

LOCAL GOVERNMENT ENERGY AUDIT PROGRAM: ENERGY AUDIT REPORT

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ENCLOSURES:

Document 1 –Justice Center Energy Report

Document 2 –Community Services Building Energy Report

Document 3 –Intermediate Care Center Energy Report

Document 4 – Bergen County Probation Office Energy Report

Document 5 – Bergen County Administration Office Energy Report

Document 6 – Williams Center Energy Report

Document 7 – Voting Machine Warehouse Energy Report

Document 8 – Animal Shelter Energy Report

Document 9 – Law and Public Safety Institute Energy Report

Document 10 –Medical Examiner’s Office Energy Report

Document 11 –Darlington Golf Clubhouse Energy Report

Document 12 –Rockleigh Golf Clubhouse Energy Report

Document 13 –Valley Brook Golf Clubhouse Energy Report

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I. EXECUTIVE SUMMARY

This report presents the findings of the energy audit conducted for:

Entity: Bergen County

Facilities: Justice Center
Community Services Building
Intermediate Care Center
Probation Office
Administration Office
Williams Center
Voting Machine Warehouse
Animal Shelter
Law and Public Safety Institute
Medical Examiner's Office
Darlington Golf Clubhouse
Rockleigh Golf Clubhouse
Valley Brook Golf Clubhouse

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This audit is performed in connection with the New Jersey Clean Energy - Local Government Energy Audit Program for the Bergen County facilities. The purpose of this analysis is to provide the county insight into the energy savings potential that exists within facilities at Bergen County. Energy Efficiency changes and upgrades requires support from the building occupants, operations personnel and the administrators of the county in order to maximize the savings and overall benefit. The efficiency improvement of public buildings provides a benefit for the environment and the residence of New Jersey. Through this report it has been demonstrated that there is a great potential for energy savings and infrastructure improvements at Bergen County.

Fast Payback Energy Conservation Measures:

The Energy Conservation Measures (ECMs) identified within the reports represent the potential annual savings at each facility. It is recommended to consider all ECMs as part of the county's initiative to save energy, reduce emissions, and lower operating costs. Several ECMs shown within this report represent significant savings relative to the cost to implement. The ECMs shown with a simple payback of 10 years and less are considered very cost effective for a public entity such as Bergen and should be considered a high priority for Bergen County. The following ECMs are highly recommended throughout the county.

- Lighting Upgrades (All facilities)

Lighting retrofits throughout the county buildings is a straight forward conservation measure that is prescriptive in nature and provides substantial savings for the investment. Lighting retrofits is

a good example of ECMs that can be implemented with “in house” staff to reduce the installation cost and further reduce paybacks. In many facilities, the measure includes replacing existing 700 series T-8 fluorescent lamps with new higher efficiency T-8 lamps. In other facilities, a whole fixture replacement provides much more energy savings. Some of the buildings utilize old T-12 fixtures with magnetic ballasts which can be replaced with high efficiency T-8 bulbs with electronic ballasts. Overall lighting upgrades represent one of the most easily implemented ECMs and are highly recommended throughout all Bergen County facilities.

- Lighting Controls (All facilities)

Similar to lighting upgrades, lighting controls are very prescriptive in nature and can save considerable energy. Lighting controls do not require replacement of the fixture and typically can save more energy than lighting upgrades. For the purpose of this energy audit, each ECM is calculated as stand-alone ECMs. The maximum savings can be achieved through the implementation of both the lighting upgrades and lighting controls ECMs. Lighting controls will automatically turn off lights when spaces and rooms are not occupied. It is important to note that ECMs are calculated as stand-alone ECMs and therefore the total savings will be slightly less than the sum of both individual ECMs (Lighting Upgrade and Lighting Controls). The discrepancy between additive ECMs is within the tolerances for this level of analysis (+/- 20%). Lighting controls provide the maximum savings in spaces that have changing occupancy schedules throughout the day. Other facilities with standard operating hours will also see substantial savings because all spaces are not occupied continuously. Lighting controls throughout Bergen County is highly recommended in addition to the lighting upgrade ECMs.

- Computer Monitor Replacement (All facilities)

Plug loads within buildings is becoming a larger and larger portion of the total energy use for commercial facilities. Plug loads are most dominant in combination with computers and computer equipment. Modern computer monitors are flat screen LCD panels that are far more efficiency than older style cathode ray-tube (CRT) monitors. Typical energy use of a flat screen monitor is approximately 1/3 of the energy used by a CRT monitor. The majority of computer monitors within the facilities are LCD style monitors. However, Bergen County utilizes some CRT monitors throughout the county buildings. It is highly recommended to replace the existing CRT monitors with flat screen monitors to take advantage of the energy savings as well as other ergonomic benefits of modern LCD monitors.

- Boiler Controls Upgrade - Space Temperature Sensors (Intermediate Care Center, Justice Center)

The boilers in the Justice Center and the Intermediate Care Center are controlled via Heat-Timer boiler controllers. These controllers are capable of various energy saving features such as night time temperature set back, temperature reset based on ambient air temperature and temperature compensation based on actual space temperatures. Currently the system throughput in each facility is controlled based on outside air only due to malfunctioning space temperatures. Although a common practice, modulation of heat based only on ambient temperature often causes over-heating of the spaces due to lack of compensation based on actual space

temperatures. Heating energy consumption of the facility can be reduced by installing space temperatures for each boiler controller.

- Gas Fired Hot Water Heaters (Admin)

Domestic hot water for the Bergen County Administration Building is provided with electric hot water heaters located in a nearby location for each bathroom. Electricity is one of the most expensive utilities to use for heating purposes including domestic hot water heating. Substantial energy cost savings can be realized by installing gas fired central domestic hot water heaters to replace the electric hot water heaters.

- Minimize/Eliminate Reheat in VAV Boxes (Admin)

The Bergen County Administration Building is conditioned with a large central VAV (Variable Air Volume) air conditioning system. The system is designed to cool supply air below the dew point to remove moisture and then re-heat supply air via hot water re-heat coils in the VAV boxes before air is introduced into the space. This is an inherently inefficient process because the reheat coils require running the hot water boilers in the summer, which in turn increases the cooling load of the building. Energy savings can be realized by minimizing or eliminating the use of hot water re-heat during the cooling season via various control strategies.

- Programmable Thermostats (Community Services Building, Darlington Golf Clubhouse)

Standard non-programmable thermostats at the Community Services Building (Electric baseboard heaters) and Darlington Golf Clubhouse do not allow a building to save energy during unoccupied periods. In the heating season the highest building loads on an HVAC system are at night when the building is empty. Programmable thermostats allow the system to set-back the temperature when the building is empty to limit the unnecessary energy use. Since programmable thermostats are a very small portion of the overall system cost, the energy savings far outweighs the cost to implement. The payback for programmable thermostat installations is typically within 1-2 months of the heating or cooling season.

- Energy Star Rated Window AC Units (Justice Center)

The primary source of cooling for the majority of the perimeter offices throughout the Justice Center is window air conditioners. There are over 200 window AC units and these units vary in size, capacity and efficiency. While some of the units are new, many of the units are significantly old and inefficient. It is recommended to utilize the energy star rating system as a minimum standard for replacing any window units that is in need of replacement.

- Valve Blanket & Pipe Insulation (Justice Center)

Hot Water and steam piping insulation is a valuable asset to avoid the loss of heat from the boiler systems in the Justice Center. Large diameter bare steel pipe can account for significant energy loss over an entire heating season. Since the piping remains hot 24/7, bare pipe heat losses are multiplied by the entire operating hours of the heating system. Pipe & valve insulation reduces

the loss compared to bare pipe by a factor of 10 or more. Pipe insulation becomes deteriorated overtime due to the repair of pipe / fitting leaks and service of components. Due to the savings from insulating the system to new condition, this ECM provides a payback within 10 years and is highly recommended.

- Thermostatic Steam Control Valves (Justice Center)

Manual shut off valves on older radiators cause energy waste. Because, manual valves require continual adjustment as conditions change. In addition, manual valves are usually unstable hence harder to operate at low outputs. Therefore, occupants tend to leave the valves at a certain position (usually fully open position) and open windows instead of adjusting the valve. These and many other problems due to manual shut off valves can be partially solved by installing thermostatic valves. The thermostatic valves follow the fluctuations in space load and radiator output, keeping space temperature stable. This reduces overheating and restores comfort in the problematic areas.

- Automatic Boiler Flue Damper (Darlington)

Flue gas damper is a control device located in the downstream of the draft diverter to reduce air flow up the chimney when the boiler cycles off. An automatic boiler flue gas damper saves energy by reducing or eliminating the air flow through the boiler heat exchanger and reduces stack losses. It is recommended to replace the flue gas damper of the boiler at the Darlington Golf Clubhouse to restore the efficiency of the boiler.

- Loading Dock Doors Weather-stripping (Voting Machine Warehouse)

Two of the loading dock doors for the Voting Machine Warehouse Facility are in poor condition with multiple openings and cracks around the framing causing leaks and draft issues. Loading dock doors account for significant energy use through leakage heat loss in warehouse type of facilities. The age and condition of the doors contribute to the leakage rate of the building. It is recommended to recondition or replace the weather-stripping around the loading dock doors for improved energy efficiency.

