HOBOKEN UNIVERSITY MEDICAL CENTER

Energy Audit

Prepared For:
Hoboken Municipal Hospital Authority

Contact
John Lorenzo,MSW, MBA
Executive Director

FINAL

Prepared By:
Dome – Tech, Inc.

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

FINAL April 2010

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HOBOKEN UNIVERSITY MEDICAL CENTER
ENERGY AUDIT REPORT
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April 15, 2010

John Lorenzo, MSW, MBA
Executive Director
Hoboken University Medical Center
307 Willow Avenue
Hoboken, NJ 07030

Re: EXECUTIVE SUMMARY FOR HOBOKEN UNIVERSITY MEDICAL CENTER
STATE OF NEW JERSEY LOCAL GOVERNMENT ENERGY AUDIT –DRAFT REPORT

Dear Mr. Lorenzo:

Dome-Tech was retained by Hoboken University Medical Center, as a prequalified participant in the Local Government Energy Audit Program, to perform an energy audit. The objective of the energy audit was to evaluate the schools' 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 period April 2008 – March 2009, the two Hospital buildings had an annual expenditure of:

- Electricity: 7,871,940 kWh at a total cost of $1,047,915
- Natural Gas: 361,500 therms at a total cost of $ 430,390

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 to be implemented, they would provide the following estimated benefits to Hoboken University Medical Center:

- Total annual electrical savings: 1,007,340 kilowatt-hours; 14%

- Total annual natural gas savings: 196,930 therms of natural gas usage; 54%
- Total annual cost savings: $370,755; 35%
- Total annual CO_2 emissions reduction: 1,485 tons
- Total estimated implementation cost: $3,729,460
- Total average simple payback: 10.1 years

The projects that are recommended for implementation (at all facilities) include: Repair/installing a Building Management System (BMS), Equipment Repair/upgrading/maintenance through a full retro-commissioning review and applying for the Pay for Performance Program, upgrading the lighting, installing vending machine power management devices, and implementing energy awareness programs.

The Hoboken University Medical Center data was entered into the US EPA ENERGY STAR's Portfolio Manager database program. The scores ranged from a low of 81 to a high of 84. Buildings with scores of 75 or higher may qualify for the ENERGY STAR Building Label. Please see report for individual building school scores. *Note: Dome-Tech believes that these scores need review as we believe utility data for additional meters is missing*.

Distributed/Renewable Energy Systems were reviewed for the Hospital buildings 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. Due to attractive payback and high potential for energy reduction, the 50 kilowatt wind turbine project appears to be the most attractive option. Should Hoboken University Medical Center decide to pursue a wind turbine project, Dome-Tech recommends commissioning a more detailed study.
- A roof-mounted 130 kw dc photovoltaic system that could provide 2% of the Hospital's annual energy usage was assessed for implementation.
- CHP, Fuel Cells, and Micro-turbines were also researched, but are not recommended due to the lack of thermal requirements in the summertime. They could be further researched for emergency back-up power options.

Regarding the procurement of utilities, Dome-Tech understands that Hoboken University Medical Center facilities are served by three electric accounts behind PSE&G , under various rate classes. Dome-Tech understands that Hoboken University Medical Center has Large Power & Lighting Service Primary and General Lighting and Power Service accounts that are currently not contracted with a retail energy supplier. The Hospital is also served by four natural gas accounts behind PSE&G. Now is an ideal time to seek longer-term rate stability through a fixed price arrangement through a retail supplier.

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 Butterly
Senior Energy Engineer

HOBOKEN HOSPITAL

	Energy Conservation Measures (ECM)	Buildings	Energy Savings			Gross Installation Costs*	Rebates/ Incentive	Avoided Cost	Net Implementation Costs	Annual Energy Cost Savings	Annual Oper. Cost Savings	Total Annual Cost Savings	Simple Pay Back	Internal Rate of Return (IRR)	Measure Life	Lifecycle Savings	CO2 Savings (tons)
			kWh	kW	Therms												
1	Steam Trap Preventative Maintenance/Repair	Medical Center	0	0	5,745	$12,420	$0	0	$12,420	$6,840	$0	$6,840	1.8	47.1%	5	$18,905	34
2	Lighting Upgrade	Medical Center	293,040	61	0	$130,230	$9,360	0	$120,870	$39,230	$0	$39,230	3.1	31.9%	15	$347,455	97
2	Lighting Upgrade	Family Health Center	19,460	0	0	$7,370	$0	0	$7,370	$3,240	$0	$3,240	2.3	43.8%	15	$31,309	6
3	Convert 100% Outside Air AHUs to Recirculating AHUs	Medical Center	207,900	27	12,360	$134,900	$0	0	$134,900	$41,740	$0	$41,740	3.2	30.8%	20	$486,086	141
4	Upgrade/Repair Building Management System (BMS)	Medical Center	316,150	80	17,480	$405,000	$0	0	$405,000	$61,900	$0	$61,900	6.5	12.8%	15	$333,958	207
5	Boiler Stack Flue Gas Economizer	Medical Center	0	0	21,230	$175,950	$0	0	$175,950	$25,260	$0	$25,260	7.0	11.6%	15	$125,602	124
6	Upgrade Boiler Combustion Controls	Medical Center	0	0	9,770	$136,390	$0	0	$136,390	$15,250	$0	$15,250	8.9	7.3%	15	$45,664	57
7	System Chilled Water Distribution	Medical Center	51,260	76	0	$81,490	$1,950	0	$79,540	$6,660	$0	$6,660	11.9	4.7%	18	$12,058	17
8	Install Small Boiler for Summer Loads	Medical Center	0	0	22,630	$317,580	$3,300	0	$314,280	$26,930	$0	$26,930	11.7	7.6%	30	$213,560	132
9	Replace 800 HP Watertube Steam Boiler	Medical Center	0	0	99,915	$2,146,670	$500,000	0	$1,646,670	$118,900	$0	$118,900	13.8	5.9%	30	$683,822	585
10	Boiler Blowdown Heat Exchanger / Recovery	Medical Center	0	0	1,180	$22,500	$0	0	$22,500	$1,405	$0	$1,405	16.0	-0.8%	15	-$5,727	7
11	Free Cooling - Waterside Economizer	Medical Center	26,250	49	0	$63,000	$0	0	$63,000	$3,410	$0	$3,410	18.5	0.8%	20	-$12,268	9
12	Water Source Heat Pump Replacement	Family Health Center	77,060	95	0	$213,820	$6,561	0	$207,260	$10,000	$0	$10,000	20.7	-3.8%	15	-$87,881	25
13	Upgrade Windows	Medical Center	16,220	0	6,620	$403,310	$0	0	$403,310	$9,990	$0	$9,990	40.4	-3.4%	25	-$229,353	44
	Totals	TOTALS	**1,007,340**	**388**	**196,930**	**$4,250,630**	**$521,171**	**$0**	**$3,729,460**	**$370,755**	**$0**	**$370,755**	**10.1**	**7%**	**18**	**$1,385,034**	**1,485**

