0	0	0	0
Oct	440	0	0	0	0	0	0
Nov	250	6	0	0	0	0	0
Dec	255	26	0	0	0	0	0
Totals	7,023	102	0	0	0	0	0

2. Non-HVAC Energy Use

Month	Electric (kWh)	Natural Gas (Therm)	Fuel Oil (na)	Propane (na)	Remote HW (na)	Remote Steam (na)
Jan	1,737	0	0	0	0	0
Feb	1,632	0	0	0	0	0
Mar	1,860	0	0	0	0	0
Apr	1,784	0	0	0	0	0
May	1,737	0	0	0	0	0
Jun	1,784	0	0	0	0	0
Jul	1,804	0	0	0	0	0
Aug	1,793	0	0	0	0	0
Sep	1,784	0	0	0	0	0
Oct	1,737	0	0	0	0	0
Nov	1,784	0	0	0	0	0
Dec	1,860	0	0	0	0	0
Totals	21,297	0	0	0	0	0

Monthly Energy Use by Component - Zone_4_NightSB

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:43PM

1. Monthly Energy Use by System Component

Component	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Air System Fans (kWh)	231	216	231	196	181	204	225	222	190	177	212	246
<i>Cooling</i>												
Electric (kWh)	0	1	31	154	484	821	1054	1022	613	263	38	9
Natural Gas (Therm)	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 (na)	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 (Therm)	37	23	8	2	0	0	0	0	0	0	6	26
Fuel Oil (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	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
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)	1264	1187	1353	1297	1264	1297	1312	1304	1297	1264	1297	1353
Electric Eqpt. (kWh)	474	445	507	487	474	487	492	489	487	474	487	507
Misc. Electric (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
<i>Misc. Fuel</i>												
Natural Gas (Therm)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	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

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:43PM

Table 1. Annual Costs

Component	Zone_4_NightSB (\$)
Air System Fans	440
Cooling	781
Heating	161
Pumps	0
Cooling Tower Fans	0
HVAC Sub-Total	1,383
Lights	2,695
Electric Equipment	1,011
Misc. Electric	0
Misc. Fuel Use	0
Non-HVAC Sub-Total	3,706
Grand Total	5,089

Table 2. Annual Cost per Unit Floor Area

Component	Zone_4_NightSB (\$/ft²)
Air System Fans	0.166
Cooling	0.295
Heating	0.061
Pumps	0.000
Cooling Tower Fans	0.000
HVAC Sub-Total	0.522
Lights	1.017
Electric Equipment	0.381
Misc. Electric	0.000
Misc. Fuel Use	0.000
Non-HVAC Sub-Total	1.398
Grand Total	1.920
Gross Floor Area (ft²)	2650.0
Conditioned Floor Area (ft²)	2650.0

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

Table 3. Component Cost as a Percentage of Total Cost

Component	Zone_4_NightSB (%)
Air System Fans	8.7
Cooling	15.4
Heating	3.2
Pumps	0.0
Cooling Tower Fans	0.0
HVAC Sub-Total	27.2
Lights	53.0
Electric Equipment	19.9
Misc. Electric	0.0
Misc. Fuel Use	0.0
Non-HVAC Sub-Total	72.8
Grand Total	100.0

Annual Energy and Emissions Summary

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:43PM

Table 1. Annual Costs

Component	Zone_4_NightSB (\$)
HVAC Components	
Electric	1,222
Natural Gas	161
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Remote CW	0
HVAC Sub-Total	1,383
Non-HVAC Components	
Electric	3,706
Natural Gas	0
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Non-HVAC Sub-Total	3,706
Grand Total	5,089

Table 2. Annual Energy Consumption

Component	Zone_4_NightSB
HVAC Components	
Electric (kWh)	7,023
Natural Gas (Therm)	102
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0
Non-HVAC Components	
Electric (kWh)	21,297
Natural Gas (Therm)	0
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Totals	
Electric (kWh)	28,319
Natural Gas (Therm)	102
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0

Annual Energy and Emissions Summary

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:43PM

Table 3. Annual Emissions

Component	Zone_4_NightSB
CO2 Equivalent (lb)	0

Table 4. Annual Cost per Unit Floor Area

Component	Zone_4_NightSB (\$/ft²)
HVAC Components	
Electric	0.461
Natural Gas	0.061
Fuel Oil	0.000
Propane	0.000
Remote HW	0.000
Remote Steam	0.000
Remote CW	0.000
HVAC Sub-Total	0.522
Non-HVAC Components	
Electric	1.398
Natural Gas	0.000
Fuel Oil	0.000
Propane	0.000
Remote HW	0.000
Remote Steam	0.000
Non-HVAC Sub-Total	1.398
Grand Total	1.920
Gross Floor Area (ft²)	2650.0
Conditioned Floor Area (ft²)	2650.0

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

Table 5. Component Cost as a Percentage of Total Cost

Component	Zone_4_NightSB (%)
HVAC Components	
Electric	24.0
Natural Gas	3.2
Fuel Oil	0.0
Propane	0.0
Remote HW	0.0
Remote Steam	0.0
Remote CW	0.0
HVAC Sub-Total	27.2
Non-HVAC Components	
Electric	72.8
Natural Gas	0.0
Fuel Oil	0.0
Propane	0.0
Remote HW	0.0
Remote Steam	0.0
Non-HVAC Sub-Total	72.8
Grand Total	100.0

APPENDIX K

ECM-8 Replace HVAC Unit with Higher Efficiency Unit (Zone 1)

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

ECM-8 Replace HVAC Unit with Higher Efficiency Unit (Zone 1)

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		
Existing Unit Demolition	1	ea		\$ 400.00		\$ -	\$ -	\$ -	\$ -	
New Packaged Unit	1	ea	\$ 7,023.00	\$ 1,500.00		\$ 6,882.54	\$ 1,815.00	\$ -	\$ 8,697.54	
Programmable Thermostat	1	ea	\$ 100.00	\$ 50.00		\$ 98.00	\$ 60.50	\$ -	\$ 158.50	

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

Subtotal	\$ 9,340.04
10% OH, 10% Profit	\$ 934.00
10% Contingency	\$ 934.00
Total	\$ 11,208.05

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

ECM-8 Replace HVAC Unit with Higher Efficiency Unit (Zone 1)

Annual Energy Use Comparison			
	Electricity kWh	Natural Gas therms	Cost \$
Existing 11.35 SEER Packaged Unit	5,574	545	\$ 1,832.00
Proposed 12.5 EER Compressor and Coil	4,606	489	\$ 1,573.00
Difference	968	56	\$ 259.00

Zone_1_ReplaceUnit Input Data

Project Name: Andover - Town Hall
Prepared by: Kitchen and Associates

06/08/2010
02:44PM

1. General Details:

Air System Name **Zone_1_ReplaceUnit**
Equipment Type **Packaged Rooftop Units**
Air System Type **Single Zone CAV**
Number of zones **1**

2. System Components:

Ventilation Air Data:

Airflow Control **Demand Controlled Ventilation**
Ventilation Sizing Method **Sum of Space OA Airflows**
Minimum Airflow **15** %
Damper Leak Rate **5** %
Minimum CO2 Differential **100** ppm
Maximum CO2 Differential **700** ppm
Outdoor Air CO2 Level **400** ppm

Economizer Data:

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

Ventilation Reclaim Data:

Reclaim Type **Sensible Heat**
Thermal Efficiency **80** %
Input kW **0.200** kW
Schedule **JFMAMJJASOND**

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 **95.0** °F
Heating Source **Combustion - Natural Gas**
Schedule **JFMAMJJASOND**
Capacity Control **Cycled or Staged Capacity - Fan On**

Supply Fan Data:

Fan Type **Forward Curved**
Configuration **Draw-thru**
Fan Performance **1.10** 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 **Ducted Return**

3. Zone Components:

Space Assignments:

Zone 1: Zone 1	
Zone_1_ReplaceUnit	x1

Thermostats and Zone Data:

Zone **All**
Cooling T-stat: Occ. **76.0** °F
Cooling T-stat: Unocc. **80.0** °F
Heating T-stat: Occ. **72.0** °F
Heating T-stat: Unocc. **62.0** °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**

Zone_1_ReplaceUnit Input Data

Project Name: Andover - Town Hall
Prepared by: Kitchen and Associates

06/08/2010
02:44PM

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

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 75.5 MBH
ARI Performance Rating 12.50 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 150.0 MBH
Average Efficiency 80.0 %
Misc. Electric 0.000 kW

Billing Details - Electric - Zone_1_ReplaceUnit

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Kitchen and Associates

06/08/2010
02:44PM

1. Component Charges

Billing Period	Energy Charges (\$)	Demand Charges (\$)	Customer Charges (\$)	Taxes (\$)	Total Charge (\$)
Jan	159	0	0	0	159
Feb	148	0	0	0	148
Mar	166	0	0	0	166
Apr	160	0	0	0	160
May	171	0	0	0	171
Jun	242	0	0	0	242
Jul	302	0	0	0	302
Aug	288	0	0	0	288
Sep	203	0	0	0	203
Oct	163	0	0	0	163
Nov	159	0	0	0	159
Dec	167	0	0	0	167
Totals	2,326	0	0	0	2,326

2. Totals

Billing Period	Total Charges (\$)	Total Consumption (kWh)	Avg Price (\$/kWh)
Jan	159	912	0.1740
Feb	148	852	0.1740
Mar	166	955	0.1740
Apr	160	918	0.1740
May	171	981	0.1740
Jun	242	1,391	0.1740
Jul	302	1,733	0.1740
Aug	288	1,654	0.1740
Sep	203	1,167	0.1740
Oct	163	934	0.1740
Nov	159	912	0.1740
Dec	167	958	0.1740
Totals	2,326	13,366	0.1740

3. Consumption Totals

Billing Period	Peak (kWh)	Mid-Peak (kWh)	Normal Peak (kWh)	Off-Peak (kWh)	Overall (kWh)
Jan	0	0	0	0	912
Feb	0	0	0	0	852
Mar	0	0	0	0	955
Apr	0	0	0	0	918
May	0	0	0	0	981
Jun	0	0	0	0	1,391
Jul	0	0	0	0	1,733
Aug	0	0	0	0	1,654
Sep	0	0	0	0	1,167
Oct	0	0	0	0	934
Nov	0	0	0	0	912
Dec	0	0	0	0	958
Totals	0	0	0	0	13,366

Billing Details - Electric - Zone_1_ReplaceUnit

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06/08/2010
02:44PM

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	3.6
Feb	0.0	0.0	0.0	0.0	3.6
Mar	0.0	0.0	0.0	0.0	3.6
Apr	0.0	0.0	0.0	0.0	6.1
May	0.0	0.0	0.0	0.0	8.7
Jun	0.0	0.0	0.0	0.0	8.5
Jul	0.0	0.0	0.0	0.0	8.9
Aug	0.0	0.0	0.0	0.0	8.6
Sep	0.0	0.0	0.0	0.0	7.9
Oct	0.0	0.0	0.0	0.0	7.3
Nov	0.0	0.0	0.0	0.0	3.6
Dec	0.0	0.0	0.0	0.0	3.6

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	3.6
Feb	0.0	0.0	0.0	0.0	3.6
Mar	0.0	0.0	0.0	0.0	3.6
Apr	0.0	0.0	0.0	0.0	6.1
May	0.0	0.0	0.0	0.0	8.7
Jun	0.0	0.0	0.0	0.0	8.5
Jul	0.0	0.0	0.0	0.0	8.9
Aug	0.0	0.0	0.0	0.0	8.6
Sep	0.0	0.0	0.0	0.0	7.9
Oct	0.0	0.0	0.0	0.0	7.3
Nov	0.0	0.0	0.0	0.0	3.6
Dec	0.0	0.0	0.0	0.0	3.6

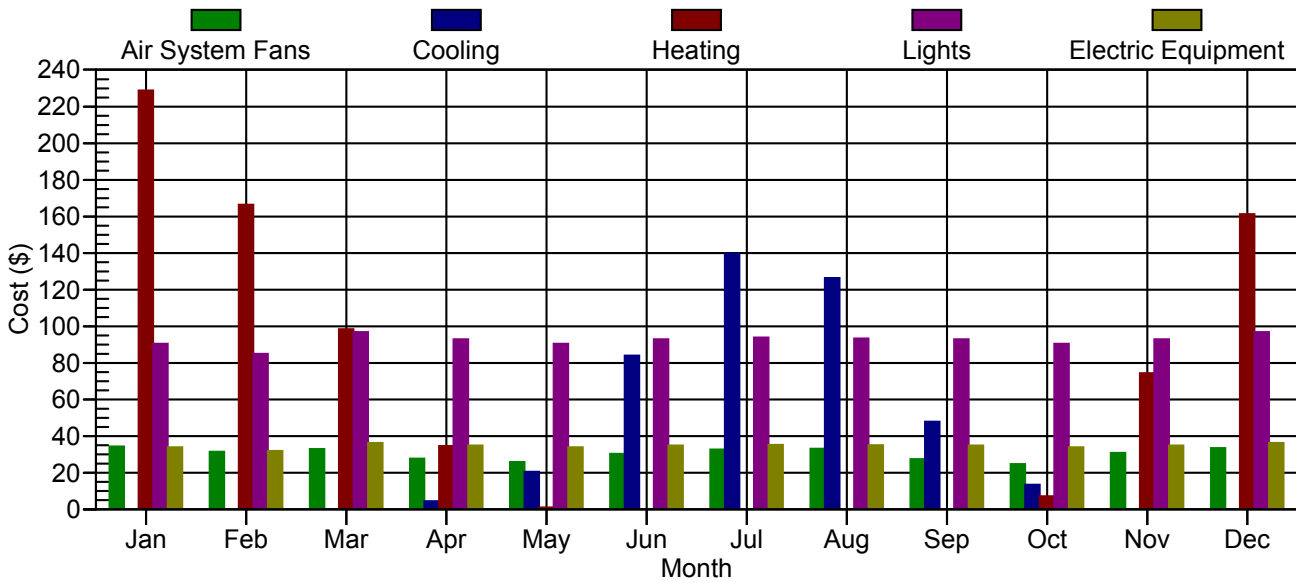
6. Time Of Maximum Demands

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	1/4/1400
Feb	n/a	n/a	n/a	n/a	2/1/1400
Mar	n/a	n/a	n/a	n/a	3/1/1400
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	6/30/1500
Jul	n/a	n/a	n/a	n/a	7/1/1600
Aug	n/a	n/a	n/a	n/a	8/4/1600
Sep	n/a	n/a	n/a	n/a	9/20/1500
Oct	n/a	n/a	n/a	n/a	10/4/1600
Nov	n/a	n/a	n/a	n/a	11/1/1400
Dec	n/a	n/a	n/a	n/a	12/1/1400

Monthly Component Costs - Zone_1_ReplaceUnit

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06/08/2010
02:44PM



1. HVAC Component Costs

Month	Air System Fans (\$)	Cooling (\$)	Heating (\$)	Pumps (\$)	Cooling Towers (\$)	HVAC Total (\$)
January	34	0	229	0	0	263
February	31	0	166	0	0	197
March	33	0	98	0	0	131
April	28	4	35	0	0	67
May	26	20	1	0	0	47
June	30	84	0	0	0	114
July	33	140	0	0	0	173
August	33	126	0	0	0	159
September	27	48	0	0	0	75
October	25	13	7	0	0	45
November	31	0	74	0	0	105
December	33	0	161	0	0	194
Total	365	437	772	0	0	1,573

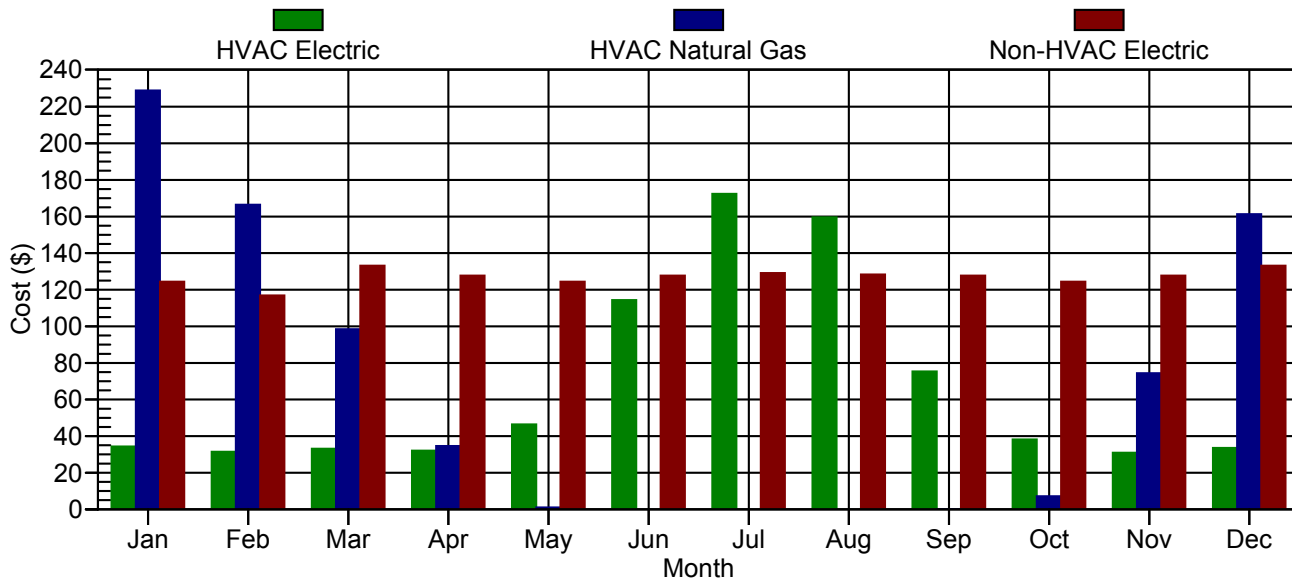
2. Non-HVAC Component Costs

Month	Lights (\$)	Electric Equipment (\$)	Misc. Electric (\$)	Misc. Fuel Use (\$)	Non-HVAC Total (\$)	Grand Total (\$)
January	90	34	0	0	124	387
February	85	32	0	0	117	314
March	97	36	0	0	133	264
April	93	35	0	0	128	195
May	90	34	0	0	124	171
June	93	35	0	0	128	242
July	94	35	0	0	129	302
August	93	35	0	0	128	287
September	93	35	0	0	128	203
October	90	34	0	0	124	169
November	93	35	0	0	128	233
December	97	36	0	0	133	327
Total	1,109	416	0	0	1,524	3,098

Monthly Energy Costs - Zone_1_ReplaceUnit

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06/08/2010
02:44PM



1. HVAC Costs

Month	Electric (\$)	Natural Gas (\$)	Fuel Oil (\$)	Propane (\$)	Remote Hot Water (\$)	Remote Steam (\$)	Remote Chilled Water (\$)
January	34	229	0	0	0	0	0
February	31	166	0	0	0	0	0
March	33	98	0	0	0	0	0
April	32	35	0	0	0	0	0
May	46	1	0	0	0	0	0
June	114	0	0	0	0	0	0
July	172	0	0	0	0	0	0
August	160	0	0	0	0	0	0
September	75	0	0	0	0	0	0
October	38	7	0	0	0	0	0
November	31	74	0	0	0	0	0
December	34	161	0	0	0	0	0
Total	801	772	0	0	0	0	0

2. Non-HVAC Costs

Month	Electric (\$)	Natural Gas (\$)	Fuel Oil (\$)	Propane (\$)	Remote Hot Water (\$)	Remote Steam (\$)
January	124	0	0	0	0	0
February	117	0	0	0	0	0
March	133	0	0	0	0	0
April	128	0	0	0	0	0
May	124	0	0	0	0	0
June	128	0	0	0	0	0
July	129	0	0	0	0	0
August	128	0	0	0	0	0
September	128	0	0	0	0	0
October	124	0	0	0	0	0
November	128	0	0	0	0	0
December	133	0	0	0	0	0
Total	1,524	0	0	0	0	0

Monthly Energy Use by Energy Type - Zone_1_ReplaceUnit

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06/08/2010
02:44PM

1. HVAC Energy Use

Month	Electric (kWh)	Natural Gas (Therm)	Fuel Oil (na)	Propane (na)	Remote HW (na)	Remote Steam (na)	Remote CW (na)
Jan	197	145	0	0	0	0	0
Feb	181	105	0	0	0	0	0
Mar	190	62	0	0	0	0	0
Apr	184	22	0	0	0	0	0
May	267	1	0	0	0	0	0
Jun	657	0	0	0	0	0	0
Jul	991	0	0	0	0	0	0
Aug	917	0	0	0	0	0	0
Sep	433	0	0	0	0	0	0
Oct	219	5	0	0	0	0	0
Nov	178	47	0	0	0	0	0
Dec	193	102	0	0	0	0	0
Totals	4,606	489	0	0	0	0	0

2. Non-HVAC Energy Use

Month	Electric (kWh)	Natural Gas (Therm)	Fuel Oil (na)	Propane (na)	Remote HW (na)	Remote Steam (na)
Jan	715	0	0	0	0	0
Feb	671	0	0	0	0	0
Mar	765	0	0	0	0	0
Apr	734	0	0	0	0	0
May	715	0	0	0	0	0
Jun	734	0	0	0	0	0
Jul	742	0	0	0	0	0
Aug	737	0	0	0	0	0
Sep	734	0	0	0	0	0
Oct	715	0	0	0	0	0
Nov	734	0	0	0	0	0
Dec	765	0	0	0	0	0
Totals	8,760	0	0	0	0	0

Monthly Energy Use by Component - Zone_1_ReplaceUnit

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06/08/2010
02:44PM

1. Monthly Energy Use by System Component

Component	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Air System Fans (kWh)	197	181	189	159	149	174	188	190	158	142	177	193
<i>Cooling</i>												
Electric (kWh)	0	0	1	25	118	483	803	726	275	77	1	0
Natural Gas (Therm)	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 (na)	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 (Therm)	145	105	62	22	1	0	0	0	0	5	47	102
Fuel Oil (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	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
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)	520	488	556	534	520	534	540	536	534	520	534	556
Electric Eqpt. (kWh)	195	183	209	200	195	200	202	201	200	195	200	209
Misc. Electric (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
<i>Misc. Fuel</i>												
Natural Gas (Therm)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	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

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:44PM

Table 1. Annual Costs

Component	Zone_1_Replace Unit (\$)
Air System Fans	365
Cooling	437
Heating	772
Pumps	0
Cooling Tower Fans	0
HVAC Sub-Total	1,573
Lights	1,109
Electric Equipment	416
Misc. Electric	0
Misc. Fuel Use	0
Non-HVAC Sub-Total	1,524
Grand Total	3,098

Table 2. Annual Cost per Unit Floor Area

Component	Zone_1_Replace Unit (\$/ft²)
Air System Fans	0.335
Cooling	0.401
Heating	0.708
Pumps	0.000
Cooling Tower Fans	0.000
HVAC Sub-Total	1.444
Lights	1.017
Electric Equipment	0.381
Misc. Electric	0.000
Misc. Fuel Use	0.000
Non-HVAC Sub-Total	1.398
Grand Total	2.842
Gross Floor Area (ft²)	1090.0
Conditioned Floor Area (ft²)	1090.0

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

Table 3. Component Cost as a Percentage of Total Cost

Component	Zone_1_Replace Unit (%)
Air System Fans	11.8
Cooling	14.1
Heating	24.9
Pumps	0.0
Cooling Tower Fans	0.0
HVAC Sub-Total	50.8
Lights	35.8
Electric Equipment	13.4
Misc. Electric	0.0
Misc. Fuel Use	0.0
Non-HVAC Sub-Total	49.2
Grand Total	100.0

Annual Energy and Emissions Summary

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:44PM

Table 1. Annual Costs

Component	Zone_1_Replace Unit (\$)
HVAC Components	
Electric	801
Natural Gas	772
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Remote CW	0
HVAC Sub-Total	1,573
Non-HVAC Components	
Electric	1,524
Natural Gas	0
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Non-HVAC Sub-Total	1,524
Grand Total	3,098

Table 2. Annual Energy Consumption

Component	Zone_1_Replace Unit
HVAC Components	
Electric (kWh)	4,606
Natural Gas (Therm)	489
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0
Non-HVAC Components	
Electric (kWh)	8,760
Natural Gas (Therm)	0
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Totals	
Electric (kWh)	13,366
Natural Gas (Therm)	489
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0

Annual Energy and Emissions Summary

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:44PM

Table 3. Annual Emissions

Component	Zone_1_Replace Unit
CO2 Equivalent (lb)	0

Table 4. Annual Cost per Unit Floor Area

Component	Zone_1_Replace Unit (\$/ft²)
HVAC Components	
Electric	0.735
Natural Gas	0.708
Fuel Oil	0.000
Propane	0.000
Remote HW	0.000
Remote Steam	0.000
Remote CW	0.000
HVAC Sub-Total	1.444
Non-HVAC Components	
Electric	1.398
Natural Gas	0.000
Fuel Oil	0.000
Propane	0.000
Remote HW	0.000
Remote Steam	0.000
Non-HVAC Sub-Total	1.398
Grand Total	2.842
Gross Floor Area (ft²)	1090.0
Conditioned Floor Area (ft²)	1090.0

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

Table 5. Component Cost as a Percentage of Total Cost

Component	Zone_1_Replace Unit (%)
HVAC Components	
Electric	25.9
Natural Gas	24.9
Fuel Oil	0.0
Propane	0.0
Remote HW	0.0
Remote Steam	0.0
Remote CW	0.0
HVAC Sub-Total	50.8
Non-HVAC Components	
Electric	49.2
Natural Gas	0.0
Fuel Oil	0.0
Propane	0.0
Remote HW	0.0
Remote Steam	0.0
Non-HVAC Sub-Total	49.2
Grand Total	100.0

APPENDIX L

ECM-9 Replace HVAC Unit with Higher Efficiency Unit (Zone 2)

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

ECM-9 Replace HVAC Unit with Higher Efficiency Unit (Zone 2)

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-9 Replace HVAC Unit with Higher Efficiency Unit (Zone 2)

Annual Energy Use Comparison			
	Electricity kWh	Natural Gas therms	Cost \$
Existing 11.35 SEER Compressor and Coil	3,592	90	\$ 767
Proposed 16 SEER Compressor and Coil	3,266	90	\$ 711
Difference	326	0	\$ 56

Zone_2_ReplaceUnit Input Data

Project Name: Andover - Town Hall
Prepared by: Kitchen and Associates

06/08/2010
02:45PM

1. General Details:

Air System Name **Zone_2_ReplaceUnit**
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

Ventilation Reclaim Data:

Reclaim Type **Sensible Heat**
Thermal Efficiency **80** %
Input kW **0.200** kW
Schedule **JFMAMJJASOND**

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 - Natural Gas**
Schedule **JFMAMJJASOND**
Capacity Control **Cycled or Staged Capacity - Fan On**

Supply Fan Data:

Fan Type **Forward Curved**
Configuration **Draw-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-F001-Z02	
Zone_2_ReplaceUnit	x1

Thermostats and Zone Data:

Zone **All**
Cooling T-stat: Occ. **76.0** °F
Cooling T-stat: Unocc. **80.0** °F
Heating T-stat: Occ. **72.0** °F
Heating T-stat: Unocc. **62.0** °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 Office HVAC**
Unoccupied Cooling is **Available**

Supply Terminals Data:

Zone **All**

Zone_2_ReplaceUnit Input Data

Project Name: Andover - Town Hall
Prepared by: Kitchen and Associates

06/08/2010
02:45PM

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

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 33.0 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

Equipment Sizing User-Defined
Gross Heating Capacity 75.5 MBH
Average Efficiency 94.0 %
Misc. Electric 0.000 kW

Billing Details - Electric - Zone_2_ReplaceUnit

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Kitchen and Associates

06/08/2010
02:45PM

1. Component Charges

Billing Period	Energy Charges (\$)	Demand Charges (\$)	Customer Charges (\$)	Taxes (\$)	Total Charge (\$)
Jan	324	0	0	0	324
Feb	304	0	0	0	304
Mar	345	0	0	0	345
Apr	334	0	0	0	334
May	342	0	0	0	342
Jun	381	0	0	0	381
Jul	404	0	0	0	404
Aug	398	0	0	0	398
Sep	365	0	0	0	365
Oct	332	0	0	0	332
Nov	330	0	0	0	330
Dec	346	0	0	0	346
Totals	4,204	0	0	0	4,204

2. Totals

Billing Period	Total Charges (\$)	Total Consumption (kWh)	Avg Price (\$/kWh)
Jan	324	1,862	0.1740
Feb	304	1,746	0.1740
Mar	345	1,981	0.1740
Apr	334	1,919	0.1740
May	342	1,963	0.1740
Jun	381	2,187	0.1740
Jul	404	2,322	0.1740
Aug	398	2,285	0.1740
Sep	365	2,099	0.1740
Oct	332	1,907	0.1740
Nov	330	1,898	0.1740
Dec	346	1,991	0.1740
Totals	4,204	24,161	0.1740

3. Consumption Totals

Billing Period	Peak (kWh)	Mid-Peak (kWh)	Normal Peak (kWh)	Off-Peak (kWh)	Overall (kWh)
Jan	0	0	0	0	1,862
Feb	0	0	0	0	1,746
Mar	0	0	0	0	1,981
Apr	0	0	0	0	1,919
May	0	0	0	0	1,963
Jun	0	0	0	0	2,187
Jul	0	0	0	0	2,322
Aug	0	0	0	0	2,285
Sep	0	0	0	0	2,099
Oct	0	0	0	0	1,907
Nov	0	0	0	0	1,898
Dec	0	0	0	0	1,991
Totals	0	0	0	0	24,161

Billing Details - Electric - Zone_2_ReplaceUnit

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06/08/2010
02:45PM

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	6.9
Feb	0.0	0.0	0.0	0.0	6.9
Mar	0.0	0.0	0.0	0.0	7.3
Apr	0.0	0.0	0.0	0.0	8.1
May	0.0	0.0	0.0	0.0	9.2
Jun	0.0	0.0	0.0	0.0	9.0
Jul	0.0	0.0	0.0	0.0	9.3
Aug	0.0	0.0	0.0	0.0	9.1
Sep	0.0	0.0	0.0	0.0	8.6
Oct	0.0	0.0	0.0	0.0	8.5
Nov	0.0	0.0	0.0	0.0	7.3
Dec	0.0	0.0	0.0	0.0	7.0

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	6.9
Feb	0.0	0.0	0.0	0.0	6.9
Mar	0.0	0.0	0.0	0.0	7.3
Apr	0.0	0.0	0.0	0.0	8.1
May	0.0	0.0	0.0	0.0	9.2
Jun	0.0	0.0	0.0	0.0	9.0
Jul	0.0	0.0	0.0	0.0	9.3
Aug	0.0	0.0	0.0	0.0	9.1
Sep	0.0	0.0	0.0	0.0	8.6
Oct	0.0	0.0	0.0	0.0	8.5
Nov	0.0	0.0	0.0	0.0	7.3
Dec	0.0	0.0	0.0	0.0	7.0

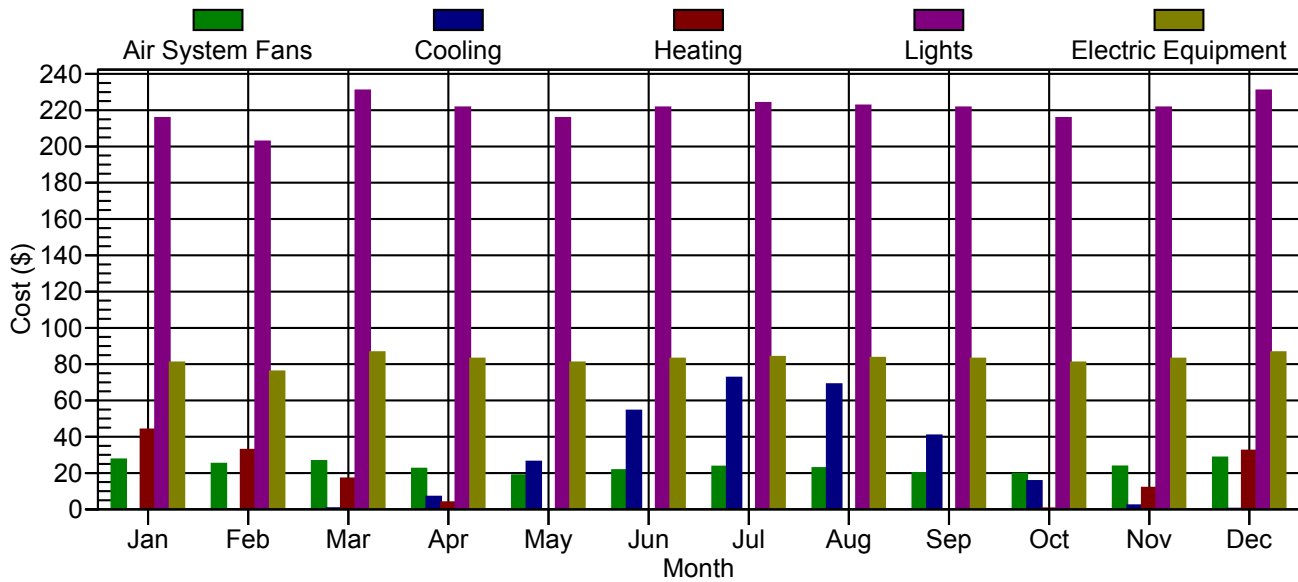
6. Time Of Maximum Demands

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	7/1/1600
Aug	n/a	n/a	n/a	n/a	8/30/1400
Sep	n/a	n/a	n/a	n/a	9/23/1600
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	12/3/1600

Monthly Component Costs - Zone_2_ReplaceUnit

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Kitchen and Associates

06/08/2010
02:45PM



1. HVAC Component Costs

Month	Air System Fans (\$)	Cooling (\$)	Heating (\$)	Pumps (\$)	Cooling Towers (\$)	HVAC Total (\$)
January	27	0	44	0	0	71
February	25	0	33	0	0	58
March	27	1	17	0	0	45
April	22	7	4	0	0	33
May	19	26	0	0	0	45
June	22	54	0	0	0	76
July	23	73	0	0	0	96
August	23	69	0	0	0	92
September	20	41	0	0	0	61
October	20	16	1	0	0	37
November	24	2	12	0	0	38
December	29	0	32	0	0	61
Total	280	288	142	0	0	711

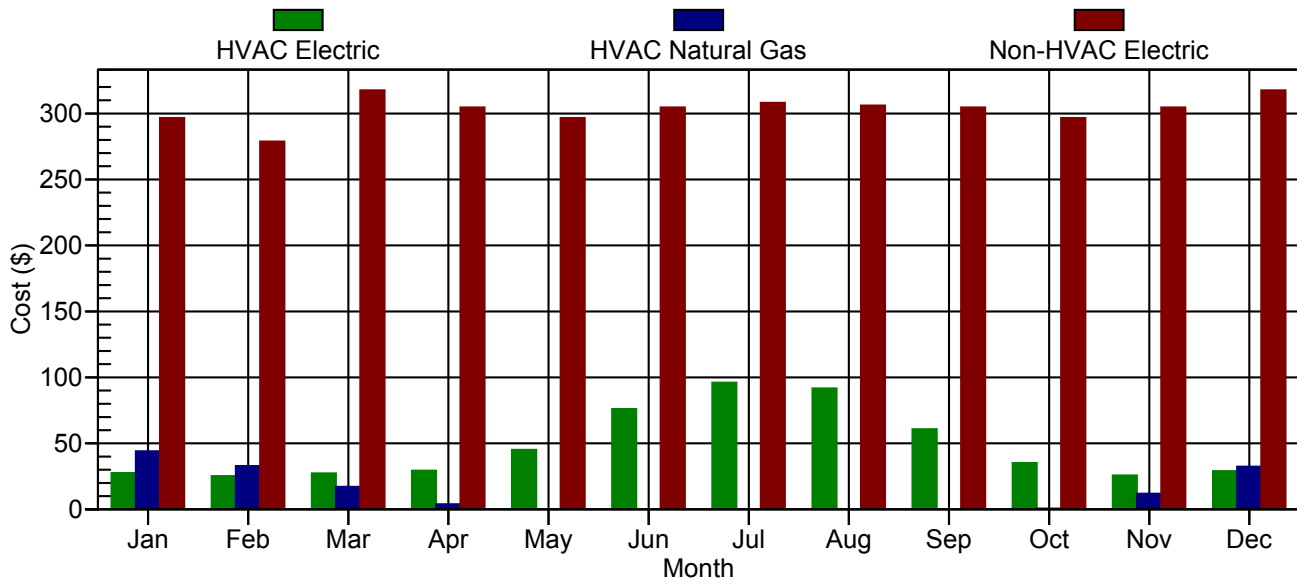
2. Non-HVAC Component Costs

Month	Lights (\$)	Electric Equipment (\$)	Misc. Electric (\$)	Misc. Fuel Use (\$)	Non-HVAC Total (\$)	Grand Total (\$)
January	216	81	0	0	297	368
February	203	76	0	0	279	337
March	231	87	0	0	317	362
April	221	83	0	0	305	338
May	216	81	0	0	297	342
June	221	83	0	0	305	381
July	224	84	0	0	308	404
August	223	83	0	0	306	398
September	221	83	0	0	305	366
October	216	81	0	0	297	334
November	221	83	0	0	305	343
December	231	87	0	0	317	378
Total	2,644	992	0	0	3,636	4,346

Monthly Energy Costs - Zone_2_ReplaceUnit

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:45PM



1. HVAC Costs

Month	Electric (\$)	Natural Gas (\$)	Fuel Oil (\$)	Propane (\$)	Remote Hot Water (\$)	Remote Steam (\$)	Remote Chilled Water (\$)
January	27	44	0	0	0	0	0
February	25	33	0	0	0	0	0
March	27	17	0	0	0	0	0
April	29	4	0	0	0	0	0
May	45	0	0	0	0	0	0
June	76	0	0	0	0	0	0
July	96	0	0	0	0	0	0
August	92	0	0	0	0	0	0
September	61	0	0	0	0	0	0
October	35	1	0	0	0	0	0
November	26	12	0	0	0	0	0
December	29	32	0	0	0	0	0
Total	568	142	0	0	0	0	0

2. Non-HVAC Costs

Month	Electric (\$)	Natural Gas (\$)	Fuel Oil (\$)	Propane (\$)	Remote Hot Water (\$)	Remote Steam (\$)
January	297	0	0	0	0	0
February	279	0	0	0	0	0
March	317	0	0	0	0	0
April	305	0	0	0	0	0
May	297	0	0	0	0	0
June	305	0	0	0	0	0
July	308	0	0	0	0	0
August	306	0	0	0	0	0
September	305	0	0	0	0	0
October	297	0	0	0	0	0
November	305	0	0	0	0	0
December	317	0	0	0	0	0
Total	3,636	0	0	0	0	0

Monthly Energy Use by Energy Type - Zone_2_ReplaceUnit

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:45PM

1. HVAC Energy Use

Month	Electric (kWh)	Natural Gas (Therm)	Fuel Oil (na)	Propane (na)	Remote HW (na)	Remote Steam (na)	Remote CW (na)
Jan	158	28	0	0	0	0	0
Feb	144	21	0	0	0	0	0
Mar	156	11	0	0	0	0	0
Apr	169	2	0	0	0	0	0
May	259	0	0	0	0	0	0
Jun	437	0	0	0	0	0	0
Jul	552	0	0	0	0	0	0
Aug	526	0	0	0	0	0	0
Sep	349	0	0	0	0	0	0
Oct	202	0	0	0	0	0	0
Nov	148	7	0	0	0	0	0
Dec	166	20	0	0	0	0	0
Totals	3,266	90	0	0	0	0	0

2. Non-HVAC Energy Use

Month	Electric (kWh)	Natural Gas (Therm)	Fuel Oil (na)	Propane (na)	Remote HW (na)	Remote Steam (na)
Jan	1,705	0	0	0	0	0
Feb	1,602	0	0	0	0	0
Mar	1,825	0	0	0	0	0
Apr	1,750	0	0	0	0	0
May	1,705	0	0	0	0	0
Jun	1,750	0	0	0	0	0
Jul	1,770	0	0	0	0	0
Aug	1,759	0	0	0	0	0
Sep	1,750	0	0	0	0	0
Oct	1,705	0	0	0	0	0
Nov	1,750	0	0	0	0	0
Dec	1,825	0	0	0	0	0
Totals	20,895	0	0	0	0	0

Monthly Energy Use by Component - Zone_2_ReplaceUnit

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06/08/2010
02:45PM

1. Monthly Energy Use by System Component

Component	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Air System Fans (kWh)	158	144	153	129	108	124	135	130	115	112	135	164
<i>Cooling</i>												
Electric (kWh)	0	0	3	40	151	313	417	396	234	90	12	2
Natural Gas (Therm)	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 (na)	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 (Therm)	28	21	11	2	0	0	0	0	0	0	7	20
Fuel Oil (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	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
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)	1240	1165	1327	1273	1240	1273	1288	1279	1273	1240	1273	1327
Electric Eqpt. (kWh)	465	437	498	477	465	477	483	480	477	465	477	498
Misc. Electric (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
<i>Misc. Fuel</i>												
Natural Gas (Therm)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	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

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:45PM

Table 1. Annual Costs

Component	Zone_2_Replace Unit (\$)
Air System Fans	280
Cooling	288
Heating	142
Pumps	0
Cooling Tower Fans	0
HVAC Sub-Total	711
Lights	2,644
Electric Equipment	992
Misc. Electric	0
Misc. Fuel Use	0
Non-HVAC Sub-Total	3,636
Grand Total	4,346

Table 2. Annual Cost per Unit Floor Area

Component	Zone_2_Replace Unit (\$/ft²)
Air System Fans	0.108
Cooling	0.111
Heating	0.055
Pumps	0.000
Cooling Tower Fans	0.000
HVAC Sub-Total	0.273
Lights	1.017
Electric Equipment	0.381
Misc. Electric	0.000
Misc. Fuel Use	0.000
Non-HVAC Sub-Total	1.398
Grand Total	1.672
Gross Floor Area (ft²)	2600.0
Conditioned Floor Area (ft²)	2600.0

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

Table 3. Component Cost as a Percentage of Total Cost

Component	Zone_2_Replace Unit (%)
Air System Fans	6.4
Cooling	6.6
Heating	3.3
Pumps	0.0
Cooling Tower Fans	0.0
HVAC Sub-Total	16.4
Lights	60.8
Electric Equipment	22.8
Misc. Electric	0.0
Misc. Fuel Use	0.0
Non-HVAC Sub-Total	83.6
Grand Total	100.0

Annual Energy and Emissions Summary

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:45PM

Table 1. Annual Costs

Component	Zone_2_Replace Unit (\$)
HVAC Components	
Electric	568
Natural Gas	142
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Remote CW	0
HVAC Sub-Total	711
Non-HVAC Components	
Electric	3,636
Natural Gas	0
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Non-HVAC Sub-Total	3,636
Grand Total	4,346

Table 2. Annual Energy Consumption

Component	Zone_2_Replace Unit
HVAC Components	
Electric (kWh)	3,266
Natural Gas (Therm)	90
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0
Non-HVAC Components	
Electric (kWh)	20,895
Natural Gas (Therm)	0
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Totals	
Electric (kWh)	24,161
Natural Gas (Therm)	90
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0

Annual Energy and Emissions Summary

Andover - Town Hall
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06/08/2010
02:45PM

Table 3. Annual Emissions

Component	Zone_2_Replace Unit
CO2 Equivalent (lb)	0

Table 4. Annual Cost per Unit Floor Area

Component	Zone_2_Replace Unit (\$/ft²)
HVAC Components	
Electric	0.219
Natural Gas	0.055
Fuel Oil	0.000
Propane	0.000
Remote HW	0.000
Remote Steam	0.000
Remote CW	0.000
HVAC Sub-Total	0.273
Non-HVAC Components	
Electric	1.398
Natural Gas	0.000
Fuel Oil	0.000
Propane	0.000
Remote HW	0.000
Remote Steam	0.000
Non-HVAC Sub-Total	1.398
Grand Total	1.672
Gross Floor Area (ft²)	2600.0
Conditioned Floor Area (ft²)	2600.0

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

Table 5. Component Cost as a Percentage of Total Cost

Component	Zone_2_Replace Unit (%)
HVAC Components	
Electric	13.1
Natural Gas	3.3
Fuel Oil	0.0
Propane	0.0
Remote HW	0.0
Remote Steam	0.0
Remote CW	0.0
HVAC Sub-Total	16.4
Non-HVAC Components	
Electric	83.7
Natural Gas	0.0
Fuel Oil	0.0
Propane	0.0
Remote HW	0.0
Remote Steam	0.0
Non-HVAC Sub-Total	83.7
Grand Total	100.0

APPENDIX M

ECM-10 Replace HVAC Unit with Higher Efficiency Unit (Zone 3)

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

ECM-10 Replace HVAC Unit with Higher Efficiency Unit (Zone 3)

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 6 Ton Condensing Unit and Cooling Coil	1	ea	\$ 4,048.00	\$ 686.00		\$ 3,967.04	\$ 830.06	\$ -	\$ 4,797.10	
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	\$ 8,142.19
10% OH, 10% Profit	\$ 814.22
10% Contingency	\$ 814.22
Total	\$ 9,770.63

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

ECM-10 Replace HVAC Unit with Higher Efficiency Unit (Zone 3)

Annual Energy Use Comparison			
	Electricity kWh	Natural Gas therms	Cost \$
Existing 11.3 SEER Compressor and Coil	5,923	104	\$ 1,194
Proposed 16 SEER Compressor and Coil	5,318	104	\$ 1,089
Difference	605	0	\$ 105

Zone_3_ReplaceUnit Input Data

Project Name: Andover - Town Hall
Prepared by: Kitchen and Associates

06/08/2010
02:46PM

1. General Details:

Air System Name **Zone_3_ReplaceUnit**
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

Ventilation Reclaim Data:

Reclaim Type **Sensible Heat**
Thermal Efficiency **80** %
Input kW **0.200** kW
Schedule **JFMAMJJASOND**

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 - Natural Gas**
Schedule **JFMAMJJASOND**
Capacity Control **Cycled or Staged Capacity - Fan On**

Supply Fan Data:

Fan Type **Forward Curved**
Configuration **Draw-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	
Zone_3_ReplaceUnit	x1

Thermostats and Zone Data:

Zone **All**
Cooling T-stat: Occ. **76.0** °F
Cooling T-stat: Unocc. **80.0** °F
Heating T-stat: Occ. **72.0** °F
Heating T-stat: Unocc. **62.0** °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 Office HVAC**
Unoccupied Cooling is **Available**

Supply Terminals Data:

Zone **All**

Zone_3_ReplaceUnit Input Data

Project Name: Andover - Town Hall
Prepared by: Kitchen and Associates

06/08/2010
02:46PM

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

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 65.7 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

Equipment Sizing User-Defined
Gross Heating Capacity 76.6 MBH
Average Efficiency 94.0 %
Misc. Electric 0.000 kW

Billing Details - Electric - Zone_3_ReplaceUnit

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06/08/2010
02:47PM

1. Component Charges

Billing Period	Energy Charges (\$)	Demand Charges (\$)	Customer Charges (\$)	Taxes (\$)	Total Charge (\$)
Jan	282	0	0	0	282
Feb	264	0	0	0	264
Mar	302	0	0	0	302
Apr	298	0	0	0	298
May	328	0	0	0	328
Jun	383	0	0	0	383
Jul	424	0	0	0	424
Aug	416	0	0	0	416
Sep	355	0	0	0	355
Oct	304	0	0	0	304
Nov	289	0	0	0	289
Dec	302	0	0	0	302
Totals	3,946	0	0	0	3,946

2. Totals

Billing Period	Total Charges (\$)	Total Consumption (kWh)	Avg Price (\$/kWh)
Jan	282	1,618	0.1740
Feb	264	1,520	0.1740
Mar	302	1,734	0.1740
Apr	298	1,712	0.1740
May	328	1,884	0.1740
Jun	383	2,199	0.1740
Jul	424	2,438	0.1740
Aug	416	2,392	0.1740
Sep	355	2,040	0.1740
Oct	304	1,744	0.1740
Nov	289	1,660	0.1740
Dec	302	1,736	0.1740
Totals	3,946	22,677	0.1740

3. Consumption Totals

Billing Period	Peak (kWh)	Mid-Peak (kWh)	Normal Peak (kWh)	Off-Peak (kWh)	Overall (kWh)
Jan	0	0	0	0	1,618
Feb	0	0	0	0	1,520
Mar	0	0	0	0	1,734
Apr	0	0	0	0	1,712
May	0	0	0	0	1,884
Jun	0	0	0	0	2,199
Jul	0	0	0	0	2,438
Aug	0	0	0	0	2,392
Sep	0	0	0	0	2,040
Oct	0	0	0	0	1,744
Nov	0	0	0	0	1,660
Dec	0	0	0	0	1,736
Totals	0	0	0	0	22,677

Billing Details - Electric - Zone_3_ReplaceUnit

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06/08/2010
02:47PM

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	5.9
Feb	0.0	0.0	0.0	0.0	6.0
Mar	0.0	0.0	0.0	0.0	6.9
Apr	0.0	0.0	0.0	0.0	8.3
May	0.0	0.0	0.0	0.0	9.5
Jun	0.0	0.0	0.0	0.0	9.2
Jul	0.0	0.0	0.0	0.0	10.0
Aug	0.0	0.0	0.0	0.0	9.2
Sep	0.0	0.0	0.0	0.0	8.5
Oct	0.0	0.0	0.0	0.0	8.4
Nov	0.0	0.0	0.0	0.0	6.7
Dec	0.0	0.0	0.0	0.0	6.5

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	5.9
Feb	0.0	0.0	0.0	0.0	6.0
Mar	0.0	0.0	0.0	0.0	6.9
Apr	0.0	0.0	0.0	0.0	8.3
May	0.0	0.0	0.0	0.0	9.5
Jun	0.0	0.0	0.0	0.0	9.2
Jul	0.0	0.0	0.0	0.0	10.0
Aug	0.0	0.0	0.0	0.0	9.2
Sep	0.0	0.0	0.0	0.0	8.5
Oct	0.0	0.0	0.0	0.0	8.4
Nov	0.0	0.0	0.0	0.0	6.7
Dec	0.0	0.0	0.0	0.0	6.5

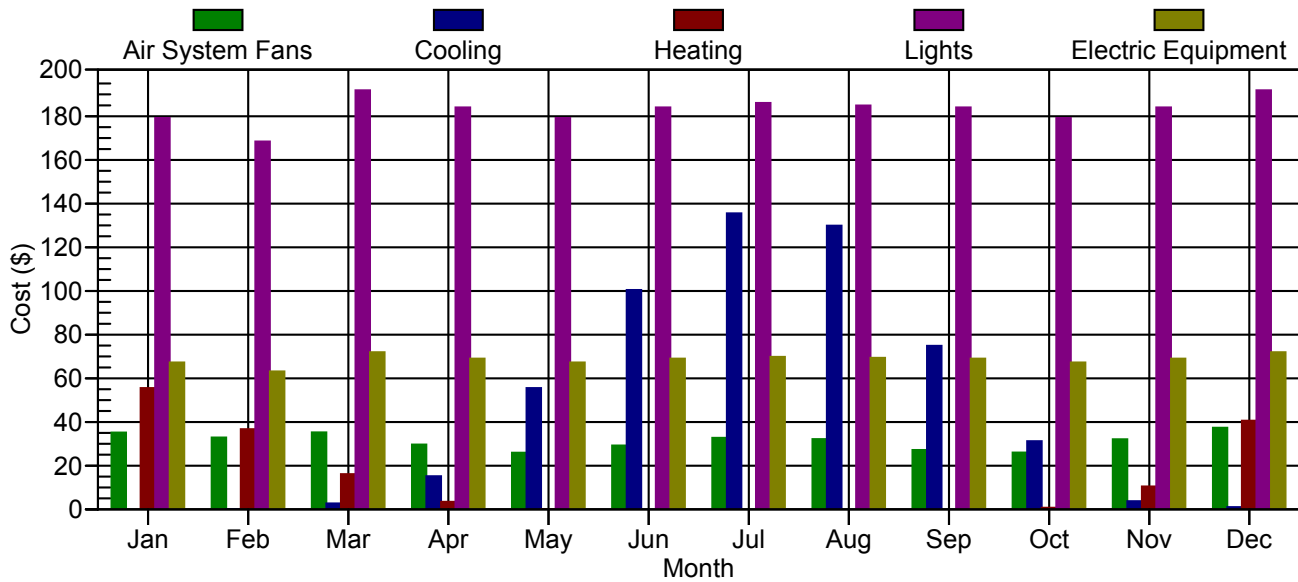
6. Time Of Maximum Demands

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	7/29/1600
Aug	n/a	n/a	n/a	n/a	8/4/1400
Sep	n/a	n/a	n/a	n/a	9/20/1300
Oct	n/a	n/a	n/a	n/a	10/1/1600
Nov	n/a	n/a	n/a	n/a	11/4/1300
Dec	n/a	n/a	n/a	n/a	12/3/1400

Monthly Component Costs - Zone_3_ReplaceUnit

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06/08/2010
02:47PM



1. HVAC Component Costs

Month	Air System Fans (\$)	Cooling (\$)	Heating (\$)	Pumps (\$)	Cooling Towers (\$)	HVAC Total (\$)
January	35	0	56	0	0	91
February	33	0	37	0	0	70
March	35	3	16	0	0	54
April	30	15	3	0	0	48
May	26	56	0	0	0	82
June	29	100	0	0	0	129
July	33	136	0	0	0	169
August	32	130	0	0	0	162
September	27	75	0	0	0	102
October	26	31	1	0	0	58
November	32	4	10	0	0	46
December	37	1	41	0	0	79
Total	375	550	164	0	0	1,089