- VFD for Pumps (Williams Center)

Constant volume pumping systems require a lot of energy to operate continuously. Systems designed with 3-way control valves do not limit flow when demand for hot or chilled water is low. As a result pumping energy remains constant approximately equal to the rating of the pump motor. Variable Frequency Drives provides in combination with 2-way control at terminal devices provides a way to limit pump energy when the system demand is reduced. VFD drives install on larger pumping systems such as the Williams Center provides the most advantageous paybacks. This ECM assumes retrofit of the existing 3-way control valves to operate as 2-way control valves. This conversion must be verified before implementation. Once the overall scope for the retrofit is determined, it is anticipated this ECM will provide a good payback for the district.

- Commercial Kitchen Exhaust Hood Controls (Intermediate Care Center)

Kitchen hood controls allows the exhaust air through the commercial kitchen hood to reduce with respect to the level of heat and smoke produced by the kitchen cooking equipment. This approach automatically slows the hood exhaust and make-up air to minimum levels at light or non use conditions. This ECM provides saving on fan motors as well as energy required to heat and cool the make-up air exhausted by the hood. The savings are extremely dependent on the operating hours of the kitchen hood exhaust fan. The payback range for this ECM can vary greatly based on the operating hours. In the Intermediate Healthcare Center, it was noted that the kitchen operates year round serving three meals per day and the staff utilize the main exhaust hood extensively throughout the day, which enables this ECM to payback in 6 years. It is recommended to review the operating hours of the kitchen exhaust fan and refine the savings as a result.

Capital Improvement Energy Conservation Measures:

The ECMs that have much longer paybacks are considered capital improvement ECMs. These ECMs typically have high installation costs that are more difficult to justify the savings based solely on the energy savings associated with the improvement. Despite the long paybacks, these ECMs in many cases provide valuable and much needed infrastructure improvements for the facility. These ECMs include boiler upgrades, HVAC equipment upgrades, as well as other large equipment replacements. The savings identified for the following ECMs provides additional incentive for Bergen County's capital improvement projects.

- AC Unit Upgrades
- Condensing Hot Water Boiler Installation
- Demand Controlled Ventilation
- Energy Recovery Systems
- Building Automation Systems
- Variable Frequency Drives (VFDs)
- Variable Refrigerant Flow (VRF) AC System
- Water Cooled Chillers
- NEMA Premium Efficiency Motors
- Solar domestic hot water heating Systems
- Window Replacement

Combined Project Approach:

Although individual projects with a simple payback of 10 years and less are considered financially self sustaining, it is important to consider how multiple projects can be combined together. When ECMs are aggregated into a single project, the lower cost ECMs provides valuable savings to offset the higher cost ECMs. Likewise when multiple facilities are aggregated together into a single entity energy efficiency project, the same benefits are seen on a larger scale.

The Energy Savings Improvement Program (ESIP) allows for financing of any combination of energy efficiency projects across multiple facilities into one large project. The term of the financing must be under 15 years and the savings provides the revenue for the financing cost. The combination of all facilities into one large ESIP project provides Bergen County with the opportunity to implement all reasonable ECMs identified within this report with an overall simple payback of 13 years. This option allows Bergen County to implement much needed infrastructure improvements such as new air conditioning equipment, new condensing boilers and furnaces, as well as high efficiency lighting and lighting controls for all facilities. The program financing allows for the implementation with no upfront cost for Bergen County. Implementation of an ESIP provides significant benefits and should be strongly considered for Bergen. The total Entity Project Summary table below shows the savings, costs, incentives and paybacks for all ECMs at Bergen County.

Table 1
ESIP -Total Entity Project Summary

ENERGY SAVINGS IMPROVEMENT PROGRAM - POTENTIAL ENERGY EFFICIENCY PROJECT					
FACILITY ENERGY EFFICIENCY PROJECTS	ANNUAL ENERGY SAVINGS (\$)	PROJECT COST (\$)	SMART START INCENTIVES	CUSTOMER COST	SIMPLE PAYBACK
Justice Center	\$135,975	\$2,189,099	\$49,224	\$2,139,875	15.7
Community Services Building	\$12,090	\$51,909	\$13,609	\$50,244	4.2
Intermediate Care Center	\$24,086	\$235,020	\$2,687	\$231,978	9.6
Probation Office	\$22,791	\$313,577	\$1,820	\$308,597	13.5
Administration Office	\$78,727	\$1,059,020	\$570	\$1,058,622	13.4
Williams Center	\$28,857	\$375,188	\$2,500	\$372,113	12.9
Voting Machine Warehouse	\$7,304	\$69,403	\$440	\$68,233	9.3
Animal Shelter	\$12,889	\$106,650	\$5,123	\$101,527	7.9
Law and Public Safety Institute	\$6,023	\$82,000	\$11,877	\$79,680	13.2
Medical Examiner's Office	\$1,528	\$25,139	\$1,265	\$23,694	15.5
Darlington Golf Clubhouse	\$8,025	\$53,587	\$370	\$50,517	6.3
Rockleigh Golf Clubhouse	\$4,472	\$47,938	\$600	\$45,831	10.2
Valley Brook Golf Clubhouse	\$10,452	\$78,497	\$0	\$75,004	7.2
Total Entity Project	\$353,218	\$4,687,024	\$90,085	\$4,596,939	13.0

Total County Energy Costs: \$1,835,538
Est. Total County Energy Savings: \$353,218
Overall County Percent Reduction: 19.2%

Implementation of all ECMs identified within the ESIP – Entity Total Project Summary table represents a total annual savings of approximately \$353,218 for Bergen County. The individual facility project summaries are shown within each facility energy audit report.

In addition, Bergen County has the option to utilize the Direct Install program for their facilities. To provide assistance to small public entities in the effort to implement valuable ECMs, the NJ Clean Energy program in combination with the BPU has initiated the “Direct Install Program”. This program provides extremely large incentives to facilities with less than 100kW electric demand. It is highly recommended to utilize all available incentives including Direct Install by contacting the Direct Install Contractor to perform the site evaluation for all facilities.

Other Considerations:

- Maintenance and Operational Measures

In addition to the ECMs, there are maintenance and operational measures that can provide significant energy savings and provide immediate benefit. The ECMs listed above represent investments that can be made to the facility which are justified by the savings seen overtime. However, the maintenance items and small operational improvements below are typically achievable with on site staff or maintenance contractors and in turn have the potential to provide substantial operational savings compared to the costs associated. The following are recommendations which should be considered a priority when moving forward with energy efficiency upgrades:

1. Chemically clean the condenser and evaporator coils periodically to optimize efficiency. Poorly maintained heat transfer surfaces can reduce efficiency 5-10%.
2. Maintain all weather stripping on entrance doors to limit unnecessary infiltration.
3. Clean all light fixtures to maximize light output to provide better light output and avoid the use of task lighting where otherwise not necessary.
4. Provide more frequent air filter changes to decrease overall system power usage and maintain better IAQ.

- Renewable Energy Measures

Renewable Energy Measures (REMs) were also reviewed for implementation at Bergen County. CEG utilized a combination of roof mounted solar arrays and canopy style parking lot solar arrays to house PV systems throughout the county buildings. The total solar electric production potential for these systems is approximately 2,985,586 kWh, which would reduce Bergen County’s grid purchased electric energy by 22% (not including the existing system installed on the municipal building). The system’s calculated simple payback of approximately 13 years is past the standard 10 year simple payback threshold; however, with alternative funding this payback could be lessened. CEG recommends the Owner review all funding options available with the implementation of this renewable energy measure.

Overall Assessment:

Overall, Bergen County is maintained and operating at a fair efficiency. There are numerous ECMs that can be implemented to reduce energy use and save on the facility's operating costs. The total energy cost of \$1,835,538 (not including missing utility data) could be reduced by approximately 22% through the implementation of the ECMs recommended in this audit. Bergen County is in a unique position to implement energy efficiency improvements and still include large capital projects. Since the total project is capable of being funded through the savings, CEG highly recommends the County to take advantage of this opportunity.

II. INTRODUCTION

The comprehensive energy audit covers the following buildings in Bergen County:

- Justice Center
- Community Services Building
- Intermediate Care Center
- Probation Office
- Administration Office
- Williams Center
- Voting Machine Warehouse
- Animal Shelter
- Law and Public Safety Institute
- Medical Examiner's Office
- Darlington Golf Clubhouse
- Rockleigh Golf Clubhouse
- Valley Brook Golf Clubhouse

This audit is performed in connection with the New Jersey Clean Energy - Local Government Energy Audit Program. The energy audit is conducted to promote the mission of the office of Clean Energy, which is to use innovation and technology to solve energy and environmental problems in a way that improves the State's economy. This can be achieved through the wiser and more efficient use of energy.

Electrical and natural gas utility information is collected and analyzed for one full year's energy use of each building. The utility information allows for analysis of the building's operational characteristics; calculate energy benchmarks for comparison to industry averages, estimated savings potential, and baseline usage/cost to monitor the effectiveness of implemented measures. A computer spreadsheet is used to calculate benchmarks and to graph utility information (see the utility profiles below).

The Energy Use Index (EUI) is established for the building. Energy Use Index (EUI) is expressed in British Thermal Units/square foot/year (BTU/ft²/yr), which is used to compare energy consumption to similar building types or to track consumption from year to year in the same building. The EUI is calculated by converting the annual consumption of all energy sources to BTU's and dividing by the area (gross square footage) of the building. Blueprints (where available) are utilized to verify the gross area of the facility. The EUI is a good indicator of the relative potential for energy savings. A low EUI indicates less potential for energy savings, while a high EUI indicates poor building performance therefore a high potential for energy savings.