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.

cars	257
trees	405

Energy Audit Purpose & Scope

Purpose:

- The objectives of the energy audit are to evaluate the site's energy consumption, establish baselines for energy consumption 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 2008 – March 2009

Buildings	Electric				Natural Gas			
	Account Number	Annual Consumption	Annual Cost	$ / kWh	Account Number	Annual Consumption	Annual Cost	$ / CCF
Hoboken Hospital	2166695825 - 778017468	7,498,069	$ 1,001,267	$0.134	2166695825 - 1639150	1,247	$ 1,764	$1.414
New Account #	4200683601				4200683601			
Hoboken Hospital	2171310146	1,711	$ 397	$0.232	2100496042 - 1784781	340,992	$ 406,283	$1.191
New Account #	unmetered				4201024601			
Hoboken Hospital					2169713808-1648640	11,015	$ 10,459	$0.950
New Account #					6560125984			
Center for Family Health - Outpatient Offices	2166695922-7280100896	372,160	$ 46,250	$0.124	2166695922-2644092	8,246	$ 11,884	$1.441
New Account #	4200745801				4200745801			
TOTAL / AVERAGE		**7,871,940**	**$ 1,047,915**	**$0.133**		**361,500**	**$ 430,390**	**$1.191**

Note: The Hospitals yearly utility usage seems low, Dome-Tech believes that utility account information for additional meters was not provided. Meter account data with a full year of billing was included. Dome-Tech feels the Energy star rating is unusually high for the hospitals actual energy efficiency .

Please see Appendix for full utility data and consumption profiles for the 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)
Hoboken Hospital	350,000	84	Yes	213.2	387.90
Center for Family Health - Outpatient Offices	33,000	81	Yes	67.1	157.50

Note: The Hospitals yearly utility usage seems low, Dome-Tech believes that utility account information for additional meters was not provided. Meter account data with a full year of billing was included. Dome-Tech feels the Energy star rating is unusually high for the hospitals actual energy efficiency.

Historic Energy Consumption (continued)

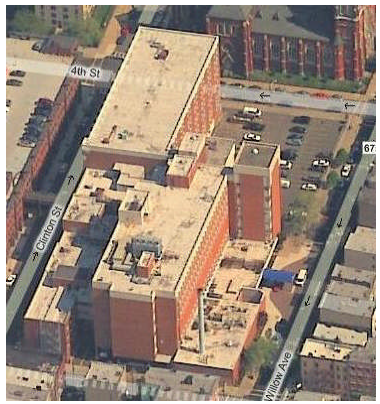
Portfolio Manager Sign - In

- An account has been created for Hoboken Municipal Hospital 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 building'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

- Username: ***HobokenMHospital***
- Password: ***DTHobokenHospital***
- Email for account: ***jlorenzo@hobokenumc.com***

Facility Information

Building Name: Hoboken University Medical Center



Address:	318 Willow Avenue, Hoboken, New Jersey
Gross Floor Area:	350,000 sf
Year Built:	Original building (Assumption Hall) built late 1800's; additions in 1950's (South) and 1970's (North)
Occupancy:	1500 – 2500 occupants; operating 24/7/365 with the exception of the offices, which operate M-F 9:00 – 5:00

The hospital has 2000 employees with approximately 1000 there at any given time; bed capacity is 220 and 150 are full at any given time; ER has 40,000 people/year and is expected to rise to between 55,000 and 65,000 per year

Construction Features:

Facade:	Six story, red brick and concrete façade with steel frame; in good condition
Roof Type:	Flat, light colored, metal deck, built up with urethane foam top layer; foam top layer in poor condition; approximately 20+ years old
Windows:	Covering 40% of façade; metal frame, two-thirds fixed, bottom 1/3 awning style operable; 20% are double glazed, approximately 10 years old and in good condition, remaining 80% are single glazed, 40+ years old and in poor condition and need replacing
Exterior Doors:	Approximately five doors; metal frame, some solid metal; main entrance is 90% glass, approximately 10-20 years old; in good condition

Facility Information (continued)

