Energy Audit

Prepared For:
City of Cape May

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Prepared By:
Dome – Tech, Inc.

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

September 2011 **FINAL**











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Energy Audit Purpose & Scope

Purpose:

- The objectives of the energy audit are to evaluate each 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: April 2010 – April 2011

Buildings	Electric - ACE				Natural Gas - SJG			
	Account Number	Annual Consumption kWh	Annual Cost	$ / kWh	Account Number	Annual Consumption CCF	Annual Cost	$ / CCF
Cape May City Hall	0385 1679 9996	266,367	$51,768.61	$0.194	41855129015	4,527	$10,723.16	$2.369
Franklin Street School	0385 2119 9992	10,898	$2,155.44	$0.198	41855095018	3,676	$8,601.57	$2.340
Welcome / Transportation	0343 9849 9979	32,218	$6,055.59	$0.188	41953448408	1,495	$3,724.63	$2.491
Water Works Building	0386 2979 9982	1,537,000	$295,147.83	$0.192	41652031000	3,255	$7,777.49	$2.389
Fire House	0385 1729 9996	116,720	$24,537.01	$0.210	41855127019	3,874	$9,252.81	$2.388
Public Works Complex	0343 9069 9915	23,203	$4,371.53	$0.188	41652005509	6,809	$11,168.80	$1.640
Physick Estate	0385 5629 9998	74,217	$11,929.91	$0.161	41854843103	3,291	$7,873.84	$2.393
Carriage House	0385 5629 9972	57,675	$9,337.04	$0.162	41854366022	2,055	$3,539.64	$1.722
Hill House	0385 5629 9980	18,672	$3,122.90	$0.167	41854481003	1,276	$2,306.01	$1.807
Library	1245 3099 9992	55,166	$10,294.06	$0.187	41952000317	2,698	$6,551.85	$2.428
Nature Center 1 *	1108 5259 9999	10,297	$2,309.70	$0.224	*NA*			
Nature Center 2 *	1108 5259 9890	4,257	$934.48	$0.220	41854825209	714	$1,917.43	$2.685
Cape May City Elementary *	0385 4449 9999	353,640	$65,263.00	$0.185	41852085012	31,600	$50,589.40	$1.601
	TOTAL	**2,560,330**	**$487,227.10**	**$0.190**	**TOTAL**	**65,270**	**$124,026.65**	**$1.900**

** Missing Electrical supplier costs for the accounts, assumption of $0.139 from the highest monthly amount charged per KWH by Glacial Electric at other facilities.*

Please see Appendix for full utility data and consumption profiles for all buildings.

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.

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)	Average Source EUI by Building Type *
Cape May City Hall	22,479	61	*NA*	61.3	157.2	
Franklin Street School	10,676	*NA*	*NA*	35.9	45.6	*136-Recreation*
Welcome / Transportation Center	2,000	*NA*	*NA*	131.1	265.2	*150 - Service*
Water Works Building	3,420	*NA*	*NA*	1634.8	5235.5	*213 - Other*
Fire House	2,000	*NA*	*NA*	398.9	234.4	*157 - Fire*
Public Works Complex	6,840	*NA*	*NA*	113.0	144.8	*213 - Other*
Physick Estate	6,632	20	*NA*	88.6	180.8	
Carriage House	3,783	*NA*	*NA*	108.1	234.4	*265-Entertain*
Hill House	1,296	*NA*	*NA*	151.0	273.8	*265-Entertain*
Library	4,164	*NA*	*NA*	111.7	221.3	*246 - Library*
Nature Center 1	1,296	*NA*	*NA*	26.4	88.1	*136-Recreation*
Nature Center 2	1,876	*NA*	*NA*	46.3	66.7	*136-Recreation*
Cape May City Elementary School	43,560	36	*NA*	101.5	169.8	

* Note for Average Source EUI: This data comes from the 2003 CBECS National Average Source and Site Energy Use and Performance Comparisions by Building Type. This is Average EUI is used only w here Portfolio Manager does not have the buidling category list

Historic Energy Consumption (continued)

Portfolio Manager Sign - In

- An account has been created for the City of Cape May 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 city'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: Cape May City Elementary School

Address:	921 Lafayette Street Cape May, NJ 08204
Gross Floor Area:	43,560 s.f.
Year Built:	1965 with major renovation in 2003
# Occupants:	140 students; 80 staff
Usage:	The building is an elementary school serving grades PreK through grade 6. The building is operated Mon-Fri from 6:30 am until 9:30 pm; closed weekends and holidays.

Construction Features:

Facade:	One story, brick/block concrete, in good condition
Roof Type:	Flat, black, concrete deck, built-up, rubber roof, in good condition
Windows:	Covering approximately 20% of façade, metal frame, dual pane, operable, in good condition
Exterior Doors:	Approximately 30+ metal frame, fiberglass, in good condition

Facility Information

Major Mechanical Systems

Air Handlers / AC Systems / Ventilation Systems

The elementary school gym has three (3) packaged rooftop units that are equipped with direct expansion (Dx) cooling. The perimeter spaces are served by unit ventilators (UV) , fan coil units (FCU) and unit heaters (UH) and are equipped with hot water heating coils. Offices and classrooms are served by twenty-seven (27) split AC units. Approximately 20 exhaust fans serve areas various areas including mechanical/boiler rooms, toilets, and offices.

Boilers

Two (2) Aerco Benchmark modular condensing, natural gas fired hot water boilers with 2,000 MBH capacity each. These boilers operate in a lead lag sequence. The boilers are served by two (2) 3-HP heating hot water pumps that operate in a lead lag sequence and supply hot water to the school.

Domestic Hot Water

Domestic hot water is supplied by from a hot water storage tank which is fed by the Aerco boilers via a heat exchanger. The kitchen is served by one (1) Ruud, natural gas fired hot water heater.

Controls

The buildings' heating and cooling equipment is controlled by a Building Management System (BMS) .

Facility Information

Building Name: Physick Estate

Address:	1048 Washington Street Cape May, NJ 08204
Gross Floor Area:	6,632 s.f.
Year Built:	1879
# Occupants:	25
Usage:	The building is a museum, open 7 days per week from 9-5 for tours. It is a historic landmark.

Construction Features:

Facade:	Three story Victorian home, wood, siding, in good condition
Roof Type:	Pitched, red, cedar and copper tile, built up, wood deck, in good condition
Windows:	Covering approximately 10% of façade, wood frame, single pane, double hung, blinds, in good condition
Exterior Doors:	Approximately 6, wood frame, in fair condition

Facility Information

Major Mechanical Systems

Air Handlers / AC Systems / Ventilation Systems

The Physick Estate is served by five (5) split AC units, which serve offices.

Boilers

One (1) Trane, natural gas fired furnace with a capacity of 113 MBH.

Domestic Hot Water

One (1) Rheem electric domestic hot water heater with a storage capacity of 2.5 gallons serves the bathroom.

Controls

The buildings' heating and cooling equipment is controlled by manual thermostats.

Facility Information

Building Name: Carriage House

Address:	1048 Washington Street Cape May, NJ 08204
Gross Floor Area:	3,783 s.f.
Year Built:	1876
# Occupants:	5 staff members
Usage:	The building is a tea room and café, located on the grounds of the Physick Estate, offering food, a gift shop, and tours. It is operated 9-5 weekdays and weekends.

Construction Features:

Facade:	Two story, wood siding, in good condition.
Roof Type:	Pitched, red, wood deck, built up, in good condition
Windows:	Covering approximately 10% of façade, wood frame, single pane, double hung, in fair condition (due to age)
Exterior Doors:	Approximately 2, wood frame, in fair condition (due to age)

Facility Information

Major Mechanical Systems

Air Handlers / AC Systems / Ventilation Systems

The Carriage House is served by three (3) split AC units, which serve offices and common areas. There is one (1) 10 ton packaged rooftop unit equipped with DX cooling coil and an indirect fired natural gas heater.

Boilers

One (1) Crown cast iron natural gas fired hot water boiler with a capacity of 280 MBH.

Domestic Hot Water

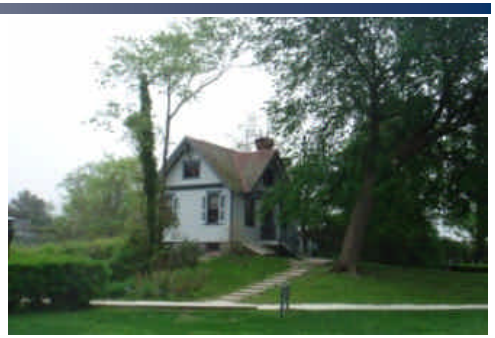
One (1) Bradford White natural gas fired domestic hot water heater with a storage capacity of 40 gallons.

Controls

The buildings' heating and cooling equipment is controlled by manual thermostats.

Facility Information

Building Name: Hill House



Address:	1049 Washington Street Cape May, NJ 08204
Gross Floor Area:	1,296 s.f.
Year Built:	Late 1800's
# Occupants:	5
Usage:	The building houses offices. It is located on the Physick Estate property. It is operated from 9-5 weekdays and weekends.

Construction Features:

Facade:	Two story, wood siding, in good condition
Roof Type:	Pitched, red, wood cedar shingles, built up, in good condition
Windows:	Covering approximately 10% of façade, wood frame, single pane, double hung, blinds, in fair condition (due to age)
Exterior Doors:	One door, wood frame, in good condition

Facility Information

Major Mechanical Systems

Air Handlers / AC Systems / Ventilation Systems

The Hill House is served by two (2) split AC units, which serve offices and common areas. Various other offices are cooled by window AC units.