Existing building architectural and engineering drawings (where available) are utilized for additional background information. The building envelope, lighting systems, HVAC equipment, and controls information gathered from building drawings allow for a more accurate and detailed review of the building. The information is compared to the energy usage profiles developed

from utility data. Through the review of the architectural and engineering drawings a building profile can be defined that documents building age, type, usage, major energy consuming equipment or systems, etc.

The preliminary audit information is gathered in preparation for the site survey. The site survey provides critical information in deciphering where energy is spent and opportunities exist within a facility. The entire site is surveyed to inventory the following to gain an understanding of how each facility operates:

- Building envelope (roof, windows, etc.)
- Heating, ventilation, and air conditioning equipment (HVAC)
- Lighting systems and controls
- Facility-specific equipment

The building site visit is performed to survey all major building components and systems. The site visit includes detailed inspection of energy consuming components. Summary of building occupancy schedules, operating and maintenance practices, and energy management programs provided by the building manager are collected along with the system and components to determine a more accurate impact on energy consumption.

III. METHOD OF ANALYSIS

This audit is consistent with an ASHRAE level 2 audit. The cost and savings for each measure is $\pm 20\%$. The evaluations are based on engineering estimations and industry standard calculation methods. More detailed analyses would require engineering simulation models, hard equipment specifications, and contractor bid pricing.

Post site visit work includes evaluation of the information gathered, researching possible conservation opportunities, organizing the audit into a comprehensive report, and making recommendations on HVAC, lighting and building envelope improvements. Data collected is processed using energy engineering calculations to anticipate energy usage for each of the proposed energy conservation measures (ECMs). The actual building's energy usage is entered directly from the utility bills provided by the owner. The anticipated energy usage is compared to the historical data to determine energy savings for the proposed ECMs.

It is pertinent to note, that the savings noted in this report are not additive. The savings for each recommendation is calculated as standalone energy conservation measures. Implementation of more than one ECM may in some cases affect the savings of each ECM. The savings may in some cases be relatively higher if an individual ECM is implemented in lieu of multiple recommended ECMs. For example implementing reduced operating schedules for inefficient lighting will result in a greater relative savings. Implementing reduced operating schedules for newly installed efficient lighting will result in a lower relative savings, because there is less energy to be saved.

The project / Entity summary tables are based on the implementation of multiple measures. The analysis is reviewed and determined if the nature of the ECMs will cause a major conflict of the overall savings. When additive measures do not cause a major effect on the overall savings the ECMs are included. Where a major conflict is identified, the combined savings is evaluated appropriately to ensure the overall estimates are $\pm 20\%$.

ECMs are determined by identifying the building's unique properties and deciphering the most beneficial energy saving measures available that meet the specific needs of the facility. The building construction type, function, operational schedule, existing conditions, and foreseen future plans are critical in the evaluation and final recommendations. Energy savings are calculated base on industry standard methods and engineering estimations. Energy consumption is calculated based on manufacturer's cataloged information when new equipment is proposed.

Cost savings are calculated based on the actual historical energy costs for the facility. Installation costs include labor and equipment costs to estimate the full up-front investment required to implement a change. Costs are derived from Means Cost Data, industry publications, and local contractors and equipment suppliers. The NJ Smart Start Building® program incentives savings (where applicable) are included for the appropriate ECM's and subtracted from the installed cost. Maintenance savings are calculated where applicable and added to the energy savings for each ECM. The life-time for each ECM is estimated based on the typical life of the equipment being replaced or altered. The costs and savings are applied and a simple payback, simple lifetime savings, and simple return on investment are calculated. See below for calculation methods:

ECM Calculation Equations:

$$\text{Simple Payback} = \left(\frac{\text{Net Cost}}{\text{Yearly Savings}} \right)$$

$$\text{Simple Lifetime Savings} = (\text{Yearly Savings} \times \text{ECM Lifetime})$$

$$\text{Simple Lifetime ROI} = \frac{(\text{Simple Lifetime Savings} - \text{Net Cost})}{\text{Net Cost}}$$

$$\text{Lifetime Maintenance Savings} = (\text{Yearly Maintenance Savings} \times \text{ECM Lifetime})$$

$$\text{Internal Rate of Return} = \sum_{n=0}^N \left(\frac{\text{Cash Flow of Period}}{(1 + \text{IRR})^n} \right)$$

$$\text{Net Present Value} = \sum_{n=0}^N \left(\frac{\text{Cash Flow of Period}}{(1 + \text{DR})^n} \right)$$

Net Present Value calculations based on Interest Rate of 3%.

IV. HISTORIC ENERGY CONSUMPTION/COST

A. Energy Usage

The energy usage for the facilities is tabulated and plotted in graph form as depicted within each facility report (see the individual facility energy audit reports for details). Each energy source has been identified and monthly consumption and cost noted per the information provided by the Owner. The electric and natural gas utilities are shown below in Table 2 & 3 for all facilities:

Table 2
Electric Utility Summary

ELECTRIC UTILITY USAGE PER FACILITY			
FACILITY	ANNUAL ELECTRIC UTILITY		
DESCRIPTION	USAGE (KWH)	COST (\$)	AVE RATE (\$/KWH)
Justice Center ¹	5,486,612	\$258,351	\$0.05
Community Services Building	1,027,703	\$175,966	\$0.17
Intermediate Care Center ¹	N/A	N/A	N/A
Probation Office ¹	N/A	N/A	N/A
Administration Office	5,523,317	\$727,016	\$0.13
Williams Center	497,020	\$90,635	\$0.18
Voting Machine Warehouse	474,560	\$88,547	\$0.19
Animal Shelter	359,325	\$59,427	\$0.17
Law and Public Safety Institute ¹	N/A	N/A	N/A
Medical Examiner's Office	126,720	\$22,478	\$0.18
Darlington Golf Clubhouse ¹	N/A	N/A	N/A
Rockleigh Golf Clubhouse ¹	N/A	N/A	N/A
Valley Brook Golf Clubhouse	370,648	\$75,668	\$0.20
Total	13,865,905	\$1,498,087	\$0.11

¹ Data not available

**Table 3
Natural Gas Summary**

NATURAL GAS UTILITY USAGE PER FACILITY			
FACILITY	ANNUAL NATURAL GAS UTILITY		
DESCRIPTION	USAGE (THERMS)	COST (\$)	AVE RATE (\$/THERM)
Justice Center	99,747	\$32,657	\$0.33
Community Services Building ³	13,817	\$6,952	\$0.50
Intermediate Care Center	41,354	\$46,837	\$1.13
Probation Office ²	N/A	N/A	N/A
Administration Office	148,407	\$134,325	\$0.91
Williams Center	25,951	\$26,561	\$1.02
Voting Machine Warehouse ¹	10,238	\$7,488	\$0.73
Animal Shelter	15,447	\$18,343	\$1.19
Law and Public Safety Institute	33,546	\$38,376	\$1.14
Medical Examiner's Office	6,237	\$6,985	\$1.12
Darlington Golf Clubhouse	11,077	\$12,263	\$1.11
Rockleigh Golf Clubhouse	8,786	\$9,675	\$1.10
Valley Brook Golf Clubhouse	7,176	\$7,609	\$1.06
Total	421,782	\$348,072	\$0.83

¹ Data obtained from the Original RFP

² Data not available

³ Third Party Utility Supplier bills not available

B. Energy Use Index (EUI)

Energy Use Index (EUI) is a measure of a building's annual energy utilization per square foot of building. This calculation is completed by converting all utility usage consumed by a building for one year, to British Thermal Units (BTU) and dividing this number by the building square footage. EUI is a good measure of a building's energy use and is utilized regularly for comparison of energy performance for similar building types. The Oak Ridge National Laboratory (ORNL) Buildings Technology Center under a contract with the U.S. Department of Energy maintains a Benchmarking Building Energy Performance Program. The ORNL website determines how a building's energy use compares with similar facilities throughout the U.S. and in a specific region or state.

Source use differs from site usage when comparing a building's energy consumption with the national average. Site energy use is the energy consumed by the building at the building site only. Source energy use includes the site energy use as well as all of the losses to create and distribute the energy to the building. Source energy represents the total amount of raw fuel that is required to operate the building. It incorporates all transmission, delivery, and production losses, which allows for a complete assessment of energy efficiency in a building. The type of utility purchased has a substantial impact on the source energy use of a building. The EPA has determined that source energy is the most comparable unit for evaluation purposes and overall global impact. Both the site and source EUI ratings for the building are provided to understand and compare the differences in energy use.

The site and source EUI for this facility is calculated as follows:

$$\text{Building Site EUI} = \frac{(\text{Electric Usage in kBtu} + \text{Gas Usage in kBtu})}{\text{Building Square Footage}}$$

$$\text{Building Source EUI} = \frac{(\text{Electric Usage in kBtu} \times \text{SS Ratio} + \text{Gas Usage in kBtu} \times \text{SS Ratio})}{\text{Building Square Footage}}$$

Table 4
Energy Use Index Summary

ENERGY USE INDEX PER FACILITY				
FACILITY	BUILDING AREA	ENERGY USE INDEX		
DESCRIPTION	(SF)	SITE (KBTU/SF/YR)	SOURCE (KBTU/SF/YR)	ELECTRIC (KWH/SF/YR)
Justice Center	424,000	67	172	12.8
Community Services Building	39,000	125	338	26.4
Intermediate Care Center	149,920	28	29	N/A
Probation Office	22,205	77	81	N/A
Administration Office	262,000	129	300	21.1
Williams Center	39,144	110	214	12.7
Voting Machine Warehouse	34,980	46	155	13.6
Animal Shelter	18,108	153	316	19.8
Law and Public Safety Institute	49,900	67	70	N/A
Medical Examiner's Office	5,000	211	420	25.3
Darlington Golf Clubhouse	8,154	136	142	N/A
Rockleigh Golf Clubhouse	9,914	89	93	N/A
Valley Brook Golf Clubhouse	14,639	135	340	25.3

See the Appendix C - Statement of Energy Performance for comparason to other facilities

Figure 1 through 4 below depicts a national EUI grading for the source energy use of various building types similar to the buildings at Bergen County.