- **Major Mechanical Systems**
  - **Air Conditioning Systems**
    - One (1) Lennox Packaged Roof Top Unit (South Wing)
    - One (1) McQuay Packaged Roof Top Unit (South Wing)
    - Five (5) Mr. Slim Packaged Split AC Systems (North Wing)
    - Three (3) Packaged Split AC Systems of various manufacturers (North Wing)
    - One (1) Liebert electric 5 Ton CRAC Dry Cooler equipped with two (2) 1.5 HP pumps
  - **Air Handlers**
    - Two (2) Trane 100% outside air custom air handlers equipped with chilled water coils and steam pre-heat coils and steam humidifiers (North Wing)
    - One (1) Trane re-circulating custom air handler with chilled water coil and steam pre-heat coil and steam humidifier (North Wing)
    - One (1) Trane custom air handler with chilled water coil and steam pre-heat coil (Old ER South Wing)
    - One (1) Pace Industries 100% outside air multi-zone, hot deck/cold deck custom air handler with chilled water coil and steam pre-heat coil and hot-water re-heat technology (South Wing)

Please see Appendix for equipment and lighting inventory for the buildings.

Facility Information (continued)

- **Air Handlers (continued)**
  - The fans are equipped with variable frequency drives; however operation was unable to be determined due to the BMS being out of service.
  - The fans range in size from 5 HP to 25 HP (over 75,000 CFM, over 500 tons connected chilled water load).

- **Boilers and Heat Exchangers**
  - One (1) 800HP Cleaver-Brooks water-tube boiler installed in 1975
  - One (1) 500HP Cleaver-Brooks fire-tube boiler installed in 2007 (in new condition)
  - Six (6) Heating Hot Water pumps (of various manufacturers; 4-50 GPM; 2-7.5 HP); five are located in the North Wing and one is in the South Wing
  - Two (2) Armstrong heating hot water heat exchangers (GPM data n/a)

- **Controls System**
  - Digital BMS overlaying a pneumatic controls system powered by one (1) Quincy 5 HP air compressor. BMS motherboard has failed and cannot be replaced. BMS is inoperable and must be replaced.

Facility Information (continued)

Major Mechanical Systems (continued)

Chilled Water

- The chilled water system is comprised of one (1) Carrier 600 ton centrifugal chiller in the boiler room and one (1) 400 ton TecoChill natural gas driven chiller (R-134A) on the South Wing roof
- The 600T & 400T chillers are equipped with two (2) Bell & Gossett chilled water pumps rated for 1,440 GPM & 1,000 GPM (30 HP & 25 HP motors)
- The chillers receive condenser water from two (2) two cell cooling towers (BAC and Evapco) equipped with two (2) condenser water pumps rated for 1,208 GPM (15 HP motors)

Domestic Hot Water

- Domestic hot water is provided by two (2) Aerco steam / domestic hot water heat exchangers and (1) domestic hot water circulating pump (not accessible) all in the 2nd floor mechanical equipment room.

Please see Appendix for equipment and lighting inventory for the buildings.

Facility Information

- **Building Name:** **Center for Family Health**

Address:	122 Clinton Street, Hoboken, New Jersey
Gross Floor Area:	33,000 sf
Year Built:	Original building – late 1800's; renovated in 1997
Occupancy:	100 employees; 8-5 are peak hours; operates 8-8 M-F; sees 21,000 visitors/year

- **Construction Features:**

Facade:	Brick, in good condition
Roof Type:	Pitched, dark colored, approximately 13 years old, shingle over wood deck and frame
Windows:	Covering approximately 40% of façade, approximately 13 years old, metal frame, fixed, no shading, in good condition
Exterior Doors:	Metal, approximately 13 years old, in good condition

Facility Information (continued)

- **Major Mechanical Systems**
  - **Air Conditioning Systems**
    - Twenty-seven (27) McQuay ceiling mounted water source heat pumps; capacity range 1 to 3 tons each.
  - **Air Handlers**
    - One (1) 5HP McQuay custom built air handling unit
  - **Boilers and Heat Exchangers**
    - Five (5) Weil-McClain natural gas modular boilers (age 13)
  - **Domestic Hot Water**
    - One (1) Weil-McClain indirect HHW / domestic hot water heat exchanger
  - **Chilled Water**
    - One (1) Evapco evaporating condenser cooling tower (approximately 13 years old)
  - **Heating Hot Water**
    - Two (2) 3HP Marathon Electric glycol pumps
    - Two (2) 1/6 HP Marathon Electric glycol pumps
    - Two (2) ¼ HP Armstrong glycol pumps

Greenhouse Gas Emission Reduction

Implementation of all the identified ECMs will yield:

- 1,007,340 kilowatt-hours of annual avoided electric usage.
- 196,930 gallons of annual avoided natural gas usage.
- This equates to the following ***annual*** reductions:

- 1,485 tons of CO2;

  -OR-

- 257 Cars removed from road;

  -OR-

- 405 Acres of trees planted annually

The Energy Information Administration (EIA) estimates that power plants in the state of Connecticut emit 0.694 lbs CO2 per kWh generated.

The Environmental Protection Agency (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.

