Energy Audit

Prepared For:
Union Township, NJ

Contact
Mr. Philip Haderer,
Township Engineer

Prepared By:
Dome-Tech, Inc.

Prepared Under the Guidelines of the State of NJ Local Government Energy Audit Program

January, 2012

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UNION TOWNSHIP
ENERGY AUDIT REPORT
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February 28, 2012

Mr. Philip Haderer, P.E., C.M.E.
Township Engineer
Union Township
1976 Morris Avenue
Union, NJ 07083

Re: EXECUTIVE SUMMARY FOR UNION TOWNSHIP
STATE OF NEW JERSEY LOCAL GOVERNMENT ENERGY AUDIT
Our Project Number DT11435

Dear Mr. Haderer:

Dome-Tech was retained by Union Township, as a pre-qualified participant in the Local Government Energy Audit Program, to perform an energy audit. The objective of the energy audit was to evaluate the Township's energy consumption, establish baselines for energy efficiency and identify opportunities to reduce the amount of energy used and/or its cost.

The scope of the audit is standardized under the Program, and consisted of the following:

- Benchmarking historic energy consumption utilizing EPA Energy Star's Portfolio Manager
- Characterizing building use, occupancy, size, and construction
- Providing a detailed equipment list including estimated service life and efficiency
- Identifying and quantifying energy conservation measures (ECMs)
- Evaluating the economic viability of various renewable/distributed energy technologies
- Performing a utility tariff analysis and assessing savings potential from energy procurement strategies
- Providing the method of analyses

Based upon data received for the twelve (12) month period August 2010 – August 2011 the Township had an annual expenditure of:

- Electricity: 258,240 kWh at a total cost of $44,808
- Natural Gas: 12,252 therms at a total cost of $12,673

Note that the electrical consumption for August 2010 was extrapolated from existing data to give a full year of data.

The following building was evaluated under this study:

- Union Township Municipal Building, 1976 Morris Avenue, Union, NJ 07093 at 28,750 square feet.

Please refer to Section 2 of this report for a detailed list of identified Energy Conservation Measures (ECMs), along with a summary of their preliminary economics (estimated project cost, estimated annual energy savings, applicable rebate(s), etc.). In this report, all identified ECMs are ranked and presented according to their simple payback; however, please note that the master ECM table can also be sorted by building, by measure type, etc.

If all identified ECMs were implemented, they would provide the following estimated benefits to the Township:

- Total annual electrical savings: 67,340 kilowatt-hours; 26.1%
- Total annual natural gas savings: 3,560 therms of natural gas usage; 29%
- Total annual cost savings: $15,370; 26.7%
- Total annual CO_2 emissions reduction: 43 tons
- Total net estimated implementation cost: $211,340
- Total average simple payback: 13.8 years

A summary of the projects that are recommended for implementation includes: installing weatherization measures; installing programmable thermostats; and upgrading lighting. Please see the report for a full list of recommended ECM's.

Distributed/Renewable Energy Systems were also reviewed with the following conclusions:

- Dome-Tech considered three different types of wind turbine technologies that consisted of both building-mounted and traditional ground-mounted variety. The Building-mounted wind turbine project appears to be the only technically viable option but is not recommended due to long payback and high noise concerns.
- CHP (Combined Heat and Power), Fuel Cells and Micro-turbines were also considered and not recommended for the building, due to lack of summertime thermal loads.
- Photovoltaic systems were considered for this building, but are not recommended due to difficulty installing on the pitched roof and significant site shading.

The Township's data was entered into the US EPA ENERGY STAR's Portfolio Manager Database program. Buildings with scores of 75 or higher may qualify for the ENERGY STAR Building Label. Please see the report for individual facility information.

Regarding the retail energy procurement process, it appears that Union Township is currently participating with a third-party retail energy supplier for both electricity and natural gas.

During the development of this audit, Dome-Tech was assisted by facility personnel, who were both knowledgeable and very helpful to our efforts. We would like to acknowledge and thank those individuals.

Sincerely,

John Carioto
Energy Engineer

UNION TOWNSHIP - ECM Summary by Payback

	Energy Conservation Measures (ECM)	Buildings	Energy Savings			Gross Installation Costs*	Rebates/ Incentive	Avoided Cost	Net Implementation Costs	Annual Energy Cost Savings	Total Annual Cost Savings	Measure Life	Gross Implementation Costs Pay Back (Gross)	Net Implementation Costs Pay Back (Net)	CO2 Savings
			kWh	kW	Therms							Yrs	Yrs	Yrs	Tons
1	Programmable Thermostat	1976 Morris Avenue	7,550		0	$ 580	$0	$0	$ 580	$ 1,310	$ 1,310	15	0.4	0.4	2.5
2	Vending Miser	1976 Morris Avenue	1,470		0	$ 220	$0	$0	$ 220	$ 260	$ 260	10	0.8	0.8	0.5
3	Kitchen Equipment Replacement	1976 Morris Avenue	470		0	$ 1,080	$0	$1,010	$ 70	$ 80	$ 80	20	13.5	0.9	0.2
4	Lighting Measures	1976 Morris Avenue	56,400		0	$ 41,000	$4,120	$0	$ 36,900	$ 9,790	$ 9,790	10	4.2	3.8	18.6
5	Door Weatherization	1976 Morris Avenue	100		160	$ 860	$0	$0	$ 860	$ 180	$ 180	20	4.8	4.8	1.0
6	Pipe Insulation	1976 Morris Avenue	0		90	$ 530	$0	$0	$ 530	$ 100	$ 100	15	5.3	5.3	0.5
7	Hot Water Reset	1976 Morris Avenue	0		160	$ 1,910	$0	$0	$ 1,910	$ 160	$ 160	15	11.9	11.9	0.9
8	DHW Timer	1976 Morris Avenue	0		20	$ 270	$0	$0	$ 270	$ 20	$ 20	15	13.5	13.5	0.1
9	Attic Insulation	1976 Morris Avenue	1,350		1,150	$ 49,000	$0	$0	$ 49,000	$ 1,420	$ 1,420	30	34.5	34.5	7.2
10	Modular Condensing Boiler	1976 Morris Avenue	0		1,980	$ 399,000	$1,800	$276,000	$ 121,000	$ 2,050	$ 2,050	25	194.6	59.0	11.6
	Totals	**TOTALS**	**67,340**	**0**	**3,560**	**$ 494,450**	**$ 5,920**	**$ 277,010**	**$ 211,340**	**$ 15,370**	**$ 15,370**	**18**	**32.2**	**13.8**	**43**

Notes:

1. KW - Where Zero (0) values are shown in the table there is no demand reduction for this measure.
2. Rebates- Where Zero (0) values are shown in the table we could not find any rebates of other financial incentives that are currently available for this measure.
3. Gross Installation Cost is the cost of installing equipment recommended by the ECM.
4. Avoided Cost is the cost of replacing equipment at end of service life with like and kind equipment.
5. Net Implementation Cost is the Gross Installation Cost less any Rebate/Incentive and any Avoided Cost. In the case of equipment that is being replaced regardless, Net Implementation Cost represents the incremental cost incurred by upgrading to equipment that produces more energy savings.
6. Note that the values shown in this tables are rounded and will not match the more detailed cost estimate and savings calculation sheets.

Energy Audit Purpose & Scope

Purpose:

- The objectives of the energy audit are to evaluate the site's energy consumption, establish baselines for energy efficiency and identify opportunities to reduce the amount of energy used and/or its cost.

Scope:

I. Historic Energy Consumption: Benchmark energy use using Energy Star Portfolio Manager

II. Facility Description – characterize building usage, occupancy, size and construction.

III. Equipment Inventory – detailed equipment list including useful life and efficiency.

IV. Energy Conservation Measures: Identify and evaluate opportunities for cost savings and economic returns.

V. Renewable/Distributed Energy Measures: evaluate economic viability of various renewable/distributed energy technologies.

VI. Energy Purchasing and Procurement Strategies: perform utility tariff analysis and assess potential for savings from energy procurement strategies.

VII. Method of Analysis: Appendices

Historic Energy Consumption

Utility Usage and Costs Summary

Time-period: August 2010 – August 2011

Buildings	Electric - PSE&G				Natural Gas - Elizabethtown Gas			
	Account Number	Annual Consumption kWh	Annual Cost	$ / kWh	Account Number	Annual Consumption Therms	Annual Cost	$ / Therms
Township Municipal Building	602100927382	258,240	$44,808	$0.174	8347434500	11,802	$ 12,004	$1.017
					4746634500	450	$ 669	$1.486
	TOTAL	**258,240**	**$44,808**	**$0.174**	**TOTAL**	**12,252**	**$ 12,673**	**$1.034**

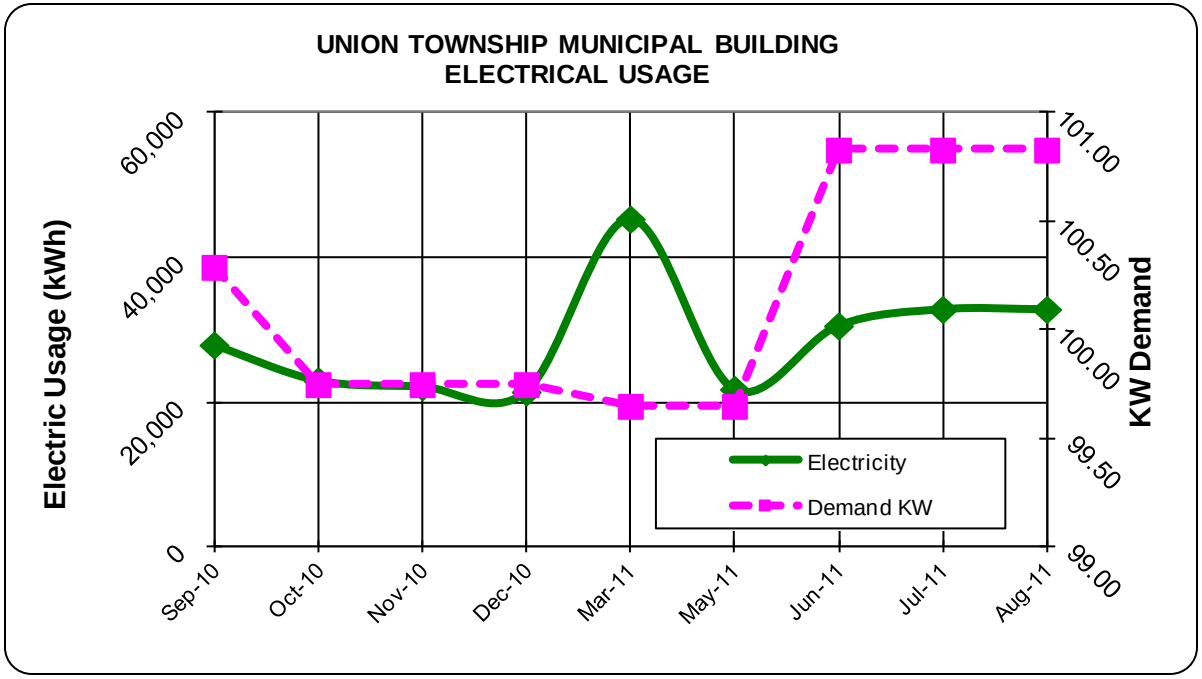
- There is missing information for the electrical costs. The Annual cost shown above is estimated and is derived from the bills provided. However, it appears that bills from 10/2010 to 6/2011 and 7/2011 are missing supply charges from a third-party supplier. For this report, supply charges are based on the “Price to Compare” price provided by PSE&G.
- August 2010 electrical consumption is extrapolated from existing data.
- Natural gas bills are missing delivery charges and consumption information for several months. Costs are not extrapolated for these dates. Missing data can be seen in the tables in section 4 (Appendix).

Please see Appendix for full utility data and consumption profiles for the building.

Historic Energy Consumption

Utility Usage and Costs Summary

Time-period: August 2010 – August 2011

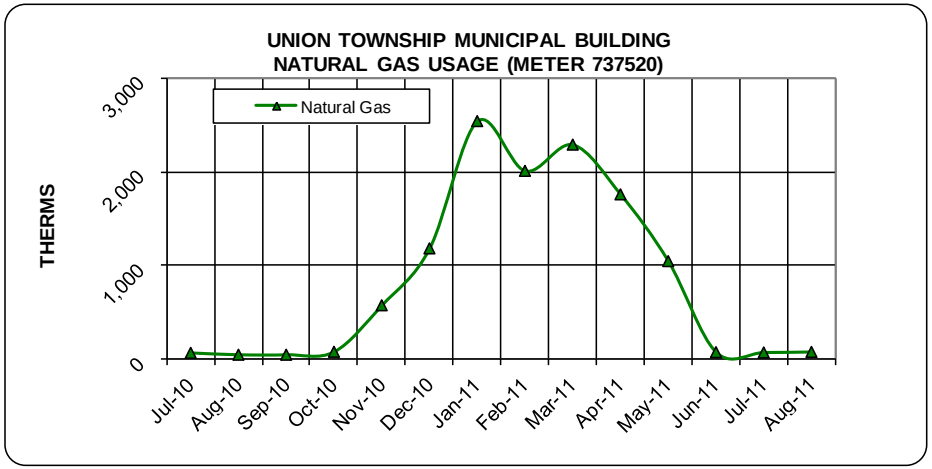


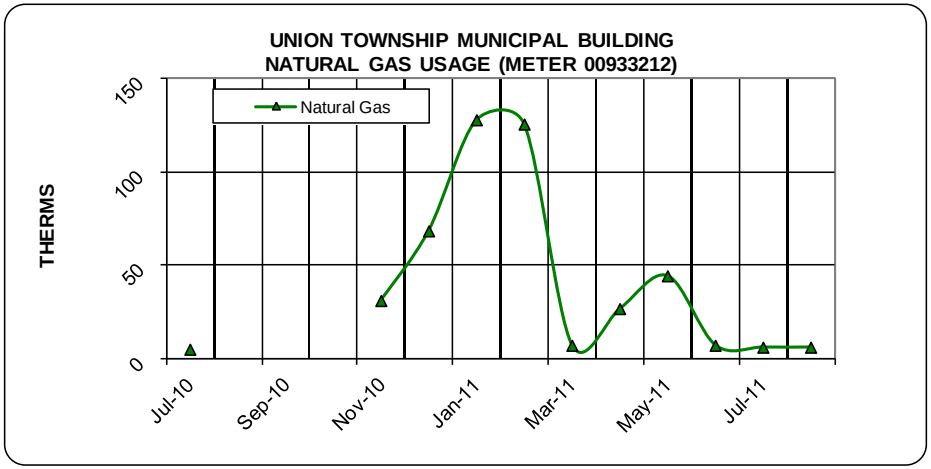
Please see Appendix for full utility data and consumption profiles for the building.

Historic Energy Consumption

Utility Usage and Costs Summary

Time-period: August 2010 – August 2011





Please see Appendix for full utility data and consumption profiles for the building.

Historic Energy Consumption

ENERGY STAR SCORES

- Energy Star Score is calculated to establish a facility-specific energy intensity baseline.
- Energy Star can be used to compare energy consumption to other similar facilities and to gauge the success of energy conservation and cost containment efforts.
- Buildings with an Energy Star rating/score of 75, or above, are eligible to apply for an official Energy Star Building label.
- Not all buildings are eligible to receive a rating. In order to receive a rating, more than 50% of your building must be defined by one of the following space types: Bank/Financial Institution, Courthouse, Hospital (Acute Care and Children's), Hotel, K-12 School, Medical Office, Office, Residence Hall/Dormitory, Retail Store, Supermarket, Warehouse (Refrigerated and Non-refrigerated), Wastewater Treatment Plant, or Data Center.
- The EnergyStar score for this building is based on estimated and temporary data to account for missing and old information.

Facility Name	Total Floor Area	Energy Star Score	Eligible to Apply for ENERGY STAR	Current Site Energy Intensity (kBtu/SF)	Current Source Energy Intensity (kBtu/SF)
Union Township Municipal Building	28,750	51	No	80.6	171.6

Historic Energy Consumption (continued)

Portfolio Manager Sign - In

- An account has been created for the Township in Portfolio Manager. You will have received an email to notify you of the generation of this account and shared access with Dome-Tech. Please use this to read your facility information. Please feel free to alter this information when the report is finalized. We would ask that you leave the sign-in information alone until then. Your facility's information is currently shared as read only.
- When the report is finalized the shared access will be changed so that you can use / edit the information and change as you wish.
- Website link to sign-in: https://www.energystar.gov/istar/pmpam/index.cfm?fuseaction=login.Login

Facility Information

Building Name:	**Township of Union Municipal Building**
Address:	1976 Morris Avenue Union, New Jersey 07083
Gross Floor Area:	28,750 sf
Year Built:	1957
# Occupants:	60
Operation:	The building is operated M-F from 7 am until 5:30 pm and occasionally during the evening hours. Closed weekends and holidays.

Construction Features:

Façade:	Three story, brick/block construction, in fair condition (original brickwork is of poor quality and there are frequent leaks)
Roof Type:	Pitched, wood decking, gray slate, two flat areas covered with black membrane. The sloped roof is in fair condition with frequent leaks. The black membrane areas are in good condition.
Windows:	Covering 30-35% of façade, metal/fiberglass frames, operable, no shades/blinds, in new condition.
Exterior Doors:	Approximately 7. Doors are a mixture of metal, wood, and glass, in good condition. No weather-stripping.

Facility Information

Major Mechanical Systems

Air Handlers / AC Systems / Ventilation Systems

Union Township has two (2) Air Handling units (AHUs) located in the basement mechanical room

The two primary AHUs are AC-1 which is a 40-ton direct expansion (DX) multi-zone unit serving the office spaces on all three floors of the building and AC-2 is a 20-ton DX single-zone unit serving the Assembly area.

Supplemental units are used to serve the datacenter, telecom room and the accounts office.

Boilers

The building is heated by one(1) natural gas fired Pacific Steel hot water boiler which is over 50 years old. The hot water system is a constant volume system with a three-way bypass valve maintaining a constant flow to the boiler.

Domestic Hot Water

The building's domestic hot water is provided by an AO Smith, natural gas fired, domestic hot water heater, located in the mechanical equipment room in the basement. It has a rated capacity of 74 gallons and an input of 80 kBTUh.

Controls

The two primary AHUs in the basement Mechanical Equipment Room (MER) as well as the boiler and hot water distribution system are controlled by a hybrid DDC/pneumatic control system. Local supplemental ACs and fin tube radiation are controlled by local thermostats. A handheld interface exists for this system, but is not in a useable state for the facility personnel to access the system.

Greenhouse Gas Emission Reduction

Implementation of all identified ECMs will yield:

- 67,340 kilowatt-hours of annual avoided electric usage.
- 3,560 therms of annual avoided natural gas usage.
- This equates to the following ***annual*** reductions:

- 43 tons of CO_2;

  -OR-

- 7 Cars removed from road;

  -OR-

- 12 Acres of trees planted annually

The Energy Information Administration (EIA) estimates that power plants in the state of New Jersey emits 0.666 lbs CO_2 per kWh generated.

The Environmental Protection Agency (EPA) estimates that one car emits 11,560 lbs CO_2 per year.

The EPA estimates that reducing CO_2 emissions by 7,333 pounds is equivalent to planting an acre of trees.

Notes and Assumptions

- Project cost estimates were based upon industry accepted published cost data, rough order of magnitude cost estimates from contractors, and regional prevailing wage rates. The cost estimates presented in this report should be used to select projects for investment grade development. The cost estimates presented in this report should not be used for budget development or acquisition requests.

- Estimated energy and cost savings are based on individual projects being implemented and do not account for potential synergies if multiple projects are implemented concurrently. Therefore, cumulative energy and cost savings shown in this report may or may not be representative of actual results.

- The average CO_2 emission rate from power plants serving the facilities within this report was obtained from the Environmental Protection Agency's (EPA) eGRID2007 report. It is stated that power plants within the state of NJ emit 0.66 lbs of CO_2 per kWh generated.
  - The EPA estimates that burning one therm of natural gas emits 11.708 lbs CO_2.
  - The EPA estimates that one car emits 11,560 lbs CO_2 per year.
  - The EPA estimates that reducing CO_2 emissions by 7,333 pounds is equivalent to planting an acre of trees.

- The following utility prices provided were used within this study:

Building	$ / kWh	$ / Therms
Union Township Municipal Building	$0.174	$1.034

ECM #1: Programmable Thermostat

Estimated Annual Savings:	$1,310
Gross Estimated Implementation Cost:	$580
NJ Smart Start Rebate:	$0
Net Estimated Implementation Cost:	$580
Simple Payback (years):	0.4
Annual Avoided CO_2 Emissions (tons):	2.5

- The supplemental unit serving the Bonnell Room is controlled by a local non-programmable thermostat.
- Dome-Tech recommends replacing the non-programmable thermostat with a programmable thermostat and implementing occupancy schedules and temperature setback.
- In general, installing programmable thermostats will provide scheduled temperature control to prevent overheating and unnecessary cooling when the building is unoccupied.

ECM #2: Vending Machine Power Management

Estimated Annual Savings:	$260
Gross Estimated Implementation Cost:	$220
NJ Smart Start Rebate:	$0
Net Estimated Implementation Cost:	$220
Simple Payback (years):	0.8
Annual Avoided CO_2 Emissions (tons):	0.5

- Dome-Tech recommends installing a vending machine power management device on all vending machines. For this building, only one (1) appropriate machine is installed.
- The device uses a passive infrared sensor to power down the machine when the area surrounding it is vacant. Then it monitors the room's temperature and automatically re-powers the cooling system at one- to three-hour intervals, independent of sales, to ensure that the product stays cold.
- The microcontroller will never power down the machine while the compressor is running, eliminating compressor short-cycling. In addition, when the machine is powered up, the cooling cycle is allowed to finish before again powering down (reduces compressor wear and tear).

ECM #3: Replace Kitchen Equipment with Energy Star Rated Equipment

Estimated Annual Savings:	$70
Gross Estimated Implementation Cost:	$1,080
NJ Smart Start Rebate:	$0
Avoided Costs (Like & Kind)[1]:	$1,010
Incremental Estimated Implementation Cost::	$70
Simple Payback (years):	0.9
Annual Avoided CO_2 Emissions (tons):	0.2

1. Like and Kind refers to the cost to replace the existing system with the same or similar grade of system.

- Most of the refrigerators in the town hall are older (approximately 10 years) and less efficient than new equipment.
- Improvements in new refrigerators include lower idle rates, better insulation- which reduces the amount of standby losses through sides and top, and high efficiency fan motors.
- The gross implementation cost is the actual project cost that would be realized by the facility if the Township decides to proceed with the project. However, due to the age of the equipment and considering that it is it's typical service life, the avoided costs are the estimate of cost for replacing the system with a similar system. The incremental cost is the premium the Township would pay for installing a more efficient system.

ECM #4: Lighting Upgrade

Estimated Annual Savings:	$9,790
Gross Estimated Implementation Cost:	$41,000
NJ Smart Start Rebate:	$4,120
Net Estimated Implementation Cost:	$36,900
Simple Payback (years):	3.8
Annual Avoided CO_2 Emissions (tons):	18.6

- In general, the building is outfitted with T-8 fluorescent lamps. These lamps and ballasts can be retrofitted with low power lamps and the fixtures can be retrofitted with reflectors which will reduce the number of lamps required to be installed in each space, while keeping the same amount of illumination in the space. This will save energy and reduce the types of lamps required to be stocked.
- Outdoor lights are metal halide and high pressure sodium lights which can be retrofit with induction lamps and ballasts.
- Incandescent light bulbs should be replaced with screw-in compact fluorescent lamps (CFLs).
- See the appendix for a detailed list of lighting upgrades.

ECM #5: Weatherstripping Exterior Doors

Estimated Annual Savings:	$180
Gross Estimated Implementation Cost:	$860
NJ Smart Start Rebate:	$0
Net Estimated Implementation Cost:	$860
Simple Payback (years):	4.8
Annual Avoided CO_2 Emissions (tons):	1.0

Picture: Union Township Municipal Building

- Several of the perimeter doors are in good condition, but are missing weather stripping. This allows infiltration to enter conditioned areas causing, an unnecessary increase in the heating and cooling loads.
- Dome-Tech recommends replacing all old weather stripping on perimeter doors that do not have vestibules.
- Energy savings will be realized by the reduction of hot and cold outside air that the building's HVAC equipment must condition to room temperature.

ECM #6: Install Pipe Insulation

Estimated Annual Savings:	$100
Gross Estimated Implementation Cost:	$530
NJ Smart Start Rebate:	$0
Net Estimated Implementation Cost:	$530
Simple Payback (years):	5.3
Annual Avoided CO_2 Emissions (tons):	0.5

Picture: AC-1 Zone Reheat Coils

- Missing or damaged insulation on heating or cooling pipes causes thermal losses and increases the work required by the equipment.
- Heating hot water pipes located at the zone reheat coils for AC-1 are missing insulation.

