Steven Winter Associates, Inc.
Architects and Engineers

293 Route 18 South, Suite 330
East Brunswick, NJ 08816
www.swinter.com

Telephone: (866) 676-1972
E-mail:swinter@swinter.com

November 18, 2010

Local Government Energy Program
Final Energy Audit Report

For

Lakewood Township
John J. Franklin Public Works Complex

1 America Ave
Lakewood, NJ 08701

Project Number: LGEA80

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INTRODUCTION

On August 18th & 23rd, 2010 Steven Winter Associates, Inc. (SWA) and Birdsall Services Group (BSG) performed an energy audit and assessment of the John J Franklin Public Works Complex (JJF PWC) in Lakewood Township, NJ. Current conditions and energy-related information were collected in order to analyze and facilitate the implementation of energy conservation measures for the building.

The Township of Lakewood Public Works Complex, located at 1 America Avenue, is comprised of five one-story buildings. Building No. 1 is a one-story, slab on grade building a floor area comprised of 50,000 square feet. The building was built in 2005, and there have been no major renovations or additions since then. The slab on grade steps from a high front section housing Reception, Offices, Lunch Room, Training Room, and Ancillary Spaces (approximately 12, 500 square feet), down to a low rear section housing a Maintenance Garage and ancillary spaces such as Maintenance Areas, Welding Shop, Truck Wash, Truck Vacuum, Small Engine Repair, Grease/Oil Storage, Parts Dept., various Shops and Toilet and Locker Rooms (approximately 35, 000 square feet). Building No. 2 is a one-story, slab on grade building a floor area comprised of 19,625 square feet. The building was built in 2005, and there have been no major renovations or additions since then. Building No. 3 is a one-story, slab on grade building with a floor area of 16,200 square feet. The building was built in 2005 and there have been no major renovations. Building 4 is a one-story, slab on grade building with a floor area of 20,000 square feet. The building was built in 2005 and there have been no major renovations. Building 5 is a one-story, slab on grade building with a floor area of 24,000 square feet. The building was built in 2005 and there have been no major renovations. Buildings 2-5 are truck storage for the sanitation and road departments as well as storage for the recreation department and recycling program.

The occupancy schedule at the JJF PWC is approximately 50 occupants on a daily basis Monday through Friday, 70 hours per week, with more hours during weather emergencies, according to staff personal.

Energy data and building information collected in the field were analyzed to determine the baseline energy performance of the building. Using spreadsheet-based calculation methods, SWA and BSG estimated the energy and cost savings associated with the installation of each of the recommended energy conservation measures. The findings for the building are summarized in this report.

The goal of this energy audit is to provide sufficient information to make decisions regarding the implementation of the most appropriate and most cost effective energy conservation measures for the building.

Launched in 2008, the LGEA Program provides subsidized energy audits for municipal and local government-owned facilities, including offices, courtrooms, town halls, police and fire stations, sanitation buildings, transportation structures, schools and community centers. The Program will subsidize 75% of the cost of the audit. If the net cost of the installed measures recommended by the audit, after applying eligible NJ SmartStart Buildings incentives, exceeds the remaining cost of the audit, then that additional 25% will also be paid by the program. The Board of Public Utilities (BPU's) Office of Clean Energy has assigned TRC Energy Services to administer the Program.

EXECUTIVE SUMMARY

This document contains the energy audit report for the John J Franklin Public Work Complex (JJF PWC) in the Township of Lakewood, NJ 08701.

Based on the field visits performed by Steven Winter Associates (SWA) and BSG staff on August 18th & 23rd, 2010, and the results of a comprehensive energy analysis, this report describes the site's current conditions and recommendations for improvements. Suggestions for measures related to energy conservation and improved comfort are provided in the scope of work. Energy and resource savings are estimated for each measure that results in a reduction of heating, cooling, and electric usage.

Current conditions

In the most recent full year of data collected, July, 2009 through June, 2010, the JJF PWC consumed a total of 897,600 kWh of electricity for a total cost of $139,595. In the most recent full year of natural gas data collected, July, 2009 through June, 2010, 45,046 therms of gas were consumed for a total cost of $57,538. With electricity and natural gas combined, the building consumed 7,567 MMBtus of energy at a total cost of $197,133.