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.
- 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:

BUILDINGS	Electricity Cost ($/ kWh)	Natural Gas Cost ($/ therm)
Hospital	$0.134	$1.191
Family Health Center	$0.124	1.441

Energy Conservation Measures - ECM #1: Steam Traps Preventive Maintenance

	Hoboken University Medical Center
Estimated Annual Energy Cost Savings:	$6,840
Estimated Gross Implementation Costs:	$12,420
NJ Smart Start Rebate:	$0
Net Estimated Implementation Costs:	$12,420
Estimated Simple Payback (years):	1.8
Annual Avoided CO_2 Emissions (tons):	33

- In steam systems that have not been maintained for 3 to 5 years, between 15% to 30% of the installed steam traps may have failed—thus allowing live steam to escape into the condensate return system.
- In systems with a regularly scheduled maintenance program, leaking traps should account for less than 5% of the trap population.
- Based on observations of the condensate return system, make-up water usage and steam vents, a large portion of the steam traps are most likely failing.
- It is recommended that a full steam trap survey be performed and a continuous site steam trap survey program be implemented.
- Repair or replacement of the failed steam traps found during the survey will save approximately $12,420.

ECM #2: Lighting Upgrade

	Hoboken Family Health Center	Hoboken University Medical Center	TOTALS
Estimated Annual Energy Cost Savings:	$2,810	$39,230	**$42,040**
Estimated Gross Implementation Costs:	$7,370	$130,230	**$137,600**
NJ Smart Start Rebate:	$0	$9,360	**$9,360**
Net Estimated Implementation Costs:	$7,370	$120,870	**$128,240**
Estimated Simple Payback (years):	2.6	3.1	**3.1**
Annual Avoided CO_2 Emissions (tons):	6	97	**103**

- Although most of the current light fixtures have higher efficiency 32-watt T-8 fluorescent lamps and ballasts, replacing the lamps with 25-watt lamps will reduce lighting energy costs without compromising light levels or quality.

- Many areas 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 reduce lighting energy costs by approximately 30%*.

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

ECM #3: Retrofit/Replace 100% Outside Air AHUs with Re-circulating AHUs

	Hoboken University Medical Center
Estimated Annual Energy Cost Savings:	$41,740
Estimated Gross Implementation Costs:	$134,900*
NJ Smart Start Rebate:	$0
Net Estimated Implementation Costs:	$134,900*
Estimated Simple Payback (years):	3.2
Annual Avoided CO_2 Emissions (tons):	142

- Several air handlers provide 100% outside air to a majority of the spaces including office and administrative areas. Although specific areas such as operating rooms, intensive care units, etc. require higher ventilation rates, reducing ventilation rates in non-critical areas will significantly reduce HVAC costs.

- Dome-Tech recommends retrofitting or replacing the existing AHUs that do not serve critical areas with units that have the capability of re-circulating air; thus, reducing the amount of outside air that requires costly conditioning.

- Further engineering and analysis is required to determine the exact HVAC design that will accomplish HVAC energy reduction from this measure while maintaining proper ventilation rates. *Note that this estimated cost does not include design engineering.

ECM #4: Upgrade/ Repair Building Management System

	Hoboken University Medical Center
Estimated Annual Energy Cost Savings:	$61,900
Estimated Gross Implementation Costs:	$405,000
NJ Smart Start Rebate:	$0
Net Estimated Implementation Costs:	$405,000
Estimated Simple Payback (years):	6.5
Annual Avoided CO_2 Emissions (tons):	186

- A building management system (BMS) is a computer system designed specifically for the automated control and monitoring of the heating, ventilation, chilled water and steam distribution systems in a single facility or group of buildings such as hospitals. The system can also be used for data collection and used to produce trend analysis and annual consumption forecasts.

- A BMS was installed and was operating in the Hospital, but has recently become inoperable for various reasons. Therefore, the HVAC, chilled water and steam systems that were previously automated are currently being operated manually. The current situation has led to significant inefficiencies and increased operating costs. Many of the control valves need repair or replacement due to being operated by hand.

ECM #4: Upgrade/ Repair Building Management System (continued)

- Dome-Tech recommends repairing and/or replacing the existing controls system/network including associated valves, dampers, etc. The following are some of the opportunities that can be implemented with the use of a BMS:
  - Time of Day Optimization (Included in ECM#4)
  - Optimum Start (Included in ECM#4)
  - Supply Air Temperature Reset (Included in ECM#4)
  - Variable Chilled Water Flow Control (see ECM#7 for more information)
  - Demand Control Ventilation (Included in ECM#4)
  - Variable Air Volume Control (Included in ECM#4)
  - AHU Static Pressure Reset (Included in ECM#4)

- Optimize Time of Day Schedule and Optimal Start/Stop - Optimizing the schedules to better reflect actual building occupancy and optimizing HVAC system start and stop based on outside conditions will reduce overall heating and cooling costs.

- Optimize and Standardize Space Temperature Set points – Without a front-end BMS computer system, space temperature set points are not being properly monitored and maintained to desired levels. This scenario leads to increased energy consumption, discomfort complaints and increased labor costs.

- AHU Supply Air Static Pressure Reset - Under a static pressure reset strategy, the BMS will periodically (every 15 minutes) poll VAV box damper positions and adjust the static pressure set point to maintain the box that is most open at 95% damper position. When compared to a fixed static pressure set point, this strategy reduces fan power significantly.

ECM #5: Boiler Stack Flue Gas Economizer

	Hoboken University Medical Center
Estimated Annual Energy Cost Savings:	$25,260
Estimated Gross Implementation Costs:	$175,950
NJ Smart Start Rebate:	**TBD**
Net Estimated Implementation Costs:	$175,950
Estimated Simple Payback (years):	7.0
Annual Avoided CO_2 Emissions (tons):	124

Note: There is a potential custom rebate available; however, the estimated incentive level has not been determined.