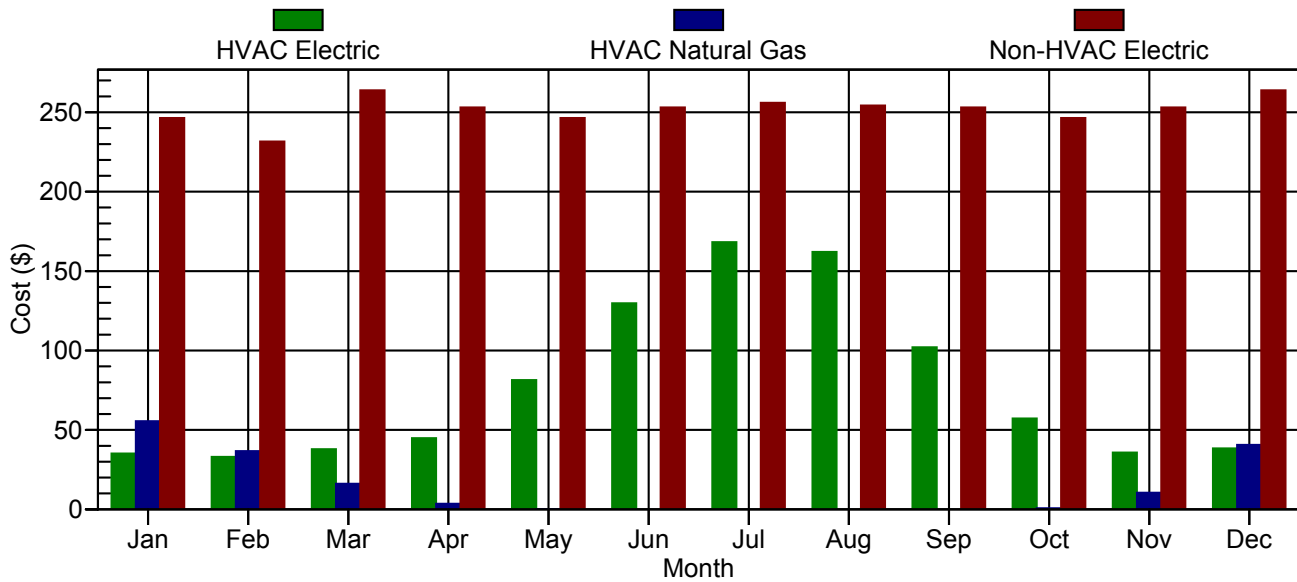
2. Non-HVAC Component Costs

Month	Lights (\$)	Electric Equipment (\$)	Misc. Electric (\$)	Misc. Fuel Use (\$)	Non-HVAC Total (\$)	Grand Total (\$)
January	179	67	0	0	246	337
February	168	63	0	0	232	302
March	192	72	0	0	264	318
April	184	69	0	0	253	301
May	179	67	0	0	246	328
June	184	69	0	0	253	382
July	186	70	0	0	256	425
August	185	69	0	0	254	416
September	184	69	0	0	253	355
October	179	67	0	0	246	304
November	184	69	0	0	253	299
December	192	72	0	0	264	343
Total	2,197	824	0	0	3,020	4,109

Monthly Energy Costs - Zone_3_ReplaceUnit

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06/08/2010
02:47PM



1. HVAC Costs

Month	Electric (\$)	Natural Gas (\$)	Fuel Oil (\$)	Propane (\$)	Remote Hot Water (\$)	Remote Steam (\$)	Remote Chilled Water (\$)
January	35	56	0	0	0	0	0
February	33	37	0	0	0	0	0
March	38	16	0	0	0	0	0
April	45	3	0	0	0	0	0
May	81	0	0	0	0	0	0
June	130	0	0	0	0	0	0
July	168	0	0	0	0	0	0
August	162	0	0	0	0	0	0
September	102	0	0	0	0	0	0
October	57	1	0	0	0	0	0
November	36	10	0	0	0	0	0
December	38	41	0	0	0	0	0
Total	925	164	0	0	0	0	0

2. Non-HVAC Costs

Month	Electric (\$)	Natural Gas (\$)	Fuel Oil (\$)	Propane (\$)	Remote Hot Water (\$)	Remote Steam (\$)
January	246	0	0	0	0	0
February	232	0	0	0	0	0
March	264	0	0	0	0	0
April	253	0	0	0	0	0
May	246	0	0	0	0	0
June	253	0	0	0	0	0
July	256	0	0	0	0	0
August	254	0	0	0	0	0
September	253	0	0	0	0	0
October	246	0	0	0	0	0
November	253	0	0	0	0	0
December	264	0	0	0	0	0
Total	3,021	0	0	0	0	0

Monthly Energy Use by Energy Type - Zone_3_ReplaceUnit

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06/08/2010
02:47PM

1. HVAC Energy Use

Month	Electric (kWh)	Natural Gas (Therm)	Fuel Oil (na)	Propane (na)	Remote HW (na)	Remote Steam (na)	Remote CW (na)
Jan	202	35	0	0	0	0	0
Feb	189	23	0	0	0	0	0
Mar	218	10	0	0	0	0	0
Apr	257	2	0	0	0	0	0
May	468	0	0	0	0	0	0
Jun	745	0	0	0	0	0	0
Jul	967	0	0	0	0	0	0
Aug	931	0	0	0	0	0	0
Sep	586	0	0	0	0	0	0
Oct	328	0	0	0	0	0	0
Nov	206	7	0	0	0	0	0
Dec	220	26	0	0	0	0	0
Totals	5,318	104	0	0	0	0	0

2. Non-HVAC Energy Use

Month	Electric (kWh)	Natural Gas (Therm)	Fuel Oil (na)	Propane (na)	Remote HW (na)	Remote Steam (na)
Jan	1,416	0	0	0	0	0
Feb	1,331	0	0	0	0	0
Mar	1,516	0	0	0	0	0
Apr	1,454	0	0	0	0	0
May	1,416	0	0	0	0	0
Jun	1,454	0	0	0	0	0
Jul	1,471	0	0	0	0	0
Aug	1,461	0	0	0	0	0
Sep	1,454	0	0	0	0	0
Oct	1,416	0	0	0	0	0
Nov	1,454	0	0	0	0	0
Dec	1,516	0	0	0	0	0
Totals	17,359	0	0	0	0	0

Monthly Energy Use by Component - Zone_3_ReplaceUnit

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06/08/2010
02:47PM

1. Monthly Energy Use by System Component

Component	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Air System Fans (kWh)	202	189	202	170	149	168	188	185	156	149	184	215
<i>Cooling</i>												
Electric (kWh)	0	0	16	87	319	577	779	746	430	179	21	6
Natural Gas (Therm)	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 (na)	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 (Therm)	35	23	10	2	0	0	0	0	0	0	7	26
Fuel Oil (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	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
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)	1030	968	1102	1058	1030	1058	1070	1063	1058	1030	1058	1102
Electric Eqpt. (kWh)	386	363	413	397	386	397	401	399	397	386	397	413
Misc. Electric (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
<i>Misc. Fuel</i>												
Natural Gas (Therm)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	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

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:47PM

Table 1. Annual Costs

Component	Zone_3_Replace Unit (\$)
Air System Fans	375
Cooling	550
Heating	164
Pumps	0
Cooling Tower Fans	0
HVAC Sub-Total	1,089
Lights	2,197
Electric Equipment	824
Misc. Electric	0
Misc. Fuel Use	0
Non-HVAC Sub-Total	3,020
Grand Total	4,109

Table 2. Annual Cost per Unit Floor Area

Component	Zone_3_Replace Unit (\$/ft²)
Air System Fans	0.174
Cooling	0.255
Heating	0.076
Pumps	0.000
Cooling Tower Fans	0.000
HVAC Sub-Total	0.504
Lights	1.017
Electric Equipment	0.381
Misc. Electric	0.000
Misc. Fuel Use	0.000
Non-HVAC Sub-Total	1.398
Grand Total	1.902
Gross Floor Area (ft²)	2160.0
Conditioned Floor Area (ft²)	2160.0

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

Table 3. Component Cost as a Percentage of Total Cost

Component	Zone_3_Replace Unit (%)
Air System Fans	9.1
Cooling	13.4
Heating	4.0
Pumps	0.0
Cooling Tower Fans	0.0
HVAC Sub-Total	26.5
Lights	53.5
Electric Equipment	20.0
Misc. Electric	0.0
Misc. Fuel Use	0.0
Non-HVAC Sub-Total	73.5
Grand Total	100.0

Annual Energy and Emissions Summary

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:47PM

Table 1. Annual Costs

Component	Zone_3_Replace Unit (\$)
HVAC Components	
Electric	925
Natural Gas	164
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Remote CW	0
HVAC Sub-Total	1,089
Non-HVAC Components	
Electric	3,021
Natural Gas	0
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Non-HVAC Sub-Total	3,021
Grand Total	4,109

Table 2. Annual Energy Consumption

Component	Zone_3_Replace Unit
HVAC Components	
Electric (kWh)	5,318
Natural Gas (Therm)	104
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0
Non-HVAC Components	
Electric (kWh)	17,359
Natural Gas (Therm)	0
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Totals	
Electric (kWh)	22,677
Natural Gas (Therm)	104
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0

Annual Energy and Emissions Summary

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:47PM

Table 3. Annual Emissions

Component	Zone_3_Replace Unit
CO2 Equivalent (lb)	0

Table 4. Annual Cost per Unit Floor Area

Component	Zone_3_Replace Unit (\$/ft²)
HVAC Components	
Electric	0.428
Natural Gas	0.076
Fuel Oil	0.000
Propane	0.000
Remote HW	0.000
Remote Steam	0.000
Remote CW	0.000
HVAC Sub-Total	0.504
Non-HVAC Components	
Electric	1.398
Natural Gas	0.000
Fuel Oil	0.000
Propane	0.000
Remote HW	0.000
Remote Steam	0.000
Non-HVAC Sub-Total	1.398
Grand Total	1.903
Gross Floor Area (ft²)	2160.0
Conditioned Floor Area (ft²)	2160.0

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

Table 5. Component Cost as a Percentage of Total Cost

Component	Zone_3_Replace Unit (%)
HVAC Components	
Electric	22.5
Natural Gas	4.0
Fuel Oil	0.0
Propane	0.0
Remote HW	0.0
Remote Steam	0.0
Remote CW	0.0
HVAC Sub-Total	26.5
Non-HVAC Components	
Electric	73.5
Natural Gas	0.0
Fuel Oil	0.0
Propane	0.0
Remote HW	0.0
Remote Steam	0.0
Non-HVAC Sub-Total	73.5
Grand Total	100.0

APPENDIX N

ECM-11 Replace HVAC Unit with Higher Efficiency Unit (Zone 4)

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

ECM-11 Replace HVAC Unit with Higher Efficiency Unit (Zone 4)

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 5 Ton Condensing Unit and Cooling Coil	1	ea	\$ 3,890.00	\$ 686.00		\$ 3,812.20	\$ 830.06	\$ -	\$ 4,642.26	
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	\$ 7,987.35
10% OH, 10% Profit	\$ 798.74
10% Contingency	\$ 798.74
Total	\$ 9,584.82

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

ECM-11 Replace HVAC Unit with Higher Efficiency Unit (Zone 4)

Annual Energy Use Comparison			
	Electricity kWh	Natural Gas therms	Cost \$
Existing 11.85 SEER Compressor and Coil	7,023	102	\$ 1,383
Proposed 16 SEER Compressor and Coil	6,356	102	\$ 1,267
Difference	667	0	\$ 116

Zone_4_ReplaceUnit Input Data

Project Name: Andover - Town Hall
Prepared by: Kitchen and Associates

06/08/2010
02:47PM

1. General Details:

Air System Name **Zone_4_ReplaceUnit**
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

Ventilation Reclaim Data:

Reclaim Type **Sensible Heat**
Thermal Efficiency **80** %
Input kW **0.200** kW
Schedule **JFMAMJJASOND**

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 - Natural Gas**
Schedule **JFMAMJJASOND**
Capacity Control **Cycled or Staged Capacity - Fan On**

Supply Fan Data:

Fan Type **Forward Curved**
Configuration **Draw-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-Z02	
Zone_4_ReplaceUnit	x1

Thermostats and Zone Data:

Zone **All**
Cooling T-stat: Occ. **76.0** °F
Cooling T-stat: Unocc. **80.0** °F
Heating T-stat: Occ. **72.0** °F
Heating T-stat: Unocc. **62.0** °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 Office HVAC**
Unoccupied Cooling is **Available**

Supply Terminals Data:

Zone **All**

Zone_4_ReplaceUnit Input Data

Project Name: Andover - Town Hall
Prepared by: Kitchen and Associates

06/08/2010
02:47PM

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**

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 **50.7** 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

Equipment Sizing **User-Defined**
Gross Heating Capacity **76.6** MBH
Average Efficiency **94.0** %
Misc. Electric **0.000** kW

Billing Details - Electric - Zone_4_ReplaceUnit

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Kitchen and Associates

06/08/2010
02:48PM

1. Component Charges

Billing Period	Energy Charges (\$)	Demand Charges (\$)	Customer Charges (\$)	Taxes (\$)	Total Charge (\$)
Jan	343	0	0	0	343
Feb	322	0	0	0	322
Mar	368	0	0	0	368
Apr	367	0	0	0	367
May	406	0	0	0	406
Jun	468	0	0	0	468
Jul	509	0	0	0	509
Aug	502	0	0	0	502
Sep	434	0	0	0	434
Oct	372	0	0	0	372
Nov	353	0	0	0	353
Dec	368	0	0	0	368
Totals	4,812	0	0	0	4,812

2. Totals

Billing Period	Total Charges (\$)	Total Consumption (kWh)	Avg Price (\$/kWh)
Jan	343	1,969	0.1740
Feb	322	1,849	0.1740
Mar	368	2,117	0.1740
Apr	367	2,112	0.1740
May	406	2,331	0.1740
Jun	468	2,687	0.1740
Jul	509	2,927	0.1740
Aug	502	2,885	0.1740
Sep	434	2,495	0.1740
Oct	372	2,139	0.1740
Nov	353	2,028	0.1740
Dec	368	2,114	0.1740
Totals	4,812	27,653	0.1740

3. Consumption Totals

Billing Period	Peak (kWh)	Mid-Peak (kWh)	Normal Peak (kWh)	Off-Peak (kWh)	Overall (kWh)
Jan	0	0	0	0	1,969
Feb	0	0	0	0	1,849
Mar	0	0	0	0	2,117
Apr	0	0	0	0	2,112
May	0	0	0	0	2,331
Jun	0	0	0	0	2,687
Jul	0	0	0	0	2,927
Aug	0	0	0	0	2,885
Sep	0	0	0	0	2,495
Oct	0	0	0	0	2,139
Nov	0	0	0	0	2,028
Dec	0	0	0	0	2,114
Totals	0	0	0	0	27,653

Billing Details - Electric - Zone_4_ReplaceUnit

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06/08/2010
02:48PM

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	7.2
Feb	0.0	0.0	0.0	0.0	7.3
Mar	0.0	0.0	0.0	0.0	8.3
Apr	0.0	0.0	0.0	0.0	9.9
May	0.0	0.0	0.0	0.0	10.7
Jun	0.0	0.0	0.0	0.0	10.6
Jul	0.0	0.0	0.0	0.0	10.8
Aug	0.0	0.0	0.0	0.0	10.6
Sep	0.0	0.0	0.0	0.0	10.0
Oct	0.0	0.0	0.0	0.0	10.0
Nov	0.0	0.0	0.0	0.0	8.1
Dec	0.0	0.0	0.0	0.0	7.8

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	7.2
Feb	0.0	0.0	0.0	0.0	7.3
Mar	0.0	0.0	0.0	0.0	8.3
Apr	0.0	0.0	0.0	0.0	9.9
May	0.0	0.0	0.0	0.0	10.7
Jun	0.0	0.0	0.0	0.0	10.6
Jul	0.0	0.0	0.0	0.0	10.8
Aug	0.0	0.0	0.0	0.0	10.6
Sep	0.0	0.0	0.0	0.0	10.0
Oct	0.0	0.0	0.0	0.0	10.0
Nov	0.0	0.0	0.0	0.0	8.1
Dec	0.0	0.0	0.0	0.0	7.8

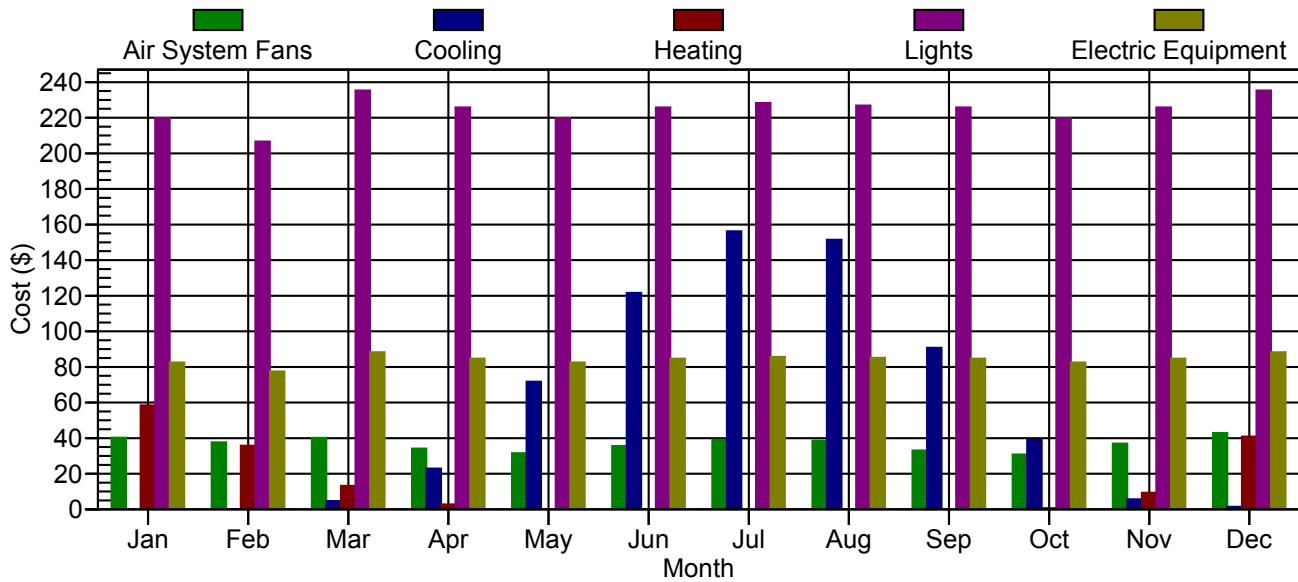
6. Time Of Maximum Demands

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	5/17/1500
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	8/4/1600
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	11/4/1400
Dec	n/a	n/a	n/a	n/a	12/2/1400

Monthly Component Costs - Zone_4_ReplaceUnit

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06/08/2010
02:48PM



1. HVAC Component Costs

Month	Air System Fans (\$)	Cooling (\$)	Heating (\$)	Pumps (\$)	Cooling Towers (\$)	HVAC Total (\$)
January	40	0	58	0	0	98
February	38	0	36	0	0	74
March	40	5	13	0	0	58
April	34	23	3	0	0	60
May	32	72	0	0	0	104
June	36	122	0	0	0	158
July	39	156	0	0	0	195
August	39	151	0	0	0	190
September	33	91	0	0	0	124
October	31	39	1	0	0	71
November	37	6	9	0	0	52
December	43	1	41	0	0	85
Total	440	665	161	0	0	1,267

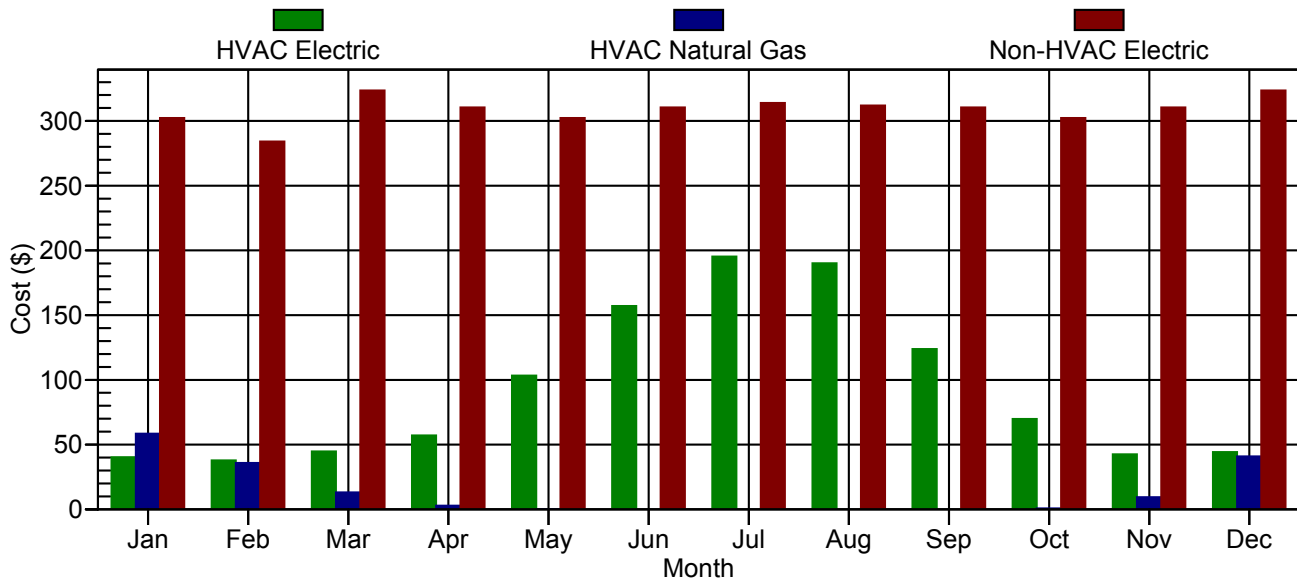
2. Non-HVAC Component Costs

Month	Lights (\$)	Electric Equipment (\$)	Misc. Electric (\$)	Misc. Fuel Use (\$)	Non-HVAC Total (\$)	Grand Total (\$)
January	220	82	0	0	302	400
February	207	77	0	0	284	358
March	235	88	0	0	324	382
April	226	85	0	0	310	370
May	220	82	0	0	302	406
June	226	85	0	0	310	468
July	228	86	0	0	314	509
August	227	85	0	0	312	502
September	226	85	0	0	310	434
October	220	82	0	0	302	373
November	226	85	0	0	310	362
December	235	88	0	0	324	409
Total	2,695	1,011	0	0	3,706	4,973

Monthly Energy Costs - Zone_4_ReplaceUnit

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Kitchen and Associates

06/08/2010
02:48PM



1. HVAC Costs

Month	Electric (\$)	Natural Gas (\$)	Fuel Oil (\$)	Propane (\$)	Remote Hot Water (\$)	Remote Steam (\$)	Remote Chilled Water (\$)
January	40	58	0	0	0	0	0
February	38	36	0	0	0	0	0
March	45	13	0	0	0	0	0
April	57	3	0	0	0	0	0
May	103	0	0	0	0	0	0
June	157	0	0	0	0	0	0
July	195	0	0	0	0	0	0
August	190	0	0	0	0	0	0
September	124	0	0	0	0	0	0
October	70	1	0	0	0	0	0
November	43	9	0	0	0	0	0
December	44	41	0	0	0	0	0
Total	1,106	161	0	0	0	0	0

2. Non-HVAC Costs

Month	Electric (\$)	Natural Gas (\$)	Fuel Oil (\$)	Propane (\$)	Remote Hot Water (\$)	Remote Steam (\$)
January	302	0	0	0	0	0
February	284	0	0	0	0	0
March	324	0	0	0	0	0
April	310	0	0	0	0	0
May	302	0	0	0	0	0
June	310	0	0	0	0	0
July	314	0	0	0	0	0
August	312	0	0	0	0	0
September	310	0	0	0	0	0
October	302	0	0	0	0	0
November	310	0	0	0	0	0
December	324	0	0	0	0	0
Total	3,706	0	0	0	0	0

Monthly Energy Use by Energy Type - Zone_4_ReplaceUnit

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06/08/2010
02:48PM

1. HVAC Energy Use

Month	Electric (kWh)	Natural Gas (Therm)	Fuel Oil (na)	Propane (na)	Remote HW (na)	Remote Steam (na)	Remote CW (na)
Jan	231	37	0	0	0	0	0
Feb	217	23	0	0	0	0	0
Mar	257	8	0	0	0	0	0
Apr	328	2	0	0	0	0	0
May	593	0	0	0	0	0	0
Jun	903	0	0	0	0	0	0
Jul	1,122	0	0	0	0	0	0
Aug	1,092	0	0	0	0	0	0
Sep	711	0	0	0	0	0	0
Oct	401	0	0	0	0	0	0
Nov	244	6	0	0	0	0	0
Dec	254	26	0	0	0	0	0
Totals	6,356	102	0	0	0	0	0

2. Non-HVAC Energy Use

Month	Electric (kWh)	Natural Gas (Therm)	Fuel Oil (na)	Propane (na)	Remote HW (na)	Remote Steam (na)
Jan	1,737	0	0	0	0	0
Feb	1,632	0	0	0	0	0
Mar	1,860	0	0	0	0	0
Apr	1,784	0	0	0	0	0
May	1,737	0	0	0	0	0
Jun	1,784	0	0	0	0	0
Jul	1,804	0	0	0	0	0
Aug	1,793	0	0	0	0	0
Sep	1,784	0	0	0	0	0
Oct	1,737	0	0	0	0	0
Nov	1,784	0	0	0	0	0
Dec	1,860	0	0	0	0	0
Totals	21,297	0	0	0	0	0

Monthly Energy Use by Component - Zone_4_ReplaceUnit

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Kitchen and Associates

06/08/2010
02:48PM

1. Monthly Energy Use by System Component

Component	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Air System Fans (kWh)	231	216	231	196	181	204	225	222	190	177	212	246
<i>Cooling</i>												
Electric (kWh)	0	1	26	132	412	699	898	870	522	224	32	8
Natural Gas (Therm)	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 (na)	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 (Therm)	37	23	8	2	0	0	0	0	0	0	6	26
Fuel Oil (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	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
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)	1264	1187	1353	1297	1264	1297	1312	1304	1297	1264	1297	1353
Electric Eqpt. (kWh)	474	445	507	487	474	487	492	489	487	474	487	507
Misc. Electric (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
<i>Misc. Fuel</i>												
Natural Gas (Therm)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	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

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:48PM

Table 1. Annual Costs

Component	Zone_4_Replace Unit (\$)
Air System Fans	440
Cooling	665
Heating	161
Pumps	0
Cooling Tower Fans	0
HVAC Sub-Total	1,267
Lights	2,695
Electric Equipment	1,011
Misc. Electric	0
Misc. Fuel Use	0
Non-HVAC Sub-Total	3,706
Grand Total	4,973