SWA/BSG has entered energy information about the JJF PWC in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. The building was classified as an office building allowing it to receive a performance rating. The building type was classified as "Other-Service" because the building is used as administrative offices, but primarily as garages and workshops. A classification of "Other-Service" does not allow it to receive a performance rating which could be used to achieve an Energy Star building certification.

The Site Energy Use Intensity is157 kBtu/ft^{2}yr compared to the national average of a similar building consuming 77 kBtu/ft^{2}yr. Implementing the recommendations included in this report will reduce the building energy consumption by approximately 37.2 kBtu/ft^{2}yr.

Based on the assessment of the JJF PWC, SWA/BSG has separated the recommendations into three categories (See Section 4 for more details). These are summarized as follows:

Category I Recommendations: Capital Improvements:

Based on the findings of SWA/BSG's survey, no capital improvements changes are recommended, due to the age and condition of the building.

Category II: Operations & Maintenance:

Based on the findings of SWA/BSG's audit, the dampers that control the ventilation in Buildings 2-5 should be adjusted so they close tightly leaving no gaps.

Category III: Energy Conservation Measures:

At this time, SWA/BSG highly recommends a total of **5** Energy Conservation Measures (ECMs) for the JJF PWC that are summarized in the following table. The total investment cost for these ECMs, with incentives, is **$2,915,550** (based on a projected eligibility for New Jersey's Office of Clean Energy current incentive and rebate programs). SWA/BSG estimates a first year savings of **$321,885** with an aggregated simple payback of **9.1 years**. This first year savings number includes the estimated revenue from the sale of Solar Renewable Energy Credits generated from the suggested photovoltaic system. SWA/BSG estimates that

implementing the highly recommended ECMs will reduce the carbon footprint of the facility by **738,850 lbs of CO_2**.

There are various incentives that the Township of Lakewood could apply for that could also help lower the cost of installing the ECMs. SWA/BSG recommends that Lakewood apply for the NJ SmartStart program through the New Jersey Office of Clean Energy. This incentive can help provide technical assistance for the building in the implementation phase of any energy conservation project.

The following table summarizes the proposed Energy Conservation Measures (ECM) and their economic relevance:

ROI: Return on Investment (%)

Assumptions:

Discount rate:	3.2% per DOE FEMP guidelines	Electricity rate	$0.17 $/kWh
Energy price escalation rate:	0% per DOE FEMP guidelines	Gas rate	$1.28 $/therm

Avg. Annual Demand: 0.00316 Area of Building (SF): 50,000

Table 1 - Highly Recommended 0-5 Year Payback ECMs

ECM #	ECM description	Source	Est. Installed Cost, $	Est. Incentives, $	Net Est. ECM Cost with Incentives, $	kWh, 1st Yr Savings	kW, Demand Reduction/Mo	Therms, 1st Yr Savings	kBtu/sq ft, 1st Yr Savings	Est. Operating Cost, 1st Yr Savings, $	Total 1st Yr Savings $	Life of Measure, Yrs	Est. Lifetime Energy Cost Savings, $	Simple Payback, Yrs	Lifetime Return on Investment, %	Annual Return on Investment, %	Internal Rate of Return, %	Net Present Value, $	CO_2 Reduced, lbs/yr
1	Vending Misers	Similar Projects	$1,000	$0	$1,000	6,440	1.70	0.00	0.44	$0.00	$1,095	10	$9,244	0.91	824%	82%	109%	$8,339	8,823
2	Replace Surge Protectors with SmartStrips	Similar Projects	$1,575	$0	$1,575	8,597	2.26	0.00	0.59	$0	$1,461	10	$12,340	1.08	683%	68%	93%	$10,891	11,777
3	DHW Time Optimization	Similar Projects	$1,000	$0	$1,000	0	0.00	242.75	0.49	$0	$311	10	$2,624	3.22	162%	16%	29%	$1,650	2,840
TOTAL			$3,575	$0	$3,575	15,037	3.96	242.75	1.51	$0.00	$2,867	-	$24,208	1.25	-	-	-	$20,880	23,440