Figure 1
Source Energy Use Intensity Distributions: Public Order Buildings

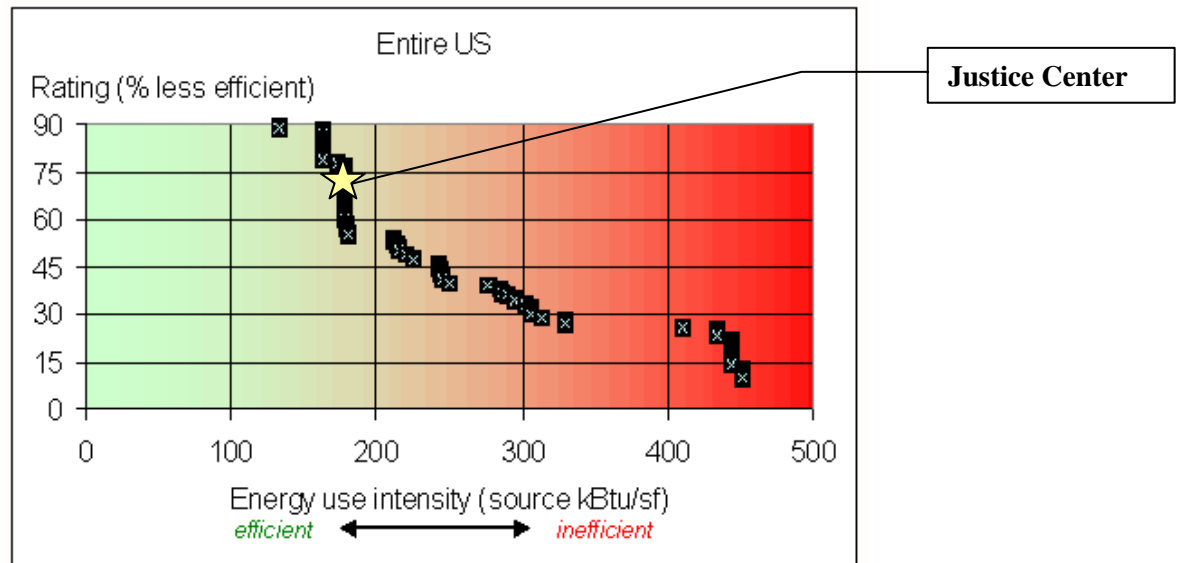
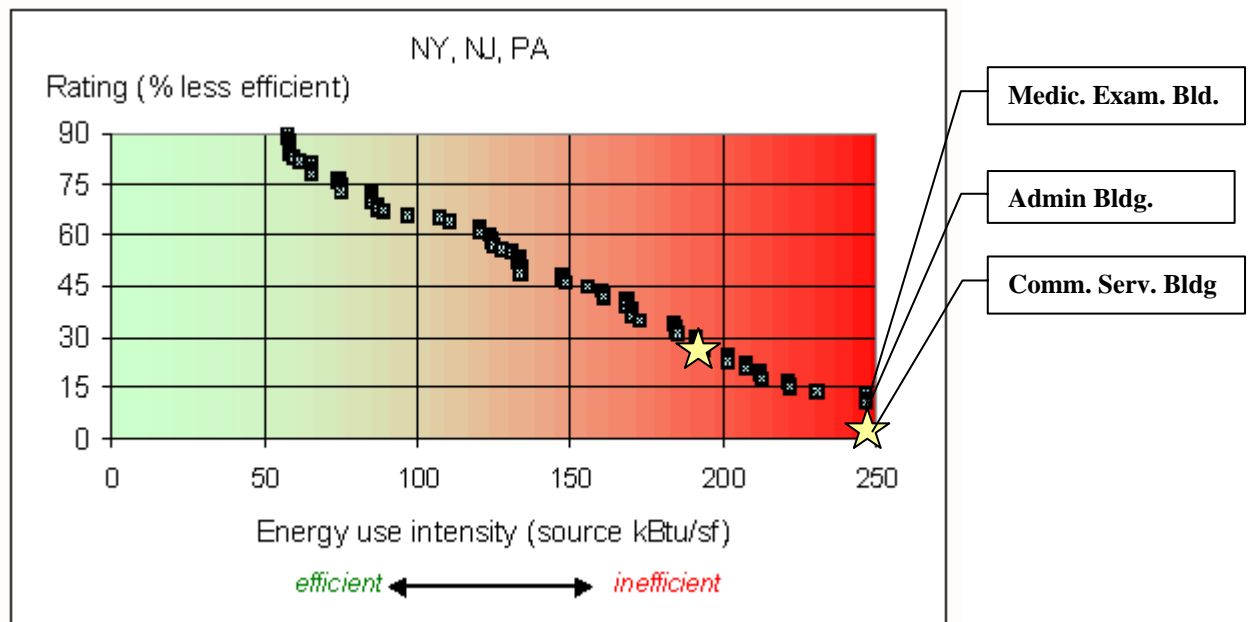


Figure 2
Source Energy Use Intensity Distributions: Office



As a comparison, data has been gathered by the US Department of Energy (DOE) for various facilities cataloguing the standard site and source energy utilization. This data has been published in the 2003 Commercial Building Energy Consumption Survey and is noted as follows for facilities of this type:

- Service (Vehicle Repair):
77 kBtu/SF Site Energy, 150 kBtu/SF Source Energy.
- Health Care: Long Term Care (Nursing Home, Assisted Living):
124 kBtu/SF Site Energy, 255 kBtu/SF Source Energy.
- Public Assembly (Library):
104 kBtu/SF Site Energy, 246 kBtu/SF Source Energy.
- Public Assembly (Recreation):
65 kBtu/SF Site Energy, 136 kBtu/SF Source Energy.
- Public Assembly (Social / Meeting):
52 kBtu/SF Site Energy, 102 kBtu/SF Source Energy.
- Public Order and Safety (Fire Station / Police Station):
78 kBtu/SF Site Energy, 157 kBtu/SF Source Energy.

EPA Energy Benchmarking System

The United States Environmental Protection Agency (EPA) in an effort to promote energy management has created a system for benchmarking energy use amongst various end users. The benchmarking tool utilized for this analysis is entitled Portfolio Manager. The Portfolio Manager tool allows tracking and assessment of energy consumption via the template forms located on the ENERGY STAR website (www.energystar.gov). The importance of benchmarking for local government municipalities is becoming more important as utility costs continue to increase and emphasis is being placed on carbon reduction, greenhouse gas emissions and other environmental impacts.

Based on information gathered from the ENERGY STAR website, Government agencies spend more than \$10 billion a year on energy to provide public services and meet constituent needs. Furthermore, energy use in commercial buildings and industrial facilities is responsible for more than 50 percent of U.S. carbon dioxide emissions. It is vital that local government municipalities assess facility energy usage, benchmark energy usage utilizing Portfolio Manager, set priorities and goals to lessen energy usage and move forward with priorities and goals.

In accordance with the Local Government Energy Audit Program, CEG has created an ENERGY STAR account for the municipality to access and monitoring the facility's yearly energy usage as it compares to facilities of similar type. The login page for the account can be accessed at the following web address; the username and password are also listed below:

<https://www.energystar.gov/istar/pmpam/index.cfm?fuseaction=login.login>

User Name: bergencounty
Password: lgeaceg2011

Security Question: What city were you born in?
Security Answer: Hackensack

The utility bills and other information gathered during the energy audit process are entered into the Portfolio Manager. The following is a summary of the results for the facility:

Table 5
Energy Star Performance Summary

ENERGY STAR PERFORMANCE RATING PER FACILITY			
FACILITY	ENERGY STAR PERFORMANCE RATING		
DESCRIPTION	SCORE	AVERAGE	POTENTIAL CERTIFICATIONS
Justice Center	N/A	50	N/A
Community Services Building	16	50	N/A
Intermediate Care Center	N/A	50	N/A
Probation Office	N/A	50	N/A
Administration Office	41	50	N/A
Williams Center	N/A	50	N/A
Voting Machine Warehouse	N/A	50	N/A
Animal Shelter	N/A	50	N/A
Law and Public Safety Institute	N/A	50	N/A
Medical Examiner's Office	N/A	50	N/A
Darlington Golf Clubhouse	N/A	50	N/A
Rockleigh Golf Clubhouse	N/A	50	N/A
Valley Brook Golf Clubhouse	N/A	50	N/A

See the Appendix C - Statement of Energy Performance for comparative facilities

Score: "N/A" represents facility that could not receive a rating. See Energy Star website for details.