Table 2. Annual Cost per Unit Floor Area

Component	Zone_4_Replace Unit (\$/ft²)
Air System Fans	0.166
Cooling	0.251
Heating	0.061
Pumps	0.000
Cooling Tower Fans	0.000
HVAC Sub-Total	0.478
Lights	1.017
Electric Equipment	0.381
Misc. Electric	0.000
Misc. Fuel Use	0.000
Non-HVAC Sub-Total	1.398
Grand Total	1.877
Gross Floor Area (ft²)	2650.0
Conditioned Floor Area (ft²)	2650.0

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

Table 3. Component Cost as a Percentage of Total Cost

Component	Zone_4_Replace Unit (%)
Air System Fans	8.9
Cooling	13.4
Heating	3.2
Pumps	0.0
Cooling Tower Fans	0.0
HVAC Sub-Total	25.5
Lights	54.2
Electric Equipment	20.3
Misc. Electric	0.0
Misc. Fuel Use	0.0
Non-HVAC Sub-Total	74.5
Grand Total	100.0

Annual Energy and Emissions Summary

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:48PM

Table 1. Annual Costs

Component	Zone_4_Replace Unit (\$)
HVAC Components	
Electric	1,106
Natural Gas	161
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Remote CW	0
HVAC Sub-Total	1,267
Non-HVAC Components	
Electric	3,706
Natural Gas	0
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Non-HVAC Sub-Total	3,706
Grand Total	4,973

Table 2. Annual Energy Consumption

Component	Zone_4_Replace Unit
HVAC Components	
Electric (kWh)	6,356
Natural Gas (Therm)	102
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0
Non-HVAC Components	
Electric (kWh)	21,297
Natural Gas (Therm)	0
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Totals	
Electric (kWh)	27,652
Natural Gas (Therm)	102
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0

Annual Energy and Emissions Summary

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:48PM

Table 3. Annual Emissions

Component	Zone_4_Replace Unit
CO2 Equivalent (lb)	0

Table 4. Annual Cost per Unit Floor Area

Component	Zone_4_Replace Unit (\$/ft²)
HVAC Components	
Electric	0.417
Natural Gas	0.061
Fuel Oil	0.000
Propane	0.000
Remote HW	0.000
Remote Steam	0.000
Remote CW	0.000
HVAC Sub-Total	0.478
Non-HVAC Components	
Electric	1.398
Natural Gas	0.000
Fuel Oil	0.000
Propane	0.000
Remote HW	0.000
Remote Steam	0.000
Non-HVAC Sub-Total	1.398
Grand Total	1.877
Gross Floor Area (ft²)	2650.0
Conditioned Floor Area (ft²)	2650.0

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

Table 5. Component Cost as a Percentage of Total Cost

Component	Zone_4_Replace Unit (%)
HVAC Components	
Electric	22.2
Natural Gas	3.2
Fuel Oil	0.0
Propane	0.0
Remote HW	0.0
Remote Steam	0.0
Remote CW	0.0
HVAC Sub-Total	25.5
Non-HVAC Components	
Electric	74.5
Natural Gas	0.0
Fuel Oil	0.0
Propane	0.0
Remote HW	0.0
Remote Steam	0.0
Non-HVAC Sub-Total	74.5
Grand Total	100.0

APPENDIX O

ECM-12 Reduce Water Use

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

ECM-12 Reduced Water Use

Budgetary Costs	Annual Utility Savings			ROI	Potential Incentive	Payback (Without Incentive)	Payback (With Incentive)
	Water	Electricity	Total				
\$	\$	\$	\$		\$	Years	Years
\$ 15.00	\$ 75.00	\$ 50.00	\$ 125.00	82.3	0	0.1	N/A

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

Simple Payback Analysis		
Cost		\$55.00
Incentive		\$0.00
Adjusted Cost		\$55.00
Savings/yr		\$121.35
Payback in years		0.45

[illegible]

**U.S. Department of Energy - Energy Efficiency and Renewable Energy
Federal Energy Management Program**

Energy Cost Calculator for Faucets and Showerheads

Vary utility cost, hours of operation, and /or efficiency level.					
INPUT SECTION					
Input the following data (if any parameter is missing, calculator will set to the default value).				Defaults	
Water Saving Product	Faucet		Faucet	Showerhead	
Flow Rate	0.5	gpm	2.2 gpm	2.5 gpm	
Water Cost (including waste water charges)	.0000000000000000 \$/1000 gal		\$4/1000 gal	\$4/1000 gal	
Gas Cost	1.71	\$/therm	0.60 \$/therm	0.60 \$/therm	
Electricity Cost	.1740	\$/kWh	0.06 \$/kWh	0.06 \$/kWh	
Minutes per Day of Operation	15	minutes	30 minutes	20 minutes	
Days per Year of Operation	260	days	260 days	365 days	
Quantity to be Purchased	1	unit(s)	1 unit	1 unit	
Calculate Reset					
OUTPUT SECTION					
Performance per Faucet	Your Choice	Base Model	FEMP Recommended Level	Best Available	Self Closing Faucet (gallon per cycle)
WATER USE ONLY					
Gallon per Minute	0.5 gpm	2.2	2	1.5	0.25
Annual Water Use	1950 gal	8580	7800	5850	1950
Annual Water Cost	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0
Lifetime Water Cost	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0
WITH ELECTRIC WATER HEATING					

Annual Energy Use	110 kWh	485	441	331	110
Annual Energy Cost	\$ 19	\$ 84	\$ 77	\$ 58	\$ 19
Lifetime Energy Cost	\$ 150	\$ 662	\$ 602	\$ 452	\$ 150
Lifetime Energy and Water Cost Savings	\$ 512	\$ 0	\$ 60	\$ 210	\$ 512
Lifetime Energy and Water Cost Savings for 1	\$ 512	\$ 0	\$ 60	\$ 210	\$ 512
Faucet(s)					

WITH GAS WATER HEATING

Annual Energy Use	6 therms	27	24	18	6
Annual Energy Cost	\$ 10	\$ 46	\$ 41	\$ 31	\$ 10
Lifetime Energy Cost	\$ 83	\$ 382	\$ 340	\$ 257	\$ 83
Lifetime Energy and Water Cost Savings	\$ 299	\$ 0	\$ 42	\$ 125	\$ 299
Lifetime Energy and Water Cost Savings for 1	\$ 299	\$ 0	\$ 42	\$ 125	\$ 299
Faucet(s)					

For electric water heating applications, your selection of an energy saving faucet with a flow rate of 0.5 gallon(s) per minute will have a combined energy and water cost savings (per faucet) of \$ 512 over an estimated 10 year life expectancy compared to the base model.

For gas water heating applications, your selection of an energy saving faucet with a flow rate of 0.5 gallon(s) per minute will have a combined energy and water cost savings (per faucet) of \$ 299 over an estimated 10 year life expectancy

compared to the base model.

Assumptions

- "Base model" has an efficiency that just meets the national minimum standard for faucets or showerheads.
- Lifetime energy cost and lifetime water cost is the sum of the discounted value of the annual energy and water costs based on an assumed faucet or showerhead life of 10 years.
- Future gas and electricity price trends and a discount rate of 3.2% are based on Federal guidelines.
- \$0.06 per kWh is the Federal average electricity price in the U.S.
- \$0.60 per therm is the Federal average gas price in the U.S.
- The assumed combined water and waste-water price is \$4.00/1000 gallons.

Disclaimer

This cost calculator is a screening tool that estimates a product's lifetime energy cost savings at various efficiency levels. Maintenance and installation costs do not vary significantly among the same product having different efficiencies; so, these costs are not included in this calculator tool. For a detailed life-cycle cost analysis, FEMP has developed a tool called [Building Life-Cycle Cost \(BLCC\)](#). This downloadable tool allows the user to vary interest rates, installation costs, maintenance costs, salvage values, and life expectancy for a product or an entire energy project.

Water Saving Product Flow Rate in gallons per minute. Default for a faucet is 2.2 gallons per minute. Default for a showerhead is 2.5 gallons per minute. Water cost including waste water charges in dollars per 1000 gallons. Default for a faucet is 4 dollars per 1000 gallons. Default for a showerhead is 4 dollars per 1000 gallons. Gas cost in dollars per therm. Default for a faucet is 0.60 dollars per therm. Default for a showerhead is 0.60 per therm. Electricity cost in dollars per kilowatt hour. Default for a faucet is 0.06 dollars per kilowatt hour. Default for a showerhead is 0.06 dollars per kilowatt hour. Minutes per day of operation, measured in minutes. Default for a faucet is 30 minutes. Default for a showerhead is 20 minutes. Days per year of operation, measured in days. Default for a faucet is 260 days. Default for a showerhead is 365 days. Quantity to be purchased, measured in units. Default for a faucet is 1 unit. Default for a showerhead is 1 unit. Performance for faucet or showerhead, depending on selection above. Your Choice with Water Use Only Form Labels Gallons per minute based on your choice, for water use only. Annual water use based on your choice, for water use only. Annual water cost based on your choice, for water use only. Lifetime water cost based on your choice, for water use only. Base Model with Water Use Only Form Labels Gallons per minute based on the base model, for water use only. Annual water use based on the base model, for water use only. Annual water cost based on the base model, for water use only. Lifetime water cost based on the base model, for water use only. FEMP Recommended Levels with Water Use Only Form Labels Gallons per minute based on FEMP recommended levels, for water use only. Annual water use based on FEMP recommended levels, for water use only. Annual water cost based on FEMP recommended levels, for water use only. Lifetime water cost based on FEMP recommended levels, for water use only. Best Available with Water Use Only Form Labels Gallons per minute based on best available levels, for water use only. Annual water use based on best available levels, for water use only. Annual water cost based on best available levels, for water use only. Lifetime water cost based on best available levels, for water use only. Self Closing Faucet with Water Use Only Form Labels Gallons per minute based on self closing faucet, measured in gallon per cycle, for water use only. Annual water use based on self closing faucet, measured in gallon per cycle, for water use only. Annual water cost based on self closing faucet, measured in gallon per cycle, for water use only. Lifetime water cost based on self closing faucet, measured in gallon per cycle, for water use only. Your Choice with Electric Water Heating Form Labels Annual energy use, based on your choice and measured in kilowatt hour, for water use with electric water heating. Annual energy cost, based on your choice and measured in dollars, for water use with electric water heating. Lifetime energy cost, based on your choice and measured in dollars, for water use with electric water heating. Lifetime energy and water cost savings, based on your choice and measured in dollars, for water use with electric water heating. Lifetime energy and water cost savings for the number of units and item you selected, based on your choice and measured in dollars, for water use with electric water heating. Base Model with Electric Water Heating Form Labels Annual energy use, based on the base model and measured in dollars, for

water use with electric water heating. Annual energy cost, based on the base model and measured in dollars, for water use with electric water heating. Lifetime energy cost, based on the base model and measured in dollars, for water use with electric water heating. Lifetime energy and water cost savings, based on the base model and measured in dollars,, for water use with electric water heating. Lifetime energy and water cost savings for the number of units and item you selected, based on the base model and measured in dollars, for water use with electric water heating. FEMP Recommended Levels with Electric Water Heating Form Labels Annual energy use, based on FEMP recommended levels and measured in dollars,, for water use with electric water heating. Annual energy cost, based on FEMP recommended levels and measured in dollars, for water use with electric water heating. 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Lifetime energy and water cost savings for the number of units and item you selected, based on self closing faucet and measured in dollars, for water use with electric water heating. Your Choice with Gas Water Heating Form Labels Annual energy use, based on your choice and measured in kilowatt hour, for water use with gas water heating. Annual energy cost, based on your choice and measured in dollars, for water use with gas water heating. Lifetime energy cost, based on your choice and measured in dollars, for water use with gas water heating. Lifetime energy and water cost savings, based on your choice and measured in dollars, for water use with gas water heating. Lifetime energy and water cost savings for the number of units and item you selected, based on your choice and measured in dollars, for water use with gas water heating. Base Model with Gas Water Heating Form Labels Annual energy use, based on the base model and measured in dollars, for water use with gas water heating. 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Lifetime energy and water cost savings, based on FEMP recommended levels and measured in dollars, for water use with gas water heating. Lifetime energy and water cost savings for the number of units and item you selected, based on FEMP recommended levels and measured in dollars, for water use with gas water heating. Best Available with Gas Water Heating Form Labels Annual energy use, based on best available levels and measured in dollars,, for water use with gas water heating. Annual energy cost, based on best available levels and measured in dollars, for water use with gas water heating. Lifetime energy cost, based on best available levels and measured in dollars, for water use with gas water heating. Lifetime energy and water cost savings, based on best available levels and measured in dollars,, for water use with gas water heating. Lifetime energy and water cost savings for the number of units and item you selected, based on best available levels and measured in dollars, for water use with gas water heating. Self Closing Faucet with Gas Water Heating Form Labels Annual energy use, based on self closing faucet and measured in dollars, for water use with gas water heating. Annual energy cost, based on self closing faucet and measured in dollars, measured in gallon per cycle, for water use with gas water heating. Lifetime energy cost, based on self closing faucet and measured in dollars, for water use with gas water heating. Lifetime energy and water cost savings, based on self closing faucet and measured in dollars, for water use with gas water heating. Units to be purchased. Either

Faucet or Showerhead, based on selection above. Lifetime energy and water cost savings for the number of units and item you selected, based on self closing faucet and measured in dollars, for water use with gas water heating. For electric water heating applications, your selection of an energy saving with a flow rate of gallon(s) per minute will have a combined energy and cost savings (per) of For gas water heating applications, your selection of an energy saving with a flow rate of gallon(s) per minute will have a combined energy and water cost savings (per) of

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Content Last Updated: 03/15/2010

BPU ENERGY AUDIT PROGRAM
Andover Township Department of Public Works Garage
CHA Project #20997

ECM-12 Reduced Water Use

Multipliers	
Material	1
Labor	1.21
Equipment	1.07

Installation Costs										
Item	Qty	Unit	Unit Costs			Subtotal Costs			Total Cost	Remarks
			Material	Labor	Equipment	Material	Labor	Equipment		
0.5 GPM Faucet Aerator	1	ea	\$ 15.00	\$ -		\$ 15.00	\$ -	\$ -	\$ 15.00	

** Intallation by Owner

Subtotal	\$ 15.00
Total	\$ 15.00

APPENDIX P

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:	0267369
State:	New Jersey
Latitude:	41.3 ° N
Longitude:	74.7 ° W
PV System Specifications	
DC Rating:	20.0 kW
DC to AC Derate Factor:	0.770
AC Rating:	15.4 kW
Array Type:	Fixed Tilt
Array Tilt:	41.3 °
Array Azimuth:	180.0 °
Energy Specifications	
Cost of Electricity:	17.4 ¢/kWh

Results			
Month	Solar Radiation (kWh/m ² /day)	AC Energy (kWh)	Energy Value (\$)
1	2.90	1435	249.69
2	3.77	1657	288.32
3	4.69	2226	387.32
4	4.72	2099	365.23
5	5.14	2263	393.76
6	5.26	2188	380.71
7	5.23	2198	382.45
8	5.05	2148	373.75
9	4.64	1960	341.04
10	4.04	1828	318.07
11	2.73	1199	208.63
12	2.41	1140	198.36
Year	4.22	22341	3887.33

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>)

Andover Twp. DPW
Andover Township, NJ



Solar Project Cash Flow
Purchase Model

Privileged and
Confidential

Project Size	32.00	Factor	116.00%	Output	37,120
				kW hr/ yr	
Array Material Cost	\$204,800				
Array Support Cost -Tax Benefit Amt	\$0				
NJCEP Rebate	\$32,000				
Project Tax Basis	\$172,800				
2009 DOE Stimulus Package Grant	\$0				
Net Project Investment	\$172,800				

Array Support Costs (necessary for solar support attachment)	
Specify Specific Material & Cost	\$0
Array Coverage Estimate	0.00%
Solar Tax Benefit Amount	\$0
Balance for Regular Business Tax	\$0 (included in loan amount only)

Assumptions	
Utility Rate (Adj. for June '08 inc.)	\$0.19934
Electricity Rate Inflation	4.50%
RECs Value Basis	\$0.62
Federal Effective Tax Rate	0.00%
State Effective Tax Rate	0.00%

Source of Funds	
Loan Level (% of Un-rebated cost)	100.00%
Loan Interest Rate	5.50%
Loan Term (years)	6
Cash Investment	\$0
Loan Amount	\$172,800
Loan to Value Ratio (System Cost)	84.38%

Annual Use	kW Hrs.	\$ Amount
	16,289	\$3,247

Operating Year >	Now	1	2	3	4	5	6
Project Costs							
Cash Investment	\$0						
Loan Amount	(\$172,800)						
Net Project Investment	(\$172,800)						

7	8	9	10
---	---	---	----

Annual Return											
Business Energy Tax Credit (1)		\$0									
Expense Deduction (per Sect 179)		\$0									
MACRS Depreciation (3)		\$0	\$0	\$0	\$0	\$0	\$0				
NJ State Depreciation Benefit		\$0	\$0	\$0	\$0	\$0	\$0				
Electricity Savings		\$7,733	\$8,040	\$8,360	\$8,692	\$9,038	\$9,374	\$9,722	\$10,084	\$10,458	\$10,847
RECS- Renewable Energy Certificates		\$23,014	\$22,292	\$21,593	\$20,916	\$20,260	\$19,625	\$18,913	\$18,274	\$18,137	\$18,001
Total Annual Return	\$0	\$30,747	\$30,333	\$29,953	\$29,608	\$29,298	\$28,949	\$28,636	\$28,358	\$28,595	\$28,848
Annual Costs											
Loan Payments		(\$33,878)	(\$33,878)	(\$33,878)	(\$33,878)	(\$33,878)	(\$33,878)	\$0	\$0	\$0	\$0
Monitoring / Maintenance Costs		(\$750)	(\$750)	(\$750)	(\$750)	(\$750)	(\$750)	(\$750)	(\$750)	(\$750)	(\$750)
Total Annual Costs	\$0	(\$34,628)	(\$34,628)	(\$34,628)	(\$34,628)	(\$34,628)	(\$34,628)	(\$750)	(\$750)	(\$750)	(\$750)
Annual Net Cash Flow	\$0	(\$3,881)	(\$4,296)	(\$4,675)	(\$5,020)	(\$5,330)	(\$5,679)	\$27,886	\$27,608	\$27,845	\$28,098
Cumulative Net Cash Flow	\$0	(\$3,881)	(\$8,177)	(\$12,852)	(\$17,872)	(\$23,202)	(\$28,881)	(\$995)	\$26,613	\$54,458	\$82,556
Cum. Net Cash Flow % Applied to Loan		0%	0%	0%							
Operating Year >	Now	1	2	3	4	5	6	7	8	9	10

Sum of Years	
11 - 20	21 - 30

\$ 133,307	\$ 192,008
\$ 35,128	\$ -
\$168,435	\$192,008

(\$7,502)	(\$7,502)
(\$7,502)	(\$7,502)

\$160,933	\$184,506
\$243,489	\$427,995
Yrs 1 - 20	Yrs 1 - 30

Notes to User:

Incentives and energy savings depend upon several factors that may not be represented in this sample. NJ BPU reserves the right to enhance or alter rebates and incentives. The figures provided should be verified by a trusted tax professional. A E T does not take responsibility for suitability of Tax benefits to clients circumstances.

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Detailed Calculations



Business Energy Tax Credit Calculation		Form 3468	For 2009 thru 2016 Reporting Only
Basis of Tax Deduction	\$172,800	Optional Method	Take Optional Pm't
2006-07 Business Energy Tax Credit Rate	0.0%		YES
Tax Deduction 2006 Calc	\$ - Line 2	Payment Rate	\$172,800 Net Cost Basis
Adjustments	0.0%	Direct Payment	0.0% Commercial Rate
Additional Tax Credits - Other	\$ - Line 11		\$0 By US Treasury Check
Applicable Deduction Line 2 + 11	\$ - Compare to Form 4626 Line 12 for Corporate AMT option.		
Reduce Un-rebated cost by	50% of Business Energy Credit		
Depreciation Basis Reduction	\$0		
Basis for depreciation Sch #2	\$172,800	\$172,800	Un-rebated cost - 50% of Business Energy Tax Credit, Restored Jan 2009

DSIREUSA and Cornell Law Web Sites
<http://www.dsireusa.org/documents/Incentives/US02F.htm>

Expense Deduction (per Sect 179)	
Tax Form 4562 Bus Assets Cap	\$ - \$ - Lesser amount of \$800,000 or Basis for depreciation x Fed Tax Rate-
After Tax Effect	\$0 Per 2009 Stimulus package
	New Caps - \$ 250 ,000 Max Deduction at \$800,000 Expenditure
Basis for depreciation Sch #3	\$172,800 Basis for depreciation Sch #2 - Expense deduction

http://www4.law.cornell.edu/uscode/html/uscode26/usc_sec_26_00000179-000-.html

MACRS Depreciation (3)								
Depreciation Schedule #3		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	
Depreciation Schedule with	Yearly % Basis	20.0%	32.0%	19.2%	11.5%	11.5%	5.8%	100%
Half Year Convention	\$172,800	\$34,560	\$55,296	\$33,178	\$19,872	\$19,872	\$10,022	\$172,800
After Tax Effect	0.00%	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -

<http://www.dsireusa.org/documents/Incentives/US06F.htm>

NJ State Depreciation Benefit								
Depreciation Schedule #3		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	
Depreciation Schedule with	Yearly Basis	20.0%	32.0%	19.2%	11.5%	11.5%	5.8%	100%
Half Year Convention	\$	\$ 34,560	\$ 55,296	\$ 33,178	\$ 19,872	\$ 19,872	\$ 10,022	\$ 172,800
After Tax Effect	0.00%	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -

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Electricity Savings

Electricity Savings Years 1 - 10

Operating Year	0	1	2	3	4	5	6	7	8	9	10
Loss factor		0.0000	0.0050	0.0050	0.0050	0.0050	0.0075	0.0075	0.0075	0.0075	0.0075
Solar Electric Output	37,120	37,120	36,934	36,750	36,566	36,383	36,110	35,839	35,571	35,304	35,039
Adjusted Utility Rate	\$ 0.19934	\$ 0.20831	\$ 0.21768	\$ 0.22748	\$ 0.23772	\$ 0.24841	\$ 0.25959	\$ 0.27128	\$ 0.28348	\$ 0.29624	\$ 0.30957
Electricity Savings		\$ 7,733	\$ 8,040	\$ 8,360	\$ 8,692	\$ 9,038	\$ 9,374	\$ 9,722	\$ 10,084	\$ 10,458	\$ 10,847
Cost Reduction	100.00%	\$ 7,733	\$ 8,040	\$ 8,360	\$ 8,692	\$ 9,038	\$ 9,374	\$ 9,722	\$ 10,084	\$ 10,458	\$ 10,847

Electricity Savings Years 11 - 20

Electricity Savings Years 11 - 20													
Operating Year		11	12	13	14	15	16	17	18	19	20	11 - 20	
Loss factor		0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075		
Solar Electric Output		34,776	34,515	34,257	34,000	33,745	33,492	33,240	32,991	32,744	32,498	336,258	
Adjusted Utility Rate		\$ 0.32350	\$ 0.33806	\$ 0.35327	\$ 0.36917	\$ 0.38578	\$ 0.40314	\$ 0.42128	\$ 0.44024	\$ 0.46005	\$ 0.48075		
Electricity Savings		\$ 11,250	\$ 11,668	\$ 12,102	\$ 12,552	\$ 13,018	\$ 13,502	\$ 14,004	\$ 14,524	\$ 15,064	\$ 15,624	\$ 133,307	
	Cost Reduction	100.00%	\$ 11,250	\$ 11,668	\$ 12,102	\$ 12,552	\$ 13,018	\$ 13,502	\$ 14,004	\$ 14,524	\$ 15,064	\$ 15,624	\$ 133,307

Electricity Savings Years 21 - 30

Electricity Savings Years 21 - 30											
Operating Year	21	22	23	24	25	26	27	28	29	30	21 - 30
Loss factor	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	
Solar Electric Output	32,254	32,012	31,772	31,534	31,298	31,063	30,830	30,599	30,369	30,141	311,873
Adjusted Utility Rate	\$ 0.50239	\$ 0.52499	\$ 0.54862	\$ 0.57331	\$ 0.59911	\$ 0.62607	\$ 0.65424	\$ 0.68368	\$ 0.71444	\$ 0.74659	
Electricity Savings	\$ 16,204	\$ 16,806	\$ 17,431	\$ 18,079	\$ 18,751	\$ 19,447	\$ 20,170	\$ 20,920	\$ 21,697	\$ 22,503	\$ 192,008
Cost Reduction	100.00%	\$ 16,204	\$ 16,806	\$ 17,431	\$ 18,079	\$ 18,751	\$ 19,447	\$ 20,170	\$ 20,920	\$ 21,697	\$ 22,503

RECS - Renewable Energy Certificates [N.J. State Issued]

3rd Annual Decline Until 2017

RECS Years 1 - 10

Operating Year	0	1	2	3	4	5	6	7	8	9	10
Solar Electric Output	37,120	37,120	36,934	36,750	36,566	36,383	36,110	35,839	35,571	35,304	35,039
RECs \$/ kW-hr	\$0.62	\$ 0.620	\$ 0.604	\$ 0.588	\$ 0.572	\$ 0.557	\$ 0.542	\$ 0.528	\$ 0.514	\$ 0.514	\$ 0.514
RECs Income	-2.65%	\$ 23,014	\$ 22,292	\$ 21,593	\$ 20,916	\$ 20,260	\$ 19,575	\$ 18,913	\$ 18,274	\$ 18,137	\$ 18,001

RECS Years 11 - 20

Operating Year	11	12	13	14	15	16	17	18	19	20	11 - 20
Solar Electric Output	34,776	34,515	34,257	34,000	33,745	33,492	33,240	32,991	32,744	32,498	336,258
RECs \$/ kW-hr	\$ 0.514	\$ 0.500	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	
RECs Income	\$ 17,866	\$ 17,262	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 35,128

RECS Years 21 - 30

Operating Year	21	22	23	24	25	26	27	28	29	30	21 - 30
Solar Electric Output	32,254	32,012	31,772	31,534	31,298	31,063	30,830	30,599	30,369	30,141	311,873
RECs \$/ kW-hr	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	
RECs Income	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -

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

Electric Rate: \$ 0.1740/kWh **More**

Monthly Electric Usage: 5,947 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 \$80,638 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 **More** buttons to learn about our assumptions and other important information used to generate your estimate. Also, please review the [notes](#) below.

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: \$ 1,035 / Month
(Assumed rate x average monthly usage)

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 14.02 kW and 21.04 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: 17.53 kW of peak power
(DC watts)

Roof Area Needed: 1,753 sq-ft

Equivalent Annual Production: 22,123 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 18 kW peak DC power system will cost between \$112,192 and \$168,288. This estimate assumes the mid-point of this cost range.