ECM #7: Hot Water Reset

Estimated Annual Savings:	$160
Gross Estimated Implementation Cost:	$1,910
NJ Smart Start Rebate:	$0
Net Estimated Implementation Cost:	$1,910
Simple Payback (years):	11.9
Annual Avoided CO_2 Emissions (tons):	0.9

- A hot water reset program will reduce the temperature of the hot water leaving the boiler during low load days. The decrease in hot temperature will decrease the amount of heat lost through the distribution piping.

- Connecting the boiler to a building management system and implementing a temperature reset program will provide savings of over $100.

ECM #8: Install Timers on Hot Water Heaters

Estimated Annual Savings:	$20
Gross Estimated Implementation Cost:	$270
NJ Smart Start Rebate:	$0
Net Estimated Implementation Cost:	$270
Simple Payback (years):	13.5
Annual Avoided CO_2 Emissions (tons):	0.1

- The building creates domestic hot water from one (1) natural gas fired hot water heater. The hot water heater is rated for 74 gallons and 80 kBtu of heating.

- Although hot water heaters/storage tanks are insulated, there is significant standby heat loss during off hours. The heating elements turn on throughout unoccupied hours to maintain the desired set point temperature.

- Placing timers on the unit will turn the unit off during unoccupied hours and turn it back on two hours prior to occupation. This setback schedule eliminates energy used to make up the standby heat loss.

ECM #9: Attic Insulation

Estimated Annual Savings:	$1,420
Gross Estimated Implementation Cost:	$49.000
NJ Smart Start Rebate:	$0
Net Estimated Implementation Cost:	$49.000
Simple Payback (years):	34.5
Annual Avoided CO_2 Emissions (tons):	7.2

- The attic space in the building is inadequately insulated. Staff indicated there are problems with heating and cooling, with noticeable cold spots in winter.
- There is no insulation in the attic spaces.
- Dome- Tech recommends installing an additional 4-1/2" of polyurethane foam insulation to bring the ceiling up to an approximate R-25 rating. While this ECM does not have a good economic payback, it is recommended to improve comfort conditions.

ECM #9: Boiler Replacement

Estimated Annual Savings:	$2,050
Gross Estimated Implementation Cost:	$399,000
NJ Smart Start Rebate:	$1,800
Avoided Costs (Like & Kind)[1]:	$276,000
Incremental Estimated Implementation Cost:	$121,000
Simple Payback (years):	59.0
Annual Avoided CO_2 Emissions (tons):	11.6

1. Like and Kind refers to the cost to replace the existing system with the same or similar grade of system.

- The site has one (1) hot water boiler generating hot water for the building. The boiler is over 50 years old and has reached the end of its rated equipment service life (ASHRAE states the service life of similar equipment is 25 years).
- Generally, as boilers approach the end of their service life, there is a direct correlation between risk of equipment failure (tube breaks & meltdown, shell cracks, furnace surface area failure) and equipment age.
- If the existing boiler were replaced with high efficiency condensing boilers, savings will be incurred in two ways. Firstly in modular boiler applications, multiple smaller boilers are installed to meet the overall building load. Each boiler operates independently, eliminating the "all on/all off" operation of single burner boilers. As building load increases, only those units necessary to meet the load are fired. This allows each unit to run at optimal efficiency. Second, condensing boilers extract more heat from the input fuel thus allowing efficiencies of 90% and above.
- The high first cost of a new boiler system preclude this ECM from being justified by economics alone. However, reliability issues warrant consideration of this project as part of a long-term capital improvement plan.
- The gross implementation cost is the actual project cost that would be realized by the facility if the Township decides to proceed with the project. However, due to the age of the equipment and considering that it is far past it's typical service life, the avoided costs are the estimate of cost for replacing the system with a similar system. The incremental cost is the premium the Township would pay for installing a more efficient system.
- NJ SmartStart program provides for a rebate of $1 per for boilers between 1500MBH and 4000MBH. The size of this boiler is approximately 1800MBH.

Renewable/Distributed Energy Measures

Distributed Generation & Renewable Energy

- Distributed Generation (on-site generation) generates electricity from many small energy sources. These sources can be renewable (solar/wind/geothermal) or can be small scale power generation technologies (CHP, fuel cells, microturbines).

- Renewable energy is energy generated from natural resources (sunlight, wind, and underground geothermal heat) which are naturally replenished

- Wind power is growing as well, mostly in Europe and the U.S.

Renewable Energy Technologies: Wind

Wind turbines generate electricity by harnessing a wind stream's kinetic energy as it spins the turbine airfoils. As with most renewable energy sources, wind energy is subject to intermittent performance due to the unpredictability of wind resources.

Wind Speed

As previously stated, wind speed is critical to the successful wind turbine installation. According to average wind data from NASA's Surface Meteorology and Solar Energy records, the average annual wind speed for the Union Township area is 4.56 meters per second. Ideal wind speeds for a successful project should average over 6 meters per second.

For Union Township, Dome-Tech considered three (3) types of wind turbine technologies; building integrated wind turbines (1 kW each) and traditional ground mounted wind turbines (5 kW & 50 kW).

Building Integrated Wind Turbines
Model: AeroVironment AVX1000
Height: 8.5'
Rotor Diameter: 6'
Weight: 130 lbs.
Cut-In Wind Speed: 2.2 m/s
Maximum Generating Capacity: 1 kW

5 kW Ground Mount
Model: WES5 Tulipo
Height: 40'
Rotor Diameter: 16'
Weight: 1,900 lbs.
Cut-In Wind Speed: 3.0 m/s
Maximum Generating Capacity: 5.2 kW

50 kW Ground Mount
Model: Entegrity EW50
Height: 102'
Rotor Diameter: 50'
Weight: 21,000 lbs.
Cut-In Wind Speed: 4.0 m/s
Maximum Generating Capacity: 50 kW

Renewable Energy Technologies: Wind

The project economics and wind turbine pros and cons are presented in the following tables:

Wind Turbine Economics: Union Township

	Building Integrated - 1 kW	Ground Mount - 5.2 kW	Ground Mount - 50 kW
Number of Units	14	2	1
Gross Installation Cost Estimate	$91,000	$62,400	$250,000
Net Installation Cost Estimate	$91,000	$62,400	$250,000
Annual Energy Savings	888	1,002	9,376
Simple Payback	102	62	27
System Capacity	14	10	50
Annual Avoided Energy Use	10,390	11,713	109,658
Annual Avoided CO2 Emmisions, Tons	4	4	38
% of Annual Electric Use*	4.5%	5.1%	47.6%

*Union Township: 230280 kWh/Year.

Wind Turbine Pros & Cons

Pros	Cons
➢Annual reduction in energy spend and use can be potentially reduced by almost about 47%. ➢Typical equipment life span is 15-30 years. ➢Reduction of annual greenhouse gas emissions by 38tons per year. ➢A wind turbine project could be incorporated into science and other curriculums to raise student awareness of energy alternatives. ➢High visible “green” project.	➢Payback period is significant (over 10 years). ➢Average area wind speed is not ideal and impacts performance. ➢Prone to lighting strikes. ➢Bird collisions are likely, but may be reduced with avian guard (building integrate only). ➢Zoning may be an issue. Check with local zoning regulations. ➢Wind turbines do create noise, although below 50 dB (a typical car ride is over 80 dB).

Should Union Township decide to pursue a wind turbine project, Dome-Tech recommends commissioning a more detailed study.

Solar Photovoltaic

- Sunlight can be converted into electricity using photovoltaics (PV).
- A solar cell or photovoltaic cell is a device that converts sunlight directly into electricity.
- Photons in sunlight hit the solar panel and are absorbed by semiconducting materials, such as silicon. Electrons are knocked loose from their atoms, allowing them to flow through the material to produce electricity.
- Solar cells are often electrically connected and encapsulated as a module, in series, creating an additive voltage. The modules are connected in an array. The power output of an array is measured in watts or kilowatts, and typical energy needs are measured in kilowatt-hours.
- This system application can be considered for potential placement on additional buildings or areas such in parking lots, in overhead mounting.
- This is not recommended for Union Township due to an abundance of shading and the difficulty of installing on pitched roofs.

Renewable Energy Technologies: CHP/Cogeneration

- CHP (combined heat and power), or cogeneration, is the use of a heat engine to simultaneously generate both electricity and useful heat.
- Fuel Cells are electrochemical conversion devices that operate by catalysis, separation the protons and the electrons of the reactant fuel, and forcing the electrons to travel through a circuit to produce electricity. The catalyst is typically a platinum group metal or alloy. Another catalytic process takes the electrons back in, combining them with the protons and oxidant, producing waste products (usually water and carbon dioxide).
- Microturbines are rotary engines that extract energy from a flow of combustion gas. They can be used with absorption chillers to provide cooling through waste heat rather than electricity. Microturbines are best suited for facilities with year-round thermal and/or cooling loads.
- Not recommended for Union Township Municipal Building.

Retail Energy Purchasing: Recommendations

Electric

- For the period studied, Union Township was utilizing a Third Party Supplier for electricity. Supplier bills were not provided therefore Dome-Tech is unable to include contract details in this report.

- Dome-Tech recommends the Township continue or develop a procurement strategy because there is an opportunity to save money by switching to an electricity supplier versus paying the BGS default rate to the utility. Currently, typical savings can be in the 5-15% range.

Natural Gas

- For the period studied, Union Township was utilizing Pepco Energy Services as a Third Party Supplier for natural gas at a fixed rate of $0.74 per therm.

- If the Township is seeking budget certainty or would like to reduce their market exposure for Natural Gas, the Township should continue with a fixed price contract with a supplier or joining a purchasing co-operative and developing a procurement strategy.

Energy Purchasing Co-Operatives

Many public entities participate in various energy aggregation buying groups. Sometimes, an entity will have multiple options to choose from. These might include purchasing through a County co-operative, or purchasing through a trade-type association like ACES. Co-operative purchasing may not necessarily get you the lowest rates; however, there is often substantial volume, and it can represent a good alternative for entities with limited energy consumption who can have a difficult time getting energy suppliers to respond to them on a direct, singular basis.

Utility Tariff and Rate Review: Electricity

- **Accounts and Rate Class:** Union Township has one facility with one main electric account with service behind Public Service Electric and Gas Company under rate class General Lighting and Power (GLP).

- **Electric Consumption and Cost:** Based on the one-year period studied, the total annual electric expenditure for the Township is about $19,000 and the total annual consumption is about 230,000 kilowatt-hours (kWh).

- **Average/Effective Rate per kWh:** For the one year period studied, the Township's average monthly cost per kilowatt-hour ranged from 16 ¢/kWh to 19 ¢/kWh, inclusive of utility delivery charges. The Township's overall, average cost per kilowatt-hour during this period was 17.4 ¢/kWh (Supplier bills were not provided, therefore actual costs my vary).
  - Note that these average electric rates are "all–inclusive"; that is, they include all supply service (generation and commodity-related) charges, as well as all delivery service charges. The supply service charges typically represent the majority (60-80%) of the total monthly bill. It is the supply portion of your bill that is deregulated, which is discussed on subsequent slides in this section.

Utility Tariff and Rate Review: Natural Gas

- **Accounts and Rate Class:** Union Township has one facility with two natural gas accounts with service behind Elizabethtown Gas. The rate class was not listed on the utility bill.

- **Natural Gas Consumption and Cost:** Based on the one-year period studied, the total annual natural gas expenditure for the Township is about $12,600 and the total annual consumption is about 12,200 therms. Natural gas is used mostly in the winter period for heating purposes.

- **Average/Effective Rate per Therm:** For the one year period studied, the Township's overall, average cost per therm during this period was $1.251 per therm.
  - Note that these average natural gas rates are "all–inclusive"; that is, they include all supply service (interstate transportation and commodity-related) charges, as well as all delivery service charges. The supply service charges typically represent the majority (60-80%) of the total monthly bill. It is the supply portion of your bill that is deregulated, which is discussed on subsequent slides in this section.

Utility Deregulation in New Jersey: Background and Retail Energy Purchasing

- In August 2003, per the Electric Discount and Energy Competition Act [N.J.S.A. 48:3-49], the State of New Jersey deregulated its electric marketplace thus making it possible for customers to shop for a third-party (someone other than the utility) supplier of retail electricity.
- Per this process, every single electric account for every customer in New Jersey was placed into one of two categories: BGS-FP or BGS-CIEP. BGS-FP stands for Basic Generation Service-Fixed Price; BGS-CIEP stands for Basic Generation Service-Commercial and Industrial Energy Pricing.
- At its first pass, this categorization of accounts was based on rate class. The largest electric accounts in the State (those served under a Primary or a Transmission-level rate class) were moved into BGS-CIEP pricing. All other accounts (the vast majority of accounts in the State of New Jersey, including residential) were placed in the BGS-FP category, receiving default electric supply service from the utility.
- The New Jersey Board of Public Utilities (NJBPU) has continued to move new large energy users from the BGS-FP category into the BGS-CIEP category by lowering the demand (kW) threshold for electric accounts receiving Secondary service. Several years ago, this threshold started at 1,500kW; now, it has come down to 1,000 kW. So, if an account's "peak load share" (as assigned by the utility) is less than 1,000 kW, then that facility/account is in the BGS-FP category. If you are unsure, you may contact Dome-tech for assistance.

Utility Deregulation in New Jersey: Background and Retail Energy Purchasing

- There are at least 3 important differentiating factors to note about each rate category:
  1. The rate structure for BGS-FP accounts and for BGS-CIEP accounts varies.
  2. The "do-nothing" option (i.e., what happens when you don't shop for retail energy) varies.
  3. The decision about whether, and why, to shop for a retail provider varies.

- **Secondary (small to medium) Electric Accounts**:
  - BGS-FP rate schedules for all utilities are set, and re-set, each year. Per the results of our State's BGS Auction process, held each February, new utility default rates go into effect every year on June 1st. The BGS-FP rates become each customer's default rates, and they dictate a customer's "Price to Compare" (benchmark) for shopping purposes. To learn more about the BGS Auction process, please go to www.bgs-auction.com.
  - A customer's decision about whether to buy energy from a retail energy supplier is, therefore, dependent upon whether a supplier can offer rates that are lower than the utility's (default) Price to Compare. In 2009, and for the first time in several years, many BGS-FP customers have "switched" from the utility to a retail energy supplier because there have been savings. This may be the same case in 2010.

- **Primary (large) Electric Accounts:**
  - The BGS-CIEP category is quite different. There are two main features to note about BGS-CIEP accounts that do not switch to a retail supplier for service. The first is that they pay an hourly market rate for energy; the second is that these accounts also pay a "retail margin adder" of $0.0053/kWh. For these large accounts, this retail adder can amount to tens of thousands of dollars. The adder is eliminated when a customer switches to a retail supplier for service.
  - For BGS-CIEP accounts, the retail adder makes a customer's decision about *whether* to switch relatively simple. However, the process of setting forth a buying strategy can be complex, which is why many public entities seek professional assistance when shopping for energy.
  - For more information concerning hourly electric market prices for our region, please refer to www.pjm.com.

Utility Deregulation in New Jersey: Background and Retail Energy Purchasing

- **Natural Gas Accounts:**

  - The natural gas market in New Jersey is also deregulated. Unlike the electric market, there are no "penalties", or "adders", for not shopping for natural gas. Most customers that remain with the utility for natural gas service pay rates that are market-based and that fluctuate on a monthly basis. While natural gas is a commodity that is exceptionally volatile and that is traded minute-by-minute during open trading sessions, market rates are "settled" each month, 3 business days prior to the subsequent month (this is called the "prompt month"). Customers that do not shop for a natural gas supplier will typically pay this monthly settlement rate to the utility, plus other costs that are necessary to bring gas from Louisiana up to New Jersey and ultimately to your facility.

  - For additional information about natural gas trading and current market futures rates for various commodities, you can refer to www.nymex.com.

  - A customer's decision about whether to buy natural gas from a retail supplier is typically dependent upon whether a customer seeks budget certainty and/or longer-term rate stability. Customers can secure longer-term fixed prices by enlisting a retail natural gas supplier. Many larger natural gas customers also seek the assistance of a professional consultant to assist in their procurement process.

Retail Energy Suppliers

- To learn more about energy deregulation, visit the New Jersey Board of Public Utilities website: www.bpu.state.nj.us
- For more information about the retail energy supply companies that are licensed and registered to serve customers in New Jersey, visit the following website for more information: http://www.bpu.state.nj.us/bpu/commercial/shopping.html
- Provided below is a list of NJ BPU-licensed retail energy suppliers:

Company	Electricity	Natural Gas	Website
Hess	X	X	hess.com
Sprague	X	X	sprageenergy.com
UGI	X	X	ugienergyservices.com
South Jersey Energy	X	X	southjerseyenergy.com
Direct	X	X	directenergy.com
Global	X	X	globalp.com
Liberty	X		libertpowercorp.com
Reliant	X		reliant.com
First Energy	X		fes.com
ConEd Solutions	X		conedsolutions.com
Constellation	X		newenergy.com
Glacial	X		glacialenergy.com
Integrys	X		integrysenergy.com
Suez	X		suezenergyresources.com
Sempra	X		semprasolutions.com
Woodruff		X	woodruffenergy.com
Mx Energy		X	mxenergy.com
Hudson		X	hudsonenergyservices.com
Great Eastern		X	greateasterngas.com

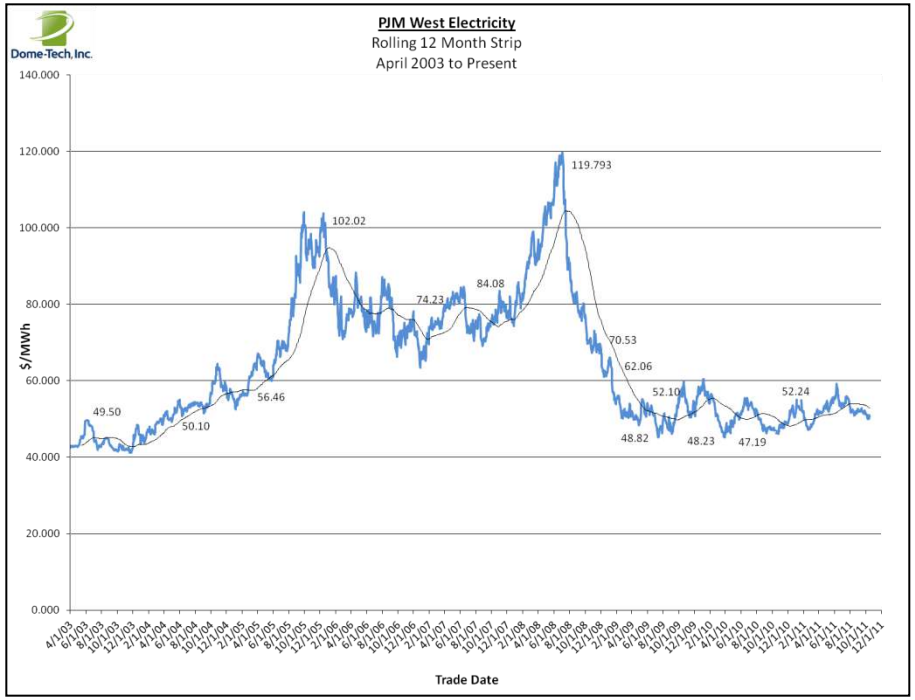
**Note: Not every Supplier serves customers in all utility territories within New Jersey.*

Historical Energy Futures Settlement Prices

- Below please find graphs that show the last several years' worth of market settlement prices for both natural gas and electricity. Each of these graphs shows the average closing prices of a rolling 12-month period of energy futures prices. The graphs are representative of the commodity, alone; they do not include any of the additional components (capacity, transmission, ancillary services, etc.) that comprise a retail energy price. They are meant to provide an indication of the level of pricing that a particular customer might expect to see, but the graphs do not account for the specific load profile of any individual energy user.

Natural Gas

Electricity



Operation and Maintenance (O&M): Measure #01

Control System Installation

- **Issue**: The existing controls at the Municipal Building are old and in poor repair but are operational. Facility personnel do not have the ability to monitor or adjust the system.
- **Impact**: A full direct digital control (DDC) will allow for better monitoring and control of the building by providing real-time feedback, historical trending and ease of use for setpoint adjustment and scheduling changes.
- **Recommendation**: Due to a high cost, Dome-Tech does not recommend this measure, but the Township may wish to consider it for operational reasons. Dome-Tech's estimate of cost for this measure is $318,300.

Potential Project Funding Sources

Through the NJ Clean Energy program, the New Jersey Board of Public Utilities currently offers a variety of subsidies or rebates for many of the project types outlined in this report. More detailed information can be found at: www.njcleanenergy.com

NJ Smart Start Buildings – Equipment Rebates noted in ECMs where available. Equipment Rebates - Water Heaters, Lighting, Lighting Controls/Sensors, Chillers, Boilers, Heat pumps, Air conditioners, Energy Mgmt. Systems/Building Controls, Motors, Motor-ASDs/VSDs, Custom/Others http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings

Pay for Performance Program – Performance-Based Incentives for installations. Provides up to 50% of total project costs. ***Based on findings in this study, up to $76,000 in incentives for project implementation could be provided under this program.*** A minimum reduction target of 15% compared to baseline must be achieved. Energy modeling of building and systems and energy reduction plan is required (incentives provided to pay for part of study costs.) http://www.njcleanenergy.com/commercial-industrial/programs/pay-performance/existing-buildings

Energy Savings Improvement Program (ESIP) Public entities can contract with energy saving companies in up to 20-year lease purchases enabling public entities to implement energy conservation measures to their facilities and pay for the costs using the value of energy savings that result from the improvements. The Energy Saving Companies (ESCO) would assist in bypassing large upfront costs to the entity.
www.**nj**.gov/dca/lgs/lfns/09lfns/2009-11.doc

Potential Project Funding Sources (continued)

Direct Install Program – NJ Clean Energy makes the investment in energy efficiency upgrades by initially covering 60% of the cost to install the recommended energy efficiency measures. If eligible, the entity will pay ONLY 40% of the total cost to install the energy efficiency measures.
http://www.njcleanenergy.com/commercial-industrial/programs/direct-install

We encourage you to contact the program directly for further information on this particular program for all the buildings

Steps to Participate for Buildings

1. CONTACT THE PARTICIPATING CONTRACTOR IN YOUR AREA
Identify the contractor assigned and trained to provide Direct Install services in the county where your project is located. Using the contact information provided, call or email the Participating Contractor to discuss your project. The contractor will schedule an Energy Assessment and work with you to complete the Program Application and Participation Agreement. If you're unable to contact the Participating Contractor or have questions, you may contact us at 866-NJSMART or send an e-mail to DirectInstall@trcsolutions.com..

2. REVIEW RESULTS
After the Energy Assessment, the contractor will review results with you, including what measures qualify and your share of the project cost.

3. DECIDE TO MOVE FORWARD
You will sign a Scope of Work document to proceed with implementation of qualifying measures.

4. ARRANGE INSTALLATION
You and the Participating Contractor will set a convenient start date for the installation.

5. CONFIRM INSTALLATION
Once the Participating Contractor completes the installation, you accept the work by signing a Project Completion Form. A program representative will approve the project as complete.

6. COMPLETE TRANSACTION
You pay the Participating Contractor your share of the project cost and the program pays its share.

Potential Project Funding Sources (continued)

Clean Energy Solutions Capital Investment Loan/Grant

The EDA offers up to $5 million in interest-free loans and grants to promote the concept of "going green" in New Jersey. Under this program, scoring criteria based on the project's environmental and economic development impact determines the percentage split of loan and grant awarded. Funding can be used to purchase fixed assets, including real estate and equipment, for an end-use energy efficiency project, combined heat and power (CHP or cogen) production facility, or new state-of-the-art efficient electric generation facility, including Class I and Class II renewable Energy.
http://www.njeda.com/web/Aspx_pg/Templates/Npic_Text.aspx?Doc_Id=1078&menuid=1360&topid=722&levelid=6&midid=1357

Clean Renewable Energy Bonds (CREBs) – For Renewable Energy Projects

Federal Loan Program for Solar Thermal Electric, Photovoltaics, Landfill Gas, Wind, Biomass, Hydroelectric, Geothermal Electric, Municipal Solid Waste, Hydrokinetic Power, Anaerobic Digestion, Tidal Energy, Wave Energy, Ocean Thermal

http://www.irs.gov/irb/2007-14_IRB/ar17.html

Renewable funding for PV & wind, plus federal credits currently available:
http://www.njcleanenergy.com/renewable-energy/programs/renewable-energy-incentive-program/applications-and-e-forms-renewable-ener

Next Steps

- **The following projects should be considered for implementation:**

  - Lighting upgrades
  - Vending machine power management
  - Programmable thermostat
  - Insulation

  Note that additional "Phase 2" engineering may be required to further develop these projects, to bring them to bidding and implementation.