Boilers

One (1) Weil McLain cast iron natural gas fired hot water boiler.

Controls

The building's heating and cooling equipment is controlled by programmable and manual thermostats.

Facility Information

- **Building Name:** **City Hall**

Address:	643 Washington Street Cape May, NJ 08204
Gross Floor Area:	22,479 s.f.
Year Built:	1917
# Occupants:	Approximately 50; police officers and administrative personnel
Usage:	The building houses the police station and municipal offices. It is operated M-F from 8:30 am until 4:30 pm; closed weekends (occasionally open for community events)

- **Construction Features:**

Facade:	Three story, brick, in fair condition (paint is fading, brick is in bad condition)
Roof Type:	Flat, gray, wood deck, built up (unable to assess condition)
Windows:	Covering approximately 20%, wood frame, dual pane, double hung, in fair condition (age)
Exterior Doors:	Approximately 8, wood/metal frame, in fair condition (age)

Facility Information

Major Mechanical Systems

Air Handlers / AC Systems / Ventilation Systems

City Hall is served by sixteen (16) split AC units, which serve offices and common areas. Two (2) window AC units also serve two offices.

Boilers

One (1) Weil McLain cast iron sectional, natural gas fired steam boiler with a capacity of 2904 MBH.

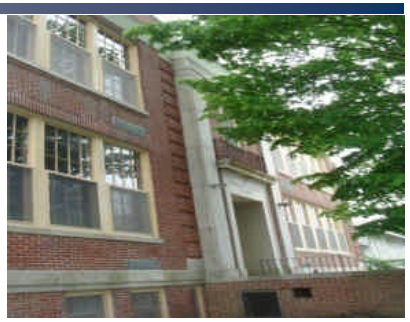
Domestic Hot Water

One (1) American Water natural gas fired, domestic hot water heater with a 70 gallon storage capacity.

Controls

The building's heating and cooling equipment is controlled by manual thermostats.

Facility Information



➢ Building Name: Franklin Street School

Address:	700 Franklin Street Cape May, NJ 08204
Gross Floor Area:	10,676 s.f.
Year Built:	1927
# Occupants:	Unoccupied, except for the recreation center
Usage:	The building is used as a community cultural center. It is operated from 9 am until 12 pm M-F.

➢ Construction Features:

Facade:	Two story, brick, in fair condition (brick is in poor condition; re-pointing needed)
Roof Type:	Flat, gray, built up (unable to assess condition)
Windows:	Covering approximately 20% of façade, wood frame, single pane, double hung, in fair condition
Exterior Doors:	Approximately 5, wood frame, in fair condition

Facility Information

Major Mechanical Systems

Air Handlers / AC Systems / Ventilation Systems

The Franklin Street School is served by two (2) 8.5 ton packaged rooftop units equipped with DX cooling coils. Several natural gas fired unit heaters serve the gym.

Boilers

One (1) Weil-McLain cast iron sectional, natural gas fired steam boiler with a capacity of 1,035 MBH.

Controls

The building's heating and cooling equipment is controlled by manual thermostats.

Facility Information

Building Name: Fire House

Address:	712 Franklin Street Cape May, NJ 08204
Gross Floor Area:	2,000 s.f.
Year Built:	1960's
# Occupants:	10
Usage:	The building is a fire house. It is operated 24/7.

Construction Features:

Facade:	Two story, brick with aluminum façade, in good condition
Roof Type:	Pitched, gray, metal deck, built up, in good condition
Windows:	Covering approximately 10% of façade, metal frame, operable, in good condition
Exterior Doors:	Approximately 4, metal frame, and seven garage bay doors, in good condition

Facility Information

Major Mechanical Systems

Air Handlers / AC Systems / Ventilation Systems

Four (4) split AC units serve various rooms and offices. One (1) window AC unit serves an office. Two (2) exhaust fans serve various areas including mechanical/boiler rooms, toilets, and offices.

Boilers

One (1) HB Smith cast iron sectional, natural gas fired hot water boiler with a capacity of 426 MBH. The boilers are served by two pumps, which distribute hot water to the building.

Domestic Hot Water

One (1) Ruud natural gas fired domestic hot water heater has a 70 gallon storage capacity and is rated for 40 kBtuh.

Controls

The building's heating and cooling equipment is controlled by a manual thermostat.

Facility Information

Building Name: Library

Address:	110 Ocean Street Cape May, NJ 08204
Gross Floor Area:	4,164 s.f.
Year Built:	1920's
# Occupants:	Seasonal variations from 100-200 people per day
Usage:	The building is a public library that is open MWF from 9 am until 5 pm, T/TH from 9 am until 8 pm, and Saturdays from 9 am until 4 pm; closed Sundays and holidays

Construction Features:

Facade:	One story, concrete block and stucco, in good condition
Roof Type:	Pitched, blue, wood deck, in good condition
Windows:	Covering approximately 20% of façade, wood frame, double hung, in good condition
Exterior Doors:	Approximately 3, wood frame, in good condition

Facility Information

Major Mechanical Systems

Air Handlers / AC Systems / Ventilation Systems

The Library has two (2) split AC units, which serve the offices.

Boilers

One (1) Weil McLain cast iron sectional, natural gas fired hot water boiler with a capacity of 427 MBH.

Domestic Hot Water

One (1) Ruud natural gas fired domestic hot water heater has a 70 gallon storage capacity and is rated for 40 kbtuh.

Controls

The building's heating and cooling equipment is controlled by a manual thermostat.

Facility Information

Building Name: Water Works Building

Address:	Park Boulevard & Canning House Lane Cape May, NJ 08204
Gross Floor Area:	3,420 s.f.
Year Built:	1926
# Occupants:	1
Usage:	The building is a municipal water supply building that houses a solar array.

Construction Features:

Facade:	Two story, brick, in good condition
Roof Type:	Flat, black, wood deck, built up, (unable to assess condition)
Windows:	Covering approximately 50% of façade, wood frame, dual pane, fixed, in good condition
Exterior Doors:	Approximately 2, metal frame plus 2 fiberglass garage bay doors

Facility Information

Major Mechanical Systems

Air Handlers / AC Systems / Ventilation Systems

The Water Works Building has two (2) Reznor natural gas fired unit heaters, which serve the entire building.

Pumps

Fifteen (15) process pumps that are associated with the RO Filtration System and CO2 System.

Controls

The building's unit heaters are by manual thermostats.

Facility Information

- **Building Name:** **Public Works Building**

Address:	Park Blvd & Canning House Lane Cape May, NJ 08204
Gross Floor Area:	6,840 s.f.
Year Built:	1970's
# Occupants:	
Usage:	Public Works facility

- **Construction Features:**

Facade:	One story, aluminum façade, in good condition
Roof Type:	Pitched, yellow, metal deck, built up, in good condition
Windows:	Covering approximately 10% of façade, metal frame, dual pane, operable, in good condition
Exterior Doors:	Approximately 2, metal frame, plus 6 garage bay doors, in good condition

Facility Information

Major Mechanical Systems

Air Handlers / AC Systems / Ventilation Systems

The Public Works Building has four (4) split AC units, which serve various rooms and offices. Two (2) window AC units condition two offices. Two (2) Reznor unit heaters and seven (7) infrared unit heaters serve the garage spaces.

Boilers

One (1) Heil natural gas fired furnace with a capacity of 150 MBH.

Controls

The building's heating and cooling equipment is controlled by manual thermostats.

Facility Information

Building Name: Welcome / Transportation Center

Address:	609 Lafayette Street Cape May, NJ 08204
Gross Floor Area:	2,000 s.f.
Year Built:	2001 with major renovation in 2005
# Occupants:	2, transient others
Usage:	The building is a welcome center and transportation center that is operated 7 days a week from 9-5 (summer) and 10-4 (winter)

Construction Features:

Facade:	Two story, wood, in good condition
Roof Type:	Pitched, red, wood deck, asphalt/aluminum, built up, in good condition
Windows:	Covering 10% of façade, wood frame, dual pane, double hung, blinds, in good condition
Exterior Doors:	Approximately 3, in good condition

Facility Information

Major Mechanical Systems

Air Handlers / AC Systems / Ventilation Systems

The Welcome Transportation Center has three (3) split AC units.

Boilers

One (1) Heil natural gas fired furnace with a capacity of 100 MBH.

Domestic Hot Water

One (1) Rheem natural gas fired domestic hot water heater with a 40 gallon storage capacity and is rated for 34 kBtuh.

Controls

The building's heating and cooling equipment is controlled by a manual thermostat.

Facility Information

- **Building Name:** **Nature Center 1**

Address:	1610 Delaware Avenue Cape May, NJ 08204
Gross Floor Area:	1,296 s.f.
Year Built:	1990's
# Occupants:	unoccupied
Usage:	The building is used occasionally for educational purposes

- **Construction Features:**

Facade:	One story, wood, in good condition
Roof Type:	Pitched, gray, wood deck, asphalt, built up, in good condition
Windows:	Covering 10% of façade, dual pane windows, in good condition
Exterior Doors:	Approximately 3, wood, in good condition

Facility Information

Major Mechanical Systems

Heating

Electric Baseboard Heat

Domestic Hot Water

One (1) State Select electric domestic hot water heater with a 40 gallon storage capacity and is rated for 5.5 kW.