- Boiler flue gas temperatures are typically 300-400°F. Depending upon the boiler run hours, this can equate to a significant annual amount of waste heat lost to the atmosphere. One method of reclaiming this waste heat is utilizing a stack economizer. This is a heat exchanger that uses boiler flue gases to preheat various heat sinks such as boiler feed water, cold makeup water, process water, glycol, and thermal fluids.

- The economizer is sized based upon fuel burned, stack gas temperatures, boiler operating profile and available heat sink. When selecting an economizer, materials of construction must be carefully reviewed due to the corrosive effect of condensed flue gases.

- Further engineering/ analysis is required to determine the exact design that will accomplish this measure's projected energy reduction.

ECM #6: Upgrade Boiler Combustion Controls

	Hoboken University Medical Center
Estimated Annual Energy Cost Savings:	$15,250
Estimated Gross Implementation Costs:	$136,390
NJ Smart Start Rebate:	$0
Net Estimated Implementation Costs:	$136,390
Estimated Simple Payback (years):	8.9
Annual Avoided CO_2 Emissions (tons):	57

- Installing an advanced boiler combustion controls package will improve boiler combustion efficiency when compared to the existing controls.
- A boiler combustion controls upgrade will improve efficiency in the following ways:
  - Precise electronic fuel to air ratio control that will result in approximately 2% natural gas savings
  - Variable speed control on combustion fans
  - Continuous, automated oxygen trim controls that will result in approximately 2% natural gas savings

ECM #7: Convert to Primary/Secondary Chilled Water Distribution

	Hoboken University Medical Center
Estimated Annual Energy Cost Savings:	$6,660
Estimated Gross Implementation Costs:	$81,490
NJ Smart Start Rebate:	$1,950
Net Estimated Implementation Costs:	$79,540
Estimated Simple Payback (years):	11.9
Annual Avoided CO_2 Emissions (tons):	17

- The existing chilled water distribution system is a constant flow primary chilled water loop served by (2) two (one standby) 30HP primary chilled water pumps in the Boiler room and 2-5HP primary chilled water pumps in the TecoChill MER.
- Converting to a primary/secondary chilled water distribution system will reduce chilled water pumping energy by installing secondary chilled water pumps driven by variable speed motors. The chilled water end users will require a conversion from 3-way control valves to 2-way control valves.
- A VFD will control the pumps with a process variable such as differential pressure to reduce energy consumption.
- Power usage is directly proportional to the cube of the pump speed, and any reduction in speed will produce significant energy savings. (For example, reducing speed by 50% requires only 12.5% of the power needed at full speed.)
- Further engineering/ analysis is required to determine the exact design that will accomplish this measure's projected energy reduction.

ECM #8:Install Small Boiler for Summer Loads

	Hoboken University Medical Center
Estimated Annual Energy Cost Savings:	$29,930
Estimated Gross Implementation Costs:	$317,580
NJ Smart Start Rebate:	$3,300
Net Estimated Implementation Costs:	$314,280
Estimated Simple Payback (years):	11.7
Annual Avoided CO_2 Emissions (tons):	7

- During summer operating hours, the site operates a 500 HP fire tube steam boiler generating 50 psig steam to meet summer steam and hot water loads, which includes:
  - HVAC steam reheat
  - Domestic hot water
  - Steam autoclaves
- The summer boiler load is approximately 100 HP. A 500 HP boiler operating at 20% load is significantly less efficient than an appropriately-sized boiler operating closer to its full firing rate.
- Installing a boiler specifically for non-heating season loads will greatly improve the steam plant's operating efficiency and reduce natural gas consumption.

ECM #9: Replace 800 HP Watertube Steam Boiler

	Hoboken University Medical Center
Estimated Annual Energy Cost Savings:	$118,900
Estimated Gross Implementation Costs:	$2,146,670
NJ Smart Start Rebate:	$500,000
Net Estimated Implementation Costs:	$1,646,670
Estimated Simple Payback (years):	13.8
Annual Avoided CO_2 Emissions (tons):	584

- The existing 800-hp water tube high pressure steam boiler was installed in 1975 and exceeds its estimated equipment service life (EESL.) ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) states the estimated equipment service life (EESL) of similar equipment to be 30 years. Considering the existing condition, the boiler is 5 years past the ASHRAE EESL.

- Generally, as boilers approach the end of their service life, the efficiency degrades and the boiler must consume more fuel in order to produce the same rated output. In addition, there is a direct correlation between risk of equipment failure (tube breaks & meltdown, shell cracks, furnace surface area failure) and equipment age.

- Replacing the boiler with a new, high efficiency (>83%) steam boiler will provide significant annual energy savings. New boilers with sophisticated combustion controls extract more thus creating higher operating efficiency.

- The high first cost of a new boiler system preclude this ECO from being justified by economics alone. However, reliability issues warrant consideration of this project as part of a long-term capital improvement plan. Installation of a new boiler would allow boiler runtimes to be equally distributed and would allow for reliable backup capacity should one boiler fail or require repairs.

- The estimated savings is based on the following assumptions:
  - **Existing Boiler Efficiency: 75%**
  - **New Boiler Efficiency: 83%**

ECM #10: Boiler Blowdown Heat Exchanger/ Recovery

	Hoboken University Medical Center
Estimated Annual Energy Cost Savings:	$1,410
Estimated Gross Implementation Costs:	$22,500
NJ Smart Start Rebate:	**TBD**
Net Estimated Implementation Costs:	$22,500
Estimated Simple Payback (years):	16.0
Annual Avoided CO_2 Emissions (tons):	7

Note: There is a potential custom rebate available; however, the estimated incentive level has not been determined.