  - **Consider applying for Direct Install Programs**

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Township of Union Municipal Building

Building ID: 2986634
For 12-month Period Ending: October 31, 2011[1]
Date SEP becomes ineligible: N/A
Date SEP Generated: January 11, 2012

Facility
Township of Union Municipal Building
1976 Morris Avenue
Union, NJ 07083

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 1957
Gross Floor Area (ft²): 28,750

Energy Performance Rating[2] (1-100) 51

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	1,094,345
Natural Gas (kBtu)[4]	1,221,582
Total Energy (kBtu)	2,315,927

Energy Intensity[4]

Site (kBtu/ft²/yr)	81
Source (kBtu/ft²/yr)	172

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	220

Electric Distribution Utility
Public Service Electric & Gas Co

National Median Comparison

National Median Site EUI	82
National Median Source EUI	175
% Difference from National Median Source EUI	-2%
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.

Certifying Professional
N/A

Meets Industry Standards[5] **for Indoor Environmental Conditions:**

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

Notes:
1. Application for the ENERGY STAR must be submitted to EPA within 4 months of the Period Ending date. Award of the ENERGY STAR is not final until approval is received from EPA.
2. The EPA Energy Performance Rating is based on total source energy. A rating of 75 is the minimum to be eligible for the ENERGY STAR.
3. Values represent energy consumption, annualized to a 12-month period.
4. Values represent energy intensity, annualized to a 12-month period.
5. 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.

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
Township of Union Municipal Building
1976 Morris Avenue
Union, NJ 07083

Facility Owner
N/A

Primary Contact for this Facility
N/A

General Information

Township of Union Municipal Building	
Gross Floor Area Excluding Parking: (ft^2)	28,750
Year Built	1957
For 12-month Evaluation Period Ending Date:	October 31, 2011

Facility Space Use Summary

Union Township Municipal Building	
Space Type	Office
Gross Floor Area(ft^2)	28,750
Weekly operating hours	40
Workers on Main Shift	40
Number of PCs	40
Percent Cooled	50% or more
Percent Heated	50% or more

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 10/31/2011)	**Baseline** (Ending Date 10/31/2011)	**Rating of 75**	**Target**	**National Median**
Energy Performance Rating	51	51	75	N/A	50
Energy Intensity					
Site (kBtu/ft^2)	81	81	61	N/A	82
Source (kBtu/ft^2)	172	172	129	N/A	175
Energy Cost					
$/year	$ 23,438.91	$ 23,438.91	$ 17,654.11	N/A	$ 23,866.66
$/$ft^2$/year	$ 0.82	$ 0.82	$ 0.62	N/A	$ 0.83
Greenhouse Gas Emissions					
$MtCO_2e$/year	220	220	166	N/A	224
$kgCO_2e/ft^2$/year	8	8	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 Median column presents energy performance data your building would have if your building had a median rating of 50.

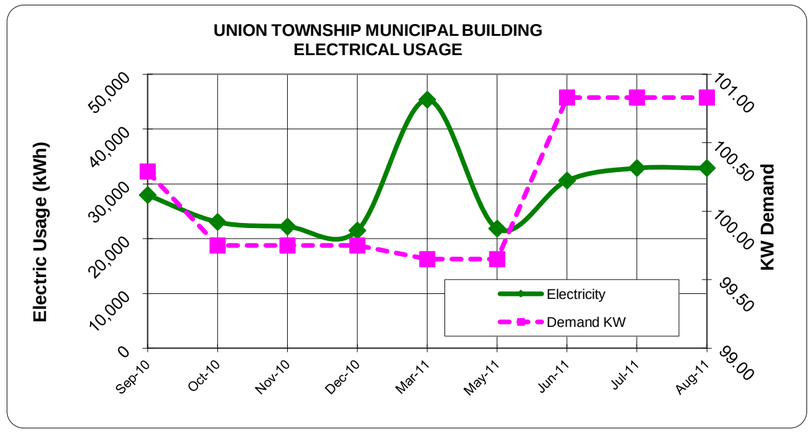
Notes:
o - This attribute is optional.
d - A default value has been supplied by Portfolio Manager.

Buildings	Electric - PSE&G				Natural Gas - Elizabethtown Gas			
	Account Number	Annual Consumption kWh	Annual Cost	$ / kWh	Account Number	Annual Consumption Therms	Annual Cost	$ / Therms
Township Municipal Building	602100927382	258,240	$44,808	$0.174	8347434500	11,802	$ 12,004	$1.017
					4746634500	450	$ 669	$1.486
	TOTAL	**258,240**	**$44,808**	**$0.174**	**TOTAL**	**12,252**	**$ 12,673**	**$1.034**

Facility Name Township of Union Municipal Building — Burke Parkway & Morris
Company PSE&G - Electric — Union Twp, NJ
Account# 602100927382
Meter# 778019459
Tariff/Rate GLP

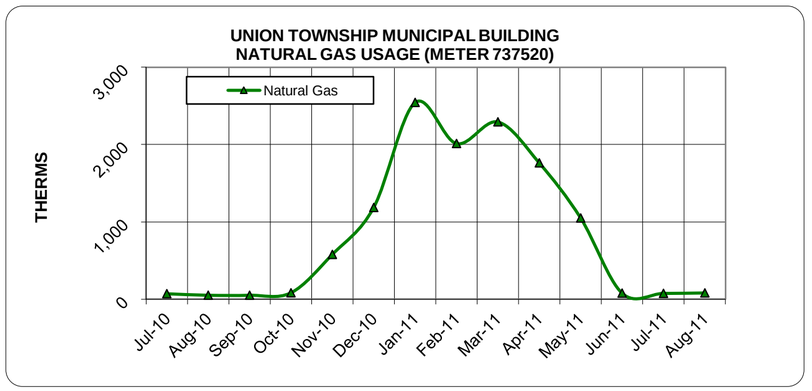
(Jan - March lumped together)
Note that usage for 8/15/2010 is estimated for EUI purposes

Energy Type	Energy Unit	Start Date	End Date	Demand KW	KWH	Supply Charge (estimated)	Utility Cost	$/kWh
Electricity	kWh	8/15/2010	9/13/2010	100.29	27,960		$4,824.07	$0.173
Electricity	kWh	9/13/2010	10/12/2010	99.75	23,040		$3,914.27	$0.170
Electricity	kWh	10/12/2010	11/12/2010	99.75	22,200	$2,560.63	$1,053.44	$0.163
Electricity	kWh	11/12/2010	12/13/2010	99.75	21,480	$2,497.23	$933.04	$0.160
Electricity	kWh	12/13/2011	3/15/2011	99.65	45,360	$5,564.52	$1,963.59	$0.166
Electricity	kWh	4/13/2011	5/13/2011	99.65	21,840	$2,576.15	$1,023.33	$0.165
Electricity	kWh	5/13/2011	6/14/2011	100.83	30,600	$3,325.68	$2,312.45	$0.184
Electricity	kWh	6/14/2011	7/14/2011	100.83	32,880		$6,010.01	$0.183
Electricity	kWh	7/14/2011	8/12/2011	100.83	32,880	$3,770.90	$2,479.02	$0.190
		TOTALS/AVERAGE		**100.1**	**258,240**	**$20,295.11**	**$24,513.22**	**$0.174**



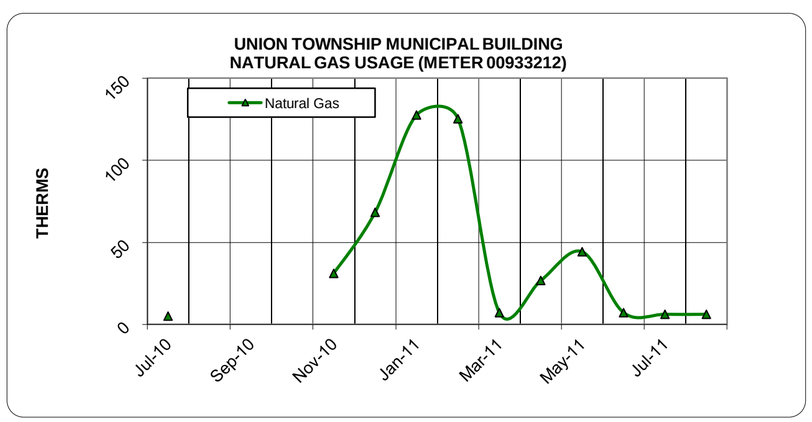
Facility Name Township of Union Municipal Building — 1976 Morris Avenue
Company Elizabethtown Gas / Pepco Energy Services — Union Twp, NJ
Account# 8347434500 / 12984030
Meter# 737520
Tariff/Rate 203

Energy Type	Energy Unit	Start Date	End Date	Therms	Delivery Cost	Supplier Cost	$/Therm
Natural Gas	Therms	6/2/2010	7/1/2010	71.4	$39.70	$48.03	$1.23
Natural Gas	Therms	7/1/2010	8/2/2010	51.9		$57.53	$1.11
Natural Gas	Therms	8/2/2010	9/1/2010	51.8		$55.87	$1.08
Natural Gas	Therms	9/1/2010	10/4/2010	83.1	$42.91	$61.77	$1.26
Natural Gas	Therms	10/4/2010	11/2/2010	579.2	$180.13	$430.55	$1.05
Natural Gas	Therms	11/2/2010	12/3/2010	1186.3		$1,295.66	$1.09
Natural Gas	Therms	12/3/2010	1/4/2011	2544.7	$766.10	$1,891.61	$1.04
Natural Gas	Therms	1/4/2011	2/1/2011	2013.6		$1,747.25	$0.87
Natural Gas	Therms	2/1/2011	3/3/2011	2293.4	$673.86	$1,704.80	$1.04
Natural Gas	Therms	3/3/2011	4/1/2011	1762.8	$522.57	$1,310.38	$1.04
Natural Gas	Therms	4/1/2011	5/3/2011	1050.4	$301.51	$780.82	$1.03
Natural Gas	Therms	5/3/2011	6/2/2011	79.0	$41.17	$58.72	$1.26
Natural Gas	Therms	6/2/2011	7/1/2011	75.8	$40.31	$56.35	$1.28
Natural Gas	Therms	7/1/2011	8/3/2011	81.6	$41.87		$0.51
		TOTALS/AVERAGE		**11,801.70**	**2,610.43**	**9,393.78**	**$1.017**



Facility Name Township of Union Municipal Building — 1976 Morris Avenue
Company Elizabethtown Gas — Union Twp, NJ
Account# 4746634500
Meter# 00933212
Tariff/Rate 203

Energy Type	Energy Unit	Start Date	End Date	Therms	Delivery Cost	Supplier Cost	$/Therm
Natural Gas	Therms	6/2/2010	7/1/2010	5.1	$21.41	$3.43	$4.87
Natural Gas	Therms	7/1/2010	8/3/2010			$4.55	#DIV/0!
Natural Gas	Therms	8/3/2010	9/1/2010			$4.59	#DIV/0!
Natural Gas	Therms	9/1/2010	10/4/2010			$4.61	#DIV/0!
Natural Gas	Therms	10/4/2010	11/2/2010	31.10	$28.61	$23.12	$1.66
Natural Gas	Therms	11/2/2010	12/3/2010	68.30	$40.02	$50.77	$1.33
Natural Gas	Therms	12/3/2010	1/4/2011	127.60	$57.40	$94.85	$1.19
Natural Gas	Therms	1/4/2011	2/1/2011	125.30	$56.72	$93.14	$1.20
Natural Gas	Therms	2/1/2011	3/3/2011	7.20	$22.05	$5.35	$3.81
Natural Gas	Therms	3/3/2011	4/1/2011	26.80	$27.64	$19.92	$1.77
Natural Gas	Therms	4/1/2011	5/3/2011	44.30	$31.87	$32.93	$1.46
Natural Gas	Therms	5/3/2011	6/2/2011	7.20	$21.93	$5.35	$3.79
Natural Gas	Therms	6/2/2011	7/1/2011	6.20	$21.66	$4.61	$4.24
Natural Gas	Therms	7/1/2011	8/3/2011	6.20	$21.66		$3.49
		TOTALS/AVERAGE		**450.20**	**329.56**	**339.24**	**$1.49**



All values in *italics* are estimated.

HVAC EQUIPMENT LIST - UNION TOWNSHIP

Prepared By Dome-Tech, Inc.

	TAG #	LOCATION	AREA SERVING	EQUIPMENT	MANUFACTURER	MODEL #	Cooling CAPACITY (Tons)	Heating CAPACITY (Btu-h)	SUPPLY AIR (CFM)	FAN (HP)	Motor Information	CONTROLS	NOTES
1	AC-1	Bsmt Boiler Room	Offices	AHU			40		14,510			DDC	
2	AC-2	Bsmt Boiler Room	Assembly Area	AHU			20					DDC	
3	DX-1	Roof	AC-1	DX Condenser	Trane		40					Interlock	
4	DX-2	Roof	AC-2	DX Condenser	Trane		20					Interlock	
5		Data Processing - Phone Room	Data Processing - Phone Room	Wall Mounted Split AC	Mitsubishi	MS09EW							
6		Data Processing - Datacenter	Data Processing - Datacenter	Wall Mounted Split AC	Mitsubishi	MS09EW							
7		Data Processing - Datacenter	Data Processing - Datacenter	Wall Mounted Split AC	Mitsubishi	MrSlim							
8		Accounts	Accounts	Wall Mounted Split AC	Fujitsu	ASU12R1A							
9		Outdoors	Accounts	DX Condenser	Fujitsu	AOU12R1							
10		Bonnel Room	Bonnel Room	Fan Coil Unit	Inter-City Products	BYMD30-46GA	3	55,000		0.33			
11		Roof above Vestible	Vestible	Heat Pump	Inter-City Products	YE036H	3						
12		Roof above Vestible	Vestible	Central Furnace	Inter-City Products	D5YS024N04506A		55,000					
13													
14													
15													
16													

MOTORS - EQUIPMENT LIST - UNION TOWNSHIP

Prepared by Dome-Tech, Inc.

Motor ID	Quantity	Loading (Constant/Variable)	Affiliated System	Control Type	MANUFACTURER	MODEL #	Motor HP	Nominal Eff	Speed (RPM)	NOTES
P-1	1	Constant	HW	DDC	Bell and Gossett		0.2		1725	
P-2	1	Constant	HW	DDC	Bell and Gossett		0.2		1725	
P-3	1	Constant	HW	DDC	Bell and Gossett		0.2		1725	
P-4	1	Constant	HW	DDC	Bell and Gossett		0.2		1725	
P-5	1	Constant	HW	DDC	Bell and Gossett		0.2		1725	
P-6	1	Constant	HW	DDC	Bell and Gossett		0.3		1725	
P-7	1	Constant	HW	DDC	Bell and Gossett		0.3		1725	
P-8	1	Constant	HW	DDC			5.0		1725	
P-9	1	Constant	HW	DDC			5.0		1725	

Union Township
1976 Morris Avenue
Union, NJ

Municipal Building

EXECUTIVE SUMMARY

ENERGY DATA

Existing Energy Usage (kWh)			108,305
Proposed Energy Usage (kWh)			51,928
Energy Saved (kWh)			56,378

FINANCIAL DATA

Annual Existing Energy Cost		$	18,805
Annual Proposed Energy Cost		$	9,016
Annual Energy Savings		$	9,789
Total Energy Savings		$	9,789
Initial Project Cost		$	41,016
Utility Rebate	(Based on NJ Smart Start Approval)	$	4,121
Project Cost		$	36,895

CASH FLOW SUMMARY

Return On Investment (R.O.I.)			27%
Payback (Years)			3.8
10 Year Savings		$	97,891
10-Year Cumulative Positive Cash Flow		$	60,995

Dome-Tech, Inc.

LIGHTING UPGRADE PROJECT

LINE x LINE DETAIL

Line	SPACE DESCRIPTION	EXISTING FIXTURES							
	Description	Pre Fixture Description	Pre Fixture Qty	Qty Exist Lamps/ Fixt	Pre LBC Code	Pre Watts / Fixture	Pre Total Watts/ Line	Default Annual Hours 2600	Pre Annual kWH
1	BST - Large Server Room	2'x4' Surface Mounted Box w/ (2) F32T8 Lamps & (1) Electronic Ballast	8	2	FO32T8 - 2 - ELEC - 1	58	464	2600	1206
2	BST - Small Server Room	2'x4' Surface Mounted Box w/ (4) F32T8 Lamps & (2) Electronic Ballasts	2	4	FO32T8 - 4 - ELEC - 1	112	224	2600	582
3	BST - Server Room Cooridor	2'x4' Surface Mounted Box w/ (2) F32T8 Lamps & (1) Electronic Ballast	2	2	FO32T8 - 2 - ELEC - 1	58	116	2600	302
4	BST - Studio Control Room	2'x4' Surface Mounted Box w/ (4) F32T8 Lamps & (2) Electronic Ballasts	2	4	FO32T8 - 4 - ELEC - 1	112	224	2600	582
5	BST - Studio	2'x4' Surface Mounted Box w/ (4) F32T8 Lamps & (2) Electronic Ballasts	3	4	FO32T8 - 4 - ELEC - 1	112	336	2600	874
6	BST - Human Resources Back Room	2'x4' Surface Mounted Box w/ (4) F32T8 Lamps & (2) Electronic Ballasts	6	4	FO32T8 - 4 - ELEC - 1	112	672	2600	1747
7	BST - Human Resources Front Room	2'x4' Surface Mounted Box w/ (4) F32T8 Lamps & (2) Electronic Ballasts	4	4	FO32T8 - 4 - ELEC - 1	112	448	2600	1165
8	BST - Economic Development	2'x4' Surface Mounted Box w/ (4) F32T8 Lamps & (2) Electronic Ballasts	6	4	FO32T8 - 4 - ELEC - 1	112	672	2600	1747
9	BST - Economic Development	2'x4' Surface Mounted Box w/ (2) F32T8 Lamps & (1) Electronic Ballast	1	2	FO32T8 - 2 - ELEC - 1	58	58	2600	151
10	BST - Large Engineering Office	2'x4' Surface Mounted Box w/ (4) F32T8 Lamps & (2) Electronic Ballasts	9	4	FO32T8 - 4 - ELEC - 1	112	1008	2600	2621
11	BST - Large Engineering Office	2'x4' Recessed Troffer w/ (2) F32T8 Lamps & (1) Electronic Ballast, Silver Reflector	7	2	FO32T8 - 2 - ELEC - 1	58	406	2600	1056
12	BST - Small Engineering Office	2'x4' Surface Mounted Box w/ (2) F32T8 Lamps & (1) Electronic Ballast	3	2	FO32T8 - 2 - ELEC - 1	58	174	2600	452
13	BST - Small Engineering Office	2'x2' Recessed Troffer w/ (3) FO17T8 Lamps & (1) Electronic Ballast	2	3	FO17T8 - 3 - ELEC - 1	54	108	2600	281
14	BST - Engineering Office Lobby	2'x4' Surface Mounted Box w/ (4) F32T8 Lamps & (2) Electronic Ballasts	2	4	FO32T8 - 4 - ELEC - 1	112	224	2600	582
15	BST - Engineering Office Lobby	2'x4' Recessed Troffer w/ (2) F32T8 Lamps & (1) Electronic Ballast	4	2	FO32T8 - 2 - ELEC - 1	58	232	2600	603
16	BST - Cafeteria	2'x4' Surface Mounted Box w/ (4) F32T8 Lamps & (2) Electronic Ballasts	6	4	FO32T8 - 4 - ELEC - 1	112	672	2600	1747
17	BST - Cafeteria	4' Vanity Luminaire w/ (1) F32T8 Lamp (1) Electronic Ballast,	1	1	FO32T8 - 1 - ELEC - 1	32	32	2600	83
18	BST - Women's Restroom	2'x4' Recessed Troffer w/ (4) F32T8 Lamps & (2) Electronic Ballasts, Microcell Lens	1	4	FO32T8 - 4 - ELEC - 1	112	112	3120	349
19	BST - Women's Restroom	4' Vanity Luminaire w/ (1) F32T8 Lamp (1) Electronic Ballast,	1	1	FO32T8 - 1 - ELEC - 1	32	32	130	4
20	BST - Women's Restroom	Incandescent Fixture w/ 13w Screw-In Compact Fluorescent Lamp	1	1	CF13SI - 1 - CF - 0	13	13	3120	41
21	BST - Men's Restroom	2'x4' Recessed Troffer w/ (4) F32T8 Lamps & (2) Electronic Ballasts, Microcell Lens	1	4	FO32T8 - 4 - ELEC - 1	112	112	3120	349
22	BST - Men's Restroom	4' Vanity Luminaire w/ (1) F32T8 Lamp (1) Electronic Ballast,	1	1	FO32T8 - 1 - ELEC - 1	32	32	130	4
23	BST - Men's Restroom	Incandescent Fixture w/ 13w Screw-In Compact Fluorescent Lamp	1	1	CF13SI - 1 - CF - 0	13	13	3120	41
24	BST - Boiler Room	Incandescent Fixture w/ (1) 300w Incandescent Lamp, Wall Mounted	2	1	Inc300A/120v - 1 - None - 0	300	600	520	312
25	BST - Boiler Room	Incandescent Wall Mounted Fixture w/ 23w Screw-In Compact Fluorescent Lamp	2	1	CF23SI - 1 - CF - 0	23	46	520	24
26	BST - Boiler Room	Incandescent Bare Lamp Fixture w/ (1) 150w Incandescent Lamp	2	1	Inc150A/120v - 1 - None - 0	150	300	520	156
27	BST - Boiler Room	Incandescent Fixture w/ (3) 20w Screw-In Compact Fluorescent Lamp	3	3	CF20SI - 3 - CF - 0	60	180	520	94
28	BST - Storage Room	2'x4' Surface Mounted Box w/ (2) F32T8 Lamps & (1) Electronic Ballast	5	2	FO32T8 - 2 - ELEC - 1	58	290	1040	302
29	BST - Storage Room	2'x4' Surface Mounted Box w/ (4) F32T8 Lamps & (2) Electronic Ballasts	2	4	FO32T8 - 4 - ELEC - 1	112	224	1040	233
30	BST - Storage Room	Incandescent Wall Mounted Fixture w/ 23w Screw-In Compact Fluorescent Lamp	3	1	CF23SI - 1 - CF - 0	23	69	1040	72
31	BST - Storage Room	Incandescent Fixture w/ (1) 60w Incandescent Lamp	1	1	Inc60A/120v - 1 - None - 0	60	60	1040	62
32	BST - Storage Room	Incandescent Fixture w/ (1) 60w Incandescent Lamp	1	1	Inc60A/120v - 1 - None - 0	60	60	1040	62
33	BST - Storage Room	Incandescent Bare Lamp Fixture w/ (1) 100w Incandescent Lamp	1	1	Inc100A/120v - 1 - None - 0	100	100	1040	104
34	BST - Storage Room	Incandescent Bare Lamp Fixture w/ (1) 150w Incandescent Lamp	1	1	Inc150A/120v - 1 - None - 0	150	150	1040	156
35	BST - Storage Room	Incandescent Fixture w/ 15w Screw-In Compact Fluorescent Lamp, Chandelier	4	1	CF15SI - 1 - CF - 1	15	60	1040	62
36	BST - Community Development	2'x4' Surface Mounted Box w/ (2) F32T8 Lamps & (1) Electronic Ballast	7	2	FO32T8 - 2 - ELEC - 1	58	406	2600	1056
37	BST - Purchasing	2'x4' Surface Mounted Box w/ (4) F32T8 Lamps & (2) Electronic Ballasts	18	4	FO32T8 - 4 - ELEC - 1	112	2016	2600	5242
38	BST - Hallway	2'x4' Surface Mounted Box w/ (2) F32T8 Lamps & (1) Electronic Ballast	14	2	FO32T8 - 2 - ELEC - 1	58	812	2600	2111
39	BST - Hallway	2'x4' Surface Mounted Box w/ (4) F32T8 Lamps & (2) Electronic Ballasts	2	4	FO32T8 - 4 - ELEC - 1	112	224	8760	1962
40	BST - Hallway Exit Signs	Exit Sign w/ (1) 5 Watt Compact Fluorescent Lamp	3	1	CF05 - 1 - CF - 1	7	21	2600	55
41	1FL - Handicap Entrance	Incandescent Fixture w/ (1) 60w Incandescent Lamp	4	1	Inc60A/120v - 1 - None - 0	60	240	2600	624
42	1FL - Handicap Entrance	Incandescent Fixture w/ 13w Screw-In Compact Fluorescent Lamp	3	1	CF13SI - 1 - CF - 0	13	39	2600	101
43	1FL - Handicap Entrance	Incandescent Fixture w/ (1) 60w Incandescent Lamp	3	1	Inc60A/120v - 1 - None - 0	60	180	2600	468
44	1FL - Hallway	2'x4' Surface Mounted Box w/ (4) F32T8 Lamps & (2) Electronic Ballasts	10	4	FO32T8 - 4 - ELEC - 1	112	1120	2600	2912
45	1FL - Hallway Exit Signs	Exit Sign w/ (1) 5 Watt Compact Fluorescent Lamp	3	1	CF05 - 1 - CF - 1	7	21	8760	184
46	1FL - Conference Room	2'x4' Surface Mounted Box w/ (4) F32T8 Lamps & (2) Electronic Ballasts	7	4	FO32T8 - 4 - ELEC - 1	112	784	1300	1019
47	1FL - Assembly Room	2'x4' Recessed Troffer w/ (2) F32T8 Lamps & (1) Electronic Ballast	6	2	FO32T8 - 2 - ELEC - 1	58	348	1300	452
48	1FL - Assembly Room	Chandelier w/ (8) 40w Incandescent Lamps	6	8	Inc40A/120v - 8 - None - 0	320	1920	1300	2496
49	1FL - Assembly Room	Chandelier w/ (12) 40w Incandescent Lamps	1	12	Inc40A/120v - 12 - None - 0	480	480	1300	624
50	1FL - Conference Room Restroom	2'x4' Surface Mounted Box w/ (4) F32T8 Lamps & (2) Electronic Ballasts	2	4	FO32T8 - 4 - ELEC - 1	112	224	1300	291
51	1FL - Conference Room Restroom	4' Vanity Luminaire w/ (1) F32T8 Lamp (1) Electronic Ballast,	1	1	FO32T8 - 1 - ELEC - 1	32	32	1300	42
52	1FL - Clerk's Office	2'x4' Recessed Troffer w/ (2) F32T8 Lamps & (1) Electronic Ballast, Silver Reflector	12	2	FO32T8 - 2 - ELEC - 1	58	696	2600	1810
53	1FL - Clerk's Office	Incandescent Fixture w/ 13w Screw-In Compact Fluorescent Lamp	2	1	CF13SI - 1 - CF - 0	13	26	2600	68
54	1FL - Clerk's Office Vault	2'x4' Recessed Troffer w/ (4) F32T8 Lamps & (2) Electronic Ballasts, Microcell Lens	1	4	FO32T8 - 4 - ELEC - 1	112	112	2600	291
55	1FL - Clerk's Office Closet	Compact Fluorescent Fixture w/ (3) 18w Compact Fluorescent Lamp	1	3	CF18 - 3 - CF - 1	60	60	2600	156
56	1FL - Accounting	2'x4' Recessed Troffer w/ (4) F32T8 Lamps & (2) Electronic Ballasts, Microcell Lens	1	4	FO32T8 - 4 - ELEC - 1	112	112	2600	291
57	1FL - Accounting	2'x4' Recessed Troffer w/ (2) F32T8 Lamps & (1) Electronic Ballast	9	2	FO32T8 - 2 - ELEC - 1	58	522	2600	1357
58	1FL - Accounting - Desk Lighting	4' Strip Fluorescent w/ (1) F32T8 Lamp & (1) Electronic Ballast	6	1	FO32T8 - 1 - ELEC - 1	32	192	2600	499
59	1FL - Administrator's Office Right Room	2'x4' Recessed Troffer w/ (4) F32T8 Lamps & (2) Electronic Ballasts, Microcell Lens	4	4	FO32T8 - 4 - ELEC - 1	112	448	2600	1165
60	1FL - Administrator's Office Main Room	2'x2' Recessed Troffer w/ (3) FO17T8 Lamps & (1) Electronic Ballast	10	3	FO17T8 - 3 - ELEC - 1	54	540	2600	1404
61	1FL - Administrator's Office Main Room above cabinet	2'x2' Recessed Troffer w/ (3) FO17T8 Lamps & (1) Electronic Ballast	1	3	FO17T8 - 3 - ELEC - 1	54	54	2600	140
62	1FL - Administrator's Office Left Room	2'x2' Recessed Troffer w/ (3) FO17T8 Lamps & (1) Electronic Ballast	2	3	FO17T8 - 3 - ELEC - 1	54	108	2600	281
63	1FL - Administrator's Office Left Room	2'x4' Recessed Troffer w/ (2) F32T8 Lamps & (1) Electronic Ballast	2	2	FO32T8 - 2 - ELEC - 1	58	116	2600	302
64	1FL - Administrator's Office Restroom	4' Vanity Luminaire w/ (1) F32T8 Lamp (1) Electronic Ballast,	1	1	FO32T8 - 1 - ELEC - 1	32	32	130	4
65	1FL - Administrator's Office Restroom	2'x4' Recessed Troffer w/ (2) F32T8 Lamps & (1) Electronic Ballast	1	2	FO32T8 - 2 - ELEC - 1	58	58	3120	181
66	1FL - Foyer and Entrance	Chandelier w/ (8) 40w Incandescent Lamps	4	8	Inc40A/120v - 8 - None - 0	320	1280	2600	3328
67	1FL - Tax Office	2'x4' Surface Mounted Box w/ (4) F32T8 Lamps & (2) Electronic Ballasts	23	4	FO32T8 - 4 - ELEC - 1	112	2576	2600	6698
68	1FL - Tax Office Counter	2'x4' Surface Mounted Box w/ (4) F32T8 Lamps & (2) Electronic Ballasts	11	4	FO32T8 - 4 - ELEC - 1	112	1232	2600	3203
69	1FL - Assessor's Office	2'x4' Surface Mounted Box w/ (4) F32T8 Lamps & (2) Electronic Ballasts	12	4	FO32T8 - 4 - ELEC - 1	112	1344	2600	3494
70	1FL - Women's Restroom	4' Vanity Luminaire w/ (1) F32T8 Lamp (1) Electronic Ballast,	1	1	FO32T8 - 1 - ELEC - 1	32	32	130	4
71	1FL - Women's Restroom	2'x4' Recessed Troffer w/ (4) F32T8 Lamps & (2) Electronic Ballasts, Microcell Lens	1	4	FO32T8 - 4 - ELEC - 1	112	112	3120	349
72	1FL - Men's Restroom	4' Vanity Luminaire w/ (1) F32T8 Lamp (1) Electronic Ballast,	1	1	FO32T8 - 1 - ELEC - 1	32	32	130	4
73	1FL - Men's Restroom	2'x4' Recessed Troffer w/ (4) F32T8 Lamps & (2) Electronic Ballasts, Microcell Lens	1	4	FO32T8 - 4 - ELEC - 1	112	112	3120	349
74	1FL - Lights above Time Clock - plug in lamps	Incandescent Fixture w/ (1) 50w Halogen Lamp	3	1	Hal50PAR38/120v - 1 - None - 0	50	150	2600	390
75	1FL - Light near Time Clock	Incandescent Fixture w/ 13w Screw-In Compact Fluorescent Lamp	1	1	CF13SI - 1 - CF - 0	13	13	2600	34