Controls

The building's heating equipment is controlled by manual thermostats.

Facility Information

Building Name: Nature Center 2

Address:	643 Washington Street Cape May, NJ 08204
Gross Floor Area:	1,876 s.f.
Year Built:	2005
# Occupants:	Peaks at 100/day
Usage:	Nature Center, operated Tues – Saturday 10 am – 3 pm; and in the summer everyday from 9 am until 4 pm

Construction Features:

Facade:	Two story, vinyl siding, in good condition
Roof Type:	Pitched, gray, wood deck, asphalt shingles, built up, in good condition
Windows:	Covering 20% of façade, wood frame, dual pane, operable, in good condition
Exterior Doors:	Approximately 2, wood frame, in good condition

Facility Information

Major Mechanical Systems

Air Handlers / AC Systems / Ventilation Systems

The Nature Center 2 has four (4) split AC units.

Boilers

Two (2) natural gas fired furnaces (Bryan and Arco-Aire).

Domestic Hot Water

One (1) Bradford Whilte natural gas fired domestic hot water heater with a 40 gallon storage capacity and is rated for 40 kBtuh.

Controls

The building's heating and cooling equipment is controlled by manual thermostats.

Greenhouse Gas Emission Reduction

Implementation of all identified ECMs will yield:

- 393,970 kilowatt-hours of annual avoided electric usage.
- 15,490 therms of annual avoided natural gas usage.
- This equates to the following ***annual*** reductions:

- 221 tons of CO_2;

  -OR-

- 38 Cars removed from road;

  -OR-

- 60 Acres of trees planted annually

The Energy Information Administration (EIA) estimates that power plants in the state of New Jersey emit s 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.

Energy Conservation Measure (ECM) #1: Destratification Fans

Franklin Street School	
Estimated Annual Savings:	$2,360
Gross Estimated Implementation Cost:	$1,450
NJ Smart Start Rebate:	$0
Net Estimated Implementation Cost:	$1,450
Simple Payback (years):	0.6
Annual Avoided CO_2 Emissions (tons):	6

- Due to a high ceiling in the Franklin Street School, thermal stratification is occurring. A 4°F temperature difference exists between the floor and the ceiling. The heat is rising and is being trapped near the ceiling.
- While the heat remains in the ceiling space, the thermostat is at eye-level. Under this scenario, the heating system cycles more frequently than it should.
- Destratification fans would gently re-distribute the heat at the ceiling back down to the floor.

ECM #2: Programmable Thermostats

- A review of the maintenance building showed that the rooftop units were controlled by non-programmable thermostats.
- Dome-Tech recommends replacing the non-programmable thermostats with programmable thermostats and implementing temperature setback.
- Installing programmable thermostats will provide scheduled temperature control to prevent overheating and unnecessary cooling when the building is unoccupied.

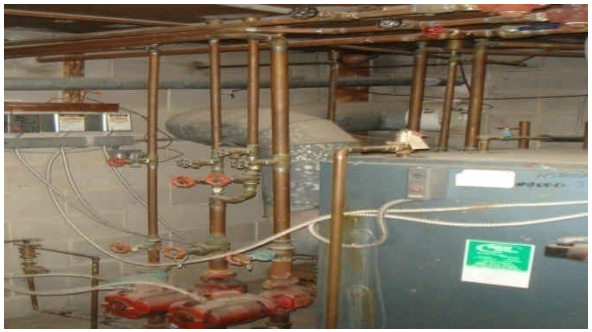
ECM #2: Programmable Thermostats (continued)

	Elementary School	Franklin St School	Carriage House	City Hall	Physick Estate	Hill House	Nature Center #2	Public Works Building	Welcome / Trans Ctr.	TOTAL
Estimated Annual Savings:	$675	$4450	$1890	$6290	$3130	$1040	$3070	$3070	$2420	**$26,035**
Gross Estimated Implementation Cost:	$800	$270	$530	$2130	$670	$270	$530	$530	$400	**$6,130**
NJ Smart Start Rebate:	$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
Net Estimated Implementation Cost:	$800	$270	$530	$2130	$670	$270	$530	$530	$400	**$6,130**
Simple Payback (years):	1.2	0.1	0.3	0.3	0.2	0.3	0.2	0.2	0.2	**0.2**
Annual Avoided CO_2 Emissions (tons):	1	9	5	41	7	3	5	7	5	**83**

ECM #3: Install / Upgrade Pipe Insulation

Fire House	
Estimated Annual Savings:	**$130**
Gross Estimated Implementation Cost:	**$50**
NJ Smart Start Rebate:	**$0**
Net Estimated Implementation Cost:	**$50**
Simple Payback (years):	**0.4**
Annual Avoided CO_2 Emissions (tons):	**0**

- Bare hot water piping was found in the Firehouse.
- Bare piping should be insulated to reduce heat loss due to convection and radiation.



Picture: Firehouse un-insulated pipes

ECM #4: Vending Machine Power Management

	Carriage House	Elementary School	Public Works Building	Welcome/ Trans. Ctr.	Fire House	TOTAL
Estimated Annual Savings:	$190	$220	$440	$440	$250	**$1,540**
Gross Estimated Implementation Cost:	$180	$180	$360	$360	$180	**$1,260**
NJ Smart Start Rebate:	$0	$0	$0	$0	$0	**$0**
Net Estimated Implementation Cost:	$180	$180	$360	$360	$180	**$1,260**
Simple Payback (years):	0.9	0.8	0.8	0.8	0.7	**0.8**
Annual Avoided CO_2 Emissions (tons):	0	0	1	1	0	**2**

- Dome-Tech recommends installing a vending machine power management device on all vending machines.
- The device uses a passive infrared sensor to power down the machine when the area surrounding it is vacant. 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 #5: Computer Power Management System

	Elementary School	Library	TOTAL
Estimated Annual Savings:	$545	$215	**$760**
Gross Estimated Implementation Cost:	$575	$225	**$800**
NJ Smart Start Rebate:	$0	$0	**$0**
Net Estimated Implementation Cost:	$575	$225	**$800**
Simple Payback (years):	1.1	1.0	**1.1**
Annual Avoided CO_2 Emissions (tons):	1	0	**0**

- According to staff, the majority of the City's computers in the Elementary School and Library are left on continuously, wasting unnecessary energy.
- Installing a computer power management system will allow IT administrators to reduce per-PC operating cost by reducing energy consumption via shutdown, standby and hibernate for PC's and sleep for monitors.
- Additionally, the software has the capability to set up profiles to optimize time of day schedules as well as enhance network security and improve the success rate of network maintenance task by ensuring that PC's are accessible when IT needs them to be.
- The capability of having an on-demand network-wide shutdown protects against virus outbreak or an imminent power outage. Similarly, shutting down unattended PCs (whether logged onto or not) after operating hours can help protect against unauthorized access to the PCs' data or to network resources.
- Approximate average annual electric consumption of computer components:
  - PC Only: 120 kWh @ $0.15 per kWh = $18 per year
  - Monitor Only: 120 – 150 kWh @ $0.15 per kWh = $ 18 – 23 per year
  - Combined PC and Monitor: 200 kWh @ $0.15 per kWh = $30 per year

ECM #6: Pool Pump VFD

Elementary School	
Estimated Annual Energy Savings:	$3,910
Gross Estimated Implementation Cost:	$8,960
NJ Smart Start Rebate:	$830
Net Estimated Implementation Cost:	$8,130
Simple Payback (years):	2.1
Annual Avoided CO_2 Emissions (tons):	7

- The indoor pool has a circulation pump that is sized for 5.05 hours per turnover, which exceeds the NJ State Sanitary Code of 8 hours per turnover or less.

- The pool pump operates at constant speed, 24 hours per day, 365 days per year. Open hours for the pool are approximately: Mon-Fri 7 A.M. - 4:00 P.M.; Hours also vary throughout the year, depending on the school and city's needs.

- By installing a VFD on the pool pump, facilities staff can reduce the pump speed during unoccupied hours to the minimum flow rate required to meet the state sanitary code requirements. The existing flow rate can be maintained during occupied hours.

ECM #7: Lighting Upgrade

- Although most of the current light fixtures have higher efficiency T-8 fluorescent lamps and ballasts, the 32-watt lamps can be replaced with 28-watt lamps while maintaining the required lighting output as per state codes.

- The Franklin Street School's multi-purpose room has old T-12 fluorescent lighting technology which should be retrofitted with High Output T-8 fluorescent fixtures. And, the Elementary School's gymnasium has high intensity discharge (HID) lighting that should also be replaced with high output T-8 fluorescent fixtures.

- Furthermore, many areas such as rest rooms and storage closets were observed to have lights on regardless of occupancy. Installing occupancy sensors in these areas will automatically turn lights on/off according to actual occupancy by sensing the presence of people in the room. Occupancy sensors will typically reduce lighting energy costs by approximately 30%*.

*Source: Turner, Wayne, Energy Management Handbook, 1999.