- Boiler manufacturers and water treatment companies recommend boiler water total dissolved solids (TDS) be maintained at certain levels. Automatic boiler surface blowdown is the most effective method of purging destructive solids from any steam boiler system. However, this protective procedure also results in a constant and costly heat loss, unless a blowdown heat recovery system is used.

- Dome-Tech investigated the installation of a two stage blowdown heat recovery system. The system's first stage is the flash area where the high pressure condensate flashes to a low pressure steam that can be used to preheat feedwater or for deaerator make up stream. The second stage is a heat exchanger that transfers the remaining heat to the incoming boiler make-up water. Preheating the make-up water maximizes boiler efficiency and improves deaerator efficiency by reducing surges caused by adding large amounts of cold make-up water to the system.

ECM #11: Free Cooling – Waterside Economizer

	Hoboken University Medical Center
Estimated Annual Energy Cost Savings:	$3,410
Estimated Gross Implementation Costs:	$63,000
NJ Smart Start Rebate:	$0
Net Estimated Implementation Costs:	$63,000
Estimated Simple Payback (years):	18.5
Annual Avoided CO_2 Emissions (tons):	9

- The Hospital has a winter cooling load of approximately 30 tons. Currently, any winter cooling load would be satisfied by mechanical cooling, i.e., chillers.
- Taking advantage of outside conditions by utilizing the existing cooling towers, condenser water loop and a plate-and-frame heat exchanger, significant energy savings can be achieved by eliminating the need to run the chiller.
- This free cooling strategy can be operated when the outdoor air is <38°F. This strategy should be considered for implementation to take advantage of significant free cooling hours.

ECM #12: Water Source Heat Pump Replacement

	Hoboken Family Health Center
Estimated Annual Energy Cost Savings:	$10,000
Estimated Gross Implementation Costs:	$213,820
NJ Smart Start Rebate:	$6,560
Net Estimated Implementation Costs:	$207,260
Estimated Simple Payback (years):	20.7
Annual Avoided CO_2 Emissions (tons):	25

- The Hoboken Family Health Center has approximately 30 water-source heat pumps with capacities between 1 and 3 tons each. Twenty two of the 13-year old heat pumps are nearing the end of their estimated equipment service lives of 19 years per ASHRAE standards.

- As a capital improvement project, the Family Health Center should consider replacing these units with premium efficiency units on a one-to-one basis. The existing heat pumps' seasonal energy efficiency ratio (SEER) is approximately 9 SEER. New, premium efficiency heat pump units have SEER ratings as high as 14.

ECM #13: Window Replacement

	Hoboken University Medical Center
Estimated Annual Energy Cost Savings:	$9,990
Estimated Gross Implementation Costs:	$403,310
NJ Smart Start Rebate:	$0
Net Estimated Implementation Costs:	$403,310
Estimated Simple Payback:	40.4
Annual Avoided CO_2 Emissions (tons):	0.0

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

- A survey of the facility revealed a mixture of types and sizes of windows, and window functionality and condition varied throughout the buildings.
- A window replacement project would result in a measurable improvement in heat retention. In addition, increased aesthetic value and occupant comfort would accompany a window project. 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 # 14: Creation of an Energy Awareness & Education Program

Estimated Annual Savings:	$2,000 - $3,000*
Gross Estimated Implementation Cost:	$1500
Expected Rebate / Energy Efficiency Credit:	None
Net Estimated Implementation Costs:	$1500
Simple Payback (yrs):	Varies
Annual Avoided CO_2 Emissions (tons):	Varies
Cost per Ton CO_2 Reduction ($/ton):	Varies

- Hoboken University Medical Center currently has no observed employee program in place.
- Employees can make a significant difference in utility spending when they are informed, aware, and engaged.

Operations & Maintenance

Coil Freeze Protection

- Issue: The chilled water coils in the 100% outside air AHUs at the Hospital are fully drained to avoid potential freezing.

- Potential Outcome: Increased labor costs to drain coils; and, potential comfort issues during unseasonably warm periods during winter months due to chilled water not being available.

- Resolution: Install side stream freeze protection pumps on the chilled water coils. With proper controls, freeze protection pumps will circulate chilled water through the coil to prevent freezing and coil destruction when outdoor air conditions are <38°F dry-bulb.

Operations & Maintenance (continued)

Chilled Water/Hot Water Control Valves

- Issue: Several control valve actuators at the Hospital have been dismantled to allow operation by hand.
- Potential Outcome: Increased labor / manpower to operate valves, poor temperature control. Activator and valve damage through manual use.
- Resolution: Repair or Replace actuator and valves.

Operations & Maintenance (continued)

Make-up Water Meter

- Issue: The make-up water meter on the cooling tower at the CFH is missing and bypassed.
- Potential Outcome: Additional sewer expense.
- Resolution: Purchase and install new meter. Work with water company to credit water used by tower with no meter.

Other Energy Related Issues

- Hoboken Hospital is due to replace several elevators and has received at least three (3) bid quotations from vendors. From an energy perspective, Dome-Tech suggests the following considerations when reviewing the bids:
  - Flexible, belt-driven system that reduces sheave size compared to conventional steel-rope traction system – also, eliminates need for separate elevator machine room.
  - Power Efficiency Controller on elevator motors – increases motor efficiency during part load operation, which occurs during the majority of elevator run time;
  - Regenerative braking – generates electric power from energy that is usually lost during braking.

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
- Photovoltaics (solar) are particularly popular in Germany and Spain and growing in popularity in the U.S.
- Wind power is growing as well, mostly in Europe and the U.S.