Customer	Union Township Town Hall	DATE OF AUDIT: 12/9/2011
Facility	Town Hall	AUDITOR: ALEX HILD

REPLACEMENT FIXTURES									ENERGY ANALYSIS			
Proposed Fixture Description	Post Fixture Qty	Lamp Qty/ Fixt	Replacement Fixt Qty	Watts / Fixture	Post Total Watts/ Line	Annual Hours 2600	Post Annual kWH	Post Watts / Sq Ft	Watts Saved/ Fixt	Total Watts Saved/ Line	Annual Hours Saved	Annual kWH Saved
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast, 2'x4' Silver Reflector Kit	8	2	8	42	336	2600	874	N/A	16	128	0	333
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast, 2'x4' Silver Reflector Kit	2	2	2	42	84	2600	218	N/A	70	140	0	364
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast, 2'x4' Silver Reflector Kit	2	2	2	42	84	2600	218	N/A	16	32	0	83
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast, 2'x4' Silver Reflector Kit	2	2	2	42	84	2600	218	N/A	70	140	0	364
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast, 2'x4' Silver Reflector Kit	3	2	3	42	126	2600	328	N/A	70	210	0	546
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast, 2'x4' Silver Reflector Kit	6	2	6	42	252	2600	655	N/A	70	420	0	1,092
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast, 2'x4' Silver Reflector Kit	4	2	4	42	168	2600	437	N/A	70	280	0	728
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast, 2'x4' Silver Reflector Kit	6	2	6	42	252	2600	655	N/A	70	420	0	1,092
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast, 2'x4' Silver Reflector Kit	1	2	1	42	42	2600	109	N/A	16	16	0	42
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast, 2'x4' Silver Reflector Kit	9	2	9	42	378	2600	983	N/A	70	630	0	1,638
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast	7	2	0	42	294	2600	764	N/A	16	112	0	291
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast, 2'x4' Silver Reflector Kit	3	2	3	42	126	2600	328	N/A	16	48	0	125
Relamp & Reballast w/ (2) F17T8 Lamps & (1) 2/17 Elec. Low-Power High Efficiency Ballast, 2'x2' Silver Reflector Kit	2	2	2	28	56	2600	146	N/A	26	52	0	135
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast, 2'x4' Silver Reflector Kit	2	2	2	42	84	2600	218	N/A	70	140	0	364
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast, 2'x4' Silver Reflector Kit	4	2	4	42	168	2600	437	N/A	16	64	0	166
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast, 2'x4' Silver Reflector Kit	6	2	6	42	252	2600	655	N/A	70	420	0	1,092
Relamp & Reballast w/ (1) F28T8 Lamp & (1) 1/32 Elec. Low-Power High Efficiency Ballast	1	1	0	22	22	2600	57	N/A	10	10	0	26
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power HE Ballast, 2'x4' Silver Reflector Kit, New 2x4 Lenses	1	2	1	42	42	3120	131	N/A	70	70	0	218
Relamp & Reballast w/ (1) F28T8 Lamp & (1) 1/32 Elec. Low-Power High Efficiency Ballast	1	1	0	22	22	130	3	N/A	10	10	0	1
No Retrofit Proposed	1	1	None	13	13	3120	41	N/A	0	0	0	0
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power HE Ballast, 2'x4' Silver Reflector Kit, New 2x4 Lenses	1	2	1	42	42	3120	131	N/A	70	70	0	218
Relamp & Reballast w/ (1) F28T8 Lamp & (1) 1/32 Elec. Low-Power High Efficiency Ballast	1	1	0	22	22	130	3	N/A	10	10	0	1
No Retrofit Proposed	1	1	None	13	13	3120	41	N/A	0	0	0	0
Relamp w/ (1) 60 watt Compact Fluorescent Screw-In	2	1	0	60	120	520	62	N/A	240	480	0	250
No Retrofit Proposed	2	1	None	23	46	520	24	N/A	0	0	0	0
Relamp w/ (1) 32 watt Compact Fluorescent Screw-In	2	1	0	32	64	520	33	N/A	118	236	0	123
No Retrofit Proposed	3	3	None	60	180	520	94	N/A	0	0	0	0
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast, 2'x4' Silver Reflector Kit	5	2	5	42	210	1040	218	N/A	16	80	0	83
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast, 2'x4' Silver Reflector Kit	2	2	2	42	84	1040	87	N/A	70	140	0	146
No Retrofit Proposed	3	1	None	23	69	1040	72	N/A	0	0	0	0
Relamp w/ (1) 14 watt Compact Fluorescent Mini Spring Lamp Screw-In, 1 Piece	1	1	0	14	14	1040	15	N/A	46	46	0	48
Relamp w/ (1) 14 watt Compact Fluorescent Mini Spring Lamp Screw-In, 1 Piece	1	1	0	14	14	1040	15	N/A	46	46	0	48
Relamp w/ (1) 27 watt Compact Fluorescent Screw-In, Rewire Existing HID fixtre	1	1	0	27	27	1040	28	N/A	73	73	0	76
Relamp w/ (1) 32 watt Compact Fluorescent Screw-In	1	1	0	32	32	1040	33	N/A	118	118	0	123
No Retrofit Proposed	4	1	CF	15	60	1040	62	N/A	0	0	0	0
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast, 2'x4' Silver Reflector Kit	7	2	7	42	294	2600	764	N/A	16	112	0	291
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast, 2'x4' Silver Reflector Kit	18	2	18	42	756	2600	1966	N/A	70	1260	0	3,276
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast, 2'x4' Silver Reflector Kit	14	2	14	42	588	2600	1529	N/A	16	224	0	582
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast, 2'x4' Silver Reflector Kit	2	2	2	42	84	8760	736	N/A	70	140	0	1,226
Exit Sign LED Retrofit Kit	3	0	3	2	6	2600	16	N/A	5	15	0	39
Relamp w/ (1) 14 watt Compact Fluorescent Mini Spring Lamp Screw-In, 1 Piece	4	1	0	14	56	2600	146	N/A	46	184	0	478
No Retrofit Proposed	3	1	None	13	39	2600	101	N/A	0	0	0	0
Relamp w/ (1) 14 watt Compact Fluorescent Mini Spring Lamp Screw-In, 1 Piece	3	1	0	14	42	2600	109	N/A	46	138	0	359
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast, 2'x4' Silver Reflector Kit	10	2	10	42	420	2600	1092	N/A	70	700	0	1,820
Exit Sign LED Retrofit Kit	3	0	3	2	6	8760	53	N/A	5	15	0	131
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast, 2'x4' Silver Reflector Kit	7	2	7	42	294	1300	382	N/A	70	490	0	637
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast, 2'x4' Silver Reflector Kit	6	2	6	42	252	1300	328	N/A	16	96	0	125
Relamp w/ (1) 11 watt Compact Fluorescent Screw-In	6	8	0	11	66	1300	86	N/A	309	1854	0	2,410
Relamp w/ (1) 11 watt Compact Fluorescent Screw-In	1	12	0	132	132	1300	172	N/A	348	348	0	452
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast, 2'x4' Silver Reflector Kit	2	2	2	42	84	1300	109	N/A	70	140	0	182
Relamp & Reballast w/ (1) F28T8 Lamp & (1) 1/32 Elec. Low-Power High Efficiency Ballast	1	1	0	22	22	1300	29	N/A	10	10	0	13
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast	12	2	0	42	504	2600	1310	N/A	16	192	0	499
No Retrofit Proposed	2	1	None	13	26	2600	68	N/A	0	0	0	0
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power HE Ballast, 2'x4' Silver Reflector Kit, New 2x4 Lenses	1	2	1	42	42	2600	109	N/A	70	70	0	182
No Retrofit Proposed	1	3	CF	60	60	2600	156	N/A	0	0	0	0
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power HE Ballast, 2'x4' Silver Reflector Kit, New 2x4 Lenses	1	2	1	42	42	2600	109	N/A	70	70	0	182
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast, 2'x4' Silver Reflector Kit	9	2	9	42	378	2600	983	N/A	16	144	0	374
Relamp & Reballast w/ (1) F28T8 Lamp & (1) 1/32 Elec. Low-Power High Efficiency Ballast	6	1	0	22	132	2600	343	N/A	10	60	0	156
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power HE Ballast, 2'x4' Silver Reflector Kit, New 2x4 Lenses	4	2	4	42	168	2600	437	N/A	70	280	0	728
Relamp & Reballast w/ (2) F17T8 Lamps & (1) 2/17 Elec. Low-Power High Efficiency Ballast, 2'x2' Silver Reflector Kit	10	2	10	28	280	2600	728	N/A	26	260	0	676
Relamp & Reballast w/ (2) F17T8 Lamps & (1) 2/17 Elec. Low-Power High Efficiency Ballast, 2'x2' Silver Reflector Kit	1	2	1	28	28	2600	73	N/A	26	26	0	68
Relamp & Reballast w/ (2) F17T8 Lamps & (1) 2/17 Elec. Low-Power High Efficiency Ballast, 2'x2' Silver Reflector Kit	2	2	2	28	56	2600	146	N/A	26	52	0	135
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast, 2'x4' Silver Reflector Kit	2	2	2	42	84	2600	218	N/A	16	32	0	83
Relamp & Reballast w/ (1) F28T8 Lamp & (1) 1/32 Elec. Low-Power High Efficiency Ballast	1	1	0	22	22	130	3	N/A	10	10	0	1
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast, 2'x4' Silver Reflector Kit	1	2	1	42	42	3120	131	N/A	16	16	0	50
Relamp w/ (1) 11 watt Compact Fluorescent Screw-In	4	8	0	88	352	2600	915	N/A	232	928	0	2,413
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast, 2'x4' Silver Reflector Kit	23	2	23	42	966	2600	2512	N/A	70	1610	0	4,186
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast, 2'x4' Silver Reflector Kit	11	2	11	42	462	2600	1201	N/A	70	770	0	2,002
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast, 2'x4' Silver Reflector Kit	12	2	12	42	504	2600	1310	N/A	70	840	0	2,184
Relamp & Reballast w/ (1) F28T8 Lamp & (1) 1/32 Elec. Low-Power High Efficiency Ballast	1	1	0	22	22	130	3	N/A	10	10	0	1
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power HE Ballast, 2'x4' Silver Reflector Kit, New 2x4 Lenses	1	2	1	42	42	3120	131	N/A	70	70	0	218
Relamp & Reballast w/ (1) F28T8 Lamp & (1) 1/32 Elec. Low-Power High Efficiency Ballast	1	1	0	22	22	130	3	N/A	10	10	0	1
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power HE Ballast, 2'x4' Silver Reflector Kit, New 2x4 Lenses	1	2	1	42	42	3120	131	N/A	70	70	0	218
Relamp w/ (1) 15 watt Compact Fluorescent Screw-In	3	1	0	15	45	2600	117	N/A	35	105	0	273
No Retrofit Proposed	1	1	None	13	13	2600	34	N/A	0	0	0	0

Dome-Tech, Inc.

LIGHTING UPGRADE PROJECT

LINE x LINE DETAIL

Line	SPACE DESCRIPTION	EXISTING FIXTURES							
	Description	Pre Fixture Description	Pre Fixture Qty	Qty Exist Lamps/ Fixt	Pre LBC Code	Pre Watts / Fixture	Pre Total Watts/ Line	Default Annual Hours 2600	Pre Annual kWH
77	1FL - Health Department Side Room 1	2'x4' Recessed Troffer w/ (2) F32T8 Lamps & (1) Electronic Ballast	2	2	FO32T8 - 2 - ELEC - 1	58	116	2600	302
78	1FL - Health Department Side Room 2	2'x4' Recessed Troffer w/ (2) F32T8 Lamps & (1) Electronic Ballast	2	2	FO32T8 - 2 - ELEC - 1	58	116	2600	302
79	2FL - Health Department Side Room 3	2'x4' Recessed Troffer w/ (2) F32T8 Lamps & (1) Electronic Ballast	2	2	FO32T8 - 2 - ELEC - 1	58	116	2600	302
80	2FL - Hallway	2'x4' Surface Mounted Box w/ (4) F32T8 Lamps & (2) Electronic Ballasts	9	4	FO32T8 - 4 - ELEC - 1	112	1008	2600	2621
81	2FL - Hallway Exit Signs	Exit Sign w/ (1) 5 Watt Compact Fluorescent Lamp	3	1	CF05 - 1 - CF - 1	7	21	8760	184
82	2FL - Bonnel Room	2'x4' Recessed Troffer w/ (2) F32T8 Lamps & (1) Electronic Ballast, Silver Reflector	14	2	FO32T8 - 2 - ELEC - 1	58	812	1300	1056
83	2FL - Pantry Room in Bonnel Room	Incandescent Fixture w/ 13w Screw-In Compact Fluorescent Lamp	4	1	CF13SI - 1 - CF - 0	13	52	2600	135
84	2FL - Building Department Room 1	2'x4' Surface Mounted Box w/ (4) F32T8 Lamps & (2) Electronic Ballasts	4	4	FO32T8 - 4 - ELEC - 1	112	448	2600	1165
85	2FL - Building Department Room 2	2'x4' Surface Mounted Box w/ (4) F32T8 Lamps & (2) Electronic Ballasts	4	4	FO32T8 - 4 - ELEC - 1	112	448	2600	1165
86	2FL - Building Department Room 3/Hallway	2'x4' Surface Mounted Box w/ (2) F32T8 Lamps & (1) Electronic Ballast	2	2	FO32T8 - 2 - ELEC - 1	58	116	2600	302
87	2FL - Building Department - Building Inspector's Room	2'x4' Surface Mounted Box w/ (4) F32T8 Lamps & (2) Electronic Ballasts	6	4	FO32T8 - 4 - ELEC - 1	112	672	2600	1747
88	2FL - Building Department - General Office	2'x4' Surface Mounted Box w/ (4) F32T8 Lamps & (2) Electronic Ballasts	13	4	FO32T8 - 4 - ELEC - 1	112	1456	2600	3786
89	2FL - Building Department - General Office	2'x4' Surface Mounted Box w/ (2) F32T8 Lamps & (1) Electronic Ballast	5	2	FO32T8 - 2 - ELEC - 1	58	290	2600	754
90	2FL - Back Storage Room	2'x4' Recessed Troffer w/ (2) F32T8 Lamps & (1) Electronic Ballast, Silver Reflector	5	2	FO32T8 - 2 - ELEC - 1	58	290	1040	302
91	2FL - Front Storage Room	2'x4' Surface Mounted Box w/ (2) F32T8 Lamps & (1) Electronic Ballast	6	2	FO32T8 - 2 - ELEC - 1	58	348	1040	362
92	2FL - Men's Restroom	2'x4' Surface Mounted Box w/ (4) F32T8 Lamps & (2) Electronic Ballasts	1	4	FO32T8 - 4 - ELEC - 1	112	112	3120	349
93	2FL - Men's Restroom	4' Vanity Luminaire w/ (1) F32T8 Lamp (1) Electronic Ballast,	1	1	FO32T8 - 1 - ELEC - 1	32	32	130	4
94	2FL - Women's Restroom	2'x4' Surface Mounted Box w/ (4) F32T8 Lamps & (2) Electronic Ballasts	1	4	FO32T8 - 4 - ELEC - 1	112	112	3120	349
95	2FL - Women's Restroom	4' Vanity Luminaire w/ (1) F32T8 Lamp (1) Electronic Ballast,	1	1	FO32T8 - 1 - ELEC - 1	32	32	130	4
96	Stairwell	2'x4' Surface Mounted Box w/ (4) F32T8 Lamps & (2) Electronic Ballasts	2	4	FO32T8 - 4 - ELEC - 1	112	224	2600	582
97	Attic	Incandescent Fixture w/ 13w Screw-In Compact Fluorescent Lamp	4	1	CF13SI - 1 - CF - 0	13	52	260	14
98	Attic	2'x4' Surface Mounted Box w/ (2) F32T8 Lamps & (1) Electronic Ballast	12	2	FO32T8 - 2 - ELEC - 1	58	696	260	181
99	Attic	Incandescent Fixture w/ (1) 300w Incandescent Lamp, Wall Mounted	2	1	Inc300A/120v - 1 - None - 0	300	600	260	156
100	Outdoor Lighting Pole - Fixture with 3 lights	HID Fixture w/ (1) 400w Metal Halide Lamp & Ballast	3	1	MH400 - 1 - HID - 1	455	1365	3650	4982
101	Outdoor Lighting Pole - Fixture with 1 lights	HID Fixture w/ (1) 150w High Pressure Sodium	10	1	HPS150 - 1 - HID - 1	190	1900	3650	6935
102	Outdoor Lighting Pole - Fixture with 4 lights	HID Fixture w/ (1) 100w High Pressure Sodium	8	1	HPS100 - 1 - HID - 1	130	1040	3650	3796
103	Outdoor Lighting Pole at Right Parking Lot - Fixture with 1 lights	HID Fixture w/ (1) 150w High Pressure Sodium	4	1	HPS150 - 1 - HID - 1	190	760	3650	2774
104	Outdoor Lighting Pole at Left Parking Lot - Fixture with 1 lights	HID Fixture w/ (1) 150w High Pressure Sodium	3	1	HPS150 - 1 - HID - 1	190	570	3650	2081
105	Outdoor Lighting on Building	Incandescent Flood Fixture w/ (2) 100w Incandescent Lamp	3	2	Inc100A/120v - 2 - None - 0	200	600	3650	2190
106	Outdoor Lighting on Building	Incandescent Fixture w/ 13w Screw-In Compact Fluorescent Lamp	1	1	CF13SI - 1 - CF - 0	13	13	3650	47
107	Outdoor Lighting on Building	Incandescent Fixture w/ (1) 60w Incandescent Lamp	2	1	Inc60A/120v - 1 - None - 0	60	120	3650	438
108	Outdoor Lighting on Building	HID Fixture w/ (1) 90w Low Pressure Sodium & Ballast	3	1	LPS90 - 1 - HID - 1	125	375	3650	1369
109	Outdoor Lighting on Building	HID Fixture w/ (1) 135w Low Pressure Sodium & Ballast	2	1	LPS135 - 1 - HID - 1	178	356	3650	1299
			455				**43,625**		**108,305**