ECM #7: Lighting Upgrade (Continued)

	Elementary School	Franklin St School	Fire House	Physick Estate	Carriage House	Hill House	Library	Nature Center #1	Nature Center #2	Waterworks Building	Welcome / Trans Ctr.	TOTAL
Estimated Annual Savings:	$8,550	$180	$6,660	$2,090	$2,340	$50	$710	$1,070	$270	$310	$860	**$23,090**
Gross Estimated Implementation Cost:	$29,630	$3,615	$13,170	$6,090	$3,690	$355	$2,310	$1,570	$710	$2,350	$2,450	**$65,940**
NJ Smart Start Rebate:	$3,400	$320	$2,640	$700	$300	$40	$0	$170	$70	$290	$530	**$8,460**
Net Estimated Implementation Cost:	$26,230	$3,295	$10,530	$5,390	$3,390	$315	$2,310	$1,400	$640	$2,060	$1,920	**$57,480**
Simple Payback (years):	3.1	18.3	1.6	2.6	1.4	6.3	3.3	1.3	2.4	6.6	2.2	**2.5**
Annual Avoided CO_2 Emissions (tons):	15	0	10	4	5	0	1	2	0	1	2	**40**

ECM #8: Rooftop Unit (RTU) Replacement

Elementary School	
Estimated Annual Savings:	**$1,400**
Gross Estimated Implementation Cost:	**$98,940**
NJ Smart Start Rebate:	**$2,370**
Avoided Cost (Like and Kind Replacement): *	**$92,940**
Net Estimated Implementation Cost:	**$3,630**
Simple Payback (years): *(Incremental and without Avoided Costs)*	**2.6 (69.0)**
Annual Avoided CO_2 Emissions (tons):	**2**

Elementary School Rooftop Unit

**Energy Efficiency Ratios: EER is the rating of cooling output (Btu) divided by the electrical energy input (watts). The higher the EER, the more efficient the unit.*

- The Elementary School has rooftop units (RTUs) that are approximately 11 years old and nearing the estimated equipment service life (EESL) per ASHRAE standards. (The EESL for package rooftop units is 15 years.)
- Replacing these RTU's with new, higher efficiency units will significantly reduce annual energy and maintenance costs.
- New Jersey SmartStart offers rebates that usually pay for the incremental cost to upgrade to higher efficient units.

*Savings do not include maintenance savings.

* Note: Avoided Cost = Cost of Like and Kind replacement. Payback is based on incremental cost.

Energy Efficiency Ratios*

Unit Capacity (tons)	Standard	Proposed
5	13	14.3
10	10.1	12.3

ECM #9: Replace Boilers with Modulating Condensing Boilers

- The Firehouse and Library boilers are 36 yrs old and 20 yrs old, respectively.
- The Firehouse boiler exceeds the estimated equipment service life per ASHRAE standards and the Library boiler is nearing the end of the equipment service life (ASHRAE states the service life of similar equipment is 25 years).
- The age and type of existing boilers do not lend themselves to efficient operation. Generally, as boilers approach the end of their service life, the efficiency degrades and the boiler consumes more fuel in order to produce the same rated output. In addition, there is a direct correlation between risk of equipment failure (shell cracks and furnace surface area failure) and equipment age.
- If the existing boilers are replaced by high efficiency, modulating condensing boilers, savings will be realized in two ways:
  - Modulating boilers, usually 1,000 MBH or smaller, employ multiple burners to meet the heating load. Each burner operates independently, eliminating the "all on/all off" operation of single burner boilers. As building load increases only those burners necessary to meet the load are fired. This allows each burner to run at optimal efficiency.
  - Condensing boilers recover energy from the exhaust gas, which results in efficiencies of 90% and above.
- When a boiler is both a modulating/modular type and a condensing type, extremely high efficiencies can be realized.

NOTE: The presented economics should be used for planning purposes only. If the client decides to proceed with any boiler replacement project, these economics should be refined with an investment grade analysis.

Picture: Old Cast Iron Sectional Boiler Firehouse

Picture: Library Cast Iron Sectional Boiler

ECM #9: Replace Boilers w/ High Efficiency Modulating Condensing Boilers (continued)

- The high first cost of a new boiler system may preclude this ECM from being justified by economics alone at some of the facilities. The ECM table details the economics at each site. However, reliability issues warrant consideration of these projects as part of a long-term capital improvement plan.

	Fire House	Library	TOTAL
Estimated Annual Savings:	$1,270	$900	**$2,170**
Gross Estimated Implementation Cost:	$21,010	$21,010	**$42,020**
NJ Smart Start Rebate:	$1,140	$750	**$1,890**
Avoided Costs * (Like in Kind):	$17,600	$16,900	**$34,500**
Net Estimated Implementation Cost:	$2,270	$3,360	**$5,630**
Simple Payback (years): *(Incremental and without Avoided Costs)*	1.8 (15.7)	3.7 (22.5)	**2.6 (18.5)**
Annual Avoided CO_2 Emissions (tons):	57	57	**114**

* Note: Avoided Cost = Cost of Like and Kind replacement. Payback is based on incremental cost.

ECM #10: Weather stripping Exterior Doors

	City Hall	Franklin St School	Fire House	Welcome/ Trans. Ctr.	Nature Ctr. #1	Nature Ctr. #2	TOTAL
Estimated Annual Savings:	$220	$110	$790	$220	$100	$120	**$1,560**
Gross Estimated Implementation Cost:	$700	$1,450	$2,450	$700	$350	$350	**$6,000**
NJ Smart Start Rebate:	$0	$0	$0	$0	$0	$0	**$0**
Net Estimated Implementation Cost:	$700	$1,450	$2,450	$700	$350	$350	**$6,000**
Simple Payback (years):	3.2	13.2	3.1	3.2	3.5	2.9	**3.9**
Annual Avoided CO_2 Emissions (tons):	0	0	2	1	0	0	**3**

Infiltration Area

Picture: City Hall Building

- Many of the perimeter doors have poor weather stripping, which allows outside air to infiltrate conditioned areas causing an unnecessary increase in the heating, cooling and dehumidification load.
- Dome-Tech recommends replacing all old weather stripping on perimeter doors that do not have vestibules.
- Energy savings will be realized by reducing the amount of unconditioned outside air to enter the buildings.

ECM #11: Replace Existing Motors with Premium Efficiency Motors

	Elementary School	Waterworks Building	TOTAL
Estimated Annual Savings:	$1,770	$140	**$1,290**
Gross Estimated Implementation Cost:	$2,385	$780	**$6,600**
NJ Smart Start Rebate:	$190	$100	**$525**
Net Estimated Implementation Cost:	$2,195	$680	**$6,075**
Simple Payback (years):	1.2	4.9	**4.7**
Annual Avoided CO_2 Emissions (tons):	3	1	**4**

- The existing motors serving pumps at the Elementary School and Waterworks Building are standard efficiency motors. Standard efficiency motors consume more power than their equivalent premium efficiency motors.
- Dome-Tech recommends replacing the regularly operated standard efficiency motors with new premium efficiency motors at the end of their useful lives.
- See the Appendix for a detailed list of motors recommended for replacement by this ECM.

ECM #12: Heat Pump Upgrade

- The existing 1-4 ton, 8 SEER* Split Heat Pump Units (HP's) are past their estimated equipment service life (EESL) per ASHRAE standards. (The EESL for heat pumps is 15 years.)
- Replacing these HP's with new, higher efficiency and fully controlled units will reduce annual energy costs.
- New Jersey SmartStart offers rebates of $67 per ton for installing heat pump systems with SEERs greater than 14.

**Seasonal Energy Efficiency Ratios: SEER is the rating of cooling output (Btu) divided by the electrical energy input (watts). The higher the SEER, the more efficient the unit.*

Nature Center Split System Heat Pump Condensing Unit

ECM #12: Heat Pump Upgrade (Continued)

	City Hall	Physick Estate	Carriage House	Hill House	Elementary School	Fire House	Public Works Building	Nature Center #2	TOTAL
Estimated Annual Savings:	$700	$100	$100	$30	$1,300	$100	$200	$100	**$2,630**
Gross Estimated Implementation Cost:	$155,090	$42,320	$18,780	$8,590	$256,815	$35,160	$40,040	$17,980	**$574,775**
NJ Smart Start Rebate:	$3,730	$850	$490	$160	$1,190	$530	$1,130	$365	**$8,445**
Avoided Costs (Like and Kind):	$145,890	$40,220	$17,580	$8,190	$253,820	$33,860	$37,240	$17,080	**$553,880**
Net Estimated Implementation Cost:	$5,470	$1,250	$710	$240	$1,805	$770	$1,670	$535	**$12,450**
Simple Payback: (*Without Avoided Costs)*	7.8 (216.2)	12.5 (414.7)	7.1 (182.9)	8.0 (281.0)	1.4 (196.6)	7.7 (346.3)	8.4 (194.6)	5.4 (176.2)	**4.7 (215.3)**
Annual Avoided CO_2 Emissions (tons):	1	0	0	0	2	0	0	0	**3**

* Note: Avoided Cost = Cost of a standard efficiency unit. Incremental cost is the cost of premium efficiency unit minus cost of standard efficiency unit.

ECM #13: Install Timers on Domestic Hot Water Heaters

Physick Estate	
Estimated Annual Savings:	**$20**
Gross Estimated Implementation Cost:	**$160**
NJ Smart Start Rebate:	**$0**
Net Estimated Implementation Cost:	**$160**
Simple Payback (years):	**8.0**
Annual Avoided CO_2 Emissions (tons):	**0**

- Electric domestic hot water (DHW) heaters are enabled 24/7. There is minimal call for hot water at night.
- Installing a timer will turn the heater on/off to match the building's occupancy and hot water use, and will reduce the standby heat loss that occurs during non-use periods.
- Note that this ECM is mutually exclusive with other DHW-related ECMs.