Assumed Installation Gross Cost: \$140,240
"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](#) \$ 170,393

NJ Renewable Energy Incentive (Commercial) [» link](#) \$ 17,530

Federal Tax Credit (30% of Gross Cost at Installation) » link	\$ 42,072
---	-----------

Modified Accelerated Cost Recovery System (MACRS) Depreciation (5 yr) » link	YES
--	-----

ESTIMATED NET COST:	\$ -89,755
----------------------------	-------------------

ESTIMATED NET COST AT INSTALLATION:	\$ 80,638
--	------------------

Cash & Loan Amounts:	\$ 80,638 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:	\$3,849
------------------------------------	----------------

Average Monthly Utility Savings: <i>over 25-year expected life of system</i>	\$538
--	--------------

Average Annual Utility Savings: <i>over 25-year expected life of system</i>	\$6,461
---	----------------

25-year Utility Savings:	\$161,522
---------------------------------	------------------

Internal Rate of Return (IRR):	25 %
---------------------------------------	-------------

Net Present Value (NPV):	\$118,035
---------------------------------	------------------

Profitability Index:	2.5
-----------------------------	------------

Greenhouse Gas (CO2) Saved: <i>over 25-year system life</i>	454 tons 908,000 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 (\$140,240)						
NJ: Solar Renewable Energy Certificates (SREC)	\$0	\$13,947	\$13,527	\$13,120	\$12,725	\$12,342
NJ Renewable Energy Incentive (Commercial)	\$17,530	\$0	\$0	\$0	\$0	\$0
Federal Tax Credit (30% of Gross Cost at Installation)	\$42,072	\$0	\$0	\$0	\$0	\$0
Tax savings from MACRS Depreciation	\$0	\$7,280	\$11,648	\$6,989	\$4,193	\$4,193
Utility Savings	\$0	\$2,565	\$2,662	\$2,762	\$2,867	\$2,975
ANNUAL CASH FLOW	\$-80,638	\$23,792	\$27,836	\$22,871	\$19,785	\$19,510
Cumulative Cash Flow	\$-80,638	\$-56,846	\$-29,010	\$-6,139	\$13,646	\$33,156
Breakeven						
Year of Operation:	6	7	8	9	10	11
Gross Cost						
NJ: Solar Renewable Energy Certificates (SREC)	\$11,971	\$11,611	\$11,261	\$10,922	\$10,594	\$10,275
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	\$2,097	\$0	\$0	\$0	\$0	\$0
Utility Savings	\$3,087	\$3,204	\$3,325	\$3,451	\$3,581	\$3,717
ANNUAL CASH FLOW	\$17,155	\$14,815	\$14,586	\$14,373	\$14,175	\$13,992
Cumulative Cash Flow	\$50,311	\$65,126	\$79,712	\$94,085	\$108,260	\$122,252
Year of Operation:	12	13	14	15	16	17
Gross Cost				(\$15,777) Inverter Replaced		
NJ: Solar Renewable Energy Certificates (SREC)	\$9,965	\$9,666	\$9,375	\$9,092	\$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	\$3,857	\$4,003	\$4,154	\$4,311	\$4,474	\$4,644
ANNUAL CASH FLOW	\$13,822	\$13,669	\$13,529	\$-2,374	\$4,474	\$4,644

Cumulative Cash Flow \$136,074 \$149,743 \$163,272 \$160,898 \$165,372 \$170,016

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 Cost at Installation)	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Tax savings from MACRS Depreciation	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Utility Savings	\$4,819	\$5,001	\$5,190	\$5,386	\$5,590	\$5,801	\$6,021	\$6,248
ANNUAL CASH FLOW	\$4,819	\$5,001	\$5,190	\$5,386	\$5,590	\$5,801	\$6,021	\$6,248
Cumulative Cash Flow	\$174,835	\$179,836	\$185,026	\$190,412	\$196,002	\$201,803	\$207,824	\$214,072

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.

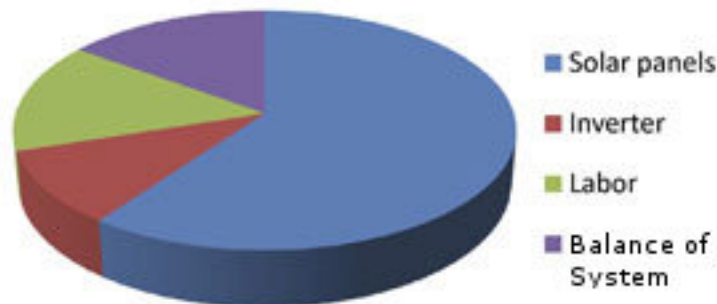
THE COST TO GO SOLAR

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

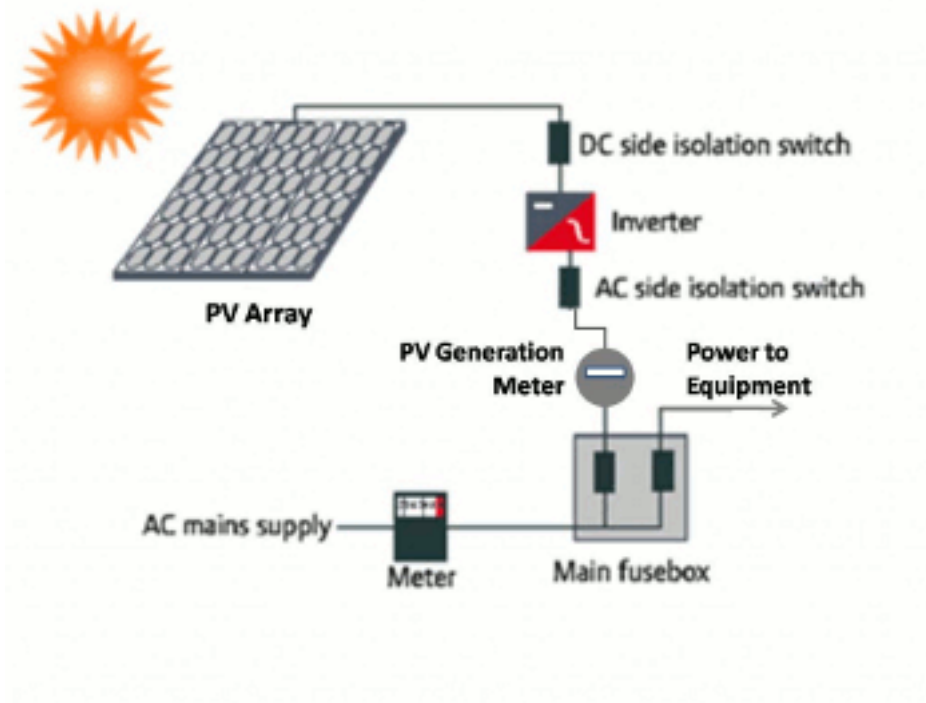
also be higher if you add other features or have special installation needs (such as application over tile roofing) or you choose to use special mounting systems (such as sun tracking systems). Other factors may also affect price, including, but not limited to, your location, the building condition, 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 & Assumptions](#)



[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 Q

Solar Thermal Domestic Hot Water Plant



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[Electric Choice](#)

[Home Energy](#)

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

[Carbon Pollution Calculator](#)

[Electric Power Pollution Calculator](#)

[PV System Economics](#)

[Solar Water Heating](#)

[What's a Watt?](#)

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	58 Water Inlet Temperature (Degrees F)	58
40 Capacity (gallons)	40	70 Ambient Temperature (Degrees F)	70
17.32 Surface Area (calculated - sq ft)	17.32	135 Hot Water Temperature (Degrees F)	135
19.25 Effective R-value	19.25	64.3 Hot Water Usage (Gallons per Day)	64.3
Energy Use			
1694		1694 Heat Delivered in Hot Water (BTU/hr)	
58.48		58.48 Heat loss through insulation (BTU/hr)	

Gas vs. Electric Water Heating		
Gas		Electric
0.8	0.8 Overall Efficiency	0.9473
0.8276	0.8276 Conversion Efficiency	0.98

2118 BTU/hr	? Power Into Water Heater	1788 BTU/hr
Cost		
\$ 1.71 /Therm	? Utility Rates	\$ 0.08 /kWh
\$ 317.2679	? Yearly Water Heating Cost	\$ 366.9812
How Does Solar Compare?		
? Solar Water Heater Cost: \$ 9305		? Percentage Solar: 70
41.89789 years for gas	? Payback Time for Solar System	36.22216 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](#).

[Window on State Government](#) | [Privacy and Security Policy](#) | [Accessibility Policy](#)

[State Energy Conservation Office \(SECO\)](#)

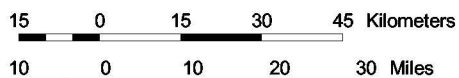
APPENDIX R

Wind

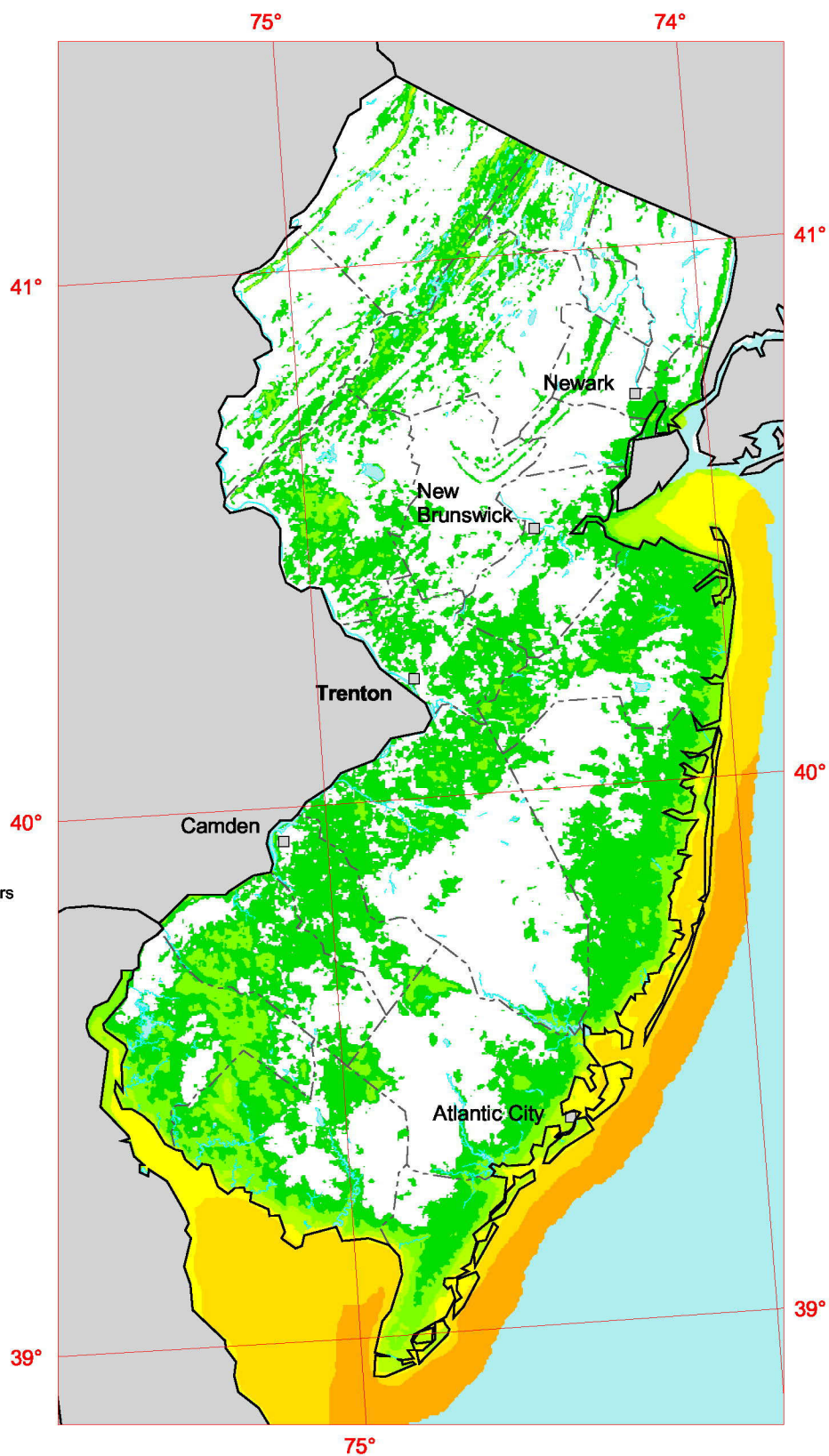
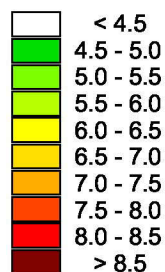
New Jersey

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 S

EPA Portfolio Manager

STATEMENT OF ENERGY PERFORMANCE

Andover Township Town Hall

Building ID: 2272201

For 12-month Period Ending: November 30, 2009¹

Date SEP becomes ineligible: N/A

Date SEP Generated: May 26, 2010

Facility	Facility Owner	Primary Contact for this Facility
Andover Township Town Hall Newton Sparta Rd and Rt 616 Newton, NJ 07860	N/A	N/A

Year Built: 1992

Gross Floor Area (ft²): 8,807Energy Performance Rating² (1-100) 58**Site Energy Use Summary³**

Electricity - Grid Purchase(kBtu)	243,617
Natural Gas (kBtu) ⁴	500,820
Total Energy (kBtu)	744,437

Energy Intensity⁵

Site (kBtu/ft ² /yr)	85
Source (kBtu/ft ² /yr)	152

Emissions (based on site energy use)

Greenhouse Gas Emissions (MtCO ₂ e/year)	64
---	----

Electric Distribution Utility

FirstEnergy - Jersey Central Power & Lt Co

National Average Comparison

National Average Site EUI	93
National Average Source EUI	167
% Difference from National Average Source EUI	-9%
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 Town Hall	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	Newton Sparta Rd and Rt 616, Newton, NJ 07860	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	8,807 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	36	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	26	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?		☐

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	4,400.00
10/01/2009	10/31/2009	5,240.00
09/01/2009	09/30/2009	5,840.00
08/01/2009	08/31/2009	8,840.00
07/01/2009	07/31/2009	6,840.00
06/01/2009	06/30/2009	6,480.00
05/01/2009	05/31/2009	6,640.00
04/01/2009	04/30/2009	4,960.00
03/01/2009	03/31/2009	5,920.00
02/01/2009	02/28/2009	5,600.00
01/01/2009	01/31/2009	5,800.00
12/01/2008	12/31/2008	4,840.00
Electric Meter Consumption (kWh (thousand Watt-hours))		71,400.00
Electric Meter Consumption (kBtu (thousand Btu))		243,616.80
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		243,616.80
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?		☐
Fuel Type: Natural Gas		
Meter: Natural Gas Meter (therms) Space(s): Entire Facility		
Start Date	End Date	Energy Use (therms)
11/01/2009	11/30/2009	80.60
10/01/2009	10/31/2009	54.00
09/01/2009	09/30/2009	3.10
08/01/2009	08/31/2009	2.10
07/01/2009	07/31/2009	2.10
06/01/2009	06/30/2009	2.10
05/01/2009	05/31/2009	3.10
04/01/2009	04/30/2009	62.10
03/01/2009	03/31/2009	139.80
02/01/2009	02/28/2009	305.10

01/01/2009	01/31/2009	402.70
12/01/2008	12/31/2008	320.20
Natural Gas Meter Consumption (therms)		1,377.00
Natural Gas Meter Consumption (kBtu (thousand Btu))		137,700.00
Meter: Natural Gas Meter B (therms) Space(s): Entire Facility		
Start Date	End Date	Energy Use (therms)
11/01/2009	11/30/2009	316.40
10/01/2009	10/31/2009	148.60
09/01/2009	09/30/2009	32.40
08/01/2009	08/31/2009	7.30
07/01/2009	07/31/2009	7.30
06/01/2009	06/30/2009	8.30
05/01/2009	05/31/2009	14.50
04/01/2009	04/30/2009	232.90
03/01/2009	03/31/2009	430.90
02/01/2009	02/28/2009	732.60
01/01/2009	01/31/2009	849.10
12/01/2008	12/31/2008	850.90
Natural Gas Meter B Consumption (therms)		3,631.20
Natural Gas Meter B Consumption (kBtu (thousand Btu))		363,120.00
Total Natural Gas Consumption (kBtu (thousand Btu))		500,820.00
Is this the total Natural Gas consumption at this building including all Natural Gas meters?		☐

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

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

Certifying Professional

(When applying for the ENERGY STAR, the Certifying Professional must be the same 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 Town Hall
Newton Sparta Rd and Rt 616
Newton, NJ 07860

Facility Owner

N/A

Primary Contact for this Facility

N/A

General Information

Andover Township Town Hall	
Gross Floor Area Excluding Parking: (ft ²)	8,807
Year Built	1992
For 12-month Evaluation Period Ending Date:	November 30, 2009

Facility Space Use Summary

Offices	
Space Type	Office
Gross Floor Area(ft ²)	8,807
Weekly operating hours	40
Workers on Main Shift	36
Number of PCs	26
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	58	58	75	N/A	50
Energy Intensity					
Site (kBtu/ft ²)	85	85	69	N/A	93
Source (kBtu/ft ²)	152	152	123	N/A	167
Energy Cost					
\$/year	\$ 20,204.18	\$ 20,204.18	\$ 16,408.58	N/A	\$ 22,185.64
\$/ft ² /year	\$ 2.29	\$ 2.29	\$ 1.86	N/A	\$ 2.51
Greenhouse Gas Emissions					
MtCO ₂ e/year	64	64	52	N/A	70
kgCO ₂ e/ft ² /year	7	7	6	N/A	8

More than 50% of your building is defined as Office. Please note that your rating accounts for all of the spaces listed. The National Average column presents energy performance data your building would have if your building had an average rating of 50.

Notes:

o - This attribute is optional.

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

APPENDIX T

Carrier Hourly Analysis Program Base Building Data

Floor1_Zone1 Input Data

Project Name: Andover - Town Hall
Prepared by: Kitchen and Associates

06/08/2010
01:39PM

1. General Details:

Air System Name Floor1_Zone1
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 5 %
Outdoor Air CO2 Level 400 ppm

Economizer Data:

Control Integrated dry-bulb control
Upper Cutoff 75.0 °F
Lower Cutoff -60.0 °F

Ventilation Reclaim Data:

Reclaim Type Sensible Heat
Thermal Efficiency 80 %
Input kW 0.200 kW
Schedule JFMAMJJASOND

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 - Natural Gas
Schedule JFMAMJJASOND
Capacity Control Cycled or Staged Capacity - Fan On

Supply Fan Data:

Fan Type Forward Curved
Configuration Draw-thru
Fan Performance 1.10 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 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. 76.0 °F
Cooling T-stat: Unocc. 76.0 °F
Heating T-stat: Occ. 72.0 °F
Heating T-stat: Unocc. 72.0 °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

Floor1_Zone1 Input Data

Project Name: Andover - Town Hall
Prepared by: Kitchen and Associates

06/08/2010
01:39PM

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**

4. Sizing Data (Computer-Generated):

System Sizing Data:

Cooling Supply Temperature **58.0** °F
Supply Fan Airflow **2580.1** CFM
Ventilation Airflow **1125.0** 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	2580.1	-	-	

5. Equipment Data

Central Cooling Unit - Air-Cooled DX

Estimated Maximum Load **87.1** MBH
Design OAT **95.0** °F
Equipment Sizing **User-Defined**
Gross Cooling Capacity **75.5** MBH
ARI Performance Rating **9.00** 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 **64.9** MBH
Equipment Sizing **User-Defined**
Gross Heating Capacity **135.0** MBH
Average Efficiency **78.0** %
Misc. Electric **0.000** kW

Space Input Data

Andover - Town Hall
Kitchen and Associates

06/08/2010
01:41PM

BLD1-F001-Z01

1. General Details:

Floor Area **1090.0** ft²
Avg. Ceiling Height **9.0** ft
Building Weight **70.0** lb/ft²

1.1. OA Ventilation Requirements:

Space Usage **User-Defined**
OA Requirement 1 **1125.0** CFM
OA Requirement 2 **0.00** CFM/ft²
Space Usage Defaults **ASHRAE Std 62.1-2007**

2. Internals:

2.1. Overhead Lighting:

Fixture Type **Recessed (Vented)**
Wattage **2.00** W/ft²
Ballast Multiplier **1.00**
Schedule **90.1 Office Lights/Elec**

2.2. Task Lighting:

Wattage **0.00** W/ft²
Schedule **None**

2.3. Electrical Equipment:

Wattage **0.75** W/ft²
Schedule **90.1 Office Lights/Elec**

3. Walls, Windows, Doors:

Exp.	Wall Gross Area (ft ²)	Window 1 Qty.	Window 2 Qty.	Door 1 Qty.
S	410.0	0	0	0
W	390.0	2	0	1
N	410.0	5	0	0

3.1. Construction Types for Exposure S

Wall Type **Light Weight Wall**

3.2. Construction Types for Exposure W

Wall Type **Light Weight Wall**
1st Window Type **Standard Glass**
Door Type **Exterior Door**

3.3. Construction Types for Exposure N

Wall Type **Light Weight Wall**
1st Window Type **Standard Glass**

4. Roofs, Skylights:

(No Roof or Skylight data).

5. Infiltration:

Design Cooling **0.50** CFM/ft²
Design Heating **0.50** CFM/ft²
Energy Analysis **0.50** CFM/ft²

Infiltration occurs at all hours.

6. Floors:

Type **Slab Floor On Grade**
Floor Area **1090.0** ft²
Total Floor U-Value **0.100** BTU/(hr-ft²-°F)
Exposed Perimeter **100.0** ft
Edge Insulation R-Value **0.00** (hr-ft²-°F)/BTU

7. Partitions:

7.1. 1st Partition Details:

Partition Type **Ceiling Partition**
Area **1090.0** ft²
U-Value **0.150** BTU/(hr-ft²-°F)
Uncondit. Space Max Temp **75.0** °F

2.4. People:

Occupancy **163.4** People
Activity Level **Seated at Rest**
Sensible **230.0** BTU/hr/person
Latent **120.0** BTU/hr/person
Schedule **Assembly Occupancy**

2.5. Miscellaneous Loads:

Sensible **0** BTU/hr
Schedule **None**
Latent **0** BTU/hr
Schedule **None**

Ambient at Space Max Temp **95.0** °F
Uncondit. Space Min Temp **60.0** °F
Ambient at Space Min Temp **10.0** °F

Space Input Data

Andover - Town Hall
Kitchen and Associates

06/08/2010
01:41PM

7.2. 2nd Partition Details:

Partition Type **Wall Partition**
Area **410.0** ft²
U-Value **0.190** BTU/(hr-ft²-°F)

Uncondit. Space Max Temp **75.0** °F
Ambient at Space Max Temp **95.0** °F
Uncondit. Space Min Temp **60.0** °F
Ambient at Space Min Temp **10.0** °F

Floor1_Zone2 Input Data

Project Name: Andover - Town Hall
Prepared by: Kitchen and Associates

06/08/2010
01:44PM

1. General Details:

Air System Name Floor1_Zone2
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

Ventilation Reclaim Data:

Reclaim Type Sensible Heat
Thermal Efficiency 80 %
Input kW 0.200 kW
Schedule JFMAMJJASOND

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 - Natural Gas
Schedule JFMAMJJASOND
Capacity Control Cycled or Staged Capacity - Fan On

Supply Fan Data:

Fan Type Forward Curved
Configuration Draw-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-F001-Z02	
BLD1-F001-Z02	x1

Thermostats and Zone Data:

Zone All
Cooling T-stat: Occ. 76.0 °F
Cooling T-stat: Unocc. 76.0 °F
Heating T-stat: Occ. 72.0 °F
Heating T-stat: Unocc. 72.0 °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 Office HVAC
Unoccupied Cooling is Available

Supply Terminals Data:

Zone All

Floor1_Zone2 Input Data

Project Name: Andover - Town Hall
Prepared by: Kitchen and Associates

06/08/2010
01:44PM

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**

4. Sizing Data (Computer-Generated):

System Sizing Data:

Cooling Supply Temperature **58.0** °F
Supply Fan Airflow **1333.2** CFM
Ventilation Airflow **210.0** 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	1333.2	-	-	

5. Equipment Data

Central Cooling Unit - Air-Cooled DX

Estimated Maximum Load **36.7** MBH
Design OAT **95.0** °F
Equipment Sizing **User-Defined**
Gross Cooling Capacity **33.0** MBH
ARI Performance Rating **11.35** 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 **22.2** MBH
Equipment Sizing **User-Defined**
Gross Heating Capacity **75.5** MBH
Average Efficiency **94.0** %
Misc. Electric **0.000** kW

Space Input Data

Andover - Town Hall
Kitchen and Associates

06/08/2010
01:43PM

BLD1-F001-Z02

1. General Details:

Floor Area **2600.0** ft²
Avg. Ceiling Height **9.0** ft
Building Weight **70.0** lb/ft²

1.1. OA Ventilation Requirements:

Space Usage **User-Defined**
OA Requirement 1 **210.0** CFM
OA Requirement 2 **0.00** CFM/ft²
Space Usage Defaults **ASHRAE Std 62.1-2007**

2. Internals:

2.1. Overhead Lighting:

Fixture Type **Recessed (Vented)**
Wattage **2.00** W/ft²
Ballast Multiplier **1.00**
Schedule **90.1 Office Lights/Elec**

2.2. Task Lighting:

Wattage **0.00** W/ft²
Schedule **None**

2.3. Electrical Equipment:

Wattage **0.75** W/ft²
Schedule **90.1 Office Lights/Elec**

3. Walls, Windows, Doors:

Exp.	Wall Gross Area (ft ²)	Window 1 Qty.	Window 2 Qty.	Door 1 Qty.
S	340.0	0	0	0
W	340.0	0	0	0
N	590.0	0	0	1
E	780.0	5	0	0

3.1. Construction Types for Exposure S

Wall Type **Light Weight Wall**

3.2. Construction Types for Exposure W

Wall Type **Light Weight Wall**

3.3. Construction Types for Exposure N

Wall Type **Light Weight Wall**
Door Type **Exterior Glass Double Doors**

3.4. Construction Types for Exposure E

Wall Type **Light Weight Wall**
1st Window Type **Standard Glass**

4. Roofs, Skylights:

(No Roof or Skylight data).

5. Infiltration:

Design Cooling **0.00** ACH
Design Heating **0.00** ACH
Energy Analysis **0.00** ACH
Infiltration occurs only when the fan is off.