Table 2 - Recommended 5-10 Year Payback ECMs

ECM #	ECM description	Source	Est. Installed Cost, $	Est. Incentives, $	Net Est. ECM Cost with Incentives, $	kWh, 1st Yr Savings	kW, Demand Reduction/Mo	Therms, 1st Yr Savings	kBtu/sq ft, 1st Yr Savings	Est. Operating Cost, 1st Yr Savings, $	Total 1st Yr Savings $	Life of Measure, Yrs	Est. Lifetime Energy Cost Savings, $	Simple Payback, Yrs	Lifetime Return on Investment, %	Annual Return on Investment, %	Internal Rate of Return, %	Net Present Value, $	CO_2 Reduced, lbs/yr
4	403-kW Roof-Mounted PV System	Similar Projects	$2,823,940	$0	$2,823,940	462,430	121.73	0.00	31.56	$0	$308,828	30	$5,899,627	9.14	109%	4%	10%	$3,229,225	633,529
5	Lighting Upgrades	Empirical Data	$99,745	$21,200	$78,545	27,776	7.31	0.00	1.90	$0	$4,722	15	$55,563	16.63	-29%	-2%	-1%	-$22,175	38,053
	Occupancy Sensors		$10,400	$910	$9,490	31,991	8.42	0.00	2.18	$0	$5,438	10	$45,921	1.74	384%	38%	57%	$36,901	43,828
TOTAL			$2,934,085	$22,110	$2,911,975	522,197	137.46	0.00	35.64	$0.00	$318,988	-	$6,001,111	9.13	-	-	-	$3,243,951	715,410