ECM #14: Replace Window AC Units

	City Hall	Public Works Building	Fire House	Hill House	TOTAL
Estimated Annual Savings:	$60	$60	$30	$30	**$180**
Gross Estimated Implementation Cost:	$500	$500	$250	$250	**$1,500**
NJ Smart Start Rebate:	$0	$0	$0	$0	**$0**
Net Estimated Implementation Cost:	$500	$500	$250	$250	**$1,500**
Simple Payback (years):	8.3	10.0	8.3	8.3	**8.3**
Annual Avoided CO_2 Emissions (tons):	0	0	0	0	**0**

- Window air conditioning units that are installed at the Firehouse, City Hall, Public Works Building and the Hill House provide localized air conditioning for small private offices and storage areas. The units are in poor physical condition and inefficient compared to today's standards.
- Dome-Tech recommends replacing these units with new, higher efficiency units.
- New 10.5 SEER (Seasonal Energy Efficiency Rating) units are estimated to be at least 14% more efficient at full/part loads than the existing equipment.

Public Works: Window AC Unit

Location	Qty.
City Hall, Public Works	2 each
Firehouse, Hill House	1 each

ECM #15: Walk-In Cooler Controllers

Elementary School	
Estimated Annual Savings:	**$240**
Gross Estimated Implementation Cost:	**$2,340**
NJ Rebate:	**$0**
Net Estimated Implementation Cost:	**$2,340**
Simple Payback (years):	**9.8**
Annual Avoided CO_2 Emissions (tons):	**0**

- Typically the walk-in cooler evaporator fans run continuously. However, full airflow is only required 50% of the runtime.
- In the most common applications (those that use single-phase power), motors for the fans are typically shaded-pole or permanent-split-capacitor types, both of which are very inefficient.
- Inexpensive controllers are currently available that slow these fans when full-speed operation is unnecessary.
- Reducing the operating speed reduces the energy consumption of the fan. In addition, the motor produces less heat at slower speeds, which means that the compressor has less heat to remove from the refrigerated compartment.

ECM #16: Pool Cover

Elementary School	
Estimated Annual Energy Savings:	**$1,900**
Gross Estimated Implementation Cost:	**$21,000**
NJ Smart Start Rebate:	**$0**
Net Estimated Implementation Cost:	**$21,000**
Simple Payback (years):	**11.1**
Annual Avoided CO_2 Emissions (tons):	**7**

- There is a significant amount of heat and evaporative losses through the water's surface. Installing a pool cover during unoccupied periods will significantly reduce the building's HVAC cooling load.

- The analysis assumes the pool cover will be in place for 8 hours per day, 180 days per year.

ECM #17: Replace Garage Bay Door

Public Works Building – Garage Bay Door	
Estimated Annual Savings:	$1,570
Gross Estimated Implementation Cost:	$44,610
NJ Smart Start Rebate:	$0
Net Estimated Implementation Cost:	$44,610
Simple Payback (years):	28.4
Annual Avoided CO_2 Emissions (tons):	6

- A garage bay door replacement project would result in a measurable improvement in heat retention. In addition, increased aesthetic value and occupant comfort would accompany a window and door project. It should be noted however, that even a garage bay door replacement project can rarely be justified solely on economic payback.
- Because the economics alone are not sufficient to justify implementation, occupant comfort and aesthetics should be the overriding considerations in deciding whether to move forward with this project.

ECM #18: Replace Kitchen Equipment with Energy Star Rated Equipment

Freezer Refrigerator

Convection Oven

Stove

Dishwasher

	Fire House	Carriage House	TOTAL
Estimated Annual Savings:	$240	$190	**$430**
Gross Estimated Implementation Cost:	$7,350	$7,350	**$14,700**
NJ Smart Start Rebate:	$0	$0	**$0**
Net Estimated Implementation Cost:	$7,350	$7,350	**$14,700**
Simple Payback (years):	30.6	38.7	**34.2**
Annual Avoided CO_2 Emissions (tons):	0	0	**0**

- Most of the kitchen equipment (reach-in coolers/freezers, food warmers, dishwashers) in the buildings are older and less efficient than newer, higher efficiency equipment.
- Replacing the electric equipment with higher efficiency Energy Star-labeled equipment will provide at approximately $430 in annual savings.
- Improvements in kitchen equipment include lower idle rates, better insulation which reduces the amount of standby losses through sides and top, and premium efficient fan motors.

ECM #19: Replace Electric Dishwasher Booster Heater

Elementary School	
Estimated Annual Savings:	**$90**
Gross Estimated Implementation Cost:	**$8,280**
NJ Rebate:	**$0**
Net Estimated Implementation Cost:	**$8,280**
Simple Payback (years):	**92.0**
Annual Avoided CO_2 Emissions (tons):	**0**

- The elementary school's kitchen is equipped with electric hot water booster heaters for dishwashing.
- The school's electric cost is over $0.185 per kilowatt hour. The equivalent natural gas cost for a 85% efficient natural gas hot water heater is $4.60 per therm. The actual price for natural gas is approximately $1.60 per therm (almost 300% less than electric heat).
- Replacing the electric heaters with natural gas units will provide at least $90 in annual savings and will reduce electric demand by 2 kW.

ECM #20: Upgrade Windows

	Physick Estate	Carriage House	Hill House	TOTAL
Estimated Annual Savings:	$2,690	$630	$360	**$3,680**
Gross Estimated Implementation Cost:	$404,930	$138,970	$77,200	**$621,100**
NJ Smart Start Rebate:	$0	$0	$0	**$0**
Net Estimated Implementation Cost:	$404,930	$138,970	$77,200	**$621,100**
Simple Payback (years):	150.5	220.6	214.4	**168.7**
Annual Avoided CO_2 Emissions (tons):	6	5	1	**12**

NOTE: The presented economics should be used for planning purposes only. If the City decides to proceed with the window replacement project, these economics should be refined with an investment grade analysis.

- A survey of the Physick Estate, Carriage House and Hill House revealed a mixture of window types, sizes and existing conditions.
- A window project would result in a measurable improvement in heat retention, aesthetics and occupant comfort. It should be noted however, that even an optimized window project can rarely be justified solely on economic payback.
- Because the economics alone are not sufficient to justify implementation, occupant comfort and aesthetics should be the overriding considerations in moving forward with this project.

ECM #21: Building Management System

Current Energy Management System

Elementary School	
Estimated Annual Savings:	$8,890
Gross Estimated Implementation Cost:	$323,250
NJ Smart Start Rebate:	$0
Net Estimated Implementation Cost:	$323,250
Simple Payback (years):	36.4
Annual Avoided CO_2 Emissions (tons):	29

The savings and economic summary shown here is the aggregate of ECM #21A thru 21D, which are shown on the following pages.

- A building management system (BMS) is a computer system designed specifically for the automated control and monitoring of the heating, ventilation and lighting systems for a single facility or group of buildings. The BMS can also be used for data collection and used to produce trend analyses and annual consumption forecasts.
- This facility has a controller-based centralized energy management system. However, the HVAC systems are currently being operated manually. The energy management system has limited capability to allow building personnel to operate the HVAC systems in a more efficient manner.
- Due to the limitations of the current controls system, Dome-Tech recommends installing a computer based Building Management System that will enable the following strategies to be implemented:
  - Time of Day Optimization
  - Setpoint Optimization
  - Demand Control Ventilation
  - Exhaust Fan TOD Optimization
  - Holiday Time of Day Optimization

ECM #21A: Demand Controlled Ventilation

Elementary School	
Estimated Annual Savings:	$2,000
Gross Estimated Implementation Cost:	$19,050
NJ Smart Start Rebate:	$0
Net Estimated Implementation Cost:	$19,050
Simple Payback (years):	9.5
Annual Avoided CO_2 Emissions (tons):	5

- Building codes require that a minimum amount of fresh air be provided to ensure adequate air quality. To comply, ventilation systems often operate at a fixed rate based on an assumed occupancy (e.g., 20 CFM per person multiplied by the maximum design occupancy). Since maximum design occupancy is rarely achieved, this results in excessive fresh air volumes which require costly and unnecessary conditioning.

- Demand-controlled ventilation (DCV) controls the amount of outside air being supplied based upon the CO_2 levels generated by building occupants. DCV should be added to any space that is ventilated by a large quantity of outdoor air, and where occupancy varies dramatically (gymnasiums).

- Because CO_2 levels correlate directly with the number of people in an occupied zone, CO_2 sensors will be used to control the amount of outside air supplied to each zone. Reducing the amount of outdoor air supplied to a zone reduces the energy required to heat and cool the air, while space conditions are kept in compliance with building codes and standards such as the ASHRAE Indoor Air Quality Standard.

ECM #21B: Optimize and Standardize the Space Temperature Setpoints

Elementary School	
Estimated Annual Savings:	$5,530
Gross Estimated Implementation Cost:	$3,200
NJ Smart Start Rebate:	$0
Net Estimated Implementation Cost:	$3,200
Simple Payback (years):	0.6
Annual Avoided CO_2 Emissions (tons):	20

- In the Elementary School, the current space temperature setpoints were inconsistent and ranged between 73-76°F.
- A majority of the Unit Ventilators (UV's) and RTUs have higher than recommended heating setpoints, which results in higher than expected heating costs.
- Dome-Tech recommends optimizing the HVAC setpoints according to the table on the following page.