Refer to **Statement of Energy Performance Appendix** for the detailed energy summary for each facility. Facilities that do not have a rating is a result of one of the following issues:

- Utility data is not consistent over the same 12 months worth of data
- Facility size is less than 5000 SF
- More than 50% of the facility space is not a pre-designated space type defined by energy star where insufficient data is available for a rating

V. RENEWABLE/DISTRIBUTED ENERGY MEASURES

Globally, renewable energy has become a priority affecting international and domestic energy policy. The State of New Jersey has taken a proactive approach, and has recently adopted in its Energy Master Plan a goal of 30% renewable energy by 2020. To help reach this goal New Jersey created the Office of Clean Energy under the direction of the Board of Public Utilities and instituted a Renewable Energy Incentive Program to provide additional funding to private and public entities for installing qualified renewable technologies. A renewable energy source can greatly reduce a building's operating expenses while producing clean environmentally friendly energy. CEG has assessed the feasibility of installing renewable energy measures (REM) for the municipality utilizing renewable technologies and concluded that there is potential for solar energy generation.

Solar Generation

Solar energy produces clean energy and reduces a building's carbon footprint. This is accomplished via photovoltaic panels which are mounted on all south and southwestern facades of the building. Flat roof, as well as sloped areas can be utilized; flat areas will have the panels turned to an optimum solar absorbing angle. (A structural survey of the roof would be necessary before the installation of PV panels is considered). Parking lots can also be utilized for the installation of a solar array. A truss system can be installed that is high enough to park vehicles under the array and no parking lot area is lost.

The state of NJ has instituted a program in which one Solar Renewable Energy Certificate (SREC) is given to the Owner for every 1000 kWh of generation. SREC's can be sold anytime on the market at their current market value. The value of the credit varies upon the current need of the power companies. The average value per credit used in our financial calculations is \$350 per MWH. This equates to \$0.35 per kWh generated.

CEG has reviewed the existing roof area and parking lot canopy area potential of the remaining facilities being audited for the purposes of determining a potential for a photovoltaic system. The facilities with structural deficiencies were not considered for a roof mounted system. Instead where applicable a parking lot canopy system was reviewed. The facilities with roof mounted PV designs are the Williams Center, Medical Examiner's Building, Animal Shelter (partially), Voting Machine Warehouse, Darlington Golf Clubhouse and Law and Public Safety Institute (partially). Parking lot canopy design and/or ground mounted designs were evaluated for the remaining buildings. The Administration Office, Probation Office and Rockleigh Golf Clubhouse were evaluated to be un-suitable for either a roof or canopy style PV system due to shading, high traffic area, or lack of space at the site and parking lots. A depiction of the area utilized at each facility is shown in **Renewable / Distributed Energy Measures Calculation Appendix**. The system sizes are shown below for each building where installation of a solar PV system is feasible. The total KWH production for all facilities combined is 2,985,586 kWh annually, reducing the overall utility bill for the county by approximately 22% percent. (This does not include the systems that are already installed or being installed). A detailed financial analysis can be found in the **Renewable / Distributed Energy Measures Calculation Appendix** within each facility report. This analysis illustrates the payback of the system over a

25 year period. The eventual degradation of the solar panels and the price of accumulated SREC's are factored into the payback.

Table 6
Renewable Energy Summary

POWER PRODUCTION SUMMARY - PHOTOVOLTAIC SYSTEM PER FACILITY			
FACILITY	PRODUCTION SUMMARY		
DESCRIPTION	ELECTRIC PRODUCTION (KWH)	TOTAL FACILITY USE (KWH)	% REDUCTION
Justice Center	890,147	5,486,612	16%
Community Services Building	309,641	1,027,703	30%
Intermediate Care Center	722,402	N/A	N/A
Probation Office	0	N/A	N/A
Administration Office	0	5,523,317	0%
Williams Center	14,185	497,020	3%
Voting Machine Warehouse	218,023	474,560	46%
Animal Shelter	66,873	359,325	19%
Law and Public Safety Institute	239,115	N/A	N/A
Medical Examiner's Office	3,700	126,720	3%
Darlington Golf Clubhouse	314,979	N/A	N/A
Rockleigh Golf Clubhouse	0	N/A	N/A
Valley Brook Golf Clubhouse	206,521	370,648	56%
Total	2,985,586	13,865,905	22%

The proposed photovoltaic array layout is designed based on the specifications for the Sun Power SPR-230 panel. This panel has a “DC” rated full load output of 230 watts, and has a total panel conversion efficiency of 18%. Although panels rated at higher wattages are available through Sun Power and other various manufacturers, in general most manufacturers who produce commercially available solar panels produce a similar panel in the 200 to 250 watt range. This provides more manufacturer options to the public entity if they wish to pursue the proposed solar recommendation without losing significant system capacity.

The array system capacity was sized based on available roof space or canopy style system area available at each existing facility. Estimated solar array generation is calculated based on the National Renewable Energy Laboratory PVWatts Version 1.0 Calculator. In order to calculate the array generation an appropriate location with solar data on file must be selected. In addition the system DC rated kilowatt (kW) capacity must be inputted, a DC to AC de-rate factor, panel tilt angle, and array azimuth angle. The DC to AC de-rate factor is based on the panel nameplate DC rating, inverter and transformer efficiencies (95%), mismatch factor (98%), diodes and connections (100%), dc and ac wiring(98%, 99%), soiling, (95%), system availability (95%), shading (if applicable), and age(new/100%). The overall DC to AC de-rate factor has been calculated at an overall rating of 81%. The PVWatts Calculator program then calculates estimated system generation based on average monthly solar irradiance and user provided inputs. The monthly energy generation and offset electric costs from the PVWatts calculator is shown in the **Renewable/Distributed Energy Measures Calculation Appendix**.

The proposed solar array for each facility is qualified by the New Jersey Board of Public Utilities Net Metering Guidelines as a Class I Renewable Energy Source. These guidelines allow onsite customer generation using renewable energy sources such as solar and wind with a capacity of 2 megawatts (MW) or less. This limits a customer system design capacity to being a net user and not a net generator of electricity on an annual basis. Although these guidelines state that if a customer does net generate (produce more electricity than they use), the customer will be credited those kilowatt-hours generated to be carried over for future usage on a month to month basis. Then, on an annual basis if the customer is a net generator the customer will then be compensated by the utility the average annual PJM Grid LMP price per kilowatt-hour for the over generation. Due to the aforementioned legislation, the customer is at limited risk if they generate more than they use at times throughout the year. With the inefficiency of today’s energy storage systems, such as batteries, the added cost of storage systems is not warranted and was not considered in the proposed design.

Direct purchase involves Bergen County paying for 100% of the total project cost upfront in lieu of one of the methods noted in the Installation Funding Options section below. Calculations include a utility inflation rate as well as the degradation of the solar panels over time. The financial summary per facility is as follows:

**Table 7
Renewable Financial Summary**

FINANCIAL SUMMARY - PHOTOVOLTAIC SYSTEM PER FACILITY			
FACILITY	DIRECT PURCHASE FINANCIAL SUMMARY		
DESCRIPTION	INSTALLATION COST (\$)	TOTAL SAVINGS (\$)	INTERNAL RATE OF RETURN
Justice Center	\$6,557,760	\$445,074	5.1%
Community Services Building	\$2,281,140	\$161,323	5.6%
Intermediate Care Center	\$2,956,650	\$361,201	11.9%
Probation Office	N/A	N/A	N/A
Administration Office	N/A	N/A	N/A
Williams Center	\$101,430	\$7,546	6.2%
Voting Machine Warehouse	\$1,585,620	\$117,078	6.1%
Animal Shelter	\$492,660	\$34,440	5.5%
Law and Public Safety Institute	\$1,761,570	\$119,558	5.1%
Medical Examiner's Office	\$26,910	\$1,950	5.9%
Darlington Golf Clubhouse	\$2,320,470	\$157,490	5.1%
Rockleigh Golf Clubhouse	N/A	N/A	N/A
Valley Brook Golf Clubhouse	\$1,521,450	\$114,413	6.4%
Total	\$19,605,660	\$1,520,071	

CEG recommends Bergen County to review all options available for installation of solar PV systems at their facilities including a Power Purchase Agreement (PPA). This option utilizes providers who will own, operate, and maintain the system for a period of 15 years. During this

time the PPA Provider would sell all of the electric generated by Solar Arrays to the county at a reduced rate compared to their existing electric rate.

Wind Generation

In addition to the Solar Analysis, CEG also conducted a review of the applicability of wind energy for the facility. Wind energy production is another option available through the Renewable Energy Incentive Program. Wind turbines of various types can be utilized to produce clean energy on a per building basis. Cash incentives are available per kWh of electric usage. Based on CEG's review of the applicability of wind energy for the facility, it was determined that the average wind speed of 5 m/s and below is not adequate, and available space is very limited for purchase of a commercial wind turbine. Therefore, wind energy is not a viable option to implement.

VI. ENERGY PURCHASING AND PROCUREMENT STRATEGY

Load Profile analysis was performed to determine the seasonal energy usage of the facilities. Irregularities in the load profile will indicate potential problems within a facility. Consequently based on the profile a recommendation will be made to remedy the irregularity in energy usage. For this report, the facilities' energy consumption data were gathered in table format and plotted in graph form to create the load profile. Refer to The Electric and Natural Gas Usage Profiles included within the report in the following sections of this report to reference the respective electricity and natural gas usage load profiles.

Electricity:

The electricity usage profile demonstrates a typical cooling load profile for facilities that have occupancy during the summer months. Historical usage is relatively steady throughout the year with an average monthly usage of 1,132,142 kWh. Largest consumption months were April, June, July and September.