Customer	Union Township Town Hall	DATE OF AUDIT: 12/9/2011
Facility	Town Hall	AUDITOR: ALEX HILD

REPLACEMENT FIXTURES									ENERGY ANALYSIS			
Proposed Fixture Description	Post Fixture Qty	Lamp Qty/ Fixt	Replacement Fixt Qty	Watts / Fixture	Post Total Watts/ Line	Annual Hours 2600	Post Annual kWH	Post Watts / Sq Ft	Watts Saved/ Fixt	Total Watts Saved/ Line	Annual Hours Saved	Annual kWH Saved
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast, 2'x4' Silver Reflector Kit	2	2	2	42	84	2600	218	N/A	16	32	0	83
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast, 2'x4' Silver Reflector Kit	2	2	2	42	84	2600	218	N/A	16	32	0	83
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast, 2'x4' Silver Reflector Kit	2	2	2	42	84	2600	218	N/A	16	32	0	83
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast, 2'x4' Silver Reflector Kit	9	2	9	42	378	2600	983	N/A	70	630	0	1,638
Exit Sign LED Retrofit Kit	3	0	3	2	6	8760	53	N/A	5	15	0	131
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast	14	2	0	42	588	1300	764	N/A	16	224	0	291
No Retrofit Proposed	4	1	None	13	52	2600	135	N/A	0	0	0	0
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast, 2'x4' Silver Reflector Kit	4	2	4	42	168	2600	437	N/A	70	280	0	728
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast, 2'x4' Silver Reflector Kit	4	2	4	42	168	2600	437	N/A	70	280	0	728
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast, 2'x4' Silver Reflector Kit	2	2	2	42	84	2600	218	N/A	16	32	0	83
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast, 2'x4' Silver Reflector Kit	6	2	6	42	252	2600	655	N/A	70	420	0	1,092
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast, 2'x4' Silver Reflector Kit	13	2	13	42	546	2600	1420	N/A	70	910	0	2,366
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast, 2'x4' Silver Reflector Kit	5	2	5	42	210	2600	546	N/A	16	80	0	208
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast	5	2	0	42	210	1040	218	N/A	16	80	0	83
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast, 2'x4' Silver Reflector Kit	6	2	6	42	252	1040	262	N/A	16	96	0	100
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast, 2'x4' Silver Reflector Kit	1	2	1	42	42	3120	131	N/A	70	70	0	218
Relamp & Reballast w/ (1) F28T8 Lamp & (1) 1/32 Elec. Low-Power High Efficiency Ballast	1	1	0	22	22	130	3	N/A	10	10	0	1
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast, 2'x4' Silver Reflector Kit	1	2	1	42	42	3120	131	N/A	70	70	0	218
Relamp & Reballast w/ (1) F28T8 Lamp & (1) 1/32 Elec. Low-Power High Efficiency Ballast	1	1	0	22	22	130	3	N/A	10	10	0	1
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast, 2'x4' Silver Reflector Kit	2	2	2	42	84	2600	218	N/A	70	140	0	364
No Retrofit Proposed	4	1	None	13	52	260	14	N/A	0	0	0	0
Relamp & Reballast w/ (2) F28T8 Lamps & (1) 2/32 Elec. Low-Power High Efficiency Ballast, 2'x4' Silver Reflector Kit	12	2	12	42	504	260	131	N/A	16	192	0	50
Relamp w/ (1) 60 watt Compact Fluorescent Screw-In	2	1	0	60	120	260	31	N/A	240	480	0	125
New Flood Fixture w/ (2) 150w ICETRON Induction Lamps & Induction Ballast, Universal Voltage	3	2	3	300	900	3650	3285	N/A	155	465	0	1,697
New Flood Fixture w/ (1) 120w ICETRON Induction Lamp & Induction Ballast, Universal Voltage	10	1	10	120	1200	3650	4380	N/A	70	700	0	2,555
New Flood Fixture w/ (1) 120w ICETRON Induction Lamp & Induction Ballast, Universal Voltage	8	1	8	120	960	3650	3504	N/A	10	80	0	292
New Flood Fixture w/ (1) 120w ICETRON Induction Lamp & Induction Ballast, Universal Voltage	4	1	4	120	480	3650	1752	N/A	70	280	0	1,022
New Flood Fixture w/ (1) 120w ICETRON Induction Lamp & Induction Ballast, Universal Voltage	3	1	3	120	360	3650	1314	N/A	70	210	0	767
Relamp w/ (2) 20 watt Compact Fluorescent Screw-In, w/ PAR38 Reflector	3	2	0	40	120	3650	438	N/A	160	480	0	1,752
No Retrofit Proposed	1	0	0	13	13	3650	47	N/A	0	0	0	0
Relamp w/ (1) 14 watt Compact Fluorescent Mini Spring Lamp Screw-In, 1 Piece	2	1	0	14	28	3650	102	N/A	46	92	0	336
New Box Fixture w/ (1) 70w ICETRON Induction Lamp & Induction Ballast, Universal Voltage	3	1	3	70	210	3650	767	N/A	55	165	0	602
New Flood Fixture w/ (1) 100w ICETRON Induction Lamp & Induction Ballast, Universal Voltage	2	1	2	100	200	3650	730	N/A	78	156	0	569
	455				**20,260**		**51,928**			**23,365**		**56,378**

HVAC EQUIPMENT LIST - UNION TOWNSHIP

Prepared By Dome-Tech, Inc.

	TAG #	LOCATION	AREA SERVING	EQUIPMENT	MANUFACTURER	MODEL #	Cooling CAPACITY (Tons)	Heating CAPACITY (Btu-h)	SUPPLY AIR (CFM)	FAN (HP)	Motor Information	CONTROLS	NOTES
1	AC-1	Bsmt Boiler Room	Offices	AHU			40		14,510			DDC	
2	AC-2	Bsmt Boiler Room	Assembly Area	AHU			20					DDC	
3	DX-1	Roof	AC-1	DX Condenser	Trane		40					Interlock	
4	DX-2	Roof	AC-2	DX Condenser	Trane		20					Interlock	
5		Data Processing - Phone Room	Data Processing - Phone Room	Wall Mounted Split AC	Mitsubishi	MS09EW							
6		Data Processing - Datacenter	Data Processing - Datacenter	Wall Mounted Split AC	Mitsubishi	MS09EW							
7		Data Processing - Datacenter	Data Processing - Datacenter	Wall Mounted Split AC	Mitsubishi	MrSlim							
8		Accounts	Accounts	Wall Mounted Split AC	Fujitsu	ASU12R1A							
9		Outdoors	Accounts	DX Condenser	Fujitsu	AOU12R1							
10		Bonnel Room	Bonnel Room	Fan Coil Unit	Inter-City Products	BYMD30-46GA	3	55,000		0.33			
11		Roof above Vestible	Vestible	Heat Pump	Inter-City Products	YE036H	3						
12		Roof above Vestible	Vestible	Central Furnace	Inter-City Products	D5YS024N04506A		55,000					
13													
14													
15													
16													

MOTORS - EQUIPMENT LIST - UNION TOWNSHIP

Prepared by Dome-Tech, Inc.

Motor ID	Quantity	Loading (Constant/Variable)	Affiliated System	Control Type	MANUFACTURER	MODEL #	Motor HP	Nominal Eff	Speed (RPM)	NOTES
P-1	1	Constant	HW	DDC	Bell and Gossett		0.2		1725	
P-2	1	Constant	HW	DDC	Bell and Gossett		0.2		1725	
P-3	1	Constant	HW	DDC	Bell and Gossett		0.2		1725	
P-4	1	Constant	HW	DDC	Bell and Gossett		0.2		1725	
P-5	1	Constant	HW	DDC	Bell and Gossett		0.2		1725	
P-6	1	Constant	HW	DDC	Bell and Gossett		0.3		1725	
P-7	1	Constant	HW	DDC	Bell and Gossett		0.3		1725	
P-8	1	Constant	HW	DDC			5.0		1725	
P-9	1	Constant	HW	DDC			5.0		1725	

ECM 1 - High Efficiency Restroom Sink Aerators

Existing Condition				Proposed Condition				Savings			
Annual Energy Consumption (kWh/yr)	Annual Steam Energy Consumption (klbs/yr)	Annual Water Consumption (Gallons/yr)	Estimated Annual Operating Cost ($/yr)	Annual Energy Consumption (kWh/yr)	Annual Steam Energy Consumption (klbs/yr)	Annual Water Consumption (Gallons/yr)	Estimated Annual Operating Cost ($/yr)	Annual Energy Savings (kWh/yr)	Annual Steam Energy Savings (klbs/yr)	Annual Water Savings (Gallons/yr)	Estimated Annual Cost Savings ($/yr)
0	94	441,520	$3,378	0	24	110,380	$845	0	71	331,140	$2,534

Occupant Type	Flow Fixture	Daily Uses per Occupant	Current Flow Rate (Gal per Minute)	Average Proposed Flow Rate (Gal per Minute)	Duration (Cycles) (Minutes)	Average # of Occupants per day	Current Daily Water Use (Gal)	New Daily Water Use (Gal)	Saved Water (Gal)
Visitor	Restroom Sinks Aerators	0.5	2.0	0.5	0.25	0	0	0	0
FTE	Restroom Sinks Aerators	3	2.0	0.5	0.25	806	1,210	302	907
						Total Daily Volume (Gallons)	1,210	302	907

Occupant Analysis	
Building Sq.ft.	491,000
Occupied Sq.ft.	491,000
LEED estimated sqft/person	250
Approximate FTE Mon-Fri	1,964
Energy Star FTE Mon-Fri	1,129
Approximate FTE Sat	0
Approximate FTE Sunday	0

Annual Values	Current Annual Water Use	New Annual Water Use	Annual Saved Water
Annual Building Open Days	365	365	
Calculated Annual Fixture Water Use (Gallons)	441,520	110,380	**331,140**
Water Cost, $	$0	$0	**$0**
Approx. Annual Bldg. Pumping kWh	0	0	**0**
Bldg. Pumping Cost	$0	$0	**$0**
Cold City Water Inlet Temp.	60	60	60
DHW Temperature Set-Point	120	120	120
% of water heated due to user temperature preference	50%	50%	50%
Hot Water Savings (btu/yr)	110,335,759	27,583,940	**82,751,819**
Nat Gas DHWH Hot Water Savings (therms/yr)	94	24	**71**
Hot Water Savings ($)	$3,378	$845	**$2,534**
		TOTAL SAVINGS (Water, Pump and Hot Water)	**$2,534**

Notes:
1) Sq.ft. / occupant based on LEED Core & Shell 2009.
2) Savings based on switching from current estimated 2.0 gpm bathroom sink aerators to high-efficiency 0.5 gpm sink aerator. Current GPM based on field observation.
3) Implementation cost assumes that 100% of the existing fixtures are two spigot and will need to be replaced with one spigot fixtures.
4) Assuming the average time each person washes their hands is 15 seconds as per LEED EBOM 2009 Reference Guide .
5) Assuming 50% of water used is cold city water and 50% percent is hot water, which is heated by the domestic water system.
6) City water temperature is estimated to be 60F and hot water temperature is estimated to be 120F.

ECM 2 - Install VFD on Condenser Water Pumps

UTILITY PRICES

1. Price of #2 Fuel Oil, $/gal	
2. Price of City Water, $/1000 gallons	
3. Price of Electricity, $/kWh (blended ra	$0.174
4. Price of the Demand of Electricity, $/k	
5. Price of Natural Gas, $/Mlb	$0.000

	Existing Condition	Proposed System	Annual Savings
Annual Energy Consumption (kWh)	262,624	191,200	**71,424**
Run Hours	3,523	3,523	**-**
Annual Cost and Savings, $	$45,807	$33,349	**$12,458**

1. VFD power consumption based on assumed load profile and affinity laws
2. Assume chillers operate above 50˚F OAT
3. Assume both CW pumps run when chillers run
4. Pumps throttled at 75%. Assume max flow required is 75% of total flow, hence 65% power

Actual Performance Data							
Pump	**Suction (PSI)**	**Discharge (PSI)**	**dP (PSI)**	**Head (Ft)**	**GPM**	**Pump Opp. Eff.**	**HP (Brake)**
Design				**60.0**	**2700**	**81%**	**50.5**
P-1	**68**	**95**	**27**	**62.4**	**2700**	**81%**	**52.5**
P-2	**62**	**95**	**33**	**76.2**	**1850**	**82%**	**43.4**
Pumps	**-**	**-**	**-**	**-**	**4550**	**-**	**95.9**
							252118.9

	Pump 1	Pump 2	Pumps
Motor HP	**60.0**	**60.0**	**120.0**
Design GPM	**2700**	**2700**	**5400**
Design Ft hd	**60**	**60**	
Motor Eff	**93.6%**	**93.6%**	**93.6%**
Annual Hours	**-**	**-**	**3523**

CW GPM/ton	total tons	GPM	GPM each
2.4	**1800.0**	**4320.0**	**2160.0**

Bin Range	Bin Hours	% Load	% Time	% Power	Pump 1	Pump 2 (kWh)	Total (kWh)	Total Cost
95	39	100%	1%	100%	1,469	1,469	2,939	$ 513
85	411	100%	12%	100%	15,485	15,485	30,970	$ 5,402
75	1146	85%	33%	78%	33,837	33,837	67,673	$ 11,804
65	951	75%	27%	65%	23,273	23,273	46,545	$ 8,118
55	976	70%	28%	59%	21,536	21,536	43,073	$ 7,513
45	0	70%	0%	59%	-	-	-	$ -
35	0	75%	0%	65%	-	-	-	$ -
25	0	85%	0%	78%	-	-	-	$ -
15	0	100%	0%	100%	-	-	-	$ -
5	0	100%	0%	100%	-	-	-	$ -
	3523		100%					

Proposed Energy Consumption	95,600	95,600	191,200	$ 33,349
Existing Energy Consumption	143,727	118,896	262,624	$ 45,807
Estimated Savings	48,127	23,296	71,424	$ 12,458

ECM 3A - Lighting Fixture & Controls Upgrade

		EXISTING FIXTURES				PROPOSED FIXTURES				SAVINGS				FINANCIAL		
Building	Sq Ft	Total Fixture Qty	Total Fixture Watts	Annual kWH Consumption	Watts / Sq Ft	Fixture Qty	Total Fixture Watts	Annual kWH Consumption	Watts / Sq Ft	Watts Saved	Annual kWH Saved	Annual Savings $	CO2 Reduction	Pre-Qualified Lighting Incentive (NYSERDA) $	Installed Cost $ (with Markup)	Simple Payback Years
LIGHTING UPGRADE AND CONTROLS	**491,000**	**5760**	**370,600**	**2,582,564**	**0.75**	**5,760**	**346,170**	**1,468,171**	**0.71**	**24,430**	**1,114,393**	**$194,372**	**368.3**			
SENSORS				**293,634**				**234,907**			**58,727**	**$10,243**	**19.4**			
											1,173,120	**$204,616**	**387.7**		**$665,423**	**3.3**

ECM 3B - Lighting Controls Upgrade

		EXISTING FIXTURES				PROPOSED FIXTURES				SAVINGS				FINANCIAL		
Building	Sq Ft	Total Fixture Qty	Total Fixture Watts	Annual kWH Consumption	Watts / Sq Ft	Fixture Qty	Total Fixture Watts	Annual kWH Consumption	Watts / Sq Ft	Watts Saved	Annual kWH Saved	Annual Savings $	CO2 Reduction	Pre-Qualified Lighting Incentive (NYSERDA) $	Installed Cost $ (with Markup)	Simple Payback Years
LIGHTING CONTROLS	**491,000**	**5760**	**370,600**	**2,582,564**	**0.75**	**5,760**	**370,600**	**1,573,988**	**0.75**	**0**	**1,008,576**	**$175,916**	**333.3**			
SENSORS				**314,798**				**251,838**			**62,960**	**$10,981**	**20.8**			
											1,071,536	**$186,897**	**354.1**		**$616,257**	**3.3**

ECM 4 - VFD on Chilled Water Pumps

	Existing Condition	Proposed System	Savings
# of CHW Pumps	2	2	
Total Pump HP	100	100	**0**
Annual Run Hours	2,936	2,936	**0**
Average % of total CHW flow	100%	72%	
Average % of total power	100%	47%	
Annual Electric Use (kWh)	135,089	63,479	**71,609**
Annual Cost and Savings, $	$ 23,562	$ 11,072	**$ 12,490**

1. Savings based on pump power reduction with VFD.
2. Run hours based on bin data and time of day factor.
3. The building has 2 CHW pumps. It is assumed that only 1 of these pumps operates to serve the chiller, and the other pump is a backup.

Note not used due to change in calcs: 2. Existing load factor of 95% is estimated and accounts for increase in full load kW with VFD.

Summary

Existing Condition						**Proposed Condition**					
Annual Electricity Consumption (kWh/yr)	Electric Demand (kW/mo)	Annual Electricity Consumption Cost ($/yr)	Annual Electric Demand Cost ($/yr)	Annual Maintenance Cost ($/yr)	Annual Total Energy & Maintenance Cost ($/yr)	Annual Energy Consumption (kWh)	Electric Demand (kW/mo)	Annual Electricity Consumption Cost ($)	Annual Electric Demand Cost ($)	Annual Maintenance Cost ($/yr)	Annual Total Energy & Maintenance Cost ($/yr)
135,089	33.7	$23,562	$0	$0	$23,562	63,479	32.6	$11,072	$0	$0	$11,072

Savings						**Implementation Costs**				**Payback**
Annual Energy Savings (kWh)	Electric Demand Savings (kW/mo)	Annual Electricity Consumption Cost Savings ($)	Annual Electric Demand Cost Savings ($)	Annual Maintenance Cost Savings ($/yr)	Annual Total Energy & Maintenance Cost Savings ($/yr)	Engineering Design Costs ($)		Subcontractor Mat & Lab, Haz Mat, Contigency ($)	Total Implementation Cost ($)	Simple Payback (years)
71,609	1.1	$12,490	$0	$0	$12,490				$0	0.0

Utility Data

Electricity Usage Rate ($/kWh)	$0.17442
Electric Demand Rate ($/kW)	$0.00

0 if using blended rate

Savings

Savings will be based on reduced pumping energy for a VFD as compared to constant speed pump.
VFDs use less energy than a bypass as load decreases, approximately according to the fan affinity laws
Annual operating hours for the chiller can be estimated through a combination of bin data and interview with site staff.

Note: Chilled water delta T was only 5.2 F at 80.3 OAT according to BAS screenshot, suggesting excess water flow or poorly performing coil.

CHW Pumps

Area Served	# of Pumps	HP (per pump)	Motor Load Factor	Actual HP (per pump)	Total HP	Motor Efficiency	Power Factor
P-1	1	50	80%	40	40	93%	0.9
P-2	1	50	80%	40	40	93%	0.9
Total	2	100	80%	80	80	93%	0.9

2 pumps total, assuming 2 run and 1 is backup. Load factor addressed in calcs below

Chiller Operating Calendar

April 15 - October 15

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.0	0.0	0.0	0.5	1.0	1.0	1.0	1.0	1.0	0.5	0.0	0.0

Chiller Operating Hours (in cooling season) 6AM-10PM

	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Total # of Hours / Week	% of Bin	Time Range
01 to 08	2	2	2	2	2	0	0	10	17.9%	12 AM - 8 AM
09 to 16	8	8	8	8	8	0	0	40	71.4%	8 AM - 4 PM
17 to 00	6	6	6	6	6	0	0	30	53.6%	4 PM - 12 AM
Total	16	16	16	16	16	0	0	80	47.6%	

ECM 4 - VFD on Chilled Water Pumps

1. Price of #2 Fuel Oil, $/gal
2. Price of City Water, $/1000 gallons
1. Price of Electricity, $/kWh (blended rate) $0.174
4. Price of the Demand of Electricity, $/kW/month
5. Price of Natural Gas, $/therm $0.000

	Existing Condition	Proposed System	Savings
# of AC Units	9	9	
Cooling Capacity, Tons	671	671	
Average Efficiency, EER	19.8	19.8	
Estimated Total Supply Fan Volume, cfm	268,390	268,390	
Estimated Total Supply Fan Power, bhp	470	470	
Wkday Occupied Run Hours when OAT > 65F, hrs	2,756	1,010	
Cooling Load Factor (OAT >65F)	80%	80%	
Unoccupied Setback Run Hours when OAT > 75F, hrs	-	640	
Cooling Load Factor (OAT >75F)	100%	100%	
Total Run Hours	2,756	1,650	1,106
Annual Cooling Production, ton-hours	1,479,366	971,572	507,794
Annual Cooling Load, kBTU per Unit	17,752,388	11,658,862	6,093,527
Annual Fan Electrical Consumption, kWh	579,785	347,114	232,671
Annual Cooling Electrical Consumption, kWh	895,016	587,801	307,215
Total Annual Electrical Demand, kW	7,455	7,455	-
Total Annual Electrical Consumption, kWh	1,474,801	934,915	**539,887**
Annual Cost and Savings for All Units, $	$ 257,235	$ 163,068	**$ 94,167**

1. Assume existing systems run all hours when outside air temperature is above 65F.
2. Assume the proposed systems operate during occupied hours when the outside air temperature (OAT) is above 65F and during unoccupied hours when the OAT is above 75F.
3. Load factor calculation represents the percentage of time when the units operate at full load during the operation schedule.
4. It is assumed that cooling is provided at a efficiency of 19.8 EER.
5.There is no demand reduction for this measure
6. No rebates or other financial incentives were available for this measure

	Existing Condition	Proposed System	Savings
# of AC Units	4	4	
Cooling Capacity, Tons	257	257	
Average Efficiency, EER	19.8	19.8	
Estimated Total Supply Fan Volume, cfm	102,910	102,910	
Estimated Total Supply Fan Power, bhp	185	185	
Wkday Occupied Run Hours when OAT > 65F, hrs	1,504	1,010	
Cooling Load Factor (OAT >65F)	80%	80%	
Unoccupied Setback Run Hours when OAT > 75F, hrs	-	179	
Cooling Load Factor (OAT >75F)	100%	100%	
Total Run Hours	1,504	1,189	315
Annual Cooling Production, ton-hours	309,553	253,930	55,623
Annual Cooling Load, kBTU per Unit	3,714,639	3,047,165	667,474
Annual Fan Electrical Consumption, kWh	124,540	98,456	26,084
Annual Cooling Electrical Consumption, kWh	187,280	153,628	33,652
Total Annual Electrical Demand, kW	2,901	2,901	-
Total Annual Electrical Consumption, kWh	311,820	252,084	**59,736**
Annual Cost and Savings for All Units, $	$ 54,388	$ 43,969	**$ 10,419**

1. Assume existing systems run all hours when outside air temperature is above 65F.
2. Assume the proposed systems operate during occupied hours when the outside air temperature (OAT) is above 65F and during unoccupied hours when the OAT is above 75F.
3. Load factor calculation represents the percentage of time when the units operate at full load during the operation schedule.
4. It is assumed that cooling is provided at a efficiency of 19.8 EER.
5.There is no demand reduction for this measure
6. No rebates or other financial incentives were available for this measure

ECM 5.2 - Unoccupied O.A. Reduction

Existing Condition			Proposed Condition			Savings		
Annual Energy Consumption (kWh)	Annual Energy Consumption (kBtu)	Estimated Annual Operating Cost ($)	Annual Energy Consumption (kWh)	Annual Energy Consumption (kBtu)	Estimated Annual Operating Cost ($)	Annual Energy Savings (kWh)	Annual Energy Savings (kBtu)	Estimated Annual Cost Savings ($)
#NAME?	690,710	#NAME?	#NAME?	214,712	#NAME?	#NAME?	475,998	#NAME?

AHU Conditioning and Motor Savings					
Current CFM	Current $/CFM	Proposed $/CFM	Current Conditioning Cost / Year	Proposed Conditioning Cost / Year	TOD Conditioning Savings / Year
371,000	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
			#NAME?	#NAME?	#NAME?