ECM #21B: Setpoint Optimization (continued)

BMS vs. Proposed Setpoints

Unit	Location	Winter Setpoint °F	Proposed Winter Setpoint °F	Temperature Difference °F	Summer Setpoint °F	Proposed Summer Setpoint °F	Temperature Difference °F
17	38CKS048S	73	70	3	73	75	2
1	38CKS048S	76	70	6	NA	NA	NA
14	38CKS048S	74	70	4	74	75	1
16	38CKS048S	73	70	3	73	75	2
17	38CKS048S	74	70	4	74	75	1
18	38CKS048S	72	70	2	72	75	3
19	38CKS048S	74	70	4	74	75	1
2	38CKS048S	74	70	4	74	75	1
20	38CKS048S	75	70	5	75	75	0
25	38CKS048S	73	70	3	73	75	2
26A	38CKS048S	75	70	5	75	75	0
26B	38CKS048S	74	70	4	74	75	1
27	38CKS048S	73	70	3	73	75	2
3	38CKS048S	74	70	4	74	75	1
30	38CKS048S	74	70	4	74	75	1
31	38CKS048S	76	70	6	NA	NA	NA
37	38CKS048S	75	70	5	75	75	0
38	38CKS048S	74	70	4	74	75	1
39	38CKS048S	75	70	5	75	75	0
4A	38CKS048S	74	70	4	74	NA	1
4B	38CKS048S	75	70	5	75	75	0

ECM #21C: Holiday Time of Day Optimization

Elementary School	
Estimated Annual Savings:	$940
Gross Estimated Implementation Cost:	$1,600
NJ Smart Start Rebate:	$0
Net Estimated Implementation Cost:	$1,600
Simple Payback (years):	1.7
Annual Avoided CO_2 Emissions (tons):	3

- A review of the BMS time of day schedules revealed that no holiday schedules are programmed.
- Unless each facility manually shuts down all the HVAC equipment, they are operating unnecessarily during school holidays. This increases HVAC conditioning costs as well as electrical motor operating costs.
- These savings can easily be achieved by programming the BMS holiday schedules to unoccupied mode and applying it to holidays in the BMS.

ECM #21D: Exhaust Fan Time of Day Optimization

Elementary School	
Estimated Annual Savings:	$420
Gross Estimated Implementation Cost:	$10,780
NJ Smart Start Rebate:	$0
Net Estimated Implementation Cost:	$10,780
Simple Payback (years):	25.7
Annual Avoided CO_2 Emissions (tons):	1

- The building's exhaust fans currently run twenty four hours per day, seven days per week. This scenario leads to unnecessary fan power and make-up air requirements.
- Setting the exhaust fans to run at certain times or on demand will lower energy consumption by $420 annually.

Unit	Area Served	HP	Existing Annual Run Hours	Proposed Annual Run Hours	Estimated Savings
EF - 1	0.125	0.75	4,320	2,700	$17
EF - 2	0.125	0.75	4,320	2,700	$17
EF - 3	0.125	0.75	4,320	2,700	$17
EF - 4	0.125	0.75	4,320	2,700	$17
EF - 5	0.125	0.75	4,320	2,700	$17
EF - 6	0.125	0.75	4,320	2,700	$17
EF - 7	0.125	0.75	4,320	2,700	$17
EF - 8	0.125	0.75	4,320	2,700	$17

Hours of Operation	On	Off	Hrs/Day
Existing	0	24	24
Proposed	6	21	15

Water Conservation

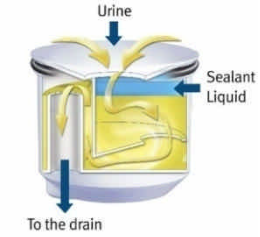


Diagram: Waterless Urinal

	Hill House	City Hall	Nature Center 2	Carriage House	Library	Water Works	Franklin Street School	Firehouse	Elementary School	Physick Estate	Public Works	Total
Estimated Annual Savings:	$44	$442	$297	$206	$564	$15	$53	$74	$740	$324	$564	**$3,323**
Gross Estimated Implementation Cost:	$1,276	$11,406	$3,212	$2,882	$6,354	$638	$3,802	$3,212	$19,010	$1,914	$6,424	**$60,130**
Simple Payback (years):	29.0	25.8	10.8	14.0	11.3	43.2	71.6	43.5	25.7	5.9	11.4	**18.1**

- Dome-Tech recommends installing low flow faucets and waterless urinals in all restrooms. These fixtures, in some cases, can use up to five (5) times less water than fixtures installed before 1980.
- Waterless urinals work completely free of water or flush valves and help eliminate odor. The fixtures are also touch free which also help to improve restroom sanitation.
- The estimated annual savings will result from reduced water consumption and hot water generated by the domestic hot water heaters.

Operations & Maintenance

Elementary School

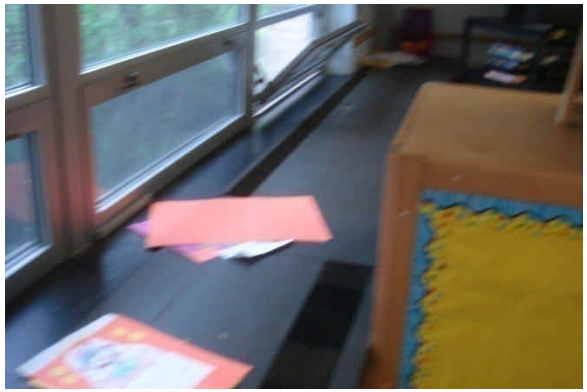
- Issue: Loaded Filters for Air Handling Units
- Impact: Pressurization issues, improper ventilation, noise hazard, wasteful over loading supply fan motor.
- Recommendation: Planned maintenance, functional checks and inspections on filters
  - *Approximately $50 annual savings expected O&M savings from this measure*

Elementary School – Loaded Filters

Operations & Maintenance (Continued)

Elementary School - Windows Open while AC is running

- Issue: Doors and Windows open while AC is running
- Impact: Excessive HVAC cost due to outside air infiltration.
- Recommendation: Emphasize closing of windows and doors while AC units are on. Energy Awareness Program.

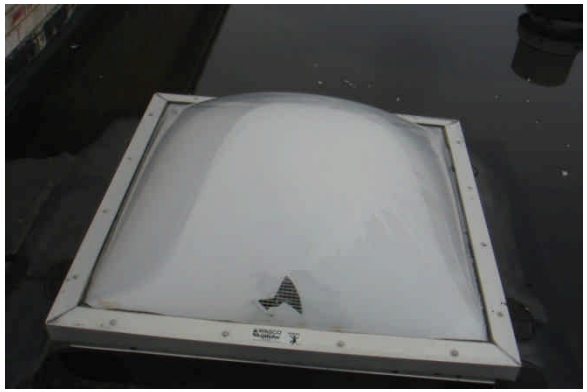


Elementary School - Open windows while space is being air-conditioned

Operations & Maintenance (Continued)

Elementary School - Damaged Skylights

- Issue: Damaged Skylights
- Impact: Excessive HVAC cost due to outside air infiltration.
- Recommendation: Replace broken skylights



Elementary School – Cracked Skylights

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.

Renewable Energy Technologies: Wind

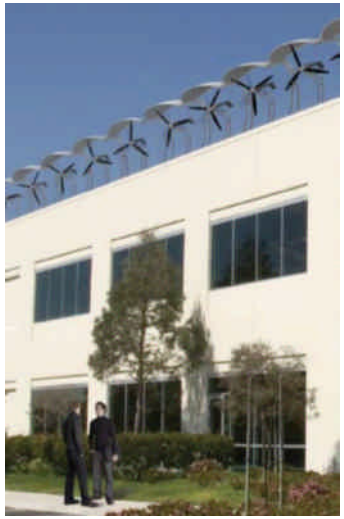
Wind turbines generate electricity by harnessing a wind stream's kinetic energy as it spins the turbine airfoils. As with most renewable energy sources, wind energy is subject to intermittent performance due to the unpredictability of wind resources.

City of Cape May Wind Speed

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 Cape May area is 9.6 meters per second. Ideal wind speeds for a successful project should average over 6 meters per second.

For City of Cape May, 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: City of Cape May - Elementary School

	Building Integrated - 1 kW	Ground Mount - 5.2 kW	Ground Mount - 50 kW
Number of Units	10	8	1
Gross Installation Cost Estimate	$65,000	$249,600	$250,000
NJ Clean Energy Rebate	$49,178	$80,783	$127,752
Net Installation Cost Estimate	$15,822	$168,817	$122,248
Annual Energy Savings	$2,843	$13,906	$31,284
Simple Payback with/without rebate**	5.6 yrs. / 22.9 yrs.	12.1 yrs. / 17.9 yrs.	3.9 yrs. / 8yrs.
System Capacity	10 kW	42 kW	50 kW
Annual Avoided Energy Use	15,368 kWh	75,167 kWh	169,103 kWh
Annual Avoided CO2 Emmisions, Tons	5	26	59
% of Annual Electric Use*	4.3%	21.3%	47.8%

*City of Cape May - Elementary School: 353640 kWh/Year.

**The NJ Clean Energy Program temporary hold on all new wind applications (as of 3/8/11) is still in existence at the time of this report.

Wind Turbine Pros & Cons

Pros	Cons
➢Annual reduction in energy spend and use can be potentially reduced by almost $31,200 (47% reduction). ➢Typical equipment life span is 15-30 years. ➢Reduction of annual greenhouse gas emissions by 59 tons 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 can be significant (over 10 years). ➢Average area wind speed is borderline which could impact overall 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 the City decide to pursue a wind turbine project, Dome-Tech recommends commissioning a more detailed study including installing an anemometer to collect site specific wind data over a year’s time.