The historical usage profile is beneficial and will allow for more competitive energy prices when shopping for alternative suppliers mainly due to the relatively flat load profile and reduction of summer load. Third Party Supplier (TPS) electric commodity contracts that offer's a firm, fixed price for 100% of the facilities electric requirements and are lower than the PSE&G's and Orange and Rockland's BGS-FP default rate are recommended.

Natural Gas:

The Natural Gas Usage Profile demonstrates a very typical natural gas (heat load) profile for all facilities except the Justice Center and Administration Building where usage is very irregular and/or high during summer months. The average winter (Nov-Mar) consumption is 51,668 therms and the average summer (Apr-Oct) consumption is 22,662 therms.

This load profile will yield less favorable natural gas pricing when shopping for alternative suppliers. This is because the higher winter month consumption will yield higher pricing which will not be offset by the summer month consumption. Nymex commodity pricing is generally higher in the winter months of November – March and lower in the summer months of April – October. Obtaining a flat load profile, (usage is similar each month), will yield optimum natural gas pricing when shopping for alternative suppliers.

Third Party Supplier (TPS) natural gas commodity contracts that offer a product structure to include either 1) a fixed basis rate with a market based Nymex/commodity rate or 2) a fixed basis rate with fixed Nymex/commodity winter rate (Nov – March) and market based Nymex/commodity rate for the summer months (April – October) for 100% of the facilities **metered** natural gas requirements are both recommended due to current market pricing.

Tariff Analysis:Electricity:

The majority of facilities receives electrical service through Public Service Gas and Electric (PSE&G) on various rate schedules to include GLP (General Light and Power), LPLS (Large Power and Light – Secondary) and LPLP (Large Power and Light – Primary) rates. In addition, the Intermediate Care Building, Rockleigh Golf Club, Darlington, Law & Public Safety and Probation facilities receives electrical service through Orange and Rockland (O&R). Bill copies and historical usage information was not reported for Orange and Rockland Accounts and current rate tariffs are unknown. The facilities have not contracted a Third Party Supplier (TPS) to provide electric commodity service. For electric supply (generation) service, the client has a choice to either use PSE&G's and O&R's default service rate BGS-FP or contract with a Third Party Supplier (TPS) to supply electric.

Each year since 2002, the four New Jersey Electric Distribution Companies (EDCs) - Public Service Gas & Electric Company (PSE&G), Atlantic City Electric Company (ACE), Jersey Central Power & Light Company (JCP&L), and Rockland Electric Company (RECO) - have procured several billion dollars of electric supply to serve their Basic Generation Service (BGS) customers through a statewide auction process held in February.

BGS refers to the service of customers who are not served by a third party supplier or competitive retailer. This service is sometimes known as Standard Offer Service, Default Service, or Provider of Last Resort Service.

The Auction Process has consisted of two auctions that are held concurrently, one for larger customers on an hourly price plan (BGS-CIEP) and one for smaller commercial and residential customers on a fixed-price plan (BGS-FP). This facility's rate structure is based on the fixed-price plan (BGS-FP).

The utilities, PSE&G and O&R will continue to be responsible for maintaining the existing network of wires, pipes and poles that make up the delivery system, which will serve all consumers, regardless of whom they choose to purchase their electricity or natural gas from.

The utilities delivery service rate includes the following charges: Customer Service Charge, Distribution Charge (kWh and Demand), Societal Benefits Charge (SBC), and Securitization Transition Charge.

Natural Gas:

The facilities currently receives natural gas distribution service through Public Service Gas & Electric (PSE&G) on rate schedules GSG (General Service Gas) and LVG (Large Volume Gas) and has contracted a Third Party Supplier (TPS) to provide natural gas commodity service for most facilities. Great Eastern Energy is the contracted Third Party Supplier (TPS) which provides natural gas commodity supply service. The terms and conditions of the natural gas contract include a fixed basis rate at \$2.33/dth with a market based Nymex/commodity rate

settling monthly. The current natural gas contract will expire June 30, 2012. It appears that not all facilities are currently under the TPS contract. These facilities include: Administration Building; Williams Center; Medical Examiners; Valley Brook Golf Clubhouse.

PSE&G provides basic gas supply service (BGSS) to customers who choose not to shop from a Third Party Supplier (TPS) for natural gas commodity. The option is essential to protect the reliability of service to consumers as well as protecting consumers if a third party supplier defaults or fails to provide commodity service. Please refer to the link below for a recap of natural gas BGSS charges from PSE&G for rate schedule GSG and LVG.

<http://www.pseg.com/companies/pseandg/schedules/pdf/commodity.pdf>

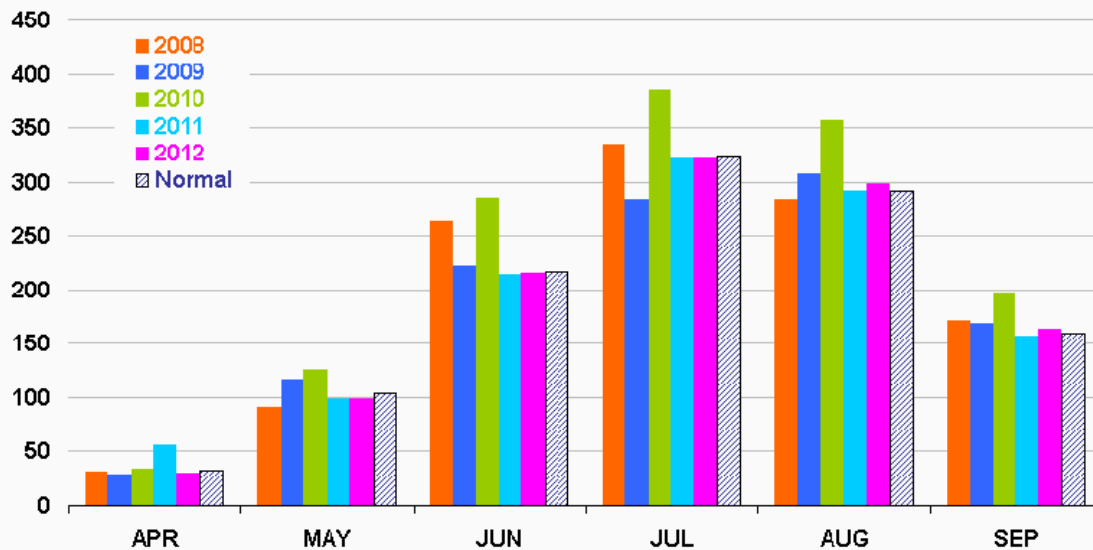
The utility, PSE&G is responsible for maintaining the existing network of wires, pipes and poles that make up the delivery system, which will serve all consumers, regardless of whom they choose to purchase their electricity or natural gas from. PSE&G's delivery service rate includes the following charges: Customer Service Charge, Distribution Charge, & Societal Benefits Charge (SBC).

Electric and Natural Gas Commodities Market Overview:

Current electricity and natural gas market pricing has remained relatively stable over the last year. Commodity pricing in 2008 marked historical highs in both natural gas and electricity commodity. Commodity pricing commencing spring of 2009 continuing through 2011, has decreased dramatically over 2008 historic highs and continues to be favorable for locking in long term (2-5 year) contracts with 3rd Party Supplier's for both natural gas and electricity supply requirements.

It is important to note that both natural gas and electric commodity market prices are moved by supply and demand, political conditions, market technicals and trader sentiment. This market is continuously changing. Energy commodity pricing is also correlated to weather forecasts. Because weather forecasts are dependable only in the short-term, prolonged temperature extremes can really cause extreme price swings.

U.S. Summer Cooling Degree-Days (population-weighted)

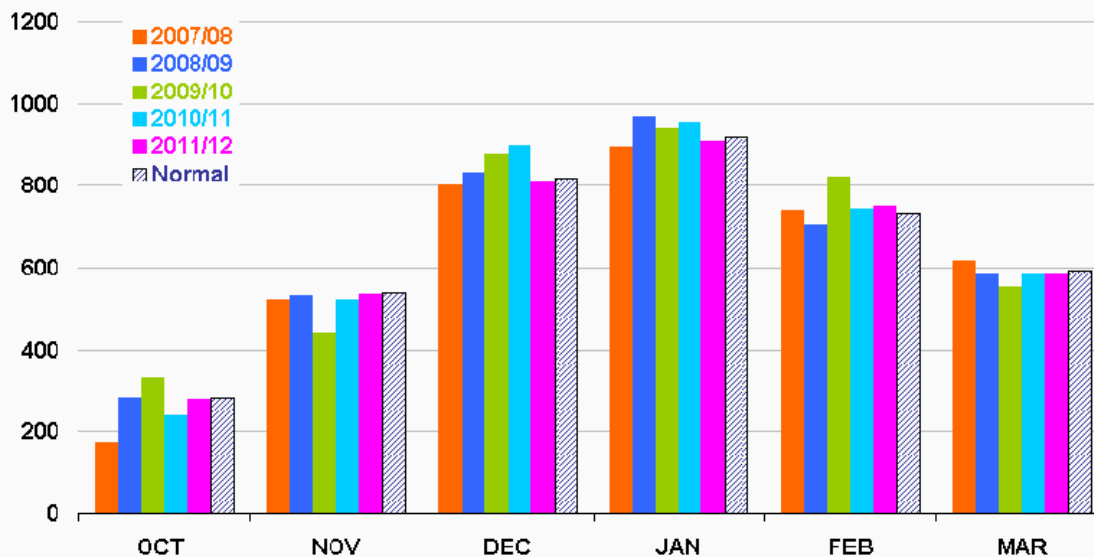


Data source: National Oceanic and Atmospheric Administration, National Weather Service
http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/cdus/degree_days/