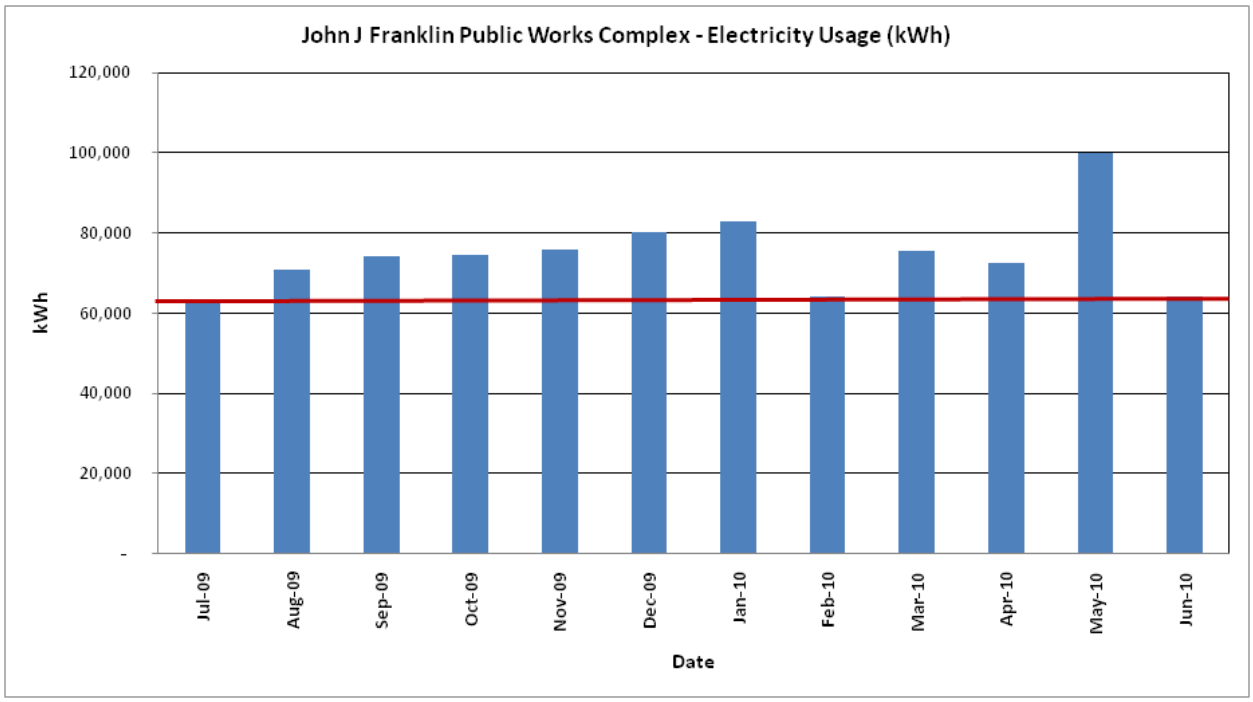
1. HISTORIC ENERGY CONSUMPTION

1.1. Energy Usage and Cost Analysis

SWA/BSG analyzed utility bills that were received from the utility company supplying the John J. Franklin Public Works Complex with electric and natural gas from July, 2009 through June, 2010.

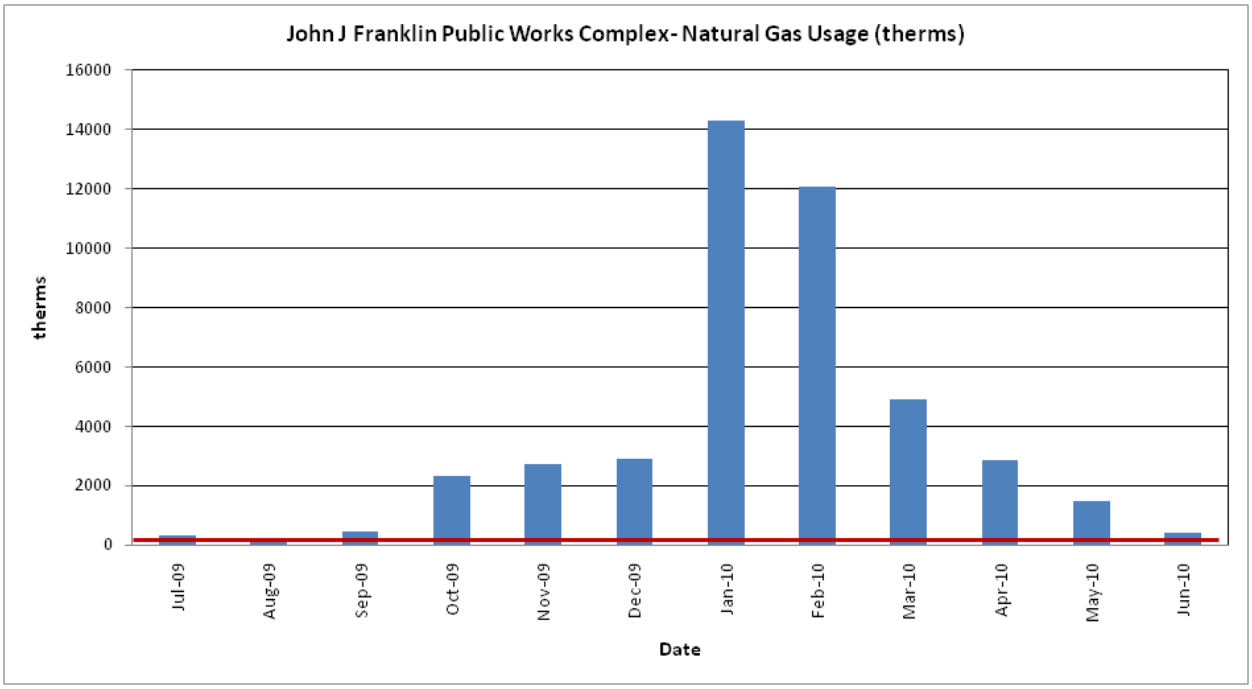
Electricity – The John J. Franklin Public Works Complex is currently served by one electric meter. The facility currently receives electricity from Jersey Central Power & Light at **an average rate of $0.17/kWh** based on 12 months of utility bills from July, 2009 through June, 2010. The facility consumed **approximately 897,600 kWh or $139,595.42 worth of electricity** in the previous year with an average monthly demand of 236.3 kW.

The following charts show electricity usage for the John J. Franklin Public Works Complex based on utility bills for the billing analysis period. The red line indicates the estimated base-load in kWh.