Renewable Energy Technologies: Wind

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

Wind Turbine Economics: City of Cape May - Waterworks Bldg

	Building Integrated - 1 kW	Ground Mount - 5.2 kW	Ground Mount - 50 kW
Number of Units	2	14	2
Gross Installation Cost Estimate	$13,000	$436,800	$500,000
NJ Clean Energy Rebate	$9,836	$108,971	$212,303
Net Installation Cost Estimate	$3,164	$327,829	$287,697
Annual Energy Savings	$590	$25,256	$64,936
Simple Payback with/without rebate**	5.4 yrs. / 22 yrs.	13.0 yrs. /17.3 yrs.	4.4 yrs. / 7.7 yrs.
System Capacity	2 kW	73 kW	100 kW
Annual Avoided Energy Use	3,074 kWh	131,542 kWh	338,206 kWh
Annual Avoided CO2 Emmisions, Tons	1	46	118
% of Annual Electric Use*	0.2%	8.6%	22.0%

*City of Cape May - Waterworks Bldg: 1537000 kWh/Year.

** The New Jersey Clean Energy Program temporary hold on all new wind applications (as of 3/8/11) is still in existence at the time of this report.

Wind Turbine Pros & Cons

Pros	Cons
➢Annual reduction in energy spend and use can be potentially reduced by almost $65,000 (22% reduction). ➢Typical equipment life span is 15-30 years. ➢Reduction of annual greenhouse gas emissions by 118 tons 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 can be significant (over 10 years). ➢Average area wind speed is borderline which could impact overall 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 the City decide to pursue a wind turbine project, Dome-Tech recommends commissioning a more detailed study.

Renewable Energy Technologies: Solar Photovoltaic

Solar Photovoltaic

- Sunlight can be converted into electricity using photovoltaic's (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.
- The Public Works building currently has an inactive solar PV system. As we understand it, the system's annual output is greater than what the building consumes and therefore, it does not comply with the utility's net-metering rules. Dome-Tech recommends considering tying the PV system at the Public Works building into the Water Works Building. Note: The City of Cape May should consider all potential utility regulations before proceeding.
- Potential Sites for recommended for further study:
  - Water Works Building
  - Elementary School

Note: The Public Works buildings are not able to support building - mounted solar photovoltaic systems. The Nature Center already has a PV Roof Mounted System

Solar Photovoltaic

Install Roof Mount Solar Photovoltaic System(s)	
Elementary School	
Assumptions	
System Capacity, kw-dc (maximum utilization of roof space)	379 kw dc
Estimated Annual AC Energy Produced by Proposed Solar PV System	422,245 kwh
Total Annual Facility Electric Use, kwhrs	353,640 kwh
Proposed % of Total Annual kWh supplied by Solar PV	119%
All-In Rate for Electric Year 1	$0.185 / kwh
Year 1 Electric Cost Savings	$78,115
Year 1 Maintenance Costs	$7,574
Estimated Year 1 SREC Value:	$349 / SREC
Estimated Year 1 SREC Revenue:	$147,334
Financial Results	
Actual Payback	**11.9 years**
IRR (25 Years)	**6.4%**
Net Present Value (25 yrs, 4% discount rate)	**$567,358**
Cost and Rebate	
Cost per kW installed	$6,000
System Installed Cost	$2,272,170

Solar Photovoltaic

Install Roof Mount Solar Photovoltaic System(s)	
Water Works Building	
Assumptions	
System Capacity, kw-dc (maximum utilization of roof space)	120 kw dc
Estimated Annual AC Energy Produced by Proposed Solar PV System	133,675 kwh
Total Annual Facility Electric Use, kwhrs	1,537,000 kwh
Proposed % of Total Annual kWh supplied by Solar PV	9%
All-In Rate for Electric Year 1	$0.192 / kwh
Year 1 Electric Cost Savings	$25,666
Year 1 Maintenance Costs	$2,398
Estimated Year 1 SREC Value:	$349 / SREC
Estimated Year 1 SREC Revenue:	$46,643
Financial Results	
Actual Payback	**11.7 years**
IRR (25 Years)	**6.7%**
Net Present Value (25 yrs, 4% discount rate)	**$202,078**
Cost and Rebate	
Cost per kW installed	$6,000
System Installed Cost	$719,325

Solar Photovoltaic

Install Roof Mount Solar Photovoltaic System(s)	
City Hall	
Assumptions	
System Capacity, kw-dc (maximum utilization of roof space)	14 kw dc
Estimated Annual AC Energy Produced by Proposed Solar PV System	15,797 kwh
Total Annual Facility Electric Use, kwhrs	266,367 kwh
Proposed % of Total Annual kWh supplied by Solar PV	6%
All-In Rate for Electric Year 1	$0.194 / kwh
Year 1 Electric Cost Savings	$3,065
Year 1 Maintenance Costs	$283
Estimated Year 1 SREC Value:	$349 / SREC
Estimated Year 1 SREC Revenue:	$5,512
Financial Results	
Actual Payback	**9.6 years**
IRR (25 Years)	**9.0%**
Net Present Value (25 yrs, 4% discount rate)	**$5,312**
Cost and Rebate	
Cost per kW installed	$6,000
System Installed Cost	$70,840

Install Roof Mount Solar Photovoltaic System(s)	
Library	
Assumptions	
System Capacity, kw-dc (maximum utilization of roof space)	5 kw dc
Estimated Annual AC Energy Produced by Proposed Solar PV System	5,026 kwh
Total Annual Facility Electric Use, kwhrs	55,166 kwh
Proposed % of Total Annual kWh supplied by Solar PV	9%
All-In Rate for Electric Year 1	$0.187 / kwh
Year 1 Electric Cost Savings	$940
Year 1 Maintenance Costs	$90
Estimated Year 1 SREC Value:	$349 / SREC
Estimated Year 1 SREC Revenue:	$1,754
Financial Results	
Actual Payback	**9.8 years**
IRR (25 Years)	**8.7%**
Net Present Value (25 yrs, 4% discount rate)	**$11,330**
Cost and Rebate	
Cost per kW installed	$6,000
System Installed Cost	$22,540

Solar Photovoltaic

Install Roof Mount Solar Photovoltaic System(s)	
Physick Estate, Hill House, Carriage House	
Assumptions	
System Capacity, kw-dc (maximum utilization of roof space)	112 kw dc
Estimated Annual AC Energy Produced by Proposed Solar PV System	124,737 kwh
Total Annual Facility Electric Use, kwhrs	150,564 kwh
Proposed % of Total Annual kWh supplied by Solar PV	83%
All-In Rate for Electric Year 1	$0.162 / kwh
Year 1 Electric Cost Savings	$20,207
Year 1 Maintenance Costs	$2,237
Estimated Year 1 SREC Value:	$349 / SREC
Estimated Year 1 SREC Revenue:	$43,525
Financial Results	
Actual Payback	**12.9 years**
IRR (25 Years)	**5.5%**
Net Present Value (25 yrs, 4% discount rate)	**$98,733**
Cost and Rebate	
Cost per kW installed	$6,000
System Installed Cost	$671,232

Install Roof Mount Solar Photovoltaic System(s)	
Franklin Street School	
Assumptions	
System Capacity, kw-dc (maximum utilization of roof space)	36 kw dc
Estimated Annual AC Energy Produced by Proposed Solar PV System	40,006 kwh
Total Annual Facility Electric Use, kwhrs	10,898 kwh
Proposed % of Total Annual kWh supplied by Solar PV	367%
All-In Rate for Electric Year 1	$0.198 / kwh
Year 1 Electric Cost Savings	$7,921
Year 1 Maintenance Costs	$718
Estimated Year 1 SREC Value:	$349 / SREC
Estimated Year 1 SREC Revenue:	$13,959
Financial Results	
Actual Payback	**9.5 years**
IRR (25 Years)	**9.1%**
Net Present Value (25 yrs, 4% discount rate)	**$100,740**
Cost and Rebate	
Cost per kW installed	$6,000
System Installed Cost	$179,400

Solar Photovoltaic

Install Roof Mount Solar Photovoltaic System(s)	
Firehouse	
Assumptions	
System Capacity, kw-dc (maximum utilization of roof space)	43 kw dc
Estimated Annual AC Energy Produced by Proposed Solar PV System	48,469 kwh
Total Annual Facility Electric Use, kwhrs	116,720 kwh
Proposed % of Total Annual kWh supplied by Solar PV	42%
All-In Rate for Electric Year 1	$0.210 / kwh
Year 1 Electric Cost Savings	$10,179
Year 1 Maintenance Costs	$869
Estimated Year 1 SREC Value:	$349 / SREC
Estimated Year 1 SREC Revenue:	$16,912
Financial Results	
Actual Payback	**9.2 years**
IRR (25 Years)	**9.6%**
Net Present Value (25 yrs, 4% discount rate)	**$136,014**
Cost and Rebate	
Cost per kW installed	$6,000
System Installed Cost	$217,350

Install Roof Mount Solar Photovoltaic System(s)	
Welcome Transportation Center	
Assumptions	
System Capacity, kw-dc (maximum utilization of roof space)	8 kw dc
Estimated Annual AC Energy Produced by Proposed Solar PV System	9,130 kwh
Total Annual Facility Electric Use, kwhrs	32,218 kwh
Proposed % of Total Annual kWh supplied by Solar PV	28%
All-In Rate for Electric Year 1	$0.188 / kwh
Year 1 Electric Cost Savings	$1,716
Year 1 Maintenance Costs	$164
Estimated Year 1 SREC Value:	$349 / SREC
Estimated Year 1 SREC Revenue:	$3,186
Financial Results	
Actual Payback	**9.7 years**
IRR (25 Years)	**8.7%**
Net Present Value (25 yrs, 4% discount rate)	**$20,798**
Cost and Rebate	
Cost per kW installed	$6,000
System Installed Cost	$40,940

Solar Photo Voltaic System

Non-Financial Benefits of Solar PV

- The implementation of solar PV projects at City of Cape May would place your facilities at the forefront of renewable energy utilization. This allows the City the opportunity to not only gain experience with this energy technology, but also to win recognition as an environmentally sensitive, socially conscience institution. Additionally, these projects could be incorporated into science education and additional curriculums to raise awareness of current energy alternatives to the younger generations.