Source: Short-Term Energy Outlook, May 2011



U.S. Winter Heating Degree-Days (population-weighted)



Data source: National Oceanic and Atmospheric Administration, National Weather Service
http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/cdus/degree_days/

Source: Short-Term Energy Outlook, May 2011



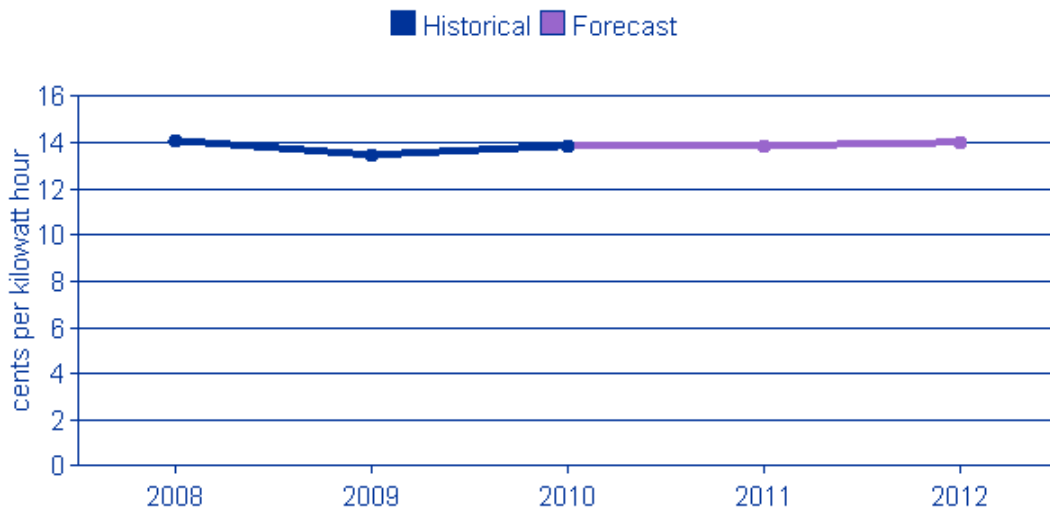
Short Term Energy Outlook - US Energy Information Administration (5/10/2011):

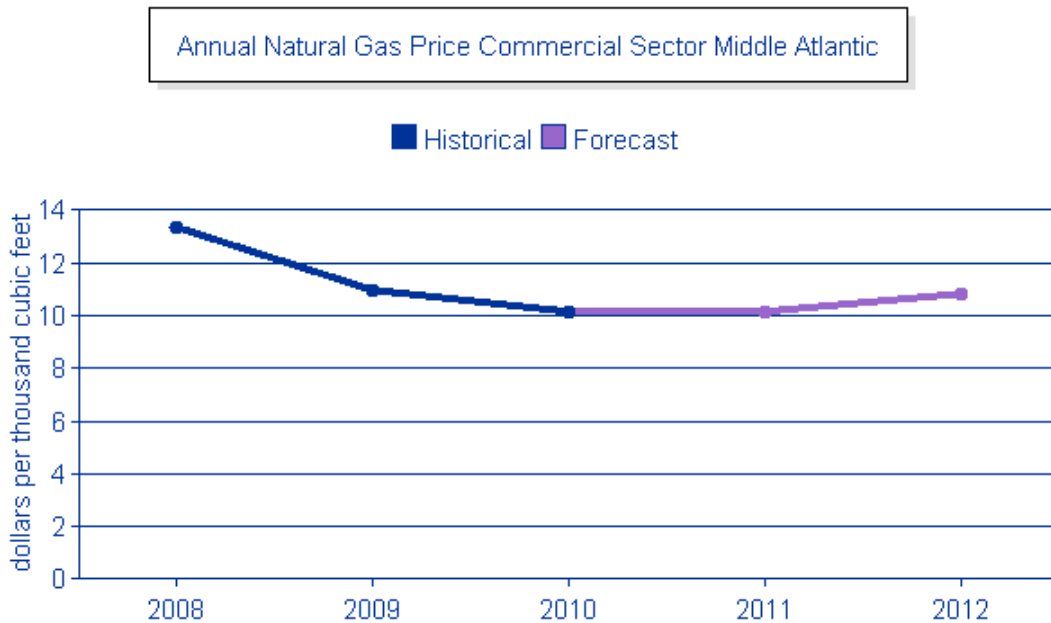
U.S. Natural Gas Prices. The Henry Hub spot price averaged \$4.25 per MMBtu in April, 28 cents higher than the March average and 25 cents higher than forecast in last month's Outlook. EIA expects that the Henry Hub price will average \$4.24 per MMBtu in 2011, a decline of 15 cents from the 2010 average. EIA expects that the forecast decline in production from current levels will contribute to a tightening domestic market next year with the Henry Hub price averaging \$4.65 per MMBtu in 2012.

Uncertainty over future natural gas prices is lower this year compared with last year at this time. Natural gas futures for July 2011 delivery (for the 5-day period ending May 5) averaged \$4.65 per MMBtu, and the average implied volatility was 34 percent. The lower and upper bounds for the 95-percent confidence interval for July 2011 contracts are \$3.61 per MMBtu and \$5.98 per MMBtu. At this time last year, the natural gas July 2010 futures contract averaged \$4.11 per MMBtu and implied volatility averaged 46 percent. The corresponding lower and upper limits of the 95-percent confidence interval were \$2.95 per MMBtu and \$5.70 per MMBtu.

U.S. Electricity Retail Prices. EIA expects U.S. residential electricity prices to rise by 2.3 percent in 2011 to an average of 11.84 cents per kilowatthour. The forecast of flat coal and natural gas prices to the electric power sector this year should contribute to very little change in retail electricity prices during 2012.

Annual Retail Price of Electricity in Commercial Sector, Middle Atlantic





Pricing in the chart above includes both utility distribution and energy commodity charges.

Recommendations:

The below recommendations presented by CEG are based on current information provided by the County for its facilities utility usage. Any savings presented with these recommendations are estimates only based on that information. It is recommended that further analysis and review of actual Orange and Rockland utility and natural gas supplier bills be performed prior to performing any of the presented recommendations.

1. CEG recommends an aggregated approach for 3rd party commodity supply procurement strategies for electric and natural gas supply service. Aggregating all County facilities for electricity and natural gas supply service would allow this facility to achieve a reduction in both electric and natural gas supply costs. Energy commodities are among the most volatile of all commodities, however at this point and time, energy is extremely competitive. The facilities could realize up to a 30% reduction in energy supply costs, if it were to aggregate usage with the other County facilities and take advantage of these current market prices quickly, before energy increases.

Overall, after review of the utility consumption, billing, and current commodity pricing outlook, CEG recommends that the County explore the utilization and advisement of a 3rd party unbiased Energy Consulting Firm experienced in the procurement of electricity and natural gas, New Jersey procurement laws, aggregation of facilities and energy supply risk and commodity management. In addition, the firm should be able to provide full service advisement over the term of the contract to identify additional opportunities to further reduce costs. Many of these opportunities may include: energy rates; utility bill auditing; energy data analytics; and efficiency improvements.

It is important that a rational, defensible strategy for purchasing commodity in volatile markets is incorporated. Examples include:

- Budgets that reflect sound market intelligence
 - An understanding of BGS historical prices and trends
 - Awareness of seasonal opportunities (e.g. shoulder months)
 - Negotiation of fair contractual terms
 - An aggressive, market based price
2. From our analysis it is not clear whether four sites that include the Administration Building, Williams Center, Medical Examiners and Valley Brook Golf Clubhouse are included in the Natural Gas Third Party Contract with Great Eastern Energy and receiving BGSS supply rates directly from PSE&G. We recommend the County investigate enrollment of these sites accounts into the existing natural gas supply contract with Great Eastern Energy on the next available meter read.
3. CEG recommends that the County consider utilizing a third party utility billing-auditing service to further analyze historical utility invoices such as water, sewer, natural gas and electric for incorrect billings and rate tariff optimization services. This service can be based on a shared savings model with no cost to the County. The service could provide refunds on potential incorrect billings that may have been passed through by the utilities and paid by the County.

VII. INSTALLATION FUNDING OPTIONS

CEG has reviewed various funding options for the facility owner to utilize in subsidizing the costs for installing the energy conservation measures noted within this report. Below are a few alternative funding methods:

A. Incentive Programs:

Pay For Performance

The New Jersey Smart Start Pay for Performance program includes incentives based on savings resulted from implemented ECMs. The program is available for all buildings that were audited as part of the NJ Clean Energy's Local Government Energy Audit Program. The facility's participation in the program is assisted by an approved program partner. An "Energy Reduction Plan" is created with the facility and approved partner to show at least 15% reduction in the building's current energy use. Multiple energy conservation measures implemented together are applicable toward the total savings of at least 15%. No more than 50% of the total energy savings can result from lighting upgrades / changes.