Renewable Energy Technologies: Wind

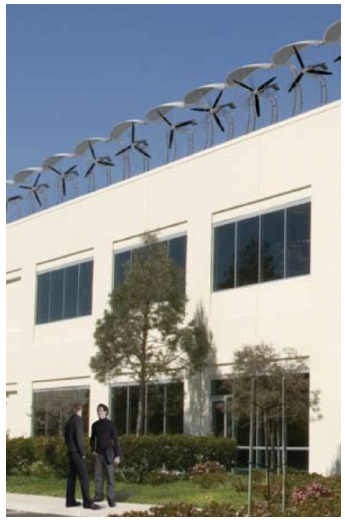
Wind turbines generate electricity by harnessing a wind stream's kinetic energy as it spins the turbine airfoils. As with most renewable energy sources, wind energy is subject to intermittent performance due to the unpredictability of wind resources.

Hoboken 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 Hoboken area is 4.6 meters per second. Ideal wind speeds for a successful project should average over 6 meters per second.

For Hoboken Hospital, 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

	Building Integrated	Ground Mount 5 kW	Ground Mount 50 kW
Gross Installation Cost Estimate	$130,000	$62,400	$250,000
NJJ SSB Rebate	$47,498	$37,483	$98,436
Net Installation Cost Estimate	$82,502	$24,917	$151,564
Annual Energy Savings	$1,930	$1,523	$14,361
Simple Payback	42.8 yrs.	16.4 yrs.	10.6 yrs.
System Capacity	20 kW	10 kW	50 kW
Annual Avoided Energy Use	14,843 kWh	11,713 kWh	110,472 kWh
Annual CO2 Emmisions, Therms	5	4	39
% of Annual Electric Use*	0.2%	0.1%	1.4%

Hoboken University Hospital: 7871940 kWh/Year.

Wind Turbine Pros & Cons

Pros	Cons
➢Annual reduction in energy spend and use can be potentially reduced by almost $62,000 (19% reduction). ➢Typical equipment life span is 15-30 years. ➢Reduction of annual greenhouse gas emissions by 126 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 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).

Due to attractive payback and high potential for energy reduction, the 50 kilowatt ground mounted wind turbine project appears to be the most attractive option. Should the Hoboken Hospital 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.
- Can be recommended in this application for placement on additional areas.
- Dome-Tech evaluated a roof mounted system for HUMC, and a system should be considered for further study at the time of roof replacement.

Solar Photovoltaic Systems

Install Roof Mount Solar Photovoltaic System(s)	
Assumptions	
System Capacity, kw-dc (maximum utilization of roof space)	130 kw dc
Estimated Annual AC Energy Produced by Proposed Solar PV System	136,725 kwh
Total Annual Facility Electric Use, kwhrs	7,871,940 kwh
Proposed % of Total Annual kWh supplied by Solar PV	2%
All-In Rate for Electric Year 1	$0.130 / kwh
Year 1 Electric Cost Savings	$17,774
Year 1 Maintenance Costs	$2,594
Estimated Year 1 SREC Value:	$640 / SREC
Estimated Year 1 SREC Revenue:	$87,459
Financial Results	
Actual Payback	**5.8 years**
IRR (25 Years)	**12.7%**
Net Present Value (25 yrs, 8% discount rate)	**$173,622**
Cost and Rebate / Tax Incentives	
Cost per kW installed	$6,000
System Installed Cost (does not include value of tax credits)	$778,320
NJ CEP Rebate ($1/watt for systems < 50 kW)	$0
Federal Business Energy Tax Credit (30%)	$233,496

Renewable Energy Technologies: Solar Photovoltaic

Non-Financial Benefits of Solar PV

The implementation of solar PV projects at Hoboken Municipal Hospital would place your facilities at the forefront of renewable energy utilization. This allows the Hospital the opportunity to not only gain experience with this energy technology, but also to win recognition as an environmentally sensitive, socially conscious institution.

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.

- 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. Given a base thermal load of approximately 3 million BTU-h, a microturbine plant is an opportunity to consider for further engineering and analysis. Please see the estimated economics on the following page.

CHP/Co-Generation

Microturbine Economics

Two (2) 400 kW Microturbine sets that will generate onsite electricity and hot water

Simple Payback		
Total Installed Cost	$3,000 /kW	$2,280,000
State Grant	$1,000 /kW	($760,000)
Federal Investment Tax Credit	$200 /kW	($152,000)
Net Installed Cost	**$1,800 /kW**	**$1,368,000**
Year 1 Annual Savings		
Avoided Electric Energy:	6,324,720 kWh	$841,188
Avoided Heating Fuel:	34,252 MMBTU	$445,281
Avoided Cooling:	0 kWh	$0
CHP Gas:	76,926 MMBTU	($923,111)
Service Contract:	2.7 ¢/kWhr	($176,426)
Net Annual Savings (Year 1)		**$186,930**
Simple Payback (years)		**7.3**

Utility Tariff and Rate Review: Electricity

- **Accounts and Rate Class:** Hoboken Hospital and The Center for Family Health (Hospital) are served by three electric accounts behind Public Service Electric & Gas under rate classes Large Power and Lighting Service Primary (LPL-P), Private Street and Area Lighting Service (PSAL) and General Lighting and Power Service (GLP).

- **Electric Consumption and Cost:** Based on the one-year period studied, the total annual electric expenditure for the Hospital is about $1,047,000 and the total annual consumption is about 7,871,000 kilowatt-hours (kWh).