Conditioning Savings Breakdown								
Current kWh / Year	Proposed kWh / Year	kWh Savings / Year	CHW Ton-hrs Savings / Year	Current BTU / Year	Proposed BTU / Year	BTU Savings / Year	kBTU Savings / Year	TOD Savings Double Check
#NAME?	#NAME?	#NAME?	#NAME?	690,709,807	214,712,169	475,997,638	475,998	#NAME?
#NAME?		#NAME?	#NAME?	690,709,807		475,997,638	475,998	#NAME?

Units	Schedule	ON/OFF	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weeks/Yr	Annual Hours
Acs	Current	ON	6	6	6	6	6	0	0	52.0	4160
		OFF	22	22	22	22	22	0	0		
	Proposed	ON	6	6	6	6	6	0	0	52.0	3120
		OFF	18	18	18	18	18	0	0		

Note:
Both AHU B-1 and B-2 were found operating with exhaust, return and outside air dampers at the same fixed position on multiple site visits.
Damper control improvements include reinstating economizer control and installing demand controlled ventilation based on space CO2 levels.
Assuming AHU B-1 and B-2 are each rated for 8,000 CFM due to no nameplate data.

Current Operation

Unit	CFM	BIN Temp Range (F)	BIN Hours	OAT Db (°F)	OAT Wb (°F)	OA Grains	OA Enthalpy	OAD Position	RAT (°F)	RAT Humidity (RH)	RA Enthalpy	Mixed Air Temp Setpoint (°F)	Calculated Actual MAT Db (°F) (Mixed Air Calc)	MA Enthalpy (BTU /LB) (Mixed Air Calc)	MA Grains	Heating Coil Dry Bulb Setpoint (deg F)	HCV Leak-By (deg F)	Preheat Discharge Temp (deg F)	Preheat Enthalpy (BTU / Lbm)	Preheat %RH	Preheat Load (BTU)	Preheat Cost ($)	Cooling Coil Dry Bulb Setpoint (°F)	CCV Leak-By (deg F)	Cooling Coil Discharge Temp. (deg F)	SA %RH	Cooling Coil Enthalpy (BTU / Lbm)	SA Grains	PH / CC DH	CC Total Load (Ton-Hrs/year)	CC Total Load (kWh/year)	CC Cost ($ / year)	Re-Heat Load (BTUh)	Re-Heat Cost ($ / year)	TOTAL COST, $
Acs	371,000	100 to 104	0	102	80	120.5	43.5	15%	68	50	24.3	55	73.1	27.2	#NAME?	55	0	73.1	#NAME?	#NAME?	0	$ -	55	0.0	55.0	####		#####	#####	#NAME?	#NAME?	#NAME?			#NAME?
		95 to 99	0	97	76	#NAME?	#NAME?	15%	68	50	24.3	55	72.4	#NAME?	#NAME?	55	0	72.4	#NAME?	#NAME?	0	$ -	55	0.0	55.0	####	#NAME?	#####	#####	#NAME?	#NAME?	#NAME?			#NAME?
		90 to 94	0	92	74.2	#NAME?	#NAME?	15%	68	50	24.3	55	71.6	#NAME?	#NAME?	55	0	71.6	#NAME?	#NAME?	0	$ -	55	0.0	55.0	####	#NAME?	#####	#####	#NAME?	#NAME?	#NAME?			#NAME?
		85 to 89	6	87	71.5	#NAME?	#NAME?	15%	68	50	24.3	55	70.9	#NAME?	#NAME?	55	0	70.9	#NAME?	#NAME?	0	$ -	55	0.0	55.0	####	#NAME?	#####	#####	#NAME?	#NAME?	#NAME?			#NAME?
		80 to 84	56	82	68.3	#NAME?	#NAME?	15%	68	50	24.3	55	70.1	#NAME?	#NAME?	55	0	70.1	#NAME?	#NAME?	0	$ -	55	0.0	55.0	####	#NAME?	#####	#####	#NAME?	#NAME?	#NAME?			#NAME?
		75 to 79	117	77	66.8	#NAME?	#NAME?	15%	68	50	24.3	55	69.4	#NAME?	#NAME?	55	0	69.4	#NAME?	#NAME?	0	$ -	55	0.0	55.0	####	#NAME?	#####	#####	#NAME?	#NAME?	#NAME?			#NAME?
		70 to 74	174	72	64	#NAME?	#NAME?	15%	68	50	24.3	55	68.6	#NAME?	#NAME?	55	0	68.6	#NAME?	#NAME?	0	$ -	55	0.0	55.0	####	#NAME?	#####	#####	#NAME?	#NAME?	#NAME?			#NAME?
		65 to 69	141	67	59.9	#NAME?	#NAME?	100%	68	50	24.3	55	67.0	#NAME?	#NAME?	55	0	67.0	#NAME?	#NAME?	0	$ -	55	0.0	55.0	####	#NAME?	#####	#####	#NAME?	#NAME?	#NAME?			#NAME?
		60 to 64	143	62	55.5	#NAME?	#NAME?	50%	68	50	24.3	65	65.0	#NAME?	#NAME?	65	0.5	65.5	#NAME?	#NAME?	78	$ 0.002	65	0.0	65.0	####	#NAME?	#####	#####	#NAME?	#NAME?	#NAME?			#NAME?
		55 to 59	138	57	50	#NAME?	#NAME?	27%	68	50	24.3	65	65.0	#NAME?	#NAME?	65	0.5	65.5	#NAME?	#NAME?	75	$ 0.002	65	0.0	65.0	####	#NAME?	#####	#####	#NAME?	#NAME?	#NAME?			#NAME?
		50 to 54	149	52	46	#NAME?	#NAME?	19%	68	50	24.3	65	65.0	#NAME?	#NAME?	65	0.5	65.5	#NAME?	#NAME?	81	$ 0.002	65	0.0	65.0	####	#NAME?	#####	#####						$ 0.002
		45 to 49	96	47	41.3	#NAME?	#NAME?	15%	68	50	24.3	65	64.9	#NAME?	#NAME?	65	0.5	65.5	#NAME?	#NAME?	68	$ 0.002	65	0.0	65.0	####	#NAME?	#####	#####						$ 0.002
		40 to 44	112	42	37.3	#NAME?	#NAME?	15%	68	50	24.3	65	64.1	#NAME?	#NAME?	65	0.5	65.5	#NAME?	#NAME?	170	$ 0.005	65	0.0	65.0	####	#NAME?	#####	#####						$ 0.005
		35 to 39	165	37	33.2	#NAME?	#NAME?	15%	68	50	24.3	65	63.4	#NAME?	#NAME?	65	0.5	65.5	#NAME?	#NAME?	385	$ 0.012	65	0.0	65.0	####	#NAME?	#####	#####						$ 0.012
		30 to 34	142	32	28.4	#NAME?	#NAME?	15%	68	50	24.3	65	62.6	#NAME?	#NAME?	65	0.5	65.5	#NAME?	#NAME?	447	$ 0.013	65	0.0	65.0	####	#NAME?	#####	#####						$ 0.013
		25 to 29	62	27	23.6	#NAME?	#NAME?	15%	68	50	24.3	65	61.9	#NAME?	#NAME?	65	0.5	65.5	#NAME?	#NAME?	246	$ 0.007	65	0.0	65.0	####	#NAME?	#####	#####						$ 0.007
		20 to 24	33	22	19.1	#NAME?	#NAME?	15%	68	50	24.3	65	61.1	#NAME?	#NAME?	65	0.5	65.5	#NAME?	#NAME?	158	$ 0.005	65	0.0	65.0	####	#NAME?	#####	#####						$ 0.005
		15 to 19	17	17	14.5	#NAME?	#NAME?	15%	68	50	24.3	65	60.4	#NAME?	#NAME?	65	0.5	65.5	#NAME?	#NAME?	95	$ 0.003	65	0.0	65.0	####	#NAME?	#####	#####						$ 0.003
		10 to 14	6	12	9.3	#NAME?	#NAME?	15%	68	50	24.3	65	59.6	#NAME?	#NAME?	65	0.5	65.5	#NAME?	#NAME?	38	$ 0.001	65	0.0	65.0	####	#NAME?	#####	#####						$ 0.001
		5 to 9	2	7	5.3	#NAME?	#NAME?	15%	68	50	24.3	65	58.9	#NAME?	#NAME?	65	0.5	65.5	#NAME?	#NAME?	14	$ 0.000	65	0.0	65.0	####	#NAME?	#####	#####						$ 0.000
		0 to 4	1	2	0.5	#NAME?	#NAME?	15%	68	50	24.3	65	58.1	#NAME?	#NAME?	65	0.5	65.5	#NAME?	#NAME?	8	$ 0.000	65	0.0	65.0	####	#NAME?	#####	#####						$ 0.000
			1560																		1862	$ 0.056								#NAME?	#NAME?	0	$ -	**#NAME?**
																																		#NAME?

Proposed Operation

Unit	CFM	BIN Temp Range (F)	BIN Hours	OAT Db (°F)	OAT Wb (°F)	OA Grains	OA Enthalpy	OAD Position	RAT (°F)	RAT Humidity (RH)	RA Enthalpy	Mixed Air Temp Setpoint (°F)	Calculated Actual MAT Db (°F) (Mixed Air Calc)	MA Enthalpy (BTU /LB) (Mixed Air Calc)	MA Grains	Heating Coil Dry Bulb Setpoint (deg F)	HCV Leak-By (deg F)	Preheat Discharge Temp (deg F)	Preheat Enthalpy (BTU / Lbm)	Preheat %RH	Preheat Load (BTU)	Preheat Cost ($)	Cooling Coil Dry Bulb Setpoint (°F)	CCV Leak-By (deg F)	Cooling Coil Discharge Temp. (deg F)	SA %RH	Cooling Coil Enthalpy (BTU / Lbm)	SA Grains	PH / CC DH	CC Total Load (Ton-Hrs/year)	CC Total Load (kWH/year)	CC Cost ($ / year)	Re-Heat Load (BTUh)	Re-Heat Cost ($ / year)	TOTAL COST, $
		100 to 104	0	102	80	120.5	43.5	5%	**68**	50	24.3	55	69.7	25.3	54.7	**55**	0	69.7	25.3	50.3	0	$ -	**55**	0.0	55.0	84.9	21.7	54.7	3.6	0.000	0.000	$ -			$ -
		95 to 99	0	97	76	#NAME?	#NAME?	5%	**68**	50	24.3	55	69.5	#NAME?	#NAME?	**55**	0	69.5	#NAME?	#NAME?	0	$ -	**55**	0.0	55.0	####	#NAME?	#####	#####	#NAME?	#NAME?	#NAME?			#NAME?
		90 to 94	0	92	74.2	#NAME?	#NAME?	5%	**68**	50	24.3	55	69.2	#NAME?	#NAME?	**55**	0	69.2	#NAME?	#NAME?	0	$ -	**55**	0.0	55.0	####	#NAME?	#####	#####	#NAME?	#NAME?	#NAME?			#NAME?
		85 to 89	6	87	71.5	#NAME?	#NAME?	5%	**68**	50	24.3	55	69.0	#NAME?	#NAME?	**55**	0	69.0	#NAME?	#NAME?	0	$ -	**55**	0.0	55.0	####	#NAME?	#####	#####	#NAME?	#NAME?	#NAME?			#NAME?
		80 to 84	56	82	68.3	#NAME?	#NAME?	5%	**68**	50	24.3	55	68.7	#NAME?	#NAME?	**55**	0	68.7	#NAME?	#NAME?	0	$ -	**55**	0.0	55.0	####	#NAME?	#####	#####	#NAME?	#NAME?	#NAME?			#NAME?
		75 to 79	117	77	66.8	#NAME?	#NAME?	5%	**68**	50	24.3	55	68.5	#NAME?	#NAME?	**55**	0	68.5	#NAME?	#NAME?	0	$ -	**55**	0.0	55.0	####	#NAME?	#####	#####	#NAME?	#NAME?	#NAME?			#NAME?
		70 to 74	174	72	64	#NAME?	#NAME?	5%	**68**	50	24.3	55	68.2	#NAME?	#NAME?	**55**	0	68.2	#NAME?	#NAME?	0	$ -	**55**	0.0	55.0	####	#NAME?	#####	#####	#NAME?	#NAME?	#NAME?			#NAME?
		65 to 69	141	67	59.9	#NAME?	#NAME?	100%	**68**	50	24.3	55	67.0	#NAME?	#NAME?	**55**	0	67.0	#NAME?	#NAME?	0	$ -	**55**	0.0	55.0	####	#NAME?	#####	#####	#NAME?	#NAME?	#NAME?			#NAME?
		60 to 64	143	62	55.5	#NAME?	#NAME?	50%	**68**	50	24.3	65	65.0	#NAME?	#NAME?	**65**	0.5	65.5	#NAME?	#NAME?	78	$ 0.002	**65**	0.0	65.0	####	#NAME?	#####	#####	#NAME?	#NAME?	#NAME?			#NAME?
		55 to 59	138	57	50	#NAME?	#NAME?	27%	**68**	50	24.3	65	65.0	#NAME?	#NAME?	**65**	0.5	65.5	#NAME?	#NAME?	75	$ 0.002	**65**	0.0	65.0	####	#NAME?	#####	#####	#NAME?	#NAME?	#NAME?			#NAME?
Acs	**371,000**	50 to 54	149	52	46	#NAME?	#NAME?	5%	**68**	50	24.3	65	67.2	#NAME?	#NAME?	**65**	0.5	67.7	#NAME?	#NAME?	81	$ 0.002	**65**	0.0	65.0	####	#NAME?	#####	#####						$ 0.002
		45 to 49	96	47	41.3	#NAME?	#NAME?	5%	**68**	50	24.3	65	67.0	#NAME?	#NAME?	**65**	0.5	67.5	#NAME?	#NAME?	52	$ 0.002	**65**	0.0	65.0	####	#NAME?	#####	#####						$ 0.002
		40 to 44	112	42	37.3	#NAME?	#NAME?	5%	**68**	50	24.3	65	66.7	#NAME?	#NAME?	**65**	0.5	67.2	#NAME?	#NAME?	61	$ 0.002	**65**	0.0	65.0	####	#NAME?	#####	#####						$ 0.002
		35 to 39	165	37	33.2	#NAME?	#NAME?	5%	**68**	50	24.3	65	66.5	#NAME?	#NAME?	**65**	0.5	67.0	#NAME?	#NAME?	90	$ 0.003	**65**	0.0	65.0	####	#NAME?	#####	#####						$ 0.003
		30 to 34	142	32	28.4	#NAME?	#NAME?	5%	**68**	50	24.3	65	66.2	#NAME?	#NAME?	**65**	0.5	66.7	#NAME?	#NAME?	77	$ 0.002	**65**	0.0	65.0	####	#NAME?	#####	#####						$ 0.002
		25 to 29	62	27	23.6	#NAME?	#NAME?	5%	**68**	50	24.3	65	66.0	#NAME?	#NAME?	**65**	0.5	66.5	#NAME?	#NAME?	34	$ 0.001	**65**	0.0	65.0	####	#NAME?	#####	#####						$ 0.001
		20 to 24	33	22	19.1	#NAME?	#NAME?	5%	**68**	50	24.3	65	65.7	#NAME?	#NAME?	**65**	0.5	66.2	#NAME?	#NAME?	18	$ 0.001	**65**	0.0	65.0	####	#NAME?	#####	#####						$ 0.001
		15 to 19	17	17	14.5	#NAME?	#NAME?	5%	**68**	50	24.3	65	65.5	#NAME?	#NAME?	**65**	0.5	66.0	#NAME?	#NAME?	9	$ 0.000	**65**	0.0	65.0	####	#NAME?	#####	#####						$ 0.000
		10 to 14	6	12	9.3	#NAME?	#NAME?	5%	**68**	50	24.3	65	65.2	#NAME?	#NAME?	**65**	0.5	65.7	#NAME?	#NAME?	3	$ 0.000	**65**	0.0	65.0	####	#NAME?	#####	#####						$ 0.000
		5 to 9	2	7	5.3	#NAME?	#NAME?	5%	**68**	50	24.3	65	65.0	#NAME?	#NAME?	**65**	0.5	65.5	#NAME?	#NAME?	1	$ 0.000	**65**	0.0	65.0	####	#NAME?	#####	#####						$ 0.000
		0 to 4	1	2	0.5	#NAME?	#NAME?	5%	**68**	50	24.3	65	64.7	#NAME?	#NAME?	**65**	0.5	65.5	#NAME?	#NAME?	1	$ 0.000	**65**	0.0	65.0	####	#NAME?	#####	#####						$ 0.000
NOTES:			1560																		579	$ 0.017								#NAME?	#NAME?	0	$ -	**#NAME?**
																																		#NAME?

ECM 5.3 - Condenser Water Reset

Chiller Capacity	600	tons
# of Chillers	3	

Existing efficiency	0.55	kW/ton
Cooling Load Factor	0.65	
Annual Cooling Hours	1,583	
Existing CHW Supply Temp	42	deg F
Cooling Tower Fan HP (each)	40	(6x) 40HP each

Assumptions

Proposed Nominal CHW Sup Temp	45	deg F
Proposed CHW Reset Schedule	1.5	deg F / 5 deg OAT
OAT to Start CHW Reset	85	deg F
Proposed Chiller Efficiency Improvement	1%	% / deg F
Proposed Cooling Tower Efficiency Improvement	1.5%	% / deg F

EXISTING CONDITION

OAT	# of cooling hours	Achievable CW Temp. Setpoint (=OA WB +7)	Existing CW Setpoint Temp	# Cooling Tower Fans	Existing Loading	%HP w/ VFD	Existing Cooling Tower kWh	CW Temp. Increase from IPLV Requirements	Chiller Efficiency Improvement	Number of Chillers Running	% of Total Tons	Efficiency Penalty due to Loading	Existing kW/ton	Existing ton-hr/yr	Existing kWh / yr
100 - 104 F	0	87	87	6	100%	100%	0	-2	-1.6%	3.0	71%	0.15	0.70	0	0
95 - 99 F	1	83	85	5	100%	100%	149	0	0.0%	2.0	99%	0.01	0.55	772	425
90 - 94 F	38	80	85	5	100%	100%	5670	0	0.0%	2.0	92%	0.04	0.59	27,269	15,952
85 - 89 F	73	79	85	4	100%	100%	8713	0	0.0%	2.0	85%	0.08	0.62	48,399	30,007
80 - 84 F	246	76	85	4	100%	100%	29363	0	0.0%	2.0	77%	0.12	0.66	147,748	97,513
75 - 79 F	434	74	85	3	100%	100%	38852	-10	-10.0%	2.0	70%	0.15	0.76	260,660	199,275
70 - 74 F	444	71	85	3	100%	100%	39747	-10	-10.0%	2.0	63%	0.19	0.80	240,000	192,720
65 - 69 F	228	67	85	2	100%	100%	13619	-10	-10.0%	1.0	55%	0.23	0.85	53,844	45,606
60 - 64 F	119	63	85	2	100%	100%	7072	-20	-20.0%	1.0	48%	0.26	0.97	26,620	25,715
Total	1,583						143,184							805,311	607,213
					100%										

PROPOSED CONDITION

OAT	# of cooling hours	Achievable CW Temp. Setpoint (=OA WB +7)	Proposed Setpoint Temp	# Cooling Tower Fans	Proposed VFD Loading	%HP w/ VFD	Proposed Cooling Tower kWh	CW Temp. Increase from IPLV Requirements	Chiller Efficiency Improvement	Number of Chillers Running	% of Total Tons	Efficiency Penalty due to Loading	Proposed kW/ton	Proposed ton-hr/yr	Proposed kWh / yr
100 - 104 F	0	87	87	6	100%	100%	0	-2	-1.6%	3.0	71%	0.15	0.70	0	0
95 - 99 F	1	83	83	5	100%	100%	149	2	1.9%	2.0	99%	0.01	0.54	772	417
90 - 94 F	38	80	80	5	100%	100%	5670	5	4.6%	2.0	92%	0.04	0.56	27,269	15,218
85 - 89 F	73	79	79	4	100%	100%	8713	7	6.5%	2.0	85%	0.08	0.58	48,399	28,057
80 - 84 F	246	76	76	4	100%	100%	29363	9	9.1%	2.0	77%	0.12	0.60	147,748	88,640
75 - 79 F	434	74	74	3	100%	100%	38852	1	0.8%	2.0	70%	0.15	0.69	236,964	163,372
70 - 74 F	444	71	71	3	100%	100%	39747	4	4.0%	2.0	63%	0.19	0.70	218,182	152,902
65 - 69 F	228	67	67	2	100%	100%	13619	8	7.9%	1.0	55%	0.23	0.71	48,949	34,713
60 - 64 F	119	63	63	2	100%	100%	7072	2	2.4%	1.0	48%	0.26	0.79	22,183	17,429
Total	1,583						143,184							750,465	500,748

ECM 6 - VFD on Cooling Tower Fans

1. Price of #2 Fuel Oil, $/gal
2. Price of City Water, $/1000 gallons
3. Price of Electricity, $/kWh (blended rate) $0.174
4. Price of the Demand of Electricity, $/kW/month
5. Price of Natural Gas, $/therm $0.000

	Existing Condition	Proposed System		Savings
kWh usage	242,414.9	198,496.7		**43,918**
Annual Natural Gas Cost and Savings, $	$ -	$ -		$ -
Annual Electric Cost and Savings, $	$ 42,282	$ 34,622		$ 7,660
Annual Cost and Savings, $	$ 42,282	$ 34,622		**$ 7,660**

NOTES:
1. Cooling tower runs during occupied hours, 24/7
2. Cooling is needed above 55F balance point.
3. Cooling tower run time is proportional to cooling load.
4. Cooling load is proportional to outdoor air temperature and is maximum (100%) above 93F (design day) and minimum (30%) at 55F.
5. Motor loads assume 75% load factor; 85% efficiency for motors.