6. Floors:

Type **Slab Floor Below Grade**
Floor Area **2600.0** ft²
Exposed Perimeter **170.0** ft
Total Floor U-Value **0.050** BTU/(hr-ft²-°F)
Floor Depth **9.0** ft
Basement Wall U-Value **0.050** BTU/(hr-ft²-°F)
Wall Insulation R-Value **8.00** (hr-ft²-°F)/BTU
Wall Insulation Depth **9.0** ft

2.4. People:

Occupancy **275.00** ft²/person
Activity Level **Office Work**
Sensible **245.0** BTU/hr/person
Latent **205.0** BTU/hr/person
Schedule **90.1 Office Occupancy**

2.5. Miscellaneous Loads:

Sensible **0** BTU/hr
Schedule **None**
Latent **0** BTU/hr
Schedule **None**

Space Input Data

Andover - Town Hall
Kitchen and Associates

06/08/2010
01:43PM

7. Partitions:

7.1. 1st Partition Details:

Partition Type	Ceiling Partition	
Area	2600.0	ft ²
U-Value	0.150	BTU/(hr-ft ² -°F)
Uncondit. Space Max Temp	75.0	°F
Ambient at Space Max Temp	95.0	°F
Uncondit. Space Min Temp	60.0	°F
Ambient at Space Min Temp	10.0	°F

7.2. 2nd Partition Details:

Partition Type	Ceiling Partition	
Area	390.0	ft ²
U-Value	0.190	BTU/(hr-ft ² -°F)
Uncondit. Space Max Temp	75.0	°F
Ambient at Space Max Temp	95.0	°F
Uncondit. Space Min Temp	60.0	°F
Ambient at Space Min Temp	10.0	°F

Floor2_Zone3 Input Data

Project Name: Andover - Town Hall
Prepared by: Kitchen and Associates

06/08/2010
01:44PM

1. General Details:

Air System Name Floor2_Zone3
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

Ventilation Reclaim Data:

Reclaim Type Sensible Heat
Thermal Efficiency 80 %
Input kW 0.200 kW
Schedule JFMAMJJASOND

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 - Natural Gas
Schedule JFMAMJJASOND
Capacity Control Cycled or Staged Capacity - Fan On

Supply Fan Data:

Fan Type Forward Curved
Configuration Draw-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. 76.0 °F
Cooling T-stat: Unocc. 76.0 °F
Heating T-stat: Occ. 72.0 °F
Heating T-stat: Unocc. 72.0 °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 Office HVAC
Unoccupied Cooling is Available

Supply Terminals Data:

Zone All

Floor2_Zone3 Input Data

Project Name: Andover - Town Hall
Prepared by: Kitchen and Associates

06/08/2010
01:44PM

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**

4. Sizing Data (Computer-Generated):

System Sizing Data:

Cooling Supply Temperature **58.0** °F
Supply Fan Airflow **1837.6** CFM
Ventilation Airflow **315.0** 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	1837.6	-	-	

5. Equipment Data

Central Cooling Unit - Air-Cooled DX

Estimated Maximum Load **51.4** MBH
Design OAT **95.0** °F
Equipment Sizing **User-Defined**
Gross Cooling Capacity **65.7** MBH
ARI Performance Rating **11.30** 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 **29.3** MBH
Equipment Sizing **User-Defined**
Gross Heating Capacity **76.6** MBH
Average Efficiency **94.0** %
Misc. Electric **0.000** kW

Space Input Data

Andover - Town Hall
Kitchen and Associates

06/08/2010
01:43PM

BLD1-F002-Z01

1. General Details:

Floor Area **2160.0** ft²
Avg. Ceiling Height **9.0** ft
Building Weight **70.0** lb/ft²

1.1. OA Ventilation Requirements:

Space Usage **User-Defined**
OA Requirement 1 **315.0** CFM
OA Requirement 2 **0.00** CFM/ft²
Space Usage Defaults **ASHRAE Std 62.1-2007**

2. Internals:

2.1. Overhead Lighting:

Fixture Type **Recessed (Vented)**
Wattage **2.00** W/ft²
Ballast Multiplier **1.00**
Schedule **90.1 Office Lights/Elec**

2.2. Task Lighting:

Wattage **0.00** W/ft²
Schedule **None**

2.3. Electrical Equipment:

Wattage **0.75** W/ft²
Schedule **90.1 Office Lights/Elec**

3. Walls, Windows, Doors:

Exp.	Wall Gross Area (ft ²)	Window 1 Qty.	Window 2 Qty.	Door 1 Qty.
S	720.0	5	0	1
W	430.0	6	0	0
N	720.0	10	0	0

3.1. Construction Types for Exposure S

Wall Type **Light Weight Wall**
1st Window Type **Standard Glass**
Door Type **Exterior Door**

3.2. Construction Types for Exposure W

Wall Type **Light Weight Wall**
1st Window Type **Standard Glass**

3.3. Construction Types for Exposure N

Wall Type **Light Weight Wall**
1st Window Type **Standard Glass**

4. Roofs, Skylights:

Exp.	Roof Gross Area (ft ²)	Roof Slope (deg.)	Skylight Qty.
N	1080.0	30	0
S	1080.0	30	0

4.1. Construction Types for Exposure N

Roof Type **Asphalt Shingle + Plywood + R-22 Batt**

4.2. Construction Types for Exposure S

Roof Type **Asphalt Shingle + Plywood + R-22 Batt**

5. Infiltration:

Design Cooling **0.00** ACH
Design Heating **0.00** ACH
Energy Analysis **0.00** ACH

Infiltration occurs only when the fan is off.

2.4. People:

Occupancy **275.00** ft²/person
Activity Level **Office Work**
Sensible **245.0** BTU/hr/person
Latent **205.0** BTU/hr/person
Schedule **90.1 Office Occupancy**

2.5. Miscellaneous Loads:

Sensible **0** BTU/hr
Schedule **None**
Latent **0** BTU/hr
Schedule **None**

Space Input Data

Andover - Town Hall
Kitchen and Associates

06/08/2010
01:43PM

6. Floors:

Type **Floor Above Conditioned Space**
(No additional input required for this floor type).

7. Partitions:

7.1. 1st Partition Details:

Partition Type **Ceiling Partition**
Area **2160.0** ft²
U-Value **0.050** BTU/(hr-ft²-°F)
Uncondit. Space Max Temp **130.0** °F
Ambient at Space Max Temp **95.0** °F
Uncondit. Space Min Temp **30.0** °F
Ambient at Space Min Temp **10.0** °F

7.2. 2nd Partition Details:

Partition Type **Wall Partition**
Area **430.0** ft²
U-Value **0.190** BTU/(hr-ft²-°F)
Uncondit. Space Max Temp **75.0** °F
Ambient at Space Max Temp **95.0** °F
Uncondit. Space Min Temp **60.0** °F
Ambient at Space Min Temp **0.0** °F

Floor2_Zone4 Input Data

Project Name: Andover - Town Hall
Prepared by: Kitchen and Associates

06/08/2010
01:44PM

1. General Details:

Air System Name Floor2_Zone4
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

Ventilation Reclaim Data:

Reclaim Type Sensible Heat
Thermal Efficiency 80 %
Input kW 0.200 kW
Schedule JFMAMJJASOND

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 - Natural Gas
Schedule JFMAMJJASOND
Capacity Control Cycled or Staged Capacity - Fan On

Supply Fan Data:

Fan Type Forward Curved
Configuration Draw-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-Z02	
BLD1-F002-Z02	x1

Thermostats and Zone Data:

Zone All
Cooling T-stat: Occ. 76.0 °F
Cooling T-stat: Unocc. 76.0 °F
Heating T-stat: Occ. 72.0 °F
Heating T-stat: Unocc. 72.0 °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 Office HVAC
Unoccupied Cooling is Available

Supply Terminals Data:

Zone All

Floor2_Zone4 Input Data

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06/08/2010
01:44PM

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

4. Sizing Data (Computer-Generated):

System Sizing Data:

Cooling Supply Temperature 58.0 °F
Supply Fan Airflow 2251.4 CFM
Ventilation Airflow 360.0 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	2251.4	-	-	

5. Equipment Data

Central Cooling Unit - Air-Cooled DX

Estimated Maximum Load 63.1 MBH
Design OAT 95.0 °F
Equipment Sizing User-Defined
Gross Cooling Capacity 50.7 MBH
ARI Performance Rating 11.85 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 34.0 MBH
Equipment Sizing User-Defined
Gross Heating Capacity 76.6 MBH
Average Efficiency 94.0 %
Misc. Electric 0.000 kW

Space Input Data

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06/08/2010
01:43PM

BLD1-F002-Z02

1. General Details:

Floor Area 2650.0 ft²
Avg. Ceiling Height 9.0 ft
Building Weight 70.0 lb/ft²

1.1. OA Ventilation Requirements:

Space Usage User-Defined
OA Requirement 1 360.0 CFM
OA Requirement 2 0.00 CFM/ft²
Space Usage Defaults ASHRAE Std 62.1-2007

2. Internals:

2.1. Overhead Lighting:

Fixture Type Recessed (Vented)
Wattage 2.00 W/ft²
Ballast Multiplier 1.00
Schedule 90.1 Office Lights/Elec

2.2. Task Lighting:

Wattage 0.00 W/ft²
Schedule None

2.3. Electrical Equipment:

Wattage 0.75 W/ft²
Schedule 90.1 Office Lights/Elec

3. Walls, Windows, Doors:

Exp.	Wall Gross Area (ft ²)	Window 1 Qty.	Window 2 Qty.	Door 1 Qty.
S	490.0	2	0	0
W	550.0	2	0	1
N	360.0	5	0	0
E	970.0	13	0	1

3.1. Construction Types for Exposure S

Wall Type Light Weight Wall
1st Window Type Standard Glass

3.2. Construction Types for Exposure W

Wall Type Light Weight Wall
1st Window Type Standard Glass
Door Type Exterior Door

3.3. Construction Types for Exposure N

Wall Type Light Weight Wall
1st Window Type Standard Glass

3.4. Construction Types for Exposure E

Wall Type Light Weight Wall
1st Window Type Standard Glass
Door Type Exterior Glass Double Doors

4. Roofs, Skylights:

Exp.	Roof Gross Area (ft ²)	Roof Slope (deg.)	Skylight Qty.
E	1325.0	30	0
W	1325.0	30	0

4.1. Construction Types for Exposure E

Roof Type Asphalt Shingle + Plywood + R-22 Batt

4.2. Construction Types for Exposure W

Roof Type Asphalt Shingle + Plywood + R-22 Batt

5. Infiltration:

2.4. People:

Occupancy 275.00 ft²/person
Activity Level Office Work
Sensible 245.0 BTU/hr/person
Latent 205.0 BTU/hr/person
Schedule 90.1 Office Occupancy

2.5. Miscellaneous Loads:

Sensible 0 BTU/hr
Schedule None
Latent 0 BTU/hr
Schedule None

Space Input Data

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06/08/2010
01:43PM

Design Cooling 0.00 ACH
Design Heating 0.00 ACH
Energy Analysis 0.00 ACH
Infiltration occurs only when the fan is off.

6. Floors:

Type Floor Above Conditioned Space
(No additional input required for this floor type).

7. Partitions:

7.1. 1st Partition Details:

Partition Type Ceiling Partition
Area 2650.0 ft²
U-Value 0.050 BTU/(hr-ft²-°F)
Uncondit. Space Max Temp 130.0 °F
Ambient at Space Max Temp 95.0 °F
Uncondit. Space Min Temp 30.0 °F
Ambient at Space Min Temp 0.0 °F

7.2. 2nd Partition Details:

Partition Type Ceiling Partition
Area 430.0 ft²
U-Value 0.190 BTU/(hr-ft²-°F)
Uncondit. Space Max Temp 75.0 °F
Ambient at Space Max Temp 95.0 °F
Uncondit. Space Min Temp 60.0 °F
Ambient at Space Min Temp 0.0 °F

Billing Details - Electric - FL1ZN1 - Outdoor Packaged DX Unit

Andover - Town Hall
Kitchen and Associates

06/08/2010
01:42PM

1. Component Charges

Billing Period	Energy Charges (\$)	Demand Charges (\$)	Customer Charges (\$)	Taxes (\$)	Total Charge (\$)
Jan	170	0	0	0	170
Feb	157	0	0	0	157
Mar	173	0	0	0	173
Apr	166	0	0	0	166
May	175	0	0	0	175
Jun	279	0	0	0	279
Jul	388	0	0	0	388
Aug	352	0	0	0	352
Sep	220	0	0	0	220
Oct	167	0	0	0	167
Nov	163	0	0	0	163
Dec	176	0	0	0	176
Totals	2,586	0	0	0	2,586

2. Totals

Billing Period	Total Charges (\$)	Total Consumption (kWh)	Avg Price (\$/kWh)
Jan	170	977	0.1740
Feb	157	902	0.1740
Mar	173	994	0.1740
Apr	166	957	0.1740
May	175	1,008	0.1740
Jun	279	1,605	0.1740
Jul	388	2,228	0.1740
Aug	352	2,021	0.1740
Sep	220	1,263	0.1740
Oct	167	958	0.1740
Nov	163	939	0.1740
Dec	176	1,010	0.1740
Totals	2,586	14,862	0.1740

3. Consumption Totals

Billing Period	Peak (kWh)	Mid-Peak (kWh)	Normal Peak (kWh)	Off-Peak (kWh)	Overall (kWh)
Jan	0	0	0	0	977
Feb	0	0	0	0	902
Mar	0	0	0	0	994
Apr	0	0	0	0	957
May	0	0	0	0	1,008
Jun	0	0	0	0	1,605
Jul	0	0	0	0	2,228
Aug	0	0	0	0	2,021
Sep	0	0	0	0	1,263
Oct	0	0	0	0	958
Nov	0	0	0	0	939
Dec	0	0	0	0	1,010
Totals	0	0	0	0	14,862

Billing Details - Electric - FL1ZN1 - Outdoor Packaged DX UnitAndover - Town Hall
Kitchen and Associates06/08/2010
01:42PM**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	3.5
Feb	0.0	0.0	0.0	0.0	3.5
Mar	0.0	0.0	0.0	0.0	3.5
Apr	0.0	0.0	0.0	0.0	6.9
May	0.0	0.0	0.0	0.0	10.2
Jun	0.0	0.0	0.0	0.0	10.3
Jul	0.0	0.0	0.0	0.0	11.0
Aug	0.0	0.0	0.0	0.0	10.4
Sep	0.0	0.0	0.0	0.0	9.0
Oct	0.0	0.0	0.0	0.0	7.8
Nov	0.0	0.0	0.0	0.0	3.5
Dec	0.0	0.0	0.0	0.0	3.5

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	3.5
Feb	0.0	0.0	0.0	0.0	3.5
Mar	0.0	0.0	0.0	0.0	3.5
Apr	0.0	0.0	0.0	0.0	6.9
May	0.0	0.0	0.0	0.0	10.2
Jun	0.0	0.0	0.0	0.0	10.3
Jul	0.0	0.0	0.0	0.0	11.0
Aug	0.0	0.0	0.0	0.0	10.4
Sep	0.0	0.0	0.0	0.0	9.0
Oct	0.0	0.0	0.0	0.0	7.8
Nov	0.0	0.0	0.0	0.0	3.5
Dec	0.0	0.0	0.0	0.0	3.5

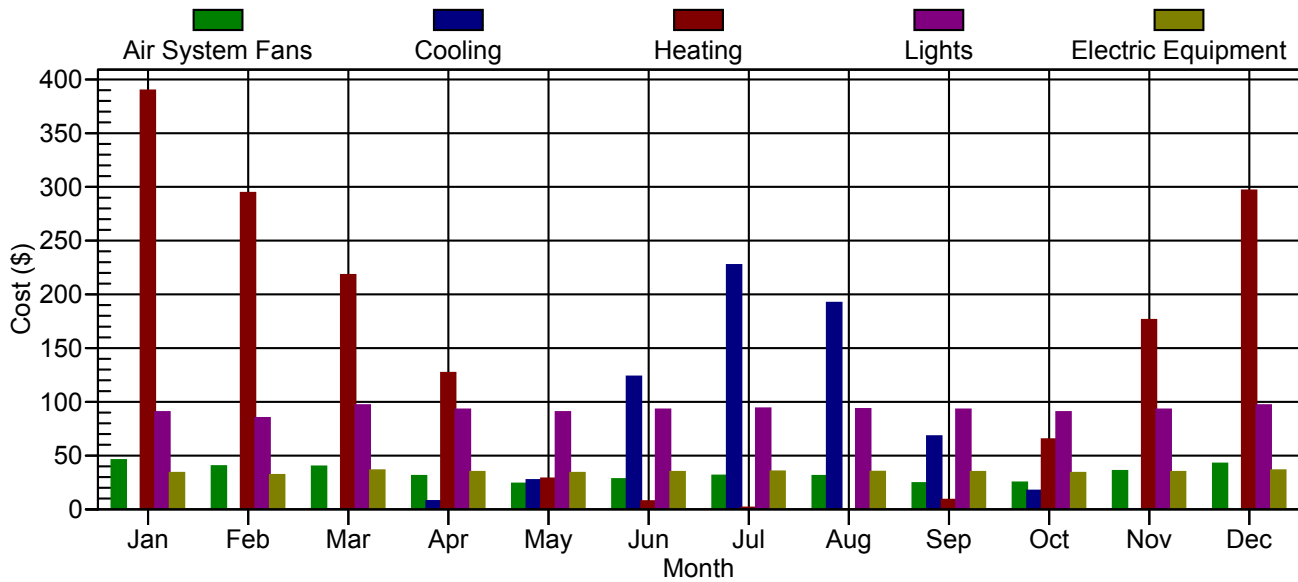
6. Time Of Maximum Demands

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	1/4/1400
Feb	n/a	n/a	n/a	n/a	2/1/1400
Mar	n/a	n/a	n/a	n/a	3/1/1400
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	6/30/1500
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	9/23/1600
Oct	n/a	n/a	n/a	n/a	10/4/1600
Nov	n/a	n/a	n/a	n/a	11/1/1400
Dec	n/a	n/a	n/a	n/a	12/1/1400

Monthly Component Costs - FL12N1 - Outdoor Packaged DX Unit

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06/08/2010
01:42PM



1. HVAC Component Costs

Month	Air System Fans (\$)	Cooling (\$)	Heating (\$)	Pumps (\$)	Cooling Towers (\$)	HVAC Total (\$)
January	46	0	390	0	0	436
February	40	0	294	0	0	334
March	40	0	218	0	0	258
April	31	8	127	0	0	166
May	24	27	29	0	0	80
June	28	124	8	0	0	160
July	31	227	2	0	0	260
August	31	192	0	0	0	223
September	24	68	9	0	0	101
October	25	17	65	0	0	107
November	36	0	176	0	0	212
December	43	0	297	0	0	340
Total	399	663	1,614	0	0	2,676

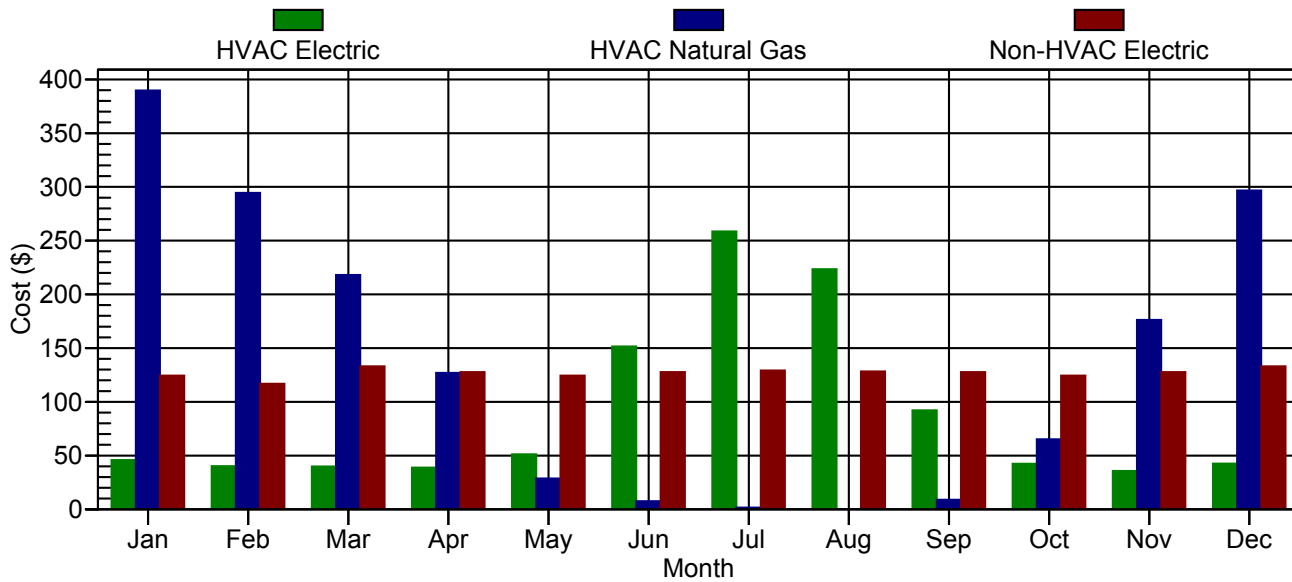
2. Non-HVAC Component Costs

Month	Lights (\$)	Electric Equipment (\$)	Misc. Electric (\$)	Misc. Fuel Use (\$)	Non-HVAC Total (\$)	Grand Total (\$)
January	90	34	0	0	124	560
February	85	32	0	0	117	451
March	97	36	0	0	133	391
April	93	35	0	0	128	294
May	90	34	0	0	124	204
June	93	35	0	0	128	288
July	94	35	0	0	129	389
August	93	35	0	0	128	351
September	93	35	0	0	128	229
October	90	34	0	0	124	231
November	93	35	0	0	128	340
December	97	36	0	0	133	473
Total	1,109	416	0	0	1,524	4,200

Monthly Energy Costs - FL12N1 - Outdoor Packaged DX Unit

Andover - Town Hall
Kitchen and Associates

06/08/2010
01:42PM



1. HVAC Costs

Month	Electric (\$)	Natural Gas (\$)	Fuel Oil (\$)	Propane (\$)	Remote Hot Water (\$)	Remote Steam (\$)	Remote Chilled Water (\$)
January	46	390	0	0	0	0	0
February	40	294	0	0	0	0	0
March	40	218	0	0	0	0	0
April	39	127	0	0	0	0	0
May	51	29	0	0	0	0	0
June	152	8	0	0	0	0	0
July	259	2	0	0	0	0	0
August	223	0	0	0	0	0	0
September	92	9	0	0	0	0	0
October	42	65	0	0	0	0	0
November	36	176	0	0	0	0	0
December	43	297	0	0	0	0	0
Total	1,062	1,614	0	0	0	0	0

2. Non-HVAC Costs

Month	Electric (\$)	Natural Gas (\$)	Fuel Oil (\$)	Propane (\$)	Remote Hot Water (\$)	Remote Steam (\$)
January	124	0	0	0	0	0
February	117	0	0	0	0	0
March	133	0	0	0	0	0
April	128	0	0	0	0	0
May	124	0	0	0	0	0
June	128	0	0	0	0	0
July	129	0	0	0	0	0
August	128	0	0	0	0	0
September	128	0	0	0	0	0
October	124	0	0	0	0	0
November	128	0	0	0	0	0
December	133	0	0	0	0	0
Total	1,524	0	0	0	0	0

Monthly Energy Use by Energy Type - FL1ZN1 - Outdoor Packaged DX Unit

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06/08/2010
01:42PM

1. HVAC Energy Use

Month	Electric (kWh)	Natural Gas (Therm)	Fuel Oil (na)	Propane (na)	Remote HW (na)	Remote Steam (na)	Remote CW (na)
Jan	263	247	0	0	0	0	0
Feb	231	186	0	0	0	0	0
Mar	229	138	0	0	0	0	0
Apr	223	80	0	0	0	0	0
May	293	18	0	0	0	0	0
Jun	871	5	0	0	0	0	0
Jul	1,486	1	0	0	0	0	0
Aug	1,283	0	0	0	0	0	0
Sep	530	6	0	0	0	0	0
Oct	244	41	0	0	0	0	0
Nov	205	111	0	0	0	0	0
Dec	245	188	0	0	0	0	0
Totals	6,102	1,021	0	0	0	0	0

2. Non-HVAC Energy Use

Month	Electric (kWh)	Natural Gas (Therm)	Fuel Oil (na)	Propane (na)	Remote HW (na)	Remote Steam (na)
Jan	715	0	0	0	0	0
Feb	671	0	0	0	0	0
Mar	765	0	0	0	0	0
Apr	734	0	0	0	0	0
May	715	0	0	0	0	0
Jun	734	0	0	0	0	0
Jul	742	0	0	0	0	0
Aug	737	0	0	0	0	0
Sep	734	0	0	0	0	0
Oct	715	0	0	0	0	0
Nov	734	0	0	0	0	0
Dec	765	0	0	0	0	0
Totals	8,760	0	0	0	0	0

Monthly Energy Use by Component - FL1ZN1 - Outdoor Packaged DX Unit

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Kitchen and Associates

06/08/2010
01:42PM

1. Monthly Energy Use by System Component

Component	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Air System Fans (kWh)	263	231	229	179	137	161	180	179	140	144	205	245
<i>Cooling</i>												
Electric (kWh)	0	0	0	44	156	710	1306	1104	390	100	0	0
Natural Gas (Therm)	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 (na)	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 (Therm)	247	186	138	80	18	5	1	0	6	41	111	188
Fuel Oil (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	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
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)	520	488	556	534	520	534	540	536	534	520	534	556
Electric Eqpt. (kWh)	195	183	209	200	195	200	202	201	200	195	200	209
Misc. Electric (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
<i>Misc. Fuel</i>												
Natural Gas (Therm)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	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

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06/08/2010
01:42PM

Table 1. Annual Costs

Component	FL1ZN1 - Outdoor Packaged DX Unit (\$)
Air System Fans	399
Cooling	663
Heating	1,614
Pumps	0
Cooling Tower Fans	0
HVAC Sub-Total	2,676
Lights	1,109
Electric Equipment	416
Misc. Electric	0
Misc. Fuel Use	0
Non-HVAC Sub-Total	1,524
Grand Total	4,200

Table 2. Annual Cost per Unit Floor Area

Component	FL1ZN1 - Outdoor Packaged DX Unit (\$/ft²)
Air System Fans	0.366
Cooling	0.608
Heating	1.481
Pumps	0.000
Cooling Tower Fans	0.000
HVAC Sub-Total	2.455
Lights	1.017
Electric Equipment	0.381
Misc. Electric	0.000
Misc. Fuel Use	0.000
Non-HVAC Sub-Total	1.398
Grand Total	3.853
Gross Floor Area (ft²)	1090.0
Conditioned Floor Area (ft²)	1090.0

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

Table 3. Component Cost as a Percentage of Total Cost

Component	FL1ZN1 - Outdoor Packaged DX Unit (%)
Air System Fans	9.5
Cooling	15.8
Heating	38.4
Pumps	0.0
Cooling Tower Fans	0.0
HVAC Sub-Total	63.7
Lights	26.4
Electric Equipment	9.9
Misc. Electric	0.0
Misc. Fuel Use	0.0
Non-HVAC Sub-Total	36.3
Grand Total	100.0

Annual Energy and Emissions Summary

Andover - Town Hall
Kitchen and Associates

06/08/2010
01:42PM

Table 1. Annual Costs

Component	FL12N1 - Outdoor Packaged DX Unit (\$)
HVAC Components	
Electric	1,062
Natural Gas	1,614
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Remote CW	0
HVAC Sub-Total	2,676
Non-HVAC Components	
Electric	1,524
Natural Gas	0
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Non-HVAC Sub-Total	1,524
Grand Total	4,200