Natural Gas – The John J. Franklin Public Works Complex is currently served by one meter for natural gas. The facility currently receives natural gas from New Jersey Natural Gas at **an average aggregated rate of $1.28/therm,** based on 12 months of utility bills for July, 2009 through June, 2010. The facility consumed **approximately 45,045.536 therms or $57,538.38 worth of natural gas** in the previous year.

The following charts show the natural gas usage for the John J. Franklin Public Works Complex based on utility bills for the analysis period of July 2009 through June 2010.



The natural gas usage mimics seasonal needs for heating the buildings showing that natural gas is primarily used for heating. The red line indicates the base-load level for the domestic hot water. The natural gas usage above the red line shows the amount of natural gas used for heating.

1.2. Utility Rate

The John J. Franklin Public Works Complex currently receives electricity from Jersey Central Power & Light at a general service market rate for electricity use (kWh) with (kW) demand charge. The facility currently pays an average rate of approximately $0.17/kWh based on the most recent 12 months of utility bills.

The John J. Franklin Public Works Complex currently receives natural gas supply from New Jersey Natural Gas at a general service market rate for natural gas in (therms). There is one gas meter that provides natural gas service to the facility. The average aggregated rate (supply and transport) for the meter is approximately $1.28/therm based on the most recent 12 months of utility bills.

1.3. Energy Benchmarking

SWA/BSG has entered energy information about the John J. Franklin Public Works Complex in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. The username is *lakewoodtwp* and the password is *lakewood*. The building type was classified as Other-Service because the building is used as administrative offices, but primarily as garages and workshops. A classification of Other-Service does not allow it to receive a performance rating which could be used to achieve an Energy Star building certification.

The Site Energy Use Intensity is 157 kBtu/sq.ft/yr compared to the national average of buildings classified as Other-Service consuming 77 kBtu/sq.ft./yr. Implementing this report's recommended Energy Conservations Measures (ECMs) will reduce use by approximately 37.2 kBtu/sq.ft./yr.

SWA/BSG has created the Portfolio Manager site information for John J. Franklin Public Works Complex. This information can be accessed at: https://www.energystar.gov/istar/pmpam/, with the following:

Username: *lakewoodtwp*
Password: *lakewood*

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
John J. Franklin Public Works Complex

Building ID: 2427087
For 12-month Period Ending: May 31, 2010[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: August 30, 2010

Facility
John J. Franklin Public Works Complex
1 America Avenue
Lakewood, NJ 08701

Facility Owner
Township of Lakewood
231 Third St
Lakewood, NJ 08701

Primary Contact for this Facility
Tony Arecchi
1 America Ave
Lakewood, NJ 08701

Year Built: 2005
Gross Floor Area (ft²): 50,000

Energy Performance Rating[2] (1-100) N/A

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	3,093,724
Natural Gas (kBtu)[4]	4,761,324
Total Energy (kBtu)	7,855,048

Energy Intensity[5]	
Site (kBtu/ft²/yr)	157
Source (kBtu/ft²/yr)	306

Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	724

Electric Distribution Utility
FirstEnergy - Jersey Central Power & Lt Co

National Average Comparison	
National Average Site EUI	77
National Average Source EUI	150
% Difference from National Average Source EUI	104%
Building Type	Service (Vehicle Repair/Service, Postal Service)

Stamp of Certifying Professional

Based on the conditions observed at the time of my visit to this building, I certify that the information contained within this statement is accurate.

Certifying Professional
N/A

Meets Industry Standards[6] **for Indoor Environmental Conditions:**	
Ventilation for Acceptable Indoor Air Quality	**N/A**
Acceptable Thermal Environmental Conditions	**N/A**
Adequate Illumination	**N/A**

Notes:
1. Application for the ENERGY STAR must be submitted to EPA within 4 months of the Period Ending date. Award of the ENERGY STAR is not final until approval is received from EPA.
2. The EPA Energy Performance Rating is based on total source energy. A rating of 75 is the minimum to be eligible for the ENERGY STAR.
3. Values represent energy consumption, annualized to a 12-month period.
4. Natural Gas values in units of volume (e.g. cubic feet) are converted to kBtu with adjustments made for elevation based on Facility zip code.
5. Values represent energy intensity, annualized to a 12-month period.
6. Based on Meeting ASHRAE Standard 62 for ventilation for acceptable indoor air quality, ASHRAE Standard 55 for thermal comfort, and IESNA Lighting Handbook for lighting quality.