CT-1: Cell 1

	Main CT			Baseline CT Fan						Proposed CT Fan		Energy
	Bin	Hours	Cooling Load	Bldg Tonnage Rq'd	Aditional Tonnage Rq'd	% Run Time	Actual Run Time	kWh	Tonnage Provided	% Speed	kWh	kWh
6	97.5	1	100%	1800	1800	100%	100%	26	350	100%	26	-
5	92.5	38	91%	1643	1643	100%	100%	1,001	350	100%	1,001	-
5	87.5	69	83%	1485	1485	100%	100%	1,817	350	100%	1,817	-
4	82.5	342	74%	1328	1328	100%	100%	9,005	350	100%	9,005	-
4	77.5	585	65%	1170	1170	100%	100%	15,403	350	100%	15,403	-
3	72.5	561	56%	1013	1013	100%	100%	14,771	350	100%	14,771	-
3	67.5	411	48%	855	855	100%	100%	10,821	350	100%	10,821	-
2	62.5	540	39%	698	698	100%	100%	14,218	350	100%	14,218	-
2	57.5	481	30%	540	540	100%	100%	12,664	350	100%	12,664	-
	Sum	3028						79,725			79,725	**-**

Cooling Tower Fan Motor Size	40	HP
Baseline Cooling Tower Fan Motor Load	26.3	kW
New Cooling Tower Fan Motor Load	26.3	kW

CT-1: Cell 2

	Main CT			Baseline CT Fan						Proposed CT Fan		Energy
	Bin	Hours	Cooling Load	Bldg Tonnage Rq'd	Aditional Tonnage Rq'd	% Run Time		kWh	Tonnage Provided	% Speed	kWh	kWh
6	97.5	1	100%	1800	1450	100%	100%	26	700	100%	26	-
5	92.5	38	91%	1643	1293	100%	100%	1,001	700	100%	1,001	-
5	87.5	69	83%	1485	1135	100%	100%	1,817	700	100%	1,817	-
4	82.5	342	74%	1328	978	100%	100%	9,005	700	100%	9,005	-
4	77.5	585	65%	1170	820	100%	100%	15,403	700	100%	15,403	-
3	72.5	561	56%	1013	663	100%	100%	14,771	700	100%	14,771	-
3	67.5	411	48%	855	505	100%	100%	10,821	700	100%	10,821	-
2	62.5	540	39%	698	348	99%	100%	14,218	698	99%	13,965	253
2	57.5	481	30%	540	190	54%	100%	12,664	540	54%	2,750	9,915
	Sum	3028						79,725			69,558	**10,167**

Cooling Tower Fan Motor Size	40	HP
Baseline Cooling Tower Fan Motor Load	26.3	kW
New Cooling Tower Fan Motor Load	26.3	kW

CT-1: Cell 3

	Main CT			Baseline CT Fan						Proposed CT Fan		Energy
	Bin	Hours	Cooling Load	Bldg Tonnage Rq'd	Aditional Tonnage Rq'd	% Run Time		kWh	Tonnage Provided	% Speed	kWh	kWh
6	97.5	1	100%	1800	1100	100%	100%	26	1,050	100%	26	-
5	92.5	38	91%	1643	943	100%	100%	1,001	1,050	100%	1,001	-
5	87.5	69	83%	1485	785	100%	100%	1,817	1,050	100%	1,817	-
4	82.5	342	74%	1328	628	100%	100%	9,005	1,050	100%	9,005	-
4	77.5	585	65%	1170	470	100%	100%	15,403	1,050	100%	15,403	-
3	72.5	561	56%	1013	313	89%	100%	14,771	1,013	89%	11,127	3,644
3	67.5	411	48%	855	155	44%	100%	10,821	855	44%	1,412	9,409
	62.5	540	39%	698	0	0%		-	698	0%	-	-
	57.5	481	30%	540	0	0%		-	540	0%	-	-
	Sum	3028						52,843			39,790	**13,053**

Cooling Tower Fan Motor Size	40	HP
Baseline Cooling Tower Fan Motor Load	26.3	kW
New Cooling Tower Fan Motor Load	26.3	kW

CT-2: Cell 1

	Main CT					Baseline CT Fan				Proposed CT Fan		Energy
	Bin	Hours	Cooling Load	Bldg Tonnage Rq'd	Aditional Tonnage Rq'd	% Run Time		kWh	Tonnage Provided	% Speed	kWh	kWh
6	97.5	1	100%	1800	750	100%	100%	26	1,400	100%	26	-
5	92.5	38	91%	1643	593	100%	100%	1,001	1,400	100%	1,001	-
5	87.5	69	83%	1485	435	100%	100%	1,817	1,400	100%	1,817	-
4	82.5	342	74%	1328	278	79%	100%	9,005	1,328	79%	5,040	3,964
4	77.5	585	65%	1170	120	34%	100%	15,403	1,170	34%	1,060	14,343
	72.5	561	56%	1013	0	0%		-	1,013	0%	-	-
	67.5	411	48%	855	0	0%		-	855	0%	-	-
	62.5	540	39%	698	0	0%		-	698	0%	-	-
	57.5	481	30%	540	0	0%		-	540	0%	-	-
	Sum	3028						27,251			8,944	**18,307**

Cooling Tower Fan Motor Size	40	HP
Baseline Cooling Tower Fan Motor Load	26.3	kW
New Cooling Tower Fan Motor Load	26.3	kW

CT-2: Cell 2

	Main CT					Baseline CT Fan				Proposed CT Fan		Energy
	Bin	Hours	Cooling Load	Bldg Tonnage Rq'd	Aditional Tonnage Rq'd	% Run Time		kWh	Tonnage Provided	% Speed	kWh	kWh
6	97.5	1	100%	1800	400	100%	100%	26	1,750	100%	26	-
5	92.5	38	91%	1643	243	69%	100%	1,001	1,643	69%	400	601
5	87.5	69	83%	1485	85	24%	100%	1,817	1,485	24%	53	1,764
	82.5	342	74%	1328	0	0%		-	1,328	0%	-	-
	77.5	585	65%	1170	0	0%		-	1,170	0%	-	-
	72.5	561	56%	1013	0	0%		-	1,013	0%	-	-
	67.5	411	48%	855	0	0%		-	855	0%	-	-
	62.5	540	39%	698	0	0%		-	698	0%	-	-
	57.5	481	30%	540	0	0%		-	540	0%	-	-
	Sum	3028						2,844			479	**2,365**

Cooling Tower Fan Motor Size	40	HP
Baseline Cooling Tower Fan Motor Load	26.3	kW
New Cooling Tower Fan Motor Load	26.3	kW

CT-2: Cell 3

	Main CT					Baseline CT Fan				Proposed CT Fan		Energy
	Bin	Hours	Cooling Load	Bldg Tonnage Rq'd	Aditional Tonnage Rq'd	% Run Time		kWh	Tonnage Provided	% Speed	kWh	kWh
6	97.5	1	100%	1800	50	14%	100%	26	1,800	14%	0	26
	92.5	38	91%	1643	0	0%		-	1,643	0%	-	-
	87.5	69	83%	1485	0	0%		-	1,485	0%	-	-
	82.5	342	74%	1328	0	0%		-	1,328	0%	-	-
	77.5	585	65%	1170	0	0%		-	1,170	0%	-	-
	72.5	561	56%	1013	0	0%		-	1,013	0%	-	-
	67.5	411	48%	855	0	0%		-	855	0%	-	-
	62.5	540	39%	698	0	0%		-	698	0%	-	-
	57.5	481	30%	540	0	0%		-	540	0%	-	-
	Sum	3028						26			0	**26**

Cooling Tower Fan Motor Size	40	HP
Baseline Cooling Tower Fan Motor Load	26.3	kW
New Cooling Tower Fan Motor Load	26.3	kW

ECM 7 - Chiller VFD Retrofit

System Data	Design	Acutal
Nominal Chiller Tonnage:	600	
Max Chiller Tonnage	600	
Quantity in Operation:	3	
Total Max Chiller Tonnage:	1800	
Primary CHW Pump GPM:	1800	1325
Quantity in Operation:	2	2
Total Max Primary CHW GPM:	3240	2650

	Design Data		
	Pump 1	Pump 2	Pumps
Motor HP	50.0	50.0	100.0
Design GPM	1800	1800	3600
Design Ft hd	80	80	
Motor Eff	93.0%	93.0%	93.0%

Actual Performance Data							
Pump	Suction (PSI)	Discharge (PSI)	dP (PSI)	Head (Ft)	GPM	Pump Opp. Eff.	HP (Brake)
Design				80.0	1800	86%	42.5
P-1	100	140	40	92.4	1325	84%	36.8
P-2	100	140	40	92.4	1325	84%	36.8
Pumps	-	-	-	-	2650	-	73.6

Existing Condition		Proposed Condition		Savings		Double Check		
Annual Energy Consumption (kWh)	Estimated Annual Operating Cost ($)	Annual Energy Consumption (kWh)	Estimated Annual Operating Cost ($)	Annual Energy Savings (kWh)	Estimated Annual Cost Savings ($)	Existing Cost	Proposed Cost	Savings
728,897	$127,134	499,590	$87,138	229,307	$39,996	$127,134	$87,138	$39,996

Demand Savings

Temperature Bins	Existing Condition	Proposed Condition	Savings
	Average Demand (kW)	Average Demand (kW)	Average Demand Savings (kW)
OAT >= 85°F	611	550	61
85°F > OAT >= 65°F	374	267	107
65°F > OAT >= 45°F	164	80	84
45°F > OAT	0	0	0

Note: Demand assumes cooling tower kW is negligible compared to compressor kW.

Notes

Based on approximated building chiller loading profile of maximum three chillers operating during the summer and no operation below 60F due to AHU economizer.
BIN data is NYC.
Chiller efficiency with and without VFDs is based on Carrier 19XR chiller data with a 75F inlet condenser water temperature.

Bin Data					Chilled Water & Compressor														
Temp Range	Bin Hours	TOD Load Factor	OAT (db)	OAT (wb)	Chilled Water Flow (gpm)	Chilled Water Return Temp (dF)	Chilled Water Supply Temp (dF)	Chilled Water (dT)	Chiller (btus/hr)	Number of Chillers Running	Chiller Tons	% Capacity	EXISTING Compressor Motor kW	EXISTING Compressor Motor kWh	EXISTING Compressor Cost, $	PROPOSED Compressor Motor kW - WITH VFD	PROPOSED Compressor Motor kWh - WITH VFD	PROPOSED Compressor Cost, $	SAVINGS Compressor VFD kWh	SAVINGS Compressor VFD $
100 to 104	**0**	1.00	102	76.1	2650	55.6	44.0	11.6	15,363,852	3	1280.3	71%	666	0	$0	497	0	$0	0	$0
95 to 99	**1**	1.00	97	76.1	2650	54.8	44.0	10.8	14,304,276	2	1192.0	99%	650	650	$113	660	660	$115	-11	-$2
90 to 94	**38**	1.00	92	73.4	2650	54.0	44.0	10.0	13,244,700	2	1103.7	92%	590	22,439	$3,914	565	21,474	$3,746	965	$168
85 to 89	**73**	1.00	87	71.5	2650	53.2	44.0	9.2	12,185,124	2	1015.4	85%	538	39,287	$6,852	477	34,839	$6,077	4,448	$776
80 to 84	246	1.00	82	68.9	2650	52.4	44.0	8.4	11,125,548	2	927.1	77%	482	118,598	$20,686	391	96,247	$16,787	22,351	$3,899
75 to 79	434	1.00	77	67.2	2650	51.6	44.0	7.6	10,065,972	2	838.8	70%	436	189,307	$33,019	321	139,250	$24,288	50,057	$8,731
70 to 74	444	1.00	72	64	2650	50.8	44.0	6.8	9,006,396	2	750.5	63%	398	176,615	$30,805	258	114,633	$19,994	61,982	$10,811
65 to 69	326	1.00	67	60.1	1325	50.0	44.0	6.0	3,973,410	1	331.1	55%	180	58,830	$10,261	99	32,383	$5,648	26,446	$4,613
60 to 64	395	1.00	62	55.6	1325	49.2	44.0	5.2	3,443,622	1	287.0	48%	169	66,797	$11,651	83	32,872	$5,734	33,925	$5,917
55 to 59	356	1.00	57	50.9	1325	48.4	44.0	4.4	2,913,834	1	242.8	40%	158	56,374	$9,833	76	27,230	$4,749	29,144	$5,083
50 to 54	392	1.00	52	46.5	1325	47.6	44.0	3.6	2,384,046	0	198.7	0%		0	$0		0	$0	0	$0
45 to 49	299	1.00	47	42.1	1325	46.8	44.0	2.8	1,854,258	0	154.5	0%		0	$0		0	$0	0	$0
40 to 44	315	1.00	42	37.4	1325	46.0	44.0	2.0	1,324,470	0	110.4	0%		0	$0		0	$0	0	$0
35 to 39	423	1.00	37	33.4	1325	45.2	44.0	1.2	794,682	0	66.2	0%		0	$0		0	$0	0	$0
30 to 34	380	1.00	32	28.4	1325	44.4	44.0	0.4	264,894	0	22.1	0%		0	$0		0	$0	0	$0
25 to 29	188	1.00	27	23.6	1325	44.0	44.0	0.0	0	0	0.0	0%		0	$0		0	$0	0	$0
20 to 24	89	1.00	22	19.1	1325	44.0	44.0	0.0	0	0	0.0	0%		0	$0		0	$0	0	$0
15 to 19	49	1.00	17	14.5	1325	44.0	44.0	0.0	0	0	0.0	0%		0	$0		0	$0	0	$0
10 to 14	14	1.00	12	9.6	1325	44.0	44.0	0.0	0	0	0.0	0%		0	$0		0	$0	0	$0
5 to 9	11	1.00	7	5.2	1325	44.0	44.0	0.0	0	0	0.0	0%		0	$0		0	$0	0	$0
0 to 4	5	1.00	2	0.5	1325	44.0	44.0	0.0	0	0	0.0	0%		0	$0		0	$0	0	$0
	4478																			
													TOTALS	728,897	$127,134		499,590	$87,138	229,307	$39,996

ECM 8 - CV to VAV

1. Price of #2 Fuel Oil, $/gal
2. Price of Steam, $/klbs $35.828
3. Price of Electricity, $/kWh (blended rate) $0.174
4. Price of the Demand of Electricity, $/kW/month
5. Price of Natural Gas, $/therm

	Existing Condition	Proposed System	Savings	
Number of Units	13	13	-	
Total Capacity, Tons	928	928	-	
Assumed Efficiency, EER	19.8	19.8	-	
Annual Electric Usage (kWh/yr)	1,064,584	902,856	161,727	15%
Annual Steam Usage (klbs/yr)	8,082	6,869	1,212	15%
Annual Electric Cost ($)	$185,685	$157,476	$28,208	15%
Annual Steam Cost ($)	$289,540	$246,109	$43,431	15%
Annual Energy Cost ($)	$475,225	$403,585	$71,639	15%

	Current		Proposed			Savings			
Component	**kWh/yr**	**klbs/yr**	**% Reduction**	**kWh/yr**	**klbs/yr**	**kWh/yr**	**klbs/yr**	**$**	
Ventilation Energy Usage	809,904	0	25%	607,428	0	202,476	0	35,316	25%
Pumping Energy Usage	254,679	0	-16%	295,428	0	-40,749	0	-7,107	-16%
Annual Heating Energy Usage	0	8,082	15%	0	6,869	0	1,212	43,431	15%
Total	**1,064,584**	**8,082**		**902,856**	**6,869**	**161,727**	**1,212**	**71,639**	

BOILER PLANT

N/N	DESCRIPTION OF WORK	UNIT	QTY	MATERIAL		LABOR		TOTAL
				Unit	Total	Unit	Total	
1	Demolition	LS	1		-	5,500	5,500	5,500
2	Concrete Pad Restoration	LS	2	450	900	1,249	2,499	3,399
3	1000 MBH Condensing HW Boiler (Gas Fired)	LS	2	16,117	32,235	10,984	21,968	54,203
4	2" Gas Pipe	LF	50	5	250	17	861	1,111
5	Control Work	LS	2		-	5,000	10,000	10,000
6	Electrical Work	LS	2		-	6,460	12,920	12,920
7	Breaching Work including a new stack	LF	400	30	12,000	19	7,616	19,616
8	Piping, Fittings, Insulation	LF	600	3	1,800	8	4,716	6,516
10	Gas/CO Monitoring System	LS	1	5,000	5,000	2,582	2,582	7,582
11	Test, Training, etc	LS	1		-	6,000	6,000	6,000
	Other Estimated Implementation Costs							272,453
	TOTAL							**$ 399,300**
	SUB-TOTAL							**126,846**
	O&P						30%	38,054
	ASBESTOS ABATEMENT					SF	1,000	16,680
	DIRECT COST							181,580
	PAYMENT & PERFORMANCE BOND						2%	3,632
	SUB-TOTAL							185,212
	CONTINGENCY						35%	58,986
	Engineering Fees						28%	47,189
	Architectural fees for Renovation						24%	40,448
	ASBESTOS CONTINGENCY						15%	2,502
	SUB-TOTAL							334,336
	ASBESTOS DESIGN & AIR MONITORING, TESTING							-
	IC FEE						15.0%	49,606
	SUB-TOTAL							383,942
	INTEREST DURING CONSTRUCTION						4%	15,358
	TOTAL							**$ 399,300**

BOILER PLANT- Avoided Cost

N/N	DESCRIPTION OF WORK	UNIT	QTY	MATERIAL		LABOR		TOTAL
				Unit	Total	Unit	Total	
1	Demolition	LS	1		-	5,500	5,500	5,500
2	Concrete Pad Restoration	LS	1	450	450	1,249	1,249	1,699
3	1800 MBH HW Boiler (Gas Fired)	LS	1	16,039	16,039	9,820	9,820	25,859
4	2" Gas Pipe	LF	50	5	250	17	861	1,111
5	Control Work	LS	1		-	5,000	5,000	5,000
6	Electrical Work	LS	1		-	6,460	6,460	6,460
7	Breaching Work including a new stack	LF	400	30	12,000	19	7,616	19,616
8	Piping, Fittings, Insulation	LF	600	3	1,800	8	4,716	6,516
10	Gas/CO Monitoring System	LS	1	5,000	5,000	2,582	2,582	7,582
11	Test, Training, etc	LS	1		-	6,000	6,000	6,000
	Other Estimated Implementation Costs							191,041
	TOTAL							**$ 276,384**
	SUB-TOTAL							**85,343**
	O&P						30%	25,603
	ASBESTOS ABATEMENT					SF	1,000	16,680
	DIRECT COST							127,625
	PAYMENT & PERFORMANCE BOND						2%	2,553
	SUB-TOTAL							130,178
	CONTINGENCY						35%	39,724
	Engineering Fees						28%	31,779
	Architectural fees for Renovation						24%	27,240
	ASBESTOS CONTINGENCY						15%	2,502
	SUB-TOTAL							231,423
	ASBESTOS DESIGN & AIR MONITORING, TESTING							-
	IC FEE						15.0%	34,331
	SUB-TOTAL							265,754
	INTEREST DURING CONSTRUCTION						4%	10,630
	TOTAL							**$ 276,384**

Pipe Insulation

N/N	DESCRIPTION OF WORK	UNIT	QTY	MATERIAL		LABOR		TOTAL
				Unit	Total	Unit	Total	
1	1/2" Pipe Insulation	LF	42	3	119	5	213	332
	Other Estimated Implementation Costs							197
	TOTAL							**$ 529**
	SUB-TOTAL							**332**
	O&P						25%	83
	ASBESTOS ABATEMENT					SF		-
	DIRECT COST							415
	PAYMENT & PERFORMANCE BOND						2%	8
	SUB-TOTAL							423
	CONTINGENCY						25%	106
	Engineering Fees						0%	-
	Architectural fees for Renovation						0%	-
	ASBESTOS CONTINGENCY						15%	-
	SUB-TOTAL							529
	ASBESTOS DESIGN & AIR MONITORING, TESTING							-
	IC FEE						0.0%	-
	SUB-TOTAL							529
	INTEREST DURING CONSTRUCTION						0%	-
	TOTAL							**$ 529**

HHW OA Reset

N/N	DESCRIPTION OF WORK	UNIT	QTY	MATERIAL		LABOR		TOTAL
				Unit	Total	Unit	Total	
1	Programming Labor	Hr	8		-	150	1,200	1,200
	Other Estimated Implementation Costs							713
	TOTAL							**$ 1,913**
	SUB-TOTAL							**1,200**
	O&P						25%	300
	ASBESTOS ABATEMENT					SF		-
	DIRECT COST							1,500
	PAYMENT & PERFORMANCE BOND						2%	30
	SUB-TOTAL							1,530
	CONTINGENCY						25%	383
	Engineering Fees						0%	-
	Architectural fees for Renovation						0%	-
	ASBESTOS CONTINGENCY						15%	-
	SUB-TOTAL							1,913
	ASBESTOS DESIGN & AIR MONITORING, TESTING							-
	IC FEE						0.0%	-
	SUB-TOTAL							1,913
	INTEREST DURING CONSTRUCTION						0%	-
	TOTAL							**$ 1,913**

Attic Insulation

N/N	DESCRIPTION OF WORK	UNIT	QTY	MATERIAL		LABOR		TOTAL
				Unit	Total	Unit	Total	
1	Spray Applied Polyurethane Foam	LF	9,832	3	30,184	1	6,882	37,067
	Other Estimated Implementation Costs							11,954
	TOTAL							**$ 49,021**
	SUB-TOTAL							**37,067**
	O&P						15%	5,560
	ASBESTOS ABATEMENT					SF		-
	DIRECT COST							42,627
	PAYMENT & PERFORMANCE BOND						0%	-
	SUB-TOTAL							42,627
	CONTINGENCY						15%	6,394
	Engineering Fees						0%	-
	Architectural fees for Renovation						0%	-
	ASBESTOS CONTINGENCY						15%	-
	SUB-TOTAL							49,021
	ASBESTOS DESIGN & AIR MONITORING, TESTING							-
	IC FEE						0.0%	-
	SUB-TOTAL							49,021
	INTEREST DURING CONSTRUCTION						0%	-
	TOTAL							**$ 49,021**

Programmable Thermostat

N/N	DESCRIPTION OF WORK	UNIT	QTY	MATERIAL		LABOR		TOTAL
				Unit	Total	Unit	Total	
1	Programmable Thermostat	Ea	1	151	151	215.33	215	366
	Other Estimated Implementation Costs							217
	TOTAL						**$**	**584**
	SUB-TOTAL							**366**
	O&P					25%		92
	ASBESTOS ABATEMENT					SF		-
	DIRECT COST							458
	PAYMENT & PERFORMANCE BOND					2%		9
	SUB-TOTAL							467
	CONTINGENCY					25%		117
	Engineering Fees					0%		-
	Architectural fees for Renovation					0%		-
	ASBESTOS CONTINGENCY					15%		-
	SUB-TOTAL							584
	ASBESTOS DESIGN & AIR MONITORING, TESTING							-
	IC FEE					0.0%		-
	SUB-TOTAL							584
	INTEREST DURING CONSTRUCTION					0%		-
	TOTAL						**$**	**584**

Door Weatherization

N/N	DESCRIPTION OF WORK	UNIT	QTY	MATERIAL		LABOR		TOTAL
				Unit	Total	Unit	Total	
1	Doors	Ea	7	$ 22	$ 151	$ 57	$ 398	$ 549
	Other Estimated Implementation Costs							309
	TOTAL							**$ 858**
	SUB-TOTAL							**549**
	O&P						25%	137
	ASBESTOS ABATEMENT					SF		-
	DIRECT COST							687
	PAYMENT & PERFORMANCE BOND						0%	-
	SUB-TOTAL							687
	CONTINGENCY						25%	172
	Engineering Fees						0%	-
	Architectural fees for Renovation						0%	-
	ASBESTOS CONTINGENCY						15%	-
	SUB-TOTAL							858
	ASBESTOS DESIGN & AIR MONITORING, TESTING							-
	IC FEE						0.0%	-
	SUB-TOTAL							858
	INTEREST DURING CONSTRUCTION						0%	-
	TOTAL							**$ 858**

DHW Timer

N/N	DESCRIPTION OF WORK	UNIT	QTY	MATERIAL		LABOR		TOTAL
				Unit	Total	Unit	Total	
1	Time Clock	Ea	1	$ 78	$ 78	$ 109	$ 109	$ 187
	Other Estimated Implementation Costs							82
	TOTAL							**$ 269**
	SUB-TOTAL							**187**
	O&P						25%	47
	ASBESTOS ABATEMENT					SF		-
	DIRECT COST							234
	PAYMENT & PERFORMANCE BOND						0%	-
	SUB-TOTAL							234
	CONTINGENCY						15%	35
	Engineering Fees						0%	-
	Architectural fees for Renovation						0%	-
	ASBESTOS CONTINGENCY						15%	-
	SUB-TOTAL							269
	ASBESTOS DESIGN & AIR MONITORING, TESTING							-
	IC FEE						0.0%	-
	SUB-TOTAL							269
	INTEREST DURING CONSTRUCTION						0%	-
	TOTAL							**$ 269**

Install Dampers on Attic Openings

N/N	DESCRIPTION OF WORK	UNIT	QTY	MATERIAL		LABOR		TOTAL
				Unit	Total	Unit	Total	
1	56"x36" (Size approx)	Ea	3	$ 287	$ 861	$ 176	$ 528	$ 1,389
2	Two Position Thermostat	Ea	3	$ 104	$ 312	$ 530	$ 1,590	$ 1,902
3	Damper Actuator	Ea	3	$ 150	$ 450	$ 530	$ 1,590	$ 2,040
4	Transformer	Ea	3	$ 50	$ 150	$ 530	$ 1,590	$ 1,740
	Other Estimated Implementation Costs							3,977
	TOTAL							**$ 11,048**
	SUB-TOTAL							**7,071**
	O&P						25%	1,768
	ASBESTOS ABATEMENT					SF		-
	DIRECT COST							8,839
	PAYMENT & PERFORMANCE BOND						0%	-
	SUB-TOTAL							8,839
	CONTINGENCY						25%	2,210
	Engineering Fees						0%	-
	Architectural fees for Renovation						0%	-
	ASBESTOS CONTINGENCY						15%	-
	SUB-TOTAL							11,048
	ASBESTOS DESIGN & AIR MONITORING, TESTING							-
	IC FEE						0.0%	-
	SUB-TOTAL							11,048
	INTEREST DURING CONSTRUCTION						0%	-
	TOTAL							**$ 11,048**

Enthalpy Economizer

N/N	DESCRIPTION OF WORK	UNIT	QTY	MATERIAL		LABOR		TOTAL
				Unit	Total	Unit	Total	
1	Controls Engineering Labor	Hr	40		$ -	$ 122	$ 4,870	$ 4,870
2					$ -		$ -	$ -
3					$ -		$ -	$ -
4					$ -		$ -	$ -
	Other Estimated Implementation Costs							2,131
	TOTAL							**$ 7,001**
	SUB-TOTAL							**4,870**
	O&P						25%	1,218
	ASBESTOS ABATEMENT					SF		-
	DIRECT COST							6,088
	PAYMENT & PERFORMANCE BOND						0%	-
	SUB-TOTAL							6,088
	CONTINGENCY						15%	913
	Engineering Fees						0%	-
	Architectural fees for Renovation						0%	-
	ASBESTOS CONTINGENCY						15%	-
	SUB-TOTAL							7,001
	ASBESTOS DESIGN & AIR MONITORING, TESTING							-
	IC FEE						0.0%	-
	SUB-TOTAL							7,001
	INTEREST DURING CONSTRUCTION						0%	-
	TOTAL							**$ 7,001**