Total incentive is capped at 50% of the project cost. The program savings is broken down into three benchmarks; Energy Reduction Plan, Project Implementation, and Measurement and Verification. Each step provides additional incentives as the energy reduction project continues. The benchmark incentives are as follows:

1. Energy Reduction Plan – Upon completion of an energy reduction plan by an approved program partner, the incentive will grant \$0.10 per square foot between \$5,000 and \$50,000, and not to exceed 50% of the facility's annual energy expense. (Benchmark #1 is not provided in addition to the local government energy audit program incentive.)
2. Project Implementation – Upon installation of the recommended measures along with the "Substantial Completion Construction Report," the incentive will grant savings per KWh or Therm based on the program's rates. Minimum saving must be 15%. (Example \$0.11 / kWh for 15% savings, \$0.12/ kWh for 17% savings, ... and \$1.10 / Therm for 15% savings, \$1.20 / Therm for 17% saving, ...) Increased incentives result from projected savings above 15%.
3. Measurement and Verification – Upon verification 12 months after implementation of all recommended measures, that actual savings have been achieved, based on a completed verification report, the incentive will grant additional savings per kWh or Therm based on the program's rates. Minimum savings must be 15%. (Example \$0.07 / kWh for 15% savings, \$0.08/ kWh for 17% savings, ... and

\$0.70 / Therm for 15% savings, \$0.80 / Therm for 17% saving, ...)
Increased incentives result from verified savings above 15%.

Direct Install Program

The New Jersey Clean Energy's Direct Install Program is a state funded program that targets small commercial and industrial facilities with peak demand of less than 100 kW. This turnkey program is aimed at providing owners a seamless, comprehensive process for analysis, equipment replacement and financial incentives to reduce consumption, lower utility costs and improve profitability. The program covers up to 60% of the cost for eligible upgrades including lighting, lighting controls, refrigeration, HVAC, motors, variable speed drives, natural gas and food service. Participating contractors (refer to www.njcleanenergy.com) conduct energy assessments in addition to your standard local government energy audit and install the cost-effective measures.

Smart Start Program

Prescriptive Measures - The New Jersey Clean Energy's Smart Start prescriptive measures incentives include unit pricing incentives for installation of energy efficient equipment and controls. Proposed equipment and controls must meet the minimum efficiency requirements as well as other application requirements. The Smart Start prescriptive incentives applicable for new construction, renovations, remodeling and equipment replacements, for a wide range of equipment including:

- Electric Chillers
- Gas Cooling
- Electric Unitary HVAC
- Ground Source Heat Pumps
- Gas Heating
- Variable Frequency Drives
- Gas Water Heating
- Premium Motors
- Prescriptive Lighting
- Lighting Controls
- Technical Studies

Custom Measures - The New Jersey Clean Energy's Smart Start prescriptive measures incentives include all measures not identified in the prescriptive measures category or measures that must have savings verified through additional analysis such as energy model simulations. Custom measures are intended to include savings as a result of unique energy efficiency measures, which are typically facility specific such as waste heat recovery. Custom incentives are provided based on the amount of energy saved and minimum internal rate of return in order to be eligible.

Energy Efficiency and Conservation Block Grants

The EECGB provides supplemental funding up to \$50,000 for counties and local government entities to implement energy conservation measures. The EECGB funding is provided through the American Recovery and Reinvestment Act (ARRA). The local government must be among the eligible local government entities listed on the NJ Clean Energy website as follows - <http://njcleanenergy.com/commercial-industrial/programs/eeecbg-eligible-entities>. This program is limited to municipalities and counties that have not already received grants directly through the US department of Energy.

CEG recommends the Owner review the use of the above-listed funding options in addition to utilizing their standard method of financing for facilities upgrades in order to fund the proposed energy conservation measures.

B. Financing Options:Municipal Bonds

Municipal bond is a bond issued by a city or other local government, or their agencies. Potential issuers of municipal bonds include cities, counties, redevelopment agencies, school districts, publicly owned airports and seaports, and any other governmental entity (or group of governments) below the state level. Municipal bonds may be general obligations of the issuer or secured by specified revenues. Interest income received by holders of municipal bonds is often exempt from the federal income tax and from the income tax of the state in which they are issued, although municipal bonds issued for certain purposes may not be tax exempt.

Power Purchase Agreement

Public Law 2008, Chapter 3 authorizes contracts of up to fifteen (15) years for energy purchase contracts commonly known as “power purchase agreements.” These are programs where the contracting unit (Owner) procures a contract for, in most cases, a third party to install, maintain, and own a renewable energy system. These renewable energy systems are typically solar panels, windmills or other systems that create renewable energy. In exchange for the third party’s work of installing, maintaining and owning the renewable energy system, the contracting unit (Owner) agrees to purchase the power generated by the renewable energy system from the third party at agreed upon energy rates.

Energy Savings Improvement Program (ESIP):

Public Law 2009, Chapter 4 authorizes government entities to make energy related improvements to their facilities and pay for the costs using the value of energy savings that result from the improvements. The “Energy Savings Improvement Program (ESIP)” law provides a flexible approach that can allow all government agencies in New Jersey to improve and reduce energy usage with minimal expenditure of new financial resources. This program provides public entities to make valuable facility infrastructure improvements that are associated with energy savings. All energy savings projects are eligible as long as the financing period does not extend beyond 15 years. The financing can be utilized for all aspects of energy efficiency project implementation including, energy savings plan development, engineering, construction management, construction management, commissioning, and measurement and verification.

This program provides the much needed financing for energy efficiency projects without the burden of increased debt. The program allows for procurement of financing without voter approval or extending existing debt. The program requires evaluation to ensure a positive cash-flow through the entire 15 year financing period. The first phase of implementing an ESIP is the development of an Energy Savings Plan (ESP) to verify the energy savings, construction costs, and overall financial model.

The underlining program requirement is the limitation of the project term to 15 years. The ESIP project size is open for multiple buildings to be included within one project. In addition all applicable incentive programs can also be utilized to help reduce the overall construction cost.

The following breakdown is an estimated project scope with the potential to qualify for the ESIP. An ESP is required to verify the costs and savings as part of an ESIP project.

Table 8
ESIP -Total Entity Project Summary

ENERGY SAVINGS IMPROVEMENT PROGRAM - POTENTIAL ENERGY EFFICIENCY PROJECT					
FACILITY ENERGY EFFICIENCY PROJECTS	ANNUAL ENERGY SAVINGS (\$)	PROJECT COST (\$)	SMART START INCENTIVES	CUSTOMER COST	SIMPLE PAYBACK
Justice Center	\$135,975	\$2,189,099	\$49,224	\$2,139,875	15.7
Community Services Building	\$12,090	\$51,909	\$13,609	\$50,244	4.2
Intermediate Care Center	\$24,086	\$235,020	\$2,687	\$231,978	9.6
Probation Office	\$22,791	\$313,577	\$1,820	\$308,597	13.5
Administration Office	\$78,727	\$1,059,020	\$570	\$1,058,622	13.4
Williams Center	\$28,857	\$375,188	\$2,500	\$372,113	12.9
Voting Machine Warehouse	\$7,304	\$69,403	\$440	\$68,233	9.3
Animal Shelter	\$12,889	\$106,650	\$5,123	\$101,527	7.9
Law and Public Safety Institute	\$6,023	\$82,000	\$11,877	\$79,680	13.2
Medical Examiner's Office	\$1,528	\$25,139	\$1,265	\$23,694	15.5
Darlington Golf Clubhouse	\$8,025	\$53,587	\$370	\$50,517	6.3
Rockleigh Golf Clubhouse	\$4,472	\$47,938	\$600	\$45,831	10.2
Valley Brook Golf Clubhouse	\$10,452	\$78,497	\$0	\$75,004	7.2
Total Entity Project	\$353,218	\$4,687,024	\$90,085	\$4,596,939	13.0

Total County Energy Costs: \$1,835,538
Est. Total County Energy Savings: \$353,218
Overall County Percent Reduction: 19.2%

VIII. ENERGY AUDIT ASSUMPTIONS

The assumptions utilized in this energy audit include but are not limited to following:

- A. Cost Estimates noted within this report are based on industry accepted costing data such as RS MeansTM Cost Data, contractor pricing and engineering estimates. All cost estimates for this level of auditing are +/- 20%. Prevailing wage rates for the specified region has been utilized to calculate installation costs. The cost estimates indicated within this audit should be utilized by the owner for prioritizing further project development post the energy audit. Project development would include investment grade auditing and detailed engineering.
- B. Energy savings noted within this audit are calculated utilizing industry standard procedures and accepted engineering assumptions. For this level of auditing, energy savings are not guaranteed.
- C. Information gathering for each facility is strongly based on interviews with operations personnel. Information dependent on verbal feedback is used for calculation assumptions including but not limited to the following:
 - a. operating hours
 - b. equipment type
 - c. control strategies
 - d. scheduling
- D. Information contained within the major equipment list is based on the existing owner documentation where available (drawings, O&M manuals, etc.). If existing owner documentation is not available, catalog information is utilized to populate the required information.
- E. Equipment incentives and energy credits are based on current pricing and status of rebate programs. Rebate availability is dependent on the individual program funding and applicability.
- F. Equipment (HVAC, Plumbing, Electrical, & Lighting) noted within an ECM recommendation is strictly noted as a **basis for calculation** of energy savings. The owner should use this equipment information as a benchmark when pursuing further investment grade project development and detailed engineering for specific energy conservation measures.
- G. Utility bill annual averages are utilized for calculation of all energy costs unless otherwise noted. Accuracy of the utility energy usage and costs are based on the information provided. Utility information including usage and costs is estimated where incomplete data is provided.