EPA Form 5900-16

2. FACILITY AND SYSTEMS DESCRIPTION

This section gives an overview of the current state of the facility and systems. Please refer to the Proposed Further Recommendations section for recommendations for improvement.

Based on visits from SWA and BSG staff on August 18 & 23, 2010 the following data was collected and analyzed.

2.1. Building Characteristics

Building No. 1, the one-story, slab on grade, 50,000 square feet JJF PWC was originally constructed in 2005 as new construction. The slab on grade steps from a high front section housing Reception, Offices, Lunch Room, Training Room, and Ancillary Spaces (approximately 12, 500 square feet), down to a low rear section housing a Maintenance Garage and ancillary spaces such as Maintenance Areas, Welding Shop, Truck Wash, Truck Vacuum, Small Engine Repair, Grease/Oil Storage, Parts Dept., various Shops and Toilet and Locker Rooms (approximately 35, 000 square feet).

Building No. 2, the one-story, slab on grade, 19,625 square feet Public Works Garage was originally constructed in 2005 as new construction.

Buildings No. 3 through 5 are constructed with similar features to Building No. 2 with notable exceptions as to size of building and types of spaces within each building.

Building No. 3 is a one-story, slab on grade building with a floor area of 16,200 square feet. The building was built in 2005 and there have been no major renovations. Building 4 is a one-story, slab on grade building with a floor area of 20,000 square feet. The building was built in 2005 and there have been no major renovations. Building 5 is a one-story, slab on grade building with a floor area of 24,000 square feet. The building was built in 2005 and there have been no major renovations. Buildings 2-5 are truck storage for the sanitation and road departments as well as storage for the recreation department and recycling program.

2.2. Building occupancy profiles

The JJF PWC occupancy is approximately 50 occupants on a daily basis Monday through Friday, 70 hours per week, according to staff personal.

2.3. Building Envelope

Building No. 1

West Facade - Front Section

South Facade

East Facade - Front Section

East Facade - Middle Section

East Facade – Rear Section

West Facade – Rear Section

North Facade

Building No. 2

West Facade

South Facade

East Facade

North Facade

Buildings No. 3 through 5 are constructed with similar features to Building No. 2 with notable exceptions as to size of building and types of spaces within each building

Due to unfavorable weather conditions (min. 18 deg. F delta-T in/outside and no/low wind), no exterior envelope infrared (IR) images were taken during the field audit.

General Note: All findings and recommendations on the exterior envelope (base, walls, roofs, doors and windows) are based on the energy auditors' experience and expertise, on construction document reviews (if available) and on detailed visual analysis, as far as accessibility and weather conditions allowed at the time of the field audit.

2.3.1. Exterior Walls

Building No. 1

The exterior wall construction is comprised of multiple assemblies.

The front section (east/south/west) wall assembly is comprised of split face block veneer, an air space, wood sheathing with a building wrap applied to the cavity surface, 6 inch metal studs filled with foil-faced batt-type insulation (R-19), with ½ inch gypsum board interior finish.

The rear section (east/north/west) wall assembly is comprised of a low section (below grade up to 10'-0") and a high section (above 10'-0" to wall/roof intersection). The low section is

comprised of a single wythe, 8-inch split-faced concrete masonry units, the cavity filled with loose-fill granular insulation (Perlite). The top course is filled solid as a bond beam (un-insulated). The high section is comprised of a metal wall panel assembly supported from the steel structure with an 8-inch metal girt system in which is installed a fiberglass blanket type insulation (R-19) with an exposed white polypropylene film to the interior of the building.

The exterior wall transition between the low and high section of the building is comprised of a similar assembly to the rear/high section described in the preceding paragraph.

Note: Wall insulation levels could not be verified in the field. Insulation types and "R-values" are identified from reviewing the construction plans and specifications.

Exterior and interior wall surfaces were inspected during the field audit. They were found to be in overall good condition with no signs of uncontrolled moisture, air-leakage and other energy-compromising issues.