Kitchen Upgrade

N/N	DESCRIPTION OF WORK	UNIT	QTY	MATERIAL		LABOR		TOTAL
				Unit	Total	Unit	Total	
1	Single Door Refrigerator (Energystar Rated)	Ea	1	$ 750	$ 750		$ -	$ 750
2					$ -		$ -	$ -
3					$ -		$ -	$ -
4					$ -		$ -	$ -
	Other Estimated Implementation Costs							328

	TOTAL		**$ 1,078**
	SUB-TOTAL		**750**
	O&P	25%	188
	ASBESTOS ABATEMENT	SF	-
	DIRECT COST		938
	PAYMENT & PERFORMANCE BOND	0%	-
	SUB-TOTAL		938
	CONTINGENCY	15%	141
	Engineering Fees	0%	-
	Architectural fees for Renovation	0%	-
	ASBESTOS CONTINGENCY	15%	-
	SUB-TOTAL		1,078
	ASBESTOS DESIGN & AIR MONITORING, TESTING		-
	IC FEE	0.0%	-
	SUB-TOTAL		1,078
	INTEREST DURING CONSTRUCTION	0%	-
	TOTAL		**$ 1,078**

Kitchen Upgrade (Avoided Cost)

N/N	DESCRIPTION OF WORK	UNIT	QTY	MATERIAL		LABOR		TOTAL
				Unit	Total	Unit	Total	
1	Single Door Refrigerator (Non-EnergyStar)	Ea	1	$ 700	$ 700		$ -	$ 700
2					$ -		$ -	$ -
3					$ -		$ -	$ -
4					$ -		$ -	$ -
	Other Estimated Implementation Costs							306

	TOTAL		**$ 1,006**
	SUB-TOTAL		**700**
	O&P	25%	175
	ASBESTOS ABATEMENT	SF	-
	DIRECT COST		875
	PAYMENT & PERFORMANCE BOND	0%	-
	SUB-TOTAL		875
	CONTINGENCY	15%	131
	Engineering Fees	0%	-
	Architectural fees for Renovation	0%	-
	ASBESTOS CONTINGENCY	15%	-
	SUB-TOTAL		1,006
	ASBESTOS DESIGN & AIR MONITORING, TESTING		-
	IC FEE	0.0%	-
	SUB-TOTAL		1,006
	INTEREST DURING CONSTRUCTION	0%	-
	TOTAL		**$ 1,006**

Vending Maching Power Management

N/N	DESCRIPTION OF WORK	UNIT	QTY	MATERIAL		LABOR		TOTAL
				Unit	Total	Unit	Total	
1	Vending Machine Power Management	Ea	1	$ 179	$ 179		$ -	$ 179
2					$ -		$ -	$ -
3					$ -		$ -	$ -
4					$ -		$ -	$ -
	Other Estimated Implementation Costs							37
	TOTAL							**$ 216**
	SUB-TOTAL							**179**
	O&P						15%	27
	ASBESTOS ABATEMENT					SF		-
	DIRECT COST							206
	PAYMENT & PERFORMANCE BOND						0%	-
	SUB-TOTAL							206
	CONTINGENCY						5%	10
	Engineering Fees						0%	-
	Architectural fees for Renovation						0%	-
	ASBESTOS CONTINGENCY						15%	-
	SUB-TOTAL							216
	ASBESTOS DESIGN & AIR MONITORING, TESTING							-
	IC FEE						0.0%	-
	SUB-TOTAL							216
	INTEREST DURING CONSTRUCTION						0%	-
	TOTAL							**$ 216**

Lighting Measures

N/N	DESCRIPTION OF WORK	UNIT	QTY	MATERIAL		LABOR		TOTAL
				Unit	Total	Unit	Total	
1	Lighting Measures	Ea	1	$ 28,952	$ 28,952	$ 12,064	$ 12,064	$ 41,016
2					$ -		$ -	$ -
3					$ -		$ -	$ -
4					$ -		$ -	$ -
	Other Estimated Implementation Costs							-

	TOTAL		**$ 41,016**
	SUB-TOTAL		**41,016**
	O&P	0%	-
	ASBESTOS ABATEMENT	SF	-
	DIRECT COST		41,016
	PAYMENT & PERFORMANCE BOND	0%	-
	SUB-TOTAL		41,016
	CONTINGENCY	0%	-
	Engineering Fees	0%	-
	Architectural fees for Renovation	0%	-
	ASBESTOS CONTINGENCY	0%	-
	SUB-TOTAL		41,016
	ASBESTOS DESIGN & AIR MONITORING, TESTING		-
	IC FEE	0.0%	-
	SUB-TOTAL		41,016
	INTEREST DURING CONSTRUCTION	0%	-
	TOTAL		**$ 41,016**

Controls Installation								
N/N	DESCRIPTION OF WORK	UNIT	QTY	MATERIAL		LABOR		TOTAL
				Unit	Total	Unit	Total	
1	Front End Computer with Software	Ea	1	$7,201	$7,201		$0	$7,201
	UPS	Ea	1	$155	$155		$0	$155
2	Printer	Ea	1	$997	$997		$0	$997
3	Graphics	Ea	10		$0	$539	$5,393	$5,393
4					$0		$0	$0
5	OAT	Ea	1	$422	$422		$0	$422
6	OARH	Ea	1	$422	$422		$0	$422
7					$0		$0	$0
8	AHU		4		$0		$0	$0
9	Mixed Air Temperature	Ea	4	$457	$1,827		$0	$1,827
10	Return Air temperature	Ea	4	$457	$1,827		$0	$1,827
11	Smoke Alarm	Ea	4	$431	$1,726		$0	$1,726
12	Supply Temperature	Ea	4	$457	$1,827		$0	$1,827
13	3-way HW Valve	Ea	4	$450	$1,800		$0	$1,800
14	Damper Actuator	Ea	4	$225	$900		$0	$900
15	DX Stage	Ea	4	$599	$2,394		$0	$2,394
16	Fan Speed Control	Ea	4		$0	$500	$2,000	$2,000
17	Fan Speed Feedback	Ea	4		$0	$500	$2,000	$2,000
18	Fan Start/Stop	Ea	4	$647	$2,589		$0	$2,589
19	Fan Status	Ea	4	$482	$1,929		$0	$1,929
20	Zone Heating Valve	Ea	5	$450	$2,250		$0	$2,250
21	Static Pressure Sensor	Ea	4	$575	$2,299		$0	$2,299
22					$0		$0	$0
23	Boiler		1		$0		$0	$0
24	HWS Temperature	Ea	2	$723	$1,447		$0	$1,447
25	HWR Temperature	Ea	2	$723	$1,447		$0	$1,447
26	Status	Ea	1	$482	$482		$0	$482
27	Start/Stop	Ea	1	$647	$647		$0	$647
28	Pump Status	Ea	9	$482	$4,340		$0	$4,340
29	Pump Start/Stop	Ea	9	$647	$5,825		$0	$5,825
30	3-way HW Valve	Ea	1	$600	$600		$0	$600
31					$0		$0	$0
32	Exhaust Fan		3		$0		$0	$0
33	Start/Stop	Ea	3	$647	$1,942		$0	$1,942
34	Status	Ea	3	$482	$1,447		$0	$1,447
35					$0		$0	$0
36	VAV	Ea	9	$933	$8,394		$0	$8,394
37					$0		$0	$0
38	HW Radiator Loop		9		$0		$0	$0
39	Space Sensor	Ea	9	$730	$6,567		$0	$6,567
40	Radiant System Piping modifications	Ea	9	$3,500	$31,500		$0	$31,500
41	Valve	Ea	9	$600	$5,400		$0	$5,400
42					$0		$0	$0
43	DHW Heaters		1		$0		$0	$0
44	Status	Ea	1	$482	$482		$0	$482
45	Start/Stop	Ea	1	$647	$647		$0	$647
46	Supply Temperature	Ea	1	$723	$723		$0	$723
47					$0		$0	$0
48	Programming/Commissioning				$0		$0	$0
49	Engineering Labor	Pt	124		$0	$104	$12,903	$12,903
50	Calibration Labor	Pt	124		$0	$133	$16,523	$16,523
51	Start up Labor	Pt	124		$0	$133	$16,523	$16,523
52	Balancing Labor	kSF	30		$0	$500	$15,000	$15,000
53	Communications Cabling	CLF	30		$0	$419	$12,563	$12,563
54					$0		$0	$0
55	Ethernet Router	Ea	1	$350	$350		$0	$350
56	Controllers	Ea	9	$2,258	$20,322		$0	$20,322
57					$0		$0	$0
	SUB-TOTAL							206,035
	O&P						20%	41,207
	ASBESTOS ABATEMENT							-
	DIRECT COST							247,242
	PAYMENT & PERFORMANCE BOND						0%	-
	SUB-TOTAL							247,242
	CONTINGENCY						25%	61,810
	ASBESTOS CONTINGENCY						0%	-
	SUB-TOTAL							309,052
	DISPOSAL							-
	MATERIAL HANDLING FEE						0.0%	-
	ASBESTOS DESIGN & AIR MONITORING, TESTING							-
	SUB-TOTAL							309,052
	IC FEE						3.0%	9,272
	SUB-TOTAL							318,324
	INTEREST DURING CONSTRUCTION						0%	-
	TOTAL							**$ 318,324**

REPLACE FIRETUBE OR CAST IRON BOILERS WITH HIGH EFFICIENCY MODULAR CONDENSING BOILERS

Price of #2 Fuel Oil, $/gal	$0.000
Price of City Water, $/1000 gallons	$0.000
Price of Electricity, $/kWh (blended rate)	$0.174
Price of the Demand of Electricity, $/kW/month	$0.000
Price of Natural Gas, $/therm	$1.034

	Existing Condition	Proposed System	Savings
Boiler Plant Capacity, kBTU	889,767	889,767	
Seasonal Efficiency	75%	90%	15%
Annual Gas Consumption, therms	11,864	9,886	1,977
Annual Cost and Savings, $	$12,271	$10,226	**$ 2,045**

INCREASE INSULATION ON PIPING

Price of #2 Fuel Oil, $/gal	$0.000
Price of City Water, $/1000 gallons	$0.000
Price of Electricity, $/kWh (blended rate)	$0.174
Price of the Demand of Electricity, $/kW/month	$0.000
Price of Natural Gas, $/therm	$1.034

	Existing Condition	Proposed Condition	Savings
Annual Energy Consumption (Therms)	120	26	**94**
Annual Op Cost	$124	$27	**$97**

1. Assume average HW temperature of 180 degrees.
2. Assume average ambient boiler room temperature of 72F.
3. There is no demand reduction for this measure
4. No rebates or other finanical incentives were available for this measure

IMPLEMENT A HHW SUPPLY WATER TEMPERATURE SETPOINT REST PROGRAM BASED ON OUTSIDE AIR TEMPERATURE.

Price of #2 Fuel Oil, $/gal	$0.000
Price of City Water, $/1000 gallons	$0.000
Price of Electricity, $/kWh (blended rate)	$0.174
Price of the Demand of Electricity, $/kW/month	$0.000
Price of Natural Gas, $/therm	$1.034

	Existing Condition	Proposed System	Savings
HHW Supply Setpoint at 0AT = 0 degrees, degrees F	**180**	180	
HHW Supply Setpoint at 0AT = 55 degrees, degrees F	180	**160**	
Annual kBtu losses	92,079	76,477	**15,602**
Annual Cost and Savings, $	$ 952	$ 791	**$ 161**

1 Assumes HHW distribution is primarily made up of 1" and 3/4" piping.
2. Assumes 1" cellular glass fiber insulation with AP-T casing
3 Assumes 75 degree ambient temperature

ATTIC INSULATION UPGRADE

Price of #2 Fuel Oil, $/gal	$0.000
Price of City Water, $/1000 gallons	$0.000
Price of Electricity, $/kWh (blended rate)	$0.174
Price of the Demand of Electricity, $/kW/month	$0.000
Price of Natural Gas, $/therm	$1.034

	Existing Condition	Proposed System	Savings
R-Value of Insulation	3.7	24.7	
Annual heating loss, therms	1,353	204	1,149
Annual cooling energy loss, kWh	1,620	265	1,355
Annual Natural Gas Cost and Savings, $	$ 1,399	$ 211	$ 1,189
Annual Electric Cost and Savings, $	$ 281	$ 46	$ 235
Annual Cost and Savings, $	$ 1,681	$ 257	**$ 1,424**

1. Attic has no existing insulation
2. Existing and proposed R-values are composite R-values

SAVINGS FROM PROGRAMMABLE THERMOSTATS

Price of #2 Fuel Oil, $/gal	$0.000
Price of City Water, $/1000 gallons	$0.000
Price of Electricity, $/kWh (blended rate)	$0.174
Price of the Demand of Electricity, $/kW/month	$0.000
Price of Natural Gas, $/therm	$1.034

	Existing Condition	Proposed System	Savings
Cooling Capacity, Tons	3	3	
Average Efficiency, EER	10.0	10.0	
Estimated Total Supply Fan Volume, cfm	833	833	
Estimated Total Supply Fan Power, bhp	0.33	0.33	
Occupied Run Hours	1,043	1,043	
Unoccupied Run Hours	2,131	248	
Total Hours Operation, hrs	3,174	1,291	
Annual Cooling Production, ton-hours	9,522	3,873	
Annual Cooling Load, kBTU per Unit	114,264	46,476	
Annual Fan Electrical Consumption, kWh	1,302	530	
Annual Cooling Electrical Consumption, kWh	11,426	4,648	
Total Annual Electrical Demand, kW	32	32	-
Total Annual Electrical Consumption, kWh	12,729	5,177	**7,551**
Annual Cost and Savings for All Units, $	$ 2,210	$ 899	**$ 1,311**

1. Assume existing systems run all hours when outside air temperature is above 65F.
2. Assume the proposed systems operate during occupied hours when the outside air temperature (OAT) is above 65F and during unoccupied hours when the OAT is above 80F
3. Load factor calculation represents the percentage of time when the units operate at full load during the operation schedule.
4.There is no demand reduction for this measure
5. No rebates or other financial incentives were available for this measure

SAVINGS FROM WEATHERSTRIPPING DOORS

Price of #2 Fuel Oil, $/gal	$0.000
Price of City Water, $/1000 gallons	$0.000
Price of Electricity, $/kWh (blended rate)	$0.174
Price of the Demand of Electricity, $/kW/mo	$0.000
Price of Natural Gas, $/therm	$1.034

	Existing Condition	Proposed System	Savings
Number of Doors	7	7	
Estimated Infiltration Rate per Door, CFM	385	96	
Annual Cooling Infiltration Hours, OAT > 80	281	281	
Annual Heating Infiltration Hours, OAT < 65	1,253	1,253	
Annual Cooling Load, kBTU	1,192	298	
Annual Cooling Electrical Consumption, kW	132	33	99
Annual Heating Load, kBTU	15,682	3,921	
Annual Heating Natural Gas Consumption,	209	52	157
Annual Cost and Savings, $	$ 239	$ 60	179

1. Infiltration rate was calculated according to ASHRAE Fundamentals 2005 Door Leakage Rate Equation F27.12
2. Estimated hours of infiltration was based on all hours below 65F for the region.
3. It is assumed that each door has a leakage area of 105 square inches (10 linear feet by 0.125 in). Vestibule doors are not included.
4. A 60% load factor was used when calculating the existing leakage rate.
5. The average outside air temperature below 55F is 39.9F.
6. Assume the natural gas fired heating units have an efficiency of 0.75.
7. There is no demand reduction for this measure
8. No rebates or other financial incentives were available for this measure

INSTALL DHW TIMERS

Price of #2 Fuel Oil, $/gal	$0.000
Price of City Water, $/1000 gallons	$0.000
Price of Electricity, $/kWh (blended rate)	$0.174
Price of the Demand of Electricity, $/kW/month	$0.000
Price of Natural Gas, $/therm	$1.034

	Existing Condition	Proposed System	Savings
Annual Standby Gas Consumption (Therms)	25	6	19
Annual Standby Cost and Savings, $	$ 26	$ 6	**$ 19**

1. Assume water heaters can be scheduled "on" 8 hours per day, 5 days per week.
2. Assume .468 Energy Factor of water heaters.

ENERGY STAR/ CEE TIER I - REFRIGERATOR/FREEZER UPGRADE

Price of #2 Fuel Oil, $/gal	$0.000
Price of City Water, $/1000 gallons	$0.000
Price of Electricity, $/kWh (blended rate)	$0.174
Price of the Demand of Electricity, $/kW/month	$0.000
Price of Natural Gas, $/therm	$1.034

	Existing Condition	Proposed System	Savings
Single Door Refrigerator (24 cu ft) Total Annual Energy Consumption (kW	1,606	1,132	**475**
Quantity	1	1	
Annual Peak Demand Reduction (kW)	0.1	0.1	0.04
Total Annual Energy Savings (kWh)	1,606	1,132	**475**
Annual Cost and Savings ($)	$ 279	$ 196	**$ 80**

1. This energy savings calculator was developed by the U.S. EPA and U.S. DOE and is provided for estimating purposes only. Actual energy savings may vary based on use and other factors.

2. No rebates or other financial incentives were available for this measure

VENDING MACHINE POWER MANAGEMENT SYSTEM

Price of #2 Fuel Oil, $/gal	$0.000
Price of City Water, $/1000 gallons	$0.000
Price of Electricity, $/kWh (blended rate)	$0.174
Price of the Demand of Electricity, $/kW/month	$0.000
Price of Natural Gas, $/therm	$1.034

	Existing Condition	Proposed System	Savings
Soda Machine Power Consumption	100%	56%	
Run Hours	8,760	8,760	
Annual Energy Consumption (kWh)	2,628	1,156	**1,472**
Annual Cost and Savings, $	$ 456	$ 201	**$ 256**

1. Run hours based on fan motors being run 8760 hrs

2. Sample Calculations Below

Vending Machine Count	1
Annual Run-Time Factor	75%
VendMiser Installation Savings	0
Annual Savings %	56%
Annual Energy Savings	$256

3. No rebates or other finanical incentives were available for this measure

Wind analysis - Union Township

Prepared by Dome-Tech, Inc.

Wind Analysis - Union Township

Performed By Dome-Tech Energy Advisors

Note: Only input to cells filled YELLOW

INPUTS	
Building Name	Union Township
Address	1976 Morris Avenue, Union NJ
Annual Electric Use, kW	258,240
Electric Cost, $/kWh	$ 0.174

Latitude	40.41
Longitude	-74.160

Longitude & Latitude Finder: iTouchMap.com
http://itouchmap.com/latlong.html

NASA Surface meteorology and Solar Energy: Data Subset
http://eosweb.larc.nasa.gov/cgi-bin/sse/subset.cgi?email=k_mccarthy@dome-tec

Log In: k_mccarthy@dome-tech.com
Password: dometech

Monthly Averaged Wind Speed At 10 m Above The Surface Of The Earth For Terrain Similar To Airports (m/s)

Latitude	Longitude	January	February	March	April	May	June	July	August	September	October	November	December	AVERAGE
40.41	-74.16	5.14	5.19	5.28	5.03	4.42	4.09	3.74	3.66	3.88	4.26	4.87	5.1	4.56

Monthly Averaged Wind Speed At 50 m Above The Surface Of The Earth (m/s)

Latitude	Longitude	January	February	March	April	May	June	July	August	September	October	November	December	AVERAGE
40.41	-74.32	6.51	6.57	6.68	6.37	5.59	5.18	4.73	4.63	4.91	5.39	6.17	6.45	5.77

WIND DIRECTION ANALYSIS

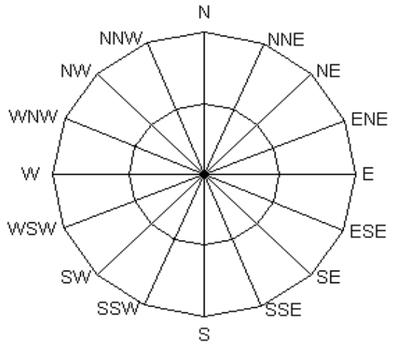
Monthly Averaged Wind Direction At 50 m Above The Surface Of The Earth (degrees)

Latitude	Longitude	January	February	March	April	May	June	July	August	September	October	November	December	AVERAGE
40.41	-74.32	297	301	301	298	296	292	289	287	288	289	288	289	292.92

Wind Direction and Degrees

Degree Direction		Cardinal
Min Deg	Max Deg	Direction
0	11.25	N
11.25	33.75	NNE
33.75	56.25	NE
56.25	78.75	ENE
78.75	101.25	E
101.25	123.75	ESE
123.75	146.25	SE
146.25	168.75	SSE
168.75	191.25	S
191.25	213.75	SSW
213.75	236.25	SW
236.25	258.75	WSW
258.75	281.25	W
281.25	303.75	WNW
303.75	326.25	NW
326.25	348.75	NNW
348.75	360	N

Average	Direction	General
292.92	WNW	WEST



Wind Direction and Degrees

Degree Direction		General
Min Deg	Max Deg	Direction
0	45	NORTH
45	135	SOUTH
135	225	EAST
225	315	WEST
315	360	NORTH

Wind analysis - Union Township

Prepared by Dome-Tech, Inc.

DESIGN CALCULATIONS			
Equipment	*Micro - 1kW*	*Traditional - 2.5 kW*	*Traditional - 50 kW*
Prevailing Wind Direction	WEST (Specifically WNW)		
Building's WEST Roof Perimeter's Available Length, Ft	329 Ft		
Ground Area Available (Row WIDTH), Ft	120 Ft		
Ground Area Available (Column DEPTH), Ft	140 Ft		
Ground Area Available, SqFt	16800		
Min. Distance Between Units (Roof), Ft	25 Ft	-	-
Min. Dist. Between Units (Ground), Rotor Dia.'s	-	3	
Min. Dist. Between Rows (Ground), Rotor Dia's	-	10	
Typical Rotor Diameter, Ft	6 Ft	16 Ft	50 Ft
Max. # of Units Possible per Row (Ground)	-	3	1
Max. # of Rows Possible (Ground)	-	1	1
Max. # of Units Possible (Roof)	14	-	-
Max Number of Units Possible	**14**	**3**	**1**
Target Minumum % of Energy Use	-	5%	
# Units Required to Reach Target	-	**3**	**1**
# Units to Install	14	3	1

ENERGY CALCULATIONS			
Equipment	*Micro - 1kW*	*Traditional - 2.5 kW*	*Traditional - 50 kW*
Average Wind Speed, (m/s)	4.56	4.56	5.77
Annual Electric Use, kWh	258,240 kWh		
Electric Cost	$0.17 / kWh		
Number of Units	14	3	1
kW Capacity, per Unit	1 kW	5.2 kW	50 kW
kW Capacity, Total	14 kW	16 kW	50 kW
Annual Production Per Unit	742 kWh	5,857 kWh	109,658 kWh
Annual Production Total	10,390 kWh	17,570 kWh	109,658 kWh
Annual Savings	$1,803	$3,049	$19,027
Installed Cost per Unit	$6,500	-	-
Installed Cost per kW	-	$6,000	$5,000
Gross Installed Cost	$91,000	$93,600	$250,000
Net Installed Cost	$91,000	$93,600	$250,000
Simple PayBack, Years	50.5	30.7	13.1
% of Total Energy Use*	4.0%	6.8%	42.5%

*Union Township: 258240 kWh/Year.

OTHER CONCERNS			
Approximate Sound Levels, dB	65	72	99
Maximum Permissable Outdoor Levels - Commercial	65 dB		
Local Noise Ordinance Compliant?, Y / N	Y		
Local Zoning Restrictions	Chapter 585		
Union Township Zoning Code	No person shall cause, suffer, allow, or permit the operation of any source of sound on any source property listed in § 585-2A above in such a manner as to create a sound level that equals or exceeds the sound levels listed below. (Shown as 65dB for Outdoors)		

Wind analysis - Union Township

Prepared by Dome-Tech, Inc.

Wind Turbine Economics: Union Township

	Building Integrated - 1 kW	Ground Mount - 5.2 kW	Ground Mount - 50 kW
Number of Units	14	3	1
Gross Installation Cost Estimate	$91,000	$93,600	$250,000
Net Installation Cost Estimate	$91,000	$93,600	$250,000
Annual Energy Savings	1,803	3,049	19,027
Simple Payback with rebate**	50	31	13
Simple Payback without rebate**	50	31	13
System Capacity	14	16	50
Annual Avoided Energy Use	10,390	17,570	109,658
Annual Avoided CO2 Emmisions, Tons	4	6	38
% of Annual Electric Use*	4.0%	6.8%	42.5%

*Union Township: 258240 kWh/Year.