Table 2. Annual Energy Consumption

Component	FL12N1 - Outdoor Packaged DX Unit
HVAC Components	
Electric (kWh)	6,102
Natural Gas (Therm)	1,021
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0
Non-HVAC Components	
Electric (kWh)	8,760
Natural Gas (Therm)	0
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Totals	
Electric (kWh)	14,862
Natural Gas (Therm)	1,021
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0

Annual Energy and Emissions Summary

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06/08/2010
01:42PM

Table 3. Annual Emissions

Component	FL12N1 - Outdoor Packaged DX Unit
CO2 Equivalent (lb)	0

Table 4. Annual Cost per Unit Floor Area

Component	FL12N1 - Outdoor Packaged DX Unit (\$/ft²)
HVAC Components	
Electric	0.974
Natural Gas	1.481
Fuel Oil	0.000
Propane	0.000
Remote HW	0.000
Remote Steam	0.000
Remote CW	0.000
HVAC Sub-Total	2.455
Non-HVAC Components	
Electric	1.398
Natural Gas	0.000
Fuel Oil	0.000
Propane	0.000
Remote HW	0.000
Remote Steam	0.000
Non-HVAC Sub-Total	1.398
Grand Total	3.853
Gross Floor Area (ft²)	1090.0
Conditioned Floor Area (ft²)	1090.0

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

Table 5. Component Cost as a Percentage of Total Cost

Component	FL12N1 - Outdoor Packaged DX Unit (%)
HVAC Components	
Electric	25.3
Natural Gas	38.4
Fuel Oil	0.0
Propane	0.0
Remote HW	0.0
Remote Steam	0.0
Remote CW	0.0
HVAC Sub-Total	63.7
Non-HVAC Components	
Electric	36.3
Natural Gas	0.0
Fuel Oil	0.0
Propane	0.0
Remote HW	0.0
Remote Steam	0.0
Non-HVAC Sub-Total	36.3
Grand Total	100.0

Billing Details - Electric - FL1ZN2 - Split System - Zone 2

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06/08/2010
01:45PM

1. Component Charges

Billing Period	Energy Charges (\$)	Demand Charges (\$)	Customer Charges (\$)	Taxes (\$)	Total Charge (\$)
Jan	327	0	0	0	327
Feb	306	0	0	0	306
Mar	346	0	0	0	346
Apr	336	0	0	0	336
May	352	0	0	0	352
Jun	398	0	0	0	398
Jul	429	0	0	0	429
Aug	421	0	0	0	421
Sep	376	0	0	0	376
Oct	336	0	0	0	336
Nov	332	0	0	0	332
Dec	348	0	0	0	348
Totals	4,307	0	0	0	4,307

2. Totals

Billing Period	Total Charges (\$)	Total Consumption (kWh)	Avg Price (\$/kWh)
Jan	327	1,880	0.1740
Feb	306	1,757	0.1740
Mar	346	1,987	0.1740
Apr	336	1,933	0.1740
May	352	2,020	0.1740
Jun	398	2,288	0.1740
Jul	429	2,466	0.1740
Aug	421	2,417	0.1740
Sep	376	2,160	0.1740
Oct	336	1,932	0.1740
Nov	332	1,908	0.1740
Dec	348	2,002	0.1740
Totals	4,307	24,750	0.1740

3. Consumption Totals

Billing Period	Peak (kWh)	Mid-Peak (kWh)	Normal Peak (kWh)	Off-Peak (kWh)	Overall (kWh)
Jan	0	0	0	0	1,880
Feb	0	0	0	0	1,757
Mar	0	0	0	0	1,987
Apr	0	0	0	0	1,933
May	0	0	0	0	2,020
Jun	0	0	0	0	2,288
Jul	0	0	0	0	2,466
Aug	0	0	0	0	2,417
Sep	0	0	0	0	2,160
Oct	0	0	0	0	1,932
Nov	0	0	0	0	1,908
Dec	0	0	0	0	2,002
Totals	0	0	0	0	24,750

Billing Details - Electric - FL1ZN2 - Split System - Zone 2

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Kitchen and Associates

06/08/2010
01:45PM

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	6.9
Feb	0.0	0.0	0.0	0.0	6.9
Mar	0.0	0.0	0.0	0.0	7.5
Apr	0.0	0.0	0.0	0.0	8.3
May	0.0	0.0	0.0	0.0	9.4
Jun	0.0	0.0	0.0	0.0	9.3
Jul	0.0	0.0	0.0	0.0	9.6
Aug	0.0	0.0	0.0	0.0	9.3
Sep	0.0	0.0	0.0	0.0	8.8
Oct	0.0	0.0	0.0	0.0	8.8
Nov	0.0	0.0	0.0	0.0	7.5
Dec	0.0	0.0	0.0	0.0	7.2

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	6.9
Feb	0.0	0.0	0.0	0.0	6.9
Mar	0.0	0.0	0.0	0.0	7.5
Apr	0.0	0.0	0.0	0.0	8.3
May	0.0	0.0	0.0	0.0	9.4
Jun	0.0	0.0	0.0	0.0	9.3
Jul	0.0	0.0	0.0	0.0	9.6
Aug	0.0	0.0	0.0	0.0	9.3
Sep	0.0	0.0	0.0	0.0	8.8
Oct	0.0	0.0	0.0	0.0	8.8
Nov	0.0	0.0	0.0	0.0	7.5
Dec	0.0	0.0	0.0	0.0	7.2

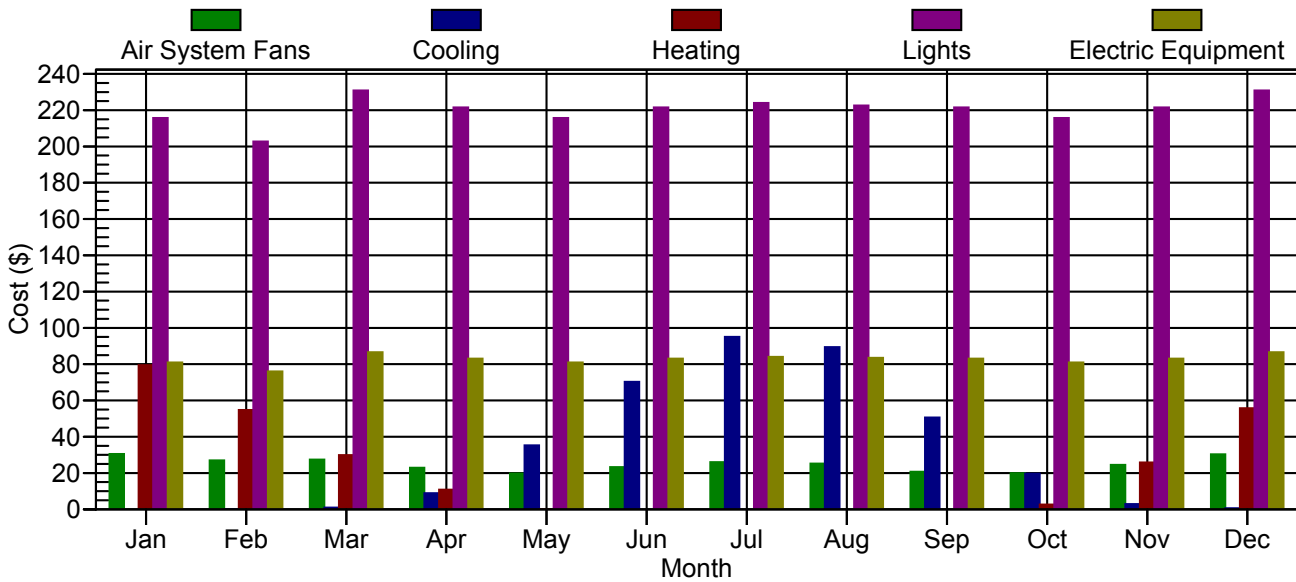
6. Time Of Maximum Demands

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	5/17/1600
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	9/23/1600
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	12/3/1500

Monthly Component Costs - FL1ZN2 - Split System - Zone 2

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Kitchen and Associates

06/08/2010
01:45PM



1. HVAC Component Costs

Month	Air System Fans (\$)	Cooling (\$)	Heating (\$)	Pumps (\$)	Cooling Towers (\$)	HVAC Total (\$)
January	31	0	79	0	0	110
February	27	0	55	0	0	82
March	27	1	30	0	0	58
April	23	9	11	0	0	43
May	20	35	0	0	0	55
June	23	70	0	0	0	93
July	26	95	0	0	0	121
August	25	89	0	0	0	114
September	21	51	0	0	0	72
October	20	20	3	0	0	43
November	25	3	26	0	0	54
December	30	1	56	0	0	87
Total	297	373	259	0	0	930

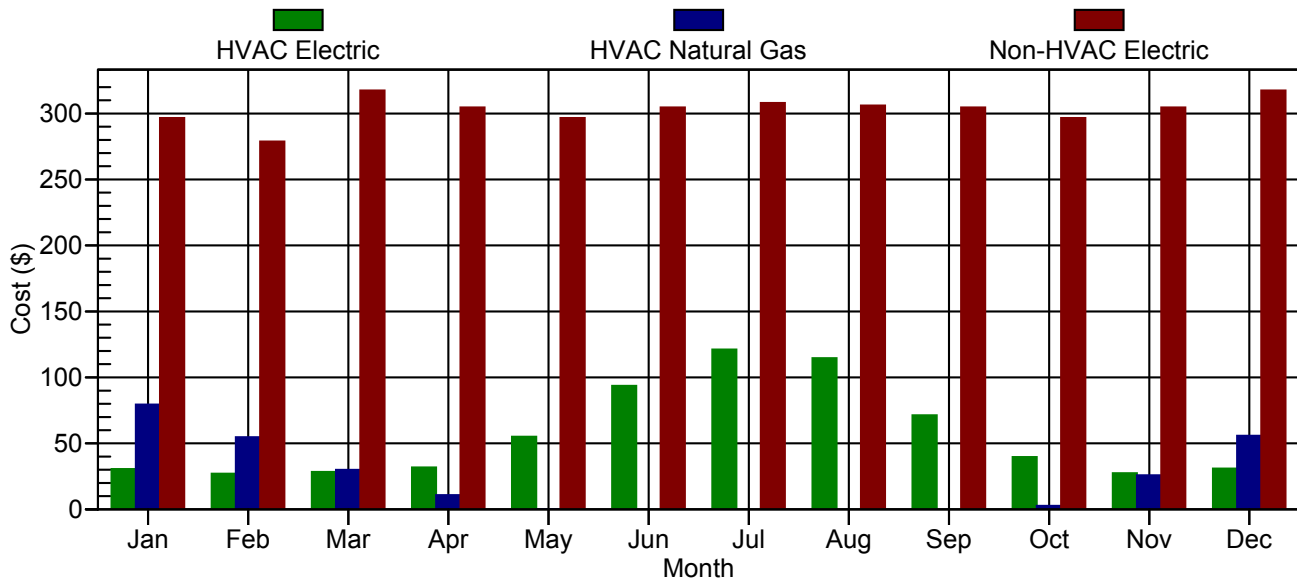
2. Non-HVAC Component Costs

Month	Lights (\$)	Electric Equipment (\$)	Misc. Electric (\$)	Misc. Fuel Use (\$)	Non-HVAC Total (\$)	Grand Total (\$)
January	216	81	0	0	297	407
February	203	76	0	0	279	361
March	231	87	0	0	317	375
April	221	83	0	0	305	348
May	216	81	0	0	297	352
June	221	83	0	0	305	398
July	224	84	0	0	308	429
August	223	83	0	0	306	420
September	221	83	0	0	305	377
October	216	81	0	0	297	340
November	221	83	0	0	305	359
December	231	87	0	0	317	404
Total	2,644	992	0	0	3,636	4,565

Monthly Energy Costs - FL1ZN2 - Split System - Zone 2

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Kitchen and Associates

06/08/2010
01:45PM



1. HVAC Costs

Month	Electric (\$)	Natural Gas (\$)	Fuel Oil (\$)	Propane (\$)	Remote Hot Water (\$)	Remote Steam (\$)	Remote Chilled Water (\$)
January	31	79	0	0	0	0	0
February	27	55	0	0	0	0	0
March	28	30	0	0	0	0	0
April	32	11	0	0	0	0	0
May	55	0	0	0	0	0	0
June	94	0	0	0	0	0	0
July	121	0	0	0	0	0	0
August	115	0	0	0	0	0	0
September	71	0	0	0	0	0	0
October	40	3	0	0	0	0	0
November	27	26	0	0	0	0	0
December	31	56	0	0	0	0	0
Total	671	259	0	0	0	0	0

2. Non-HVAC Costs

Month	Electric (\$)	Natural Gas (\$)	Fuel Oil (\$)	Propane (\$)	Remote Hot Water (\$)	Remote Steam (\$)
January	297	0	0	0	0	0
February	279	0	0	0	0	0
March	317	0	0	0	0	0
April	305	0	0	0	0	0
May	297	0	0	0	0	0
June	305	0	0	0	0	0
July	308	0	0	0	0	0
August	306	0	0	0	0	0
September	305	0	0	0	0	0
October	297	0	0	0	0	0
November	305	0	0	0	0	0
December	317	0	0	0	0	0
Total	3,636	0	0	0	0	0

Monthly Energy Use by Energy Type - FL1ZN2 - Split System - Zone 2

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06/08/2010
01:45PM

1. HVAC Energy Use

Month	Electric (kWh)	Natural Gas (Therm)	Fuel Oil (na)	Propane (na)	Remote HW (na)	Remote Steam (na)	Remote CW (na)
Jan	175	50	0	0	0	0	0
Feb	155	35	0	0	0	0	0
Mar	162	19	0	0	0	0	0
Apr	183	7	0	0	0	0	0
May	316	0	0	0	0	0	0
Jun	537	0	0	0	0	0	0
Jul	696	0	0	0	0	0	0
Aug	659	0	0	0	0	0	0
Sep	410	0	0	0	0	0	0
Oct	227	2	0	0	0	0	0
Nov	157	16	0	0	0	0	0
Dec	177	35	0	0	0	0	0
Totals	3,855	164	0	0	0	0	0

2. Non-HVAC Energy Use

Month	Electric (kWh)	Natural Gas (Therm)	Fuel Oil (na)	Propane (na)	Remote HW (na)	Remote Steam (na)
Jan	1,705	0	0	0	0	0
Feb	1,602	0	0	0	0	0
Mar	1,825	0	0	0	0	0
Apr	1,750	0	0	0	0	0
May	1,705	0	0	0	0	0
Jun	1,750	0	0	0	0	0
Jul	1,770	0	0	0	0	0
Aug	1,759	0	0	0	0	0
Sep	1,750	0	0	0	0	0
Oct	1,705	0	0	0	0	0
Nov	1,750	0	0	0	0	0
Dec	1,825	0	0	0	0	0
Totals	20,895	0	0	0	0	0

Monthly Energy Use by Component - FL1ZN2 - Split System - Zone 2

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06/08/2010
01:45PM

1. Monthly Energy Use by System Component

Component	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Air System Fans (kWh)	175	155	157	132	113	133	150	145	119	114	141	174
<i>Cooling</i>												
Electric (kWh)	0	0	5	51	202	404	546	514	291	113	17	3
Natural Gas (Therm)	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 (na)	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 (Therm)	50	35	19	7	0	0	0	0	0	2	16	35
Fuel Oil (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	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
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)	1240	1165	1327	1273	1240	1273	1288	1279	1273	1240	1273	1327
Electric Eqpt. (kWh)	465	437	498	477	465	477	483	480	477	465	477	498
Misc. Electric (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
<i>Misc. Fuel</i>												
Natural Gas (Therm)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	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

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06/08/2010
01:45PM

Table 1. Annual Costs

Component	FL1ZN2 - Split System - Zone 2 (\$)
Air System Fans	297
Cooling	373
Heating	259
Pumps	0
Cooling Tower Fans	0
HVAC Sub-Total	930
Lights	2,644
Electric Equipment	992
Misc. Electric	0
Misc. Fuel Use	0
Non-HVAC Sub-Total	3,636
Grand Total	4,565

Table 2. Annual Cost per Unit Floor Area

Component	FL1ZN2 - Split System - Zone 2 (\$/ft²)
Air System Fans	0.114
Cooling	0.144
Heating	0.100
Pumps	0.000
Cooling Tower Fans	0.000
HVAC Sub-Total	0.358
Lights	1.017
Electric Equipment	0.381
Misc. Electric	0.000
Misc. Fuel Use	0.000
Non-HVAC Sub-Total	1.398
Grand Total	1.756
Gross Floor Area (ft²)	2600.0
Conditioned Floor Area (ft²)	2600.0

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

Table 3. Component Cost as a Percentage of Total Cost

Component	FL1ZN2 - Split System - Zone 2 (%)
Air System Fans	6.5
Cooling	8.2
Heating	5.7
Pumps	0.0
Cooling Tower Fans	0.0
HVAC Sub-Total	20.4
Lights	57.9
Electric Equipment	21.7
Misc. Electric	0.0
Misc. Fuel Use	0.0
Non-HVAC Sub-Total	79.6
Grand Total	100.0

Annual Energy and Emissions Summary

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06/08/2010
01:45PM

Table 1. Annual Costs

Component	FL1ZN2 - Split System - Zone 2 (\$)
HVAC Components	
Electric	671
Natural Gas	259
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Remote CW	0
HVAC Sub-Total	930
Non-HVAC Components	
Electric	3,636
Natural Gas	0
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Non-HVAC Sub-Total	3,636
Grand Total	4,565

Table 2. Annual Energy Consumption

Component	FL1ZN2 - Split System - Zone 2
HVAC Components	
Electric (kWh)	3,855
Natural Gas (Therm)	164
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0
Non-HVAC Components	
Electric (kWh)	20,895
Natural Gas (Therm)	0
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Totals	
Electric (kWh)	24,750
Natural Gas (Therm)	164
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0

Annual Energy and Emissions Summary

Andover - Town Hall
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06/08/2010
01:45PM

Table 3. Annual Emissions

Component	FL1ZN2 - Split System - Zone 2
CO2 Equivalent (lb)	0

Table 4. Annual Cost per Unit Floor Area

Component	FL1ZN2 - Split System - Zone 2 (\$/ft²)
HVAC Components	
Electric	0.258
Natural Gas	0.100
Fuel Oil	0.000
Propane	0.000
Remote HW	0.000
Remote Steam	0.000
Remote CW	0.000
HVAC Sub-Total	0.358
Non-HVAC Components	
Electric	1.398
Natural Gas	0.000
Fuel Oil	0.000
Propane	0.000
Remote HW	0.000
Remote Steam	0.000
Non-HVAC Sub-Total	1.398
Grand Total	1.756
Gross Floor Area (ft²)	2600.0
Conditioned Floor Area (ft²)	2600.0

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

Table 5. Component Cost as a Percentage of Total Cost

Component	FL1ZN2 - Split System - Zone 2 (%)
HVAC Components	
Electric	14.7
Natural Gas	5.7
Fuel Oil	0.0
Propane	0.0
Remote HW	0.0
Remote Steam	0.0
Remote CW	0.0
HVAC Sub-Total	20.4
Non-HVAC Components	
Electric	79.6
Natural Gas	0.0
Fuel Oil	0.0
Propane	0.0
Remote HW	0.0
Remote Steam	0.0
Non-HVAC Sub-Total	79.6
Grand Total	100.0

Billing Details - Electric - FL2ZN3 - Split System - Zone 3

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06/08/2010
02:08PM

1. Component Charges

Billing Period	Energy Charges (\$)	Demand Charges (\$)	Customer Charges (\$)	Taxes (\$)	Total Charge (\$)
Jan	285	0	0	0	285
Feb	267	0	0	0	267
Mar	304	0	0	0	304
Apr	304	0	0	0	304
May	351	0	0	0	351
Jun	416	0	0	0	416
Jul	466	0	0	0	466
Aug	455	0	0	0	455
Sep	382	0	0	0	382
Oct	317	0	0	0	317
Nov	290	0	0	0	290
Dec	305	0	0	0	305
Totals	4,142	0	0	0	4,142

2. Totals

Billing Period	Total Charges (\$)	Total Consumption (kWh)	Avg Price (\$/kWh)
Jan	285	1,641	0.1740
Feb	267	1,534	0.1740
Mar	304	1,747	0.1740
Apr	304	1,745	0.1740
May	351	2,016	0.1740
Jun	416	2,389	0.1740
Jul	466	2,678	0.1740
Aug	455	2,614	0.1740
Sep	382	2,194	0.1740
Oct	317	1,823	0.1740
Nov	290	1,668	0.1740
Dec	305	1,754	0.1740
Totals	4,142	23,803	0.1740

3. Consumption Totals

Billing Period	Peak (kWh)	Mid-Peak (kWh)	Normal Peak (kWh)	Off-Peak (kWh)	Overall (kWh)
Jan	0	0	0	0	1,641
Feb	0	0	0	0	1,534
Mar	0	0	0	0	1,747
Apr	0	0	0	0	1,745
May	0	0	0	0	2,016
Jun	0	0	0	0	2,389
Jul	0	0	0	0	2,678
Aug	0	0	0	0	2,614
Sep	0	0	0	0	2,194
Oct	0	0	0	0	1,823
Nov	0	0	0	0	1,668
Dec	0	0	0	0	1,754
Totals	0	0	0	0	23,803

Billing Details - Electric - FL2ZN3 - Split System - Zone 3

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06/08/2010
02:08PM

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	5.9
Feb	0.0	0.0	0.0	0.0	6.0
Mar	0.0	0.0	0.0	0.0	7.1
Apr	0.0	0.0	0.0	0.0	8.6
May	0.0	0.0	0.0	0.0	9.8
Jun	0.0	0.0	0.0	0.0	9.6
Jul	0.0	0.0	0.0	0.0	10.4
Aug	0.0	0.0	0.0	0.0	9.5
Sep	0.0	0.0	0.0	0.0	8.8
Oct	0.0	0.0	0.0	0.0	8.8
Nov	0.0	0.0	0.0	0.0	6.8
Dec	0.0	0.0	0.0	0.0	6.6

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	5.9
Feb	0.0	0.0	0.0	0.0	6.0
Mar	0.0	0.0	0.0	0.0	7.1
Apr	0.0	0.0	0.0	0.0	8.6
May	0.0	0.0	0.0	0.0	9.8
Jun	0.0	0.0	0.0	0.0	9.6
Jul	0.0	0.0	0.0	0.0	10.4
Aug	0.0	0.0	0.0	0.0	9.5
Sep	0.0	0.0	0.0	0.0	8.8
Oct	0.0	0.0	0.0	0.0	8.8
Nov	0.0	0.0	0.0	0.0	6.8
Dec	0.0	0.0	0.0	0.0	6.6

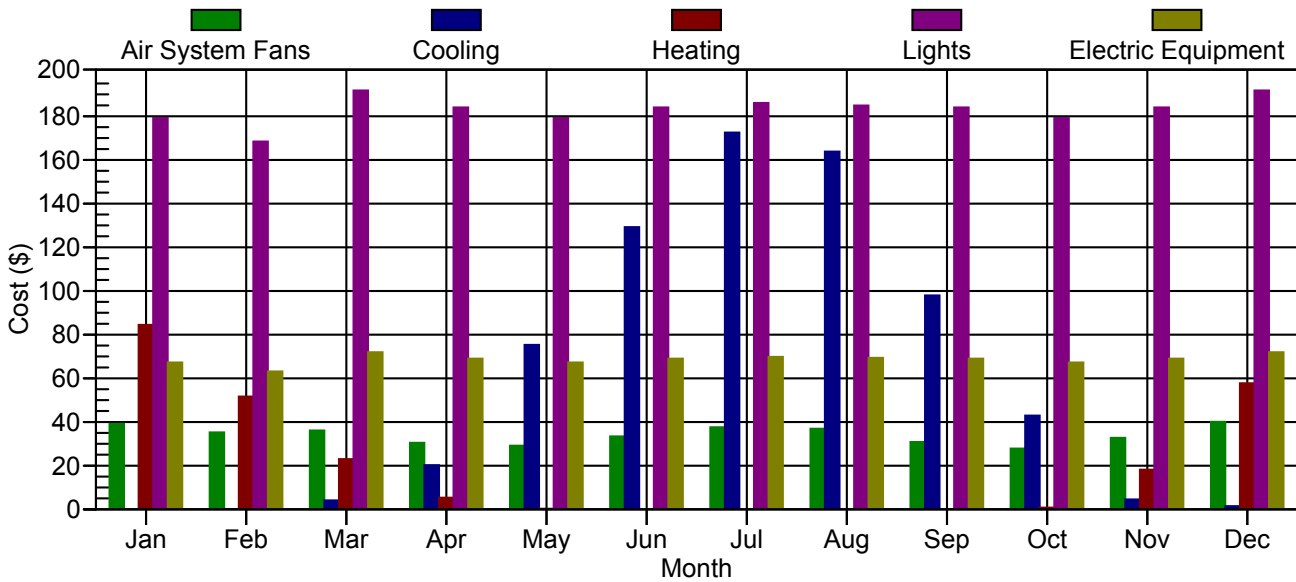
6. Time Of Maximum Demands

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	2/12/1600
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	6/11/1600
Jul	n/a	n/a	n/a	n/a	7/29/1600
Aug	n/a	n/a	n/a	n/a	8/4/1400
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	11/3/1600
Dec	n/a	n/a	n/a	n/a	12/2/1500

Monthly Component Costs - FL2ZN3 - Split System - Zone 3

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:08PM



1. HVAC Component Costs

Month	Air System Fans (\$)	Cooling (\$)	Heating (\$)	Pumps (\$)	Cooling Towers (\$)	HVAC Total (\$)
January	39	0	84	0	0	123
February	35	0	52	0	0	87
March	36	4	23	0	0	63
April	30	20	5	0	0	55
May	29	75	0	0	0	104
June	33	129	0	0	0	162
July	38	173	0	0	0	211
August	37	164	0	0	0	201
September	31	98	0	0	0	129
October	28	43	1	0	0	72
November	33	4	18	0	0	55
December	40	1	58	0	0	99
Total	409	712	241	0	0	1,362