- **Average/Effective Rate per kWh:** For the one year period studied, the Hospital's average monthly cost per kilowatt-hour ranged from 6.33 ¢/kWh to 27.94 ¢/kWh (PSAL account), inclusive of utility delivery charges. The Hospital's overall, average cost per kilowatt-hour during this period was 13.31 ¢/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:** Hoboken Hospital and The Center for Family Health (Hospital) are served by four natural gas accounts behind Public Service Electric & Gas under rate classes Basic Gas Supply Service-General Service Gas (BGSS-GSG) and Non-Firm Transportation Gas Service (TSG-NF).

- **Natural Gas Consumption and Cost:** Based on the one-year period studied, the total annual natural gas expenditure for the Hospital is about $430,000 and the total annual consumption is about 361,000 (CCF). Natural gas is used predominantly throughout the winter period for heating purposes.

- **Average/Effective Rate per Therm:** For the one year period studied, the Hospital's average cost per CCF ranged from $0.82 to $3.24 per CCF, inclusive of utility delivery charges. The Hospital's overall, average cost per CCF during this period was $1.19 per CCF.

  - 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 (continued)

- 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 (ie, 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.

- 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 (continued)

- 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

- Electric
  - The Hospital has one BGS-CIEP account with PSE&G and is currently paying the retail energy adder. Based on current and recent market conditions, and actual bid processes run by Dome-Tech for various clients, we have seen customers with BGS-CIEP accounts produce savings by locking into a fixed price or index price contract. Dome-Tech can assist the Hospital with a competitive bid process for procuring electricity for their BGS-CIEP account. 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.
- Natural Gas
  - Based on current and recent market conditions, and actual bid processes run by Dome-Tech for various clients during the summer of 2009, 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.
- 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.
- To determine whether a savings opportunity currently exists for your entity, or for guidance on how to get started, you may contact Dome-Tech to discuss. There is also additional information provided below.

Retail Energy Purchasing: Recommendations and Resources (continued)

- 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:

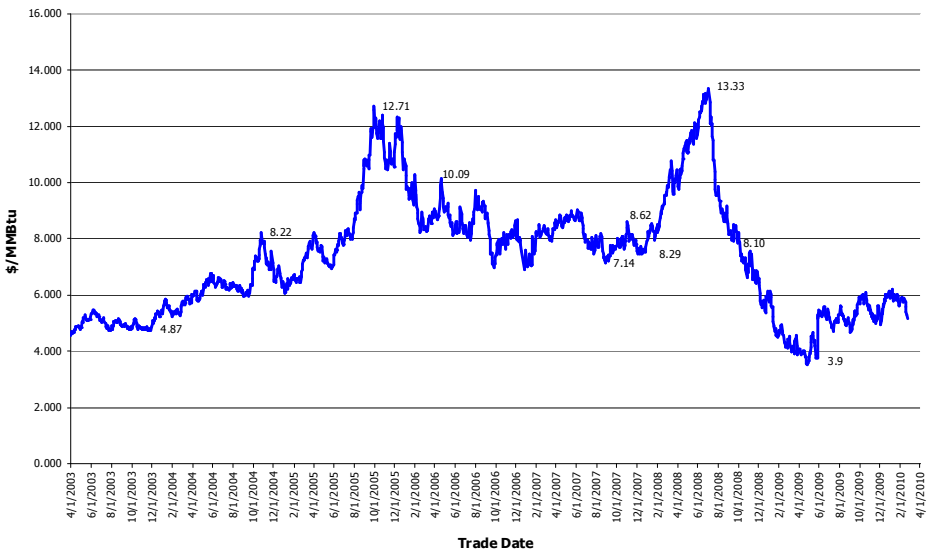
Company	Electricity	Natural Gas	Website
Pepco	X	X	www.pepcoenergy.com
Hess	X	X	www.hess.com
Sprague	X	X	www.spragueenergy.com
UGI	X	X	www.gasmark.com
South Jersey Energy	X	X	www.sjindutries.com
Direct	X	X	www.directenergy.com
Global	X	X	www.globalp.com
Liberty	X		www.libertypowercorp.com
ConEd Solutions	X		www.conedsolutions.com
Constellation	X		www.constellation.com
Glacial	X		www.glacialenergy.com
Integrys	X		www.intergryenergy.com
Suez	X		www.suezenergyna.com
Sempra	X		www.semprasolutions.com
Woodruff		X	www.woodruffenergy.com
Mx Energy		X	www.mxenergy.com
Hudson		X	www.hudsonenergy.net
Great Eastern		X	www.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 $285,000 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.)

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)

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

PSE&G Direct Install Program for Government Facilities - PSE&G makes the investment in energy efficiency upgrades by initially covering 100% of the cost to install the recommended energy efficiency measures. If eligible, the municipality will repay ONLY 20% of the total cost to install the energy efficiency measures, interest free, over two years on your PSE&G bill. For more information call Rachael Fredericks at 973-430-5263 or 1-877-533-7387.
http://www.pseg.com/customer/business/small/efficiency/gov/overview.jsp

Next Steps

- **<u>The following projects should be considered for implementation:</u>**
  - Replace/Repair Building Management System
  - Replace 800HP Boiler as capital improvement project
  - Install summer load boiler
  - Lighting upgrades
  - Steam trap repair and ongoing maintenance program
  - Vending machine power management
  - Start Energy Awareness Program
  - Energy Procurement (Electricity & Gas)
  - Retro-Commissioning Opportunities

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

- **<u>Consider applying for Pay-For-Performance Program</u>**