Building No. 2 *(Buildings No. 3 through 5 are constructed with similar features to Building No. 2 with notable exceptions as to size of building and types of spaces within each building)*

The exterior wall construction is comprised of one wall assembly.

The wall assembly is comprised of a low section (below grade up to 10'-0") and a high section (above 10'-0" to wall/roof intersection). The low section is comprised of a single wythe, 8-inch split-faced concrete masonry units, the cavity filled with loose-fill granular insulation (Perlite). The top course is filled solid as a bond beam (un-insulated). The high section is comprised of a metal wall panel assembly supported from the steel structure with an 8-inch metal girt system in which is installed a fiberglass blanket type insulation (R-19) with an exposed white polypropylene film to the interior of the building.

Note: Wall insulation levels could not be verified in the field. Insulation types and "R-values" are identified from reviewing the construction plans and specifications.

Exterior and interior wall surfaces were inspected during the field audit. They were found to be in overall good condition with no signs of uncontrolled moisture, air-leakage and other energy-compromising issues.

2.3.2. Roof

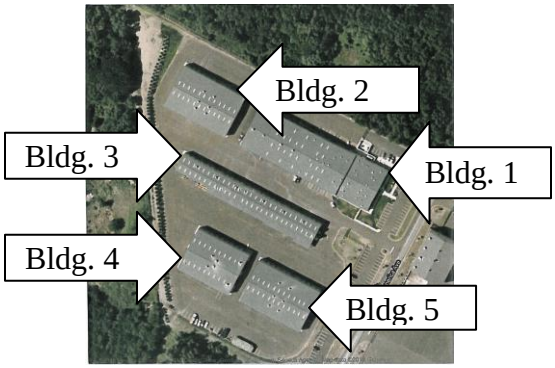
Building No. 1

The building is comprised of two types of roof assemblies.

The front section roofing assembly is comprised of a pre-engineered building rigid frame with "Z" girt purlins spanning between the frames. Spanning between the purlins are standing seam metal structural roof panels. Faced mineral-fiber blanket insulation (R-20) is draped over purlins in a continuous manner. At roof/wall intersections, roof and wall insulation is overlapped and sealed.

The rear section roofing assembly is comprised of a pre-engineered building rigid frame with "Z" girt purlins spanning between the frames. Spanning between the purlins are standing seam

metal structural roof panels. There are twenty six (26) 2'-0" X 10'-0"insulated translucent roof panels consisting of two sheets of glass-fiber-reinforced polyester, translucent plastic, located between standing seam battens throughout the roof. Faced mineral-fiber blanket insulation (R-20) is draped over purlins in a continuous manner. At roof/wall intersections, roof and wall insulation is overlapped and sealed.



Building No. 2 *(Buildings No. 3 through 5 are constructed with similar features to Building No. 2 with notable exceptions as to size of building and types of spaces within each building)*

The building is comprised of one roof assembly.

The roofing assembly is comprised of a pre-engineered building rigid frame with "Z" girt purlins spanning between the frames. Spanning between the purlins are standing seam metal structural roof panels. There are twenty four (24) 2'-0" X 10'-0"insulated translucent roof panels consisting of two sheets of glass-fiber-reinforced polyester, translucent plastic, located between standing seam battens throughout the roof. Faced mineral-fiber blanket insulation (R-20) is draped over purlins in a continuous manner. At roof/wall intersections, roof and wall insulation is overlapped and sealed.

2.3.3.Base

Building No. 1

The building's base is comprised of a slab-on-grade floor with a perimeter foundation and 2"molded-polystyrene perimeter insulation (R-10) installed vertically on the inboard face of the exterior wall from bottom of slab to top of footing.

The building's base and its perimeter were inspected for signs of uncontrolled moisture or water presence and other energy-compromising issues. Overall the base was observed to be in acceptable condition with no signs of uncontrolled moisture, air-leakage, and/or other energy-compromising issues.

Building No. 2 *(Buildings No. 3 through 5 are constructed with similar features to Building No. 2 with notable exceptions as to size of building and types of spaces within each building)*

The building's base is comprised of a slab-on-grade floor with a perimeter foundation and 2"molded-polystyrene perimeter insulation (R-10) installed vertically on the inboard face of the exterior wall from bottom of slab to top of footing.