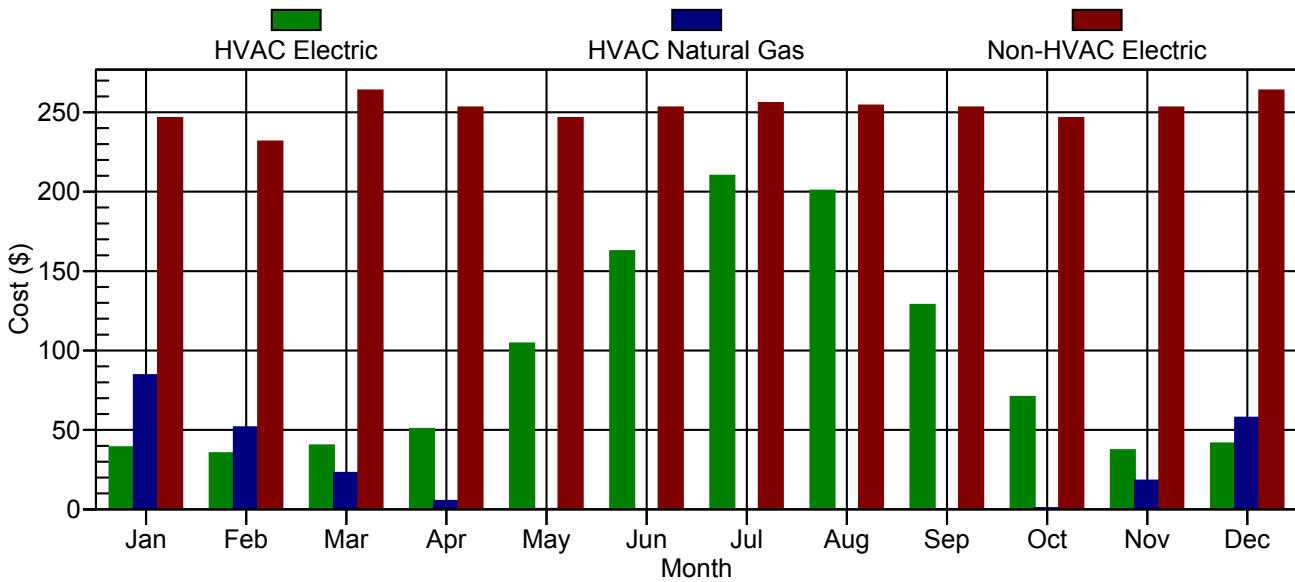
2. Non-HVAC Component Costs

Month	Lights (\$)	Electric Equipment (\$)	Misc. Electric (\$)	Misc. Fuel Use (\$)	Non-HVAC Total (\$)	Grand Total (\$)
January	179	67	0	0	246	369
February	168	63	0	0	232	319
March	192	72	0	0	264	327
April	184	69	0	0	253	308
May	179	67	0	0	246	350
June	184	69	0	0	253	415
July	186	70	0	0	256	467
August	185	69	0	0	254	455
September	184	69	0	0	253	382
October	179	67	0	0	246	318
November	184	69	0	0	253	308
December	192	72	0	0	264	363
Total	2,197	824	0	0	3,020	4,383

Monthly Energy Costs - FL2ZN3 - Split System - Zone 3

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06/08/2010
02:08PM



1. HVAC Costs

Month	Electric (\$)	Natural Gas (\$)	Fuel Oil (\$)	Propane (\$)	Remote Hot Water (\$)	Remote Steam (\$)	Remote Chilled Water (\$)
January	39	84	0	0	0	0	0
February	35	52	0	0	0	0	0
March	40	23	0	0	0	0	0
April	51	5	0	0	0	0	0
May	104	0	0	0	0	0	0
June	163	0	0	0	0	0	0
July	210	0	0	0	0	0	0
August	201	0	0	0	0	0	0
September	129	0	0	0	0	0	0
October	71	1	0	0	0	0	0
November	37	18	0	0	0	0	0
December	41	58	0	0	0	0	0
Total	1,121	241	0	0	0	0	0

2. Non-HVAC Costs

Month	Electric (\$)	Natural Gas (\$)	Fuel Oil (\$)	Propane (\$)	Remote Hot Water (\$)	Remote Steam (\$)
January	246	0	0	0	0	0
February	232	0	0	0	0	0
March	264	0	0	0	0	0
April	253	0	0	0	0	0
May	246	0	0	0	0	0
June	253	0	0	0	0	0
July	256	0	0	0	0	0
August	254	0	0	0	0	0
September	253	0	0	0	0	0
October	246	0	0	0	0	0
November	253	0	0	0	0	0
December	264	0	0	0	0	0
Total	3,021	0	0	0	0	0

Monthly Energy Use by Energy Type - FL2ZN3 - Split System - Zone 3

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Kitchen and Associates

06/08/2010
02:08PM

1. HVAC Energy Use

Month	Electric (kWh)	Natural Gas (Therm)	Fuel Oil (na)	Propane (na)	Remote HW (na)	Remote Steam (na)	Remote CW (na)
Jan	225	53	0	0	0	0	0
Feb	203	33	0	0	0	0	0
Mar	231	15	0	0	0	0	0
Apr	291	3	0	0	0	0	0
May	600	0	0	0	0	0	0
Jun	935	0	0	0	0	0	0
Jul	1,207	0	0	0	0	0	0
Aug	1,153	0	0	0	0	0	0
Sep	740	0	0	0	0	0	0
Oct	406	0	0	0	0	0	0
Nov	214	11	0	0	0	0	0
Dec	238	37	0	0	0	0	0
Totals	6,444	153	0	0	0	0	0

2. Non-HVAC Energy Use

Month	Electric (kWh)	Natural Gas (Therm)	Fuel Oil (na)	Propane (na)	Remote HW (na)	Remote Steam (na)
Jan	1,416	0	0	0	0	0
Feb	1,331	0	0	0	0	0
Mar	1,516	0	0	0	0	0
Apr	1,454	0	0	0	0	0
May	1,416	0	0	0	0	0
Jun	1,454	0	0	0	0	0
Jul	1,471	0	0	0	0	0
Aug	1,461	0	0	0	0	0
Sep	1,454	0	0	0	0	0
Oct	1,416	0	0	0	0	0
Nov	1,454	0	0	0	0	0
Dec	1,516	0	0	0	0	0
Totals	17,359	0	0	0	0	0

Monthly Energy Use by Component - FL2ZN3 - Split System - Zone 3

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Kitchen and Associates

06/08/2010
02:08PM

1. Monthly Energy Use by System Component

Component	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Air System Fans (kWh)	225	202	208	175	167	192	216	212	177	160	188	230
<i>Cooling</i>												
Electric (kWh)	0	1	24	116	433	743	992	941	563	247	26	8
Natural Gas (Therm)	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 (na)	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 (Therm)	53	33	15	3	0	0	0	0	0	0	11	37
Fuel Oil (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	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
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)	1030	968	1102	1058	1030	1058	1070	1063	1058	1030	1058	1102
Electric Eqpt. (kWh)	386	363	413	397	386	397	401	399	397	386	397	413
Misc. Electric (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
<i>Misc. Fuel</i>												
Natural Gas (Therm)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	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

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:08PM

Table 1. Annual Costs

Component	FL2ZN3 - Split System - Zone 3 (\$)
Air System Fans	409
Cooling	712
Heating	241
Pumps	0
Cooling Tower Fans	0
HVAC Sub-Total	1,362
Lights	2,197
Electric Equipment	824
Misc. Electric	0
Misc. Fuel Use	0
Non-HVAC Sub-Total	3,020
Grand Total	4,383

Table 2. Annual Cost per Unit Floor Area

Component	FL2ZN3 - Split System - Zone 3 (\$/ft²)
Air System Fans	0.189
Cooling	0.330
Heating	0.112
Pumps	0.000
Cooling Tower Fans	0.000
HVAC Sub-Total	0.631
Lights	1.017
Electric Equipment	0.381
Misc. Electric	0.000
Misc. Fuel Use	0.000
Non-HVAC Sub-Total	1.398
Grand Total	2.029
Gross Floor Area (ft²)	2160.0
Conditioned Floor Area (ft²)	2160.0

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

Table 3. Component Cost as a Percentage of Total Cost

Component	FL2ZN3 - Split System - Zone 3 (%)
Air System Fans	9.3
Cooling	16.2
Heating	5.5
Pumps	0.0
Cooling Tower Fans	0.0
HVAC Sub-Total	31.1
Lights	50.1
Electric Equipment	18.8
Misc. Electric	0.0
Misc. Fuel Use	0.0
Non-HVAC Sub-Total	68.9
Grand Total	100.0

Annual Energy and Emissions Summary

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:08PM

Table 1. Annual Costs

Component	FL2ZN3 - Split System - Zone 3 (\$)
HVAC Components	
Electric	1,121
Natural Gas	241
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Remote CW	0
HVAC Sub-Total	1,362
Non-HVAC Components	
Electric	3,021
Natural Gas	0
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Non-HVAC Sub-Total	3,021
Grand Total	4,383

Table 2. Annual Energy Consumption

Component	FL2ZN3 - Split System - Zone 3
HVAC Components	
Electric (kWh)	6,444
Natural Gas (Therm)	153
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0
Non-HVAC Components	
Electric (kWh)	17,359
Natural Gas (Therm)	0
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Totals	
Electric (kWh)	23,803
Natural Gas (Therm)	153
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0

Annual Energy and Emissions Summary

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:08PM

Table 3. Annual Emissions

Component	FL2ZN3 - Split System - Zone 3
CO2 Equivalent (lb)	0

Table 4. Annual Cost per Unit Floor Area

Component	FL2ZN3 - Split System - Zone 3 (\$/ft²)
HVAC Components	
Electric	0.519
Natural Gas	0.112
Fuel Oil	0.000
Propane	0.000
Remote HW	0.000
Remote Steam	0.000
Remote CW	0.000
HVAC Sub-Total	0.631
Non-HVAC Components	
Electric	1.398
Natural Gas	0.000
Fuel Oil	0.000
Propane	0.000
Remote HW	0.000
Remote Steam	0.000
Non-HVAC Sub-Total	1.398
Grand Total	2.029
Gross Floor Area (ft²)	2160.0
Conditioned Floor Area (ft²)	2160.0

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

Table 5. Component Cost as a Percentage of Total Cost

Component	FL2ZN3 - Split System - Zone 3 (%)
HVAC Components	
Electric	25.6
Natural Gas	5.5
Fuel Oil	0.0
Propane	0.0
Remote HW	0.0
Remote Steam	0.0
Remote CW	0.0
HVAC Sub-Total	31.1
Non-HVAC Components	
Electric	68.9
Natural Gas	0.0
Fuel Oil	0.0
Propane	0.0
Remote HW	0.0
Remote Steam	0.0
Non-HVAC Sub-Total	68.9
Grand Total	100.0

Billing Details - Electric - FL2ZN4 - Split System - Zone 4

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06/08/2010
02:08PM

1. Component Charges

Billing Period	Energy Charges (\$)	Demand Charges (\$)	Customer Charges (\$)	Taxes (\$)	Total Charge (\$)
Jan	347	0	0	0	347
Feb	324	0	0	0	324
Mar	371	0	0	0	371
Apr	376	0	0	0	376
May	434	0	0	0	434
Jun	505	0	0	0	505
Jul	557	0	0	0	557
Aug	546	0	0	0	546
Sep	465	0	0	0	465
Oct	388	0	0	0	388
Nov	355	0	0	0	355
Dec	371	0	0	0	371
Totals	5,039	0	0	0	5,039

2. Totals

Billing Period	Total Charges (\$)	Total Consumption (kWh)	Avg Price (\$/kWh)
Jan	347	1,994	0.1740
Feb	324	1,863	0.1740
Mar	371	2,134	0.1740
Apr	376	2,158	0.1740
May	434	2,492	0.1740
Jun	505	2,904	0.1740
Jul	557	3,202	0.1740
Aug	546	3,137	0.1740
Sep	465	2,672	0.1740
Oct	388	2,231	0.1740
Nov	355	2,038	0.1740
Dec	371	2,133	0.1740
Totals	5,039	28,959	0.1740

3. Consumption Totals

Billing Period	Peak (kWh)	Mid-Peak (kWh)	Normal Peak (kWh)	Off-Peak (kWh)	Overall (kWh)
Jan	0	0	0	0	1,994
Feb	0	0	0	0	1,863
Mar	0	0	0	0	2,134
Apr	0	0	0	0	2,158
May	0	0	0	0	2,492
Jun	0	0	0	0	2,904
Jul	0	0	0	0	3,202
Aug	0	0	0	0	3,137
Sep	0	0	0	0	2,672
Oct	0	0	0	0	2,231
Nov	0	0	0	0	2,038
Dec	0	0	0	0	2,133
Totals	0	0	0	0	28,959

Billing Details - Electric - FL2ZN4 - Split System - Zone 4

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Kitchen and Associates

06/08/2010
02:08PM

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	7.2
Feb	0.0	0.0	0.0	0.0	7.4
Mar	0.0	0.0	0.0	0.0	8.5
Apr	0.0	0.0	0.0	0.0	10.2
May	0.0	0.0	0.0	0.0	11.3
Jun	0.0	0.0	0.0	0.0	11.2
Jul	0.0	0.0	0.0	0.0	11.4
Aug	0.0	0.0	0.0	0.0	11.1
Sep	0.0	0.0	0.0	0.0	10.3
Oct	0.0	0.0	0.0	0.0	10.3
Nov	0.0	0.0	0.0	0.0	8.3
Dec	0.0	0.0	0.0	0.0	8.1

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	7.2
Feb	0.0	0.0	0.0	0.0	7.4
Mar	0.0	0.0	0.0	0.0	8.5
Apr	0.0	0.0	0.0	0.0	10.2
May	0.0	0.0	0.0	0.0	11.3
Jun	0.0	0.0	0.0	0.0	11.2
Jul	0.0	0.0	0.0	0.0	11.4
Aug	0.0	0.0	0.0	0.0	11.1
Sep	0.0	0.0	0.0	0.0	10.3
Oct	0.0	0.0	0.0	0.0	10.3
Nov	0.0	0.0	0.0	0.0	8.3
Dec	0.0	0.0	0.0	0.0	8.1

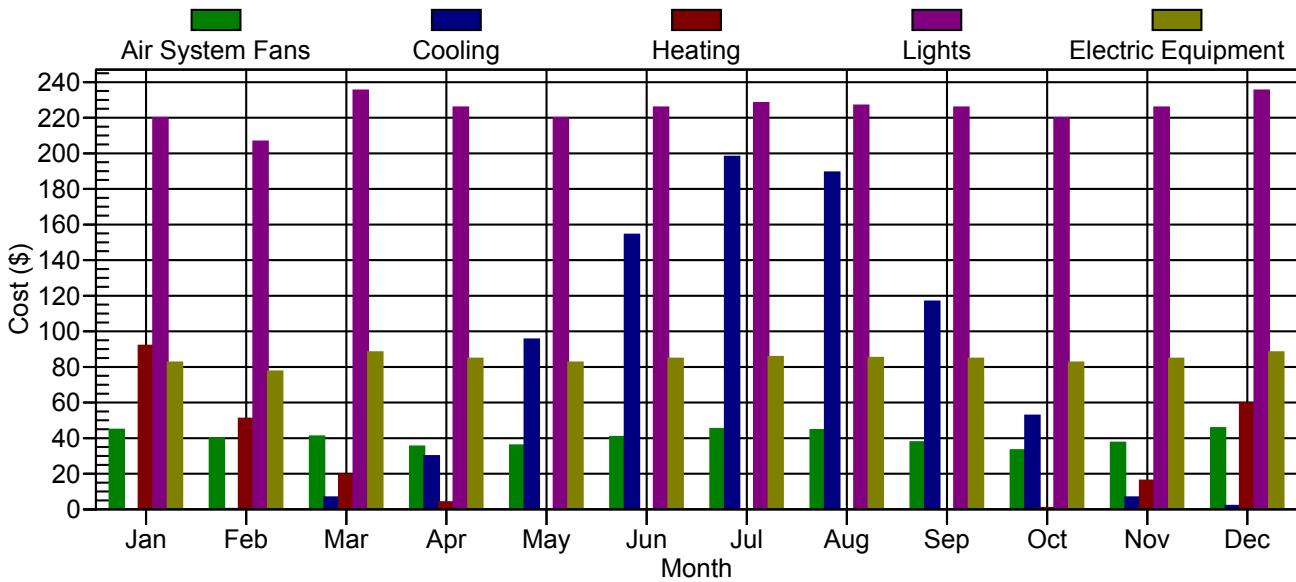
6. Time Of Maximum Demands

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	6/11/1500
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	9/10/1500
Oct	n/a	n/a	n/a	n/a	10/1/1500
Nov	n/a	n/a	n/a	n/a	11/4/1300
Dec	n/a	n/a	n/a	n/a	12/2/1500

Monthly Component Costs - FL2ZN4 - Split System - Zone 4

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Kitchen and Associates

06/08/2010
02:08PM



1. HVAC Component Costs

Month	Air System Fans (\$)	Cooling (\$)	Heating (\$)	Pumps (\$)	Cooling Towers (\$)	HVAC Total (\$)
January	45	0	92	0	0	137
February	40	0	51	0	0	91
March	41	7	19	0	0	67
April	35	30	4	0	0	69
May	36	95	0	0	0	131
June	41	154	0	0	0	195
July	45	198	0	0	0	243
August	45	189	0	0	0	234
September	38	117	0	0	0	155
October	33	53	1	0	0	87
November	37	7	16	0	0	60
December	46	2	60	0	0	108
Total	481	852	243	0	0	1,576

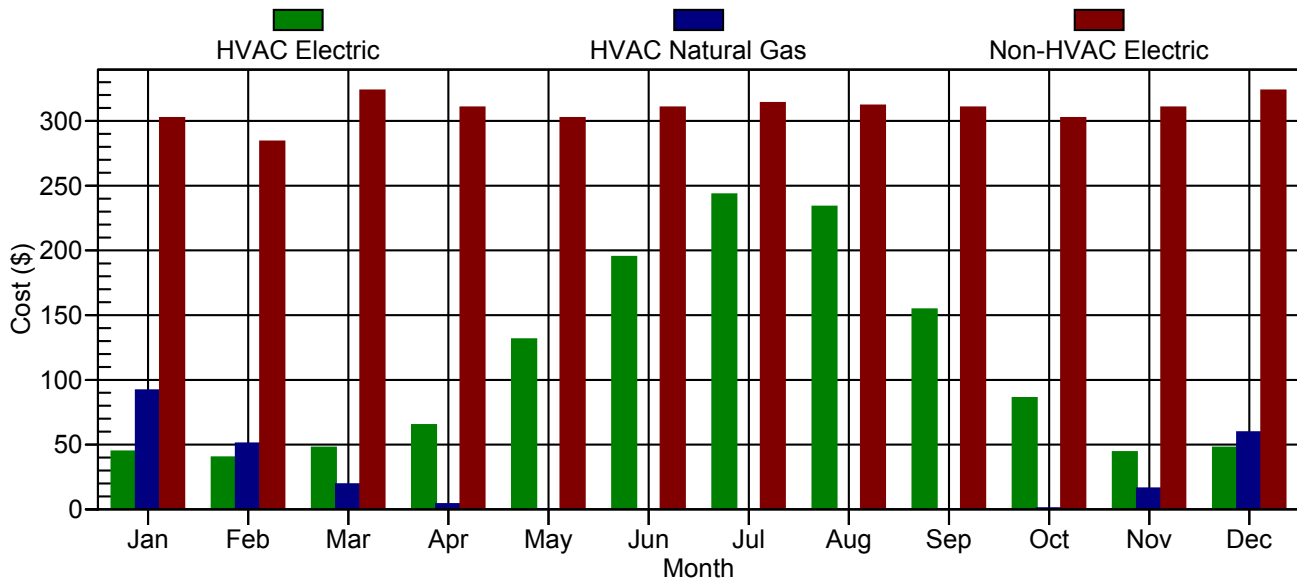
2. Non-HVAC Component Costs

Month	Lights (\$)	Electric Equipment (\$)	Misc. Electric (\$)	Misc. Fuel Use (\$)	Non-HVAC Total (\$)	Grand Total (\$)
January	220	82	0	0	302	439
February	207	77	0	0	284	375
March	235	88	0	0	324	391
April	226	85	0	0	310	379
May	220	82	0	0	302	433
June	226	85	0	0	310	505
July	228	86	0	0	314	557
August	227	85	0	0	312	546
September	226	85	0	0	310	465
October	220	82	0	0	302	389
November	226	85	0	0	310	370
December	235	88	0	0	324	432
Total	2,695	1,011	0	0	3,706	5,282

Monthly Energy Costs - FL2ZN4 - Split System - Zone 4

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:08PM



1. HVAC Costs

Month	Electric (\$)	Natural Gas (\$)	Fuel Oil (\$)	Propane (\$)	Remote Hot Water (\$)	Remote Steam (\$)	Remote Chilled Water (\$)
January	45	92	0	0	0	0	0
February	40	51	0	0	0	0	0
March	48	19	0	0	0	0	0
April	65	4	0	0	0	0	0
May	131	0	0	0	0	0	0
June	195	0	0	0	0	0	0
July	243	0	0	0	0	0	0
August	234	0	0	0	0	0	0
September	154	0	0	0	0	0	0
October	86	1	0	0	0	0	0
November	44	16	0	0	0	0	0
December	48	60	0	0	0	0	0
Total	1,333	243	0	0	0	0	0

2. Non-HVAC Costs

Month	Electric (\$)	Natural Gas (\$)	Fuel Oil (\$)	Propane (\$)	Remote Hot Water (\$)	Remote Steam (\$)
January	302	0	0	0	0	0
February	284	0	0	0	0	0
March	324	0	0	0	0	0
April	310	0	0	0	0	0
May	302	0	0	0	0	0
June	310	0	0	0	0	0
July	314	0	0	0	0	0
August	312	0	0	0	0	0
September	310	0	0	0	0	0
October	302	0	0	0	0	0
November	310	0	0	0	0	0
December	324	0	0	0	0	0
Total	3,706	0	0	0	0	0

Monthly Energy Use by Energy Type - FL2ZN4 - Split System - Zone 4

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:08PM

1. HVAC Energy Use

Month	Electric (kWh)	Natural Gas (Therm)	Fuel Oil (na)	Propane (na)	Remote HW (na)	Remote Steam (na)	Remote CW (na)
Jan	257	58	0	0	0	0	0
Feb	231	32	0	0	0	0	0
Mar	274	12	0	0	0	0	0
Apr	374	3	0	0	0	0	0
May	755	0	0	0	0	0	0
Jun	1,120	0	0	0	0	0	0
Jul	1,398	0	0	0	0	0	0
Aug	1,344	0	0	0	0	0	0
Sep	888	0	0	0	0	0	0
Oct	494	1	0	0	0	0	0
Nov	254	10	0	0	0	0	0
Dec	274	38	0	0	0	0	0
Totals	7,662	154	0	0	0	0	0

2. Non-HVAC Energy Use

Month	Electric (kWh)	Natural Gas (Therm)	Fuel Oil (na)	Propane (na)	Remote HW (na)	Remote Steam (na)
Jan	1,737	0	0	0	0	0
Feb	1,632	0	0	0	0	0
Mar	1,860	0	0	0	0	0
Apr	1,784	0	0	0	0	0
May	1,737	0	0	0	0	0
Jun	1,784	0	0	0	0	0
Jul	1,804	0	0	0	0	0
Aug	1,793	0	0	0	0	0
Sep	1,784	0	0	0	0	0
Oct	1,737	0	0	0	0	0
Nov	1,784	0	0	0	0	0
Dec	1,860	0	0	0	0	0
Totals	21,297	0	0	0	0	0

Monthly Energy Use by Component - FL2ZN4 - Split System - Zone 4

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:08PM

1. Monthly Energy Use by System Component

Component	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Air System Fans (kWh)	257	229	235	203	206	234	260	256	217	191	215	263
<i>Cooling</i>												
Electric (kWh)	0	1	39	172	548	887	1138	1088	671	303	39	11
Natural Gas (Therm)	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 (na)	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 (Therm)	58	32	12	3	0	0	0	0	0	1	10	38
Fuel Oil (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	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
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)	1264	1187	1353	1297	1264	1297	1312	1304	1297	1264	1297	1353
Electric Eqpt. (kWh)	474	445	507	487	474	487	492	489	487	474	487	507
Misc. Electric (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
<i>Misc. Fuel</i>												
Natural Gas (Therm)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	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

Andover - Town Hall
Kitchen and Associates

06/08/2010
02:08PM

Table 1. Annual Costs

Component	FL2ZN4 - Split System - Zone 4 (\$)
Air System Fans	481
Cooling	852
Heating	243
Pumps	0
Cooling Tower Fans	0
HVAC Sub-Total	1,576
Lights	2,695
Electric Equipment	1,011
Misc. Electric	0
Misc. Fuel Use	0
Non-HVAC Sub-Total	3,706
Grand Total	5,282

Table 2. Annual Cost per Unit Floor Area

Component	FL2ZN4 - Split System - Zone 4 (\$/ft²)
Air System Fans	0.182
Cooling	0.322
Heating	0.092
Pumps	0.000
Cooling Tower Fans	0.000
HVAC Sub-Total	0.595
Lights	1.017
Electric Equipment	0.381
Misc. Electric	0.000
Misc. Fuel Use	0.000
Non-HVAC Sub-Total	1.398
Grand Total	1.993
Gross Floor Area (ft²)	2650.0
Conditioned Floor Area (ft²)	2650.0

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

Table 3. Component Cost as a Percentage of Total Cost

Component	FL2ZN4 - Split System - Zone 4 (%)
Air System Fans	9.1
Cooling	16.1
Heating	4.6
Pumps	0.0
Cooling Tower Fans	0.0
HVAC Sub-Total	29.8
Lights	51.0
Electric Equipment	19.1
Misc. Electric	0.0
Misc. Fuel Use	0.0
Non-HVAC Sub-Total	70.2
Grand Total	100.0

Annual Energy and Emissions Summary

Andover - Town Hall
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06/08/2010
02:08PM

Table 1. Annual Costs

Component	FL2ZN4 - Split System - Zone 4 (\$)
HVAC Components	
Electric	1,333
Natural Gas	243
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Remote CW	0
HVAC Sub-Total	1,576
Non-HVAC Components	
Electric	3,706
Natural Gas	0
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Non-HVAC Sub-Total	3,706
Grand Total	5,282

Table 2. Annual Energy Consumption

Component	FL2ZN4 - Split System - Zone 4
HVAC Components	
Electric (kWh)	7,662
Natural Gas (Therm)	154
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0
Non-HVAC Components	
Electric (kWh)	21,297
Natural Gas (Therm)	0
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Totals	
Electric (kWh)	28,959
Natural Gas (Therm)	154
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0

Annual Energy and Emissions Summary

Andover - Town Hall
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06/08/2010
02:08PM

Table 3. Annual Emissions

Component	FL2ZN4 - Split System - Zone 4
CO2 Equivalent (lb)	0

Table 4. Annual Cost per Unit Floor Area

Component	FL2ZN4 - Split System - Zone 4 (\$/ft²)
HVAC Components	
Electric	0.503
Natural Gas	0.092
Fuel Oil	0.000
Propane	0.000
Remote HW	0.000
Remote Steam	0.000
Remote CW	0.000
HVAC Sub-Total	0.595
Non-HVAC Components	
Electric	1.398
Natural Gas	0.000
Fuel Oil	0.000
Propane	0.000
Remote HW	0.000
Remote Steam	0.000
Non-HVAC Sub-Total	1.398
Grand Total	1.993
Gross Floor Area (ft²)	2650.0
Conditioned Floor Area (ft²)	2650.0

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

Table 5. Component Cost as a Percentage of Total Cost

Component	FL2ZN4 - Split System - Zone 4 (%)
HVAC Components	
Electric	25.2
Natural Gas	4.6
Fuel Oil	0.0
Propane	0.0
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 U

Site Aerial Image