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 Cape May City due to a lack of a continuous year-round thermal load.**

Utility Tariff and Rate Review: Electricity

- **Accounts and Rate Class:** City of Cape May has thirteen electric accounts with service behind Atlantic City Electric Company under rate classes Monthly General Service and Annual General Service.

- **Electric Consumption and Cost:** Based on the one-year period studied, the total annual electric expenditure for the City is about $487,000 and the total annual consumption is about 2,560,330 kilowatt-hours (kWh).

- **Average/Effective Rate per kWh:** For the one year period studied, the City's average monthly cost per kilowatt-hour ranged from 16.07 ¢/kWh to 22.43 ¢/kWh, inclusive of utility delivery charges. The City's overall, average cost per kilowatt-hour during this period was 19.03 ¢/kWh.
  - 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:** City of Cape May has twelve natural gas accounts with service behind South Jersey Gas Company under rate classes Monthly and Periodic Service.

- **Natural Gas Consumption and Cost:** Based on the one-year period studied, the total annual natural gas expenditure for the City is about $124,000 and the total annual consumption is about 67,000 therms (th). Natural gas is used predominantly throughout the winter period for heating purposes.

- **Average/Effective Rate per Therm:** For the one year period studied, the City's overall, average cost per therm during this period was $1.900 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 (cont.)

- 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 occurred in 2010 as well and the market is poised for it to occur again in 2011.

- Primary (large) Electric Accounts:
  - The BGS-CIEP category is quite different. The main feature to note about BGS-CIEP accounts that do not switch to a retail supplier for service is that they pay an hourly market rate for energy. These accounts also paid a "retail margin adder" of $0.0053/kWh but this was removed starting June 1, 2011.
  - For BGS-CIEP accounts, 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 (cont.)

- 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 Purchasing: Recommendations and Resources

- 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. 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.

- Electric
  - Based on current and recent market conditions, and actual bid processes run by Dome-Tech, we have seen customers with BGS-FP accounts save approximately 10-15% in projected energy costs by switching to retail energy supplier. It is important to note that actual rates and potential savings will be dependent on several factors, including market conditions, account usage characteristics/load profile (load factor), volume, and contract term. For the period studied, the City was utilizing a Third Party Supplier for the supply of electricity to three larger BGS-FP accounts (City Hall, Water Works Building and Firehouse). These electric accounts are part of the South Jersey Power Co-Operative's existing contract with Hess Corporation which started in September 2010 and lasts until September 2011 at the fixed rate of $0.09147 per kWh.

- Natural Gas
  - Based on current and recent market conditions, and actual bid processes run by Dome-Tech, we have seen many customers entering into longer-term contracts for fixed natural gas rates. These rates vary substantially based on load type, volume, and term. For the period studied, the City was utilizing a Third Party Supplier for the supply of natural gas to their SJGAS accounts. The City's gas accounts are part of the South Jersey Power Co-Operative's existing contract with Woodruff Energy. The contract term is until December 2011 at the fixed rate of $1.0815 per therm.

Retail Energy Purchasing: Recommendations and Resources (cont.)

- 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:

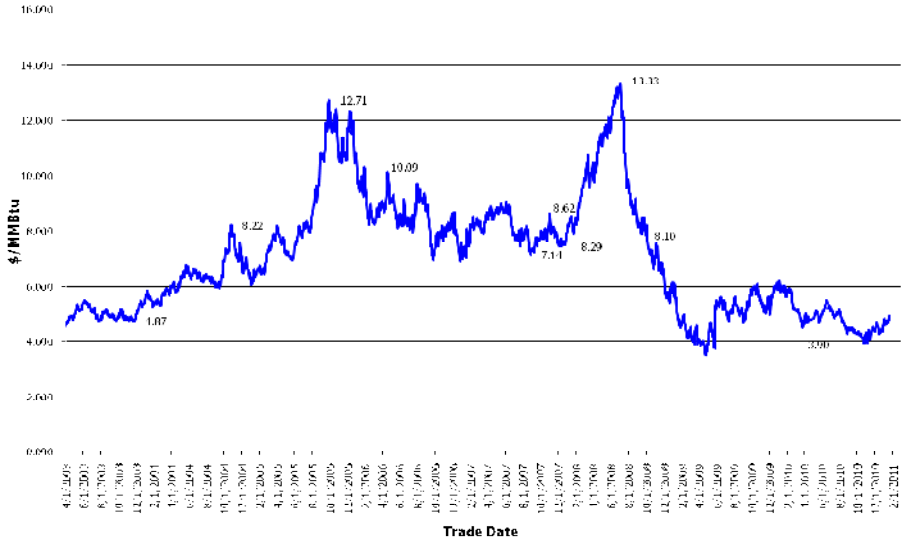
Company	Electricity	Natural Gas	Website
Hess	X	X	hess.com
Sprague	X	X	spragueenergy.com
UGI	X	X	ugienergyservices.com
South Jersey Energy	X	X	southjerseyenergy.com
Direct	X	X	directenergy.com
Global	X	X	globalp.com
Liberty	X		libertpowercorp.com
Reliant	X		reliant.com
First Energy	X		fes.com
ConEd Solutions	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.*

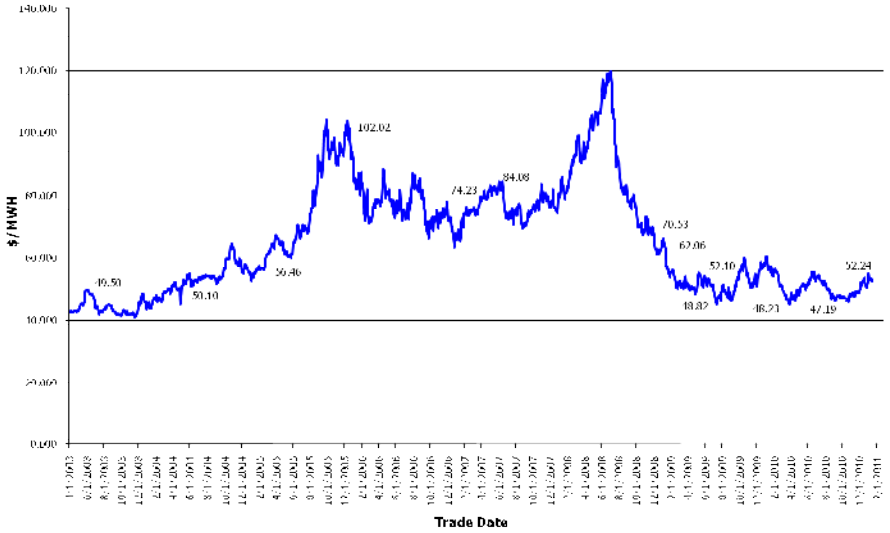
Historical Energy Futures Settlement Prices

- 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.

Henry Hub 12 month strip



PJM West 12 month strip



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 $594,000 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.)

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 Services 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)

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, Photovoltaic's, 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

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 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.

Next Steps

- **<u>The following projects should be considered for implementation:</u>**

  - Controls Upgrades
    - Time of Day Optimization
    - Temperature Setpoint Optimization
    - Demand Control Ventilation
  - Boiler Upgrades
  - Lighting upgrades
  - Vending machine power management

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

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.
- Some ECM's proposed in this report are mutually exclusive (e.g. Building Management Systems). ECM savings are not cumulative.
- Interactive effects between ECM's have not been accounted for in all cases.
- The average CO2 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 CO2 per kWh generated.
  - *The EPA estimates that burning one therm of natural gas emits 11.708 lbs CO2.*
  - *The EPA estimates that one car emits 11,560 lbs CO2 per year.*
  - *The EPA estimates that reducing CO2 emissions by 7,333 pounds is equivalent to planting an acre of trees.*
- The following utility prices provided were used within this study:

Facility	Electric $ / KWH	Natural Gas $ / therm
Cape May City Hall	$0.194	$2.369
Franklin Street School	$0.198	$2.340
Welcome / Transportation Center	$0.188	$2.491
Water Works Building	$0.192	$2.389
Fire House	$0.210	$2.388
Public Works Complex	$0.188	$1.640
Physick Estate	$0.161	$2.393
Carriage House	$0.162	$1.722
Hill House	$0.167	$1.807
Library	$0.187	$2.428
Nature Center 1 *	$0.224	*NA*
Nature Center 2 *	$0.220	$2.685
Cape May City Elementary *	$0.185	$1.601

** Missing Electrical supplier costs for these accounts, assumption of $0.139 from the top amount charged per KWH by Glacial Electric.*