The building's base and its perimeter were inspected for signs of uncontrolled moisture or water presence and other energy-compromising issues. Overall the base was observed to be in acceptable condition with no signs of uncontrolled moisture, air-leakage, and/or other energy-compromising issues.

2.3.4. Windows

Building No. 1

The building contains multiple window types including: combination windows (hinged and fixed) and hinged emergency-access/egress windows.

> Windows are aluminum with a thermal-break construction. Glazing is one-inch sealed insulating units consisting of 1/4-inch tempered clear exterior pane, 1/2 –inch air space, 1/4-inch Low-E clear interior pane. The windows are original and have never been replaced.

Windows, shading devices, sills, related flashings and sealants were inspected where accessible for signs of moisture, air-leakage, and other compromising issues. Overall, the windows were found to be in acceptable condition with no signs of uncontrolled moisture, air-leakage and/or other energy-comprising issues. No specific window problem spots were identified

Building No. 2 *(Buildings No. 3 through 5 are constructed with similar features to Building No. 2 with notable exceptions as to size of building and types of spaces within each building)*

There are no windows on these buildings, only large overhead doors.

2.3.5. Exterior Doors

Building No. 1

The front section of the building contains aluminum storefronts, aluminum entry doors and frames, and steel insulated doors and steel frames at Mechanical Room.

1. Aluminum entry doors in storefront are medium stile (3 ½-inch nominal width) insulated doors, glazed with one-inch sealed insulating units consisting of 1/4-inch tempered clear exterior pane, 1/2 –inch air space, 1/4-inch Low-E clear interior pane. Compression weather-stripping is supplied at fixed stops.

2. Aluminum storefront is comprised of thermally broken construction, glazed with one-inch sealed insulating units consisting of 1/4-inch tempered clear exterior pane, 1/2 –inch air space, 1/4-inch Low-E clear interior pane.

3. Galvanized steel door at Mechanical Room is comprised of insulation with a "U-value" assembly of 0.41 Btu/sq. ft. x h x deg F or better. Galvanized steel frame is not insulated, but is filled solid with grout.

The rear section of the building contains steel insulated doors and steel frames.

1. Galvanized steel doors are comprised of insulation with a "U-value" assembly of 0.41 Btu/sq. ft. x h x deg F or better. Door vision panels are single glazed with ¼-inch tempered glass. Galvanized steel frames are not insulated, but is filled solid with grout. Weatherstripping is installed at the bottom of each door. There is no weatherstripping at head or jambs at each door.

2. Sectional overhead doors are 2-inches thick, comprised of 26-gage galvanized steel sheets with an insulated inner core of thermal insulation. Two vision panels glazed with clear acrylic plastic are located in each door. Continuous weatherstripping is installed at head, jambs and bottom of each door.

All exterior doors, thresholds, related flashings, sealants and weatherstripping were inspected where accessible for signs of moisture, air-leakage, and other energy-compromising issues. Overall, the doors were found to be in acceptable condition with no signs of uncontrolled moisture, air-leakage and/or other energy-comprising issues. No specific door problem spots were identified.

Building No. 2 *(Buildings No. 3 through 5 are constructed with similar features to Building No. 2 with notable exceptions as to size of building and types of spaces within each building)*

The building contains steel insulated doors and steel frames.

1. Galvanized steel doors are comprised of insulation with a "U-value" assembly of 0.41 Btu/sq. ft. x h x deg F or better. Door vision panels are single glazed with ¼-inch tempered glass. Galvanized steel frames are not insulated, but is filled solid with grout. Weatherstripping is installed at the bottom of each door. There is no weatherstripping at head or jambs at each door.

2. Sectional overhead doors are 2-inches thick, comprised of 26-gage galvanized steel sheets with an insulated inner core of thermal insulation. Two vision panels glazed with clear acrylic plastic are located in each door. Continuous weatherstripping is installed at head, jambs and bottom of each door.

All exterior doors, thresholds, related flashings, sealants and weatherstripping were inspected where accessible for signs of moisture, air-leakage, and other energy-compromising issues. Overall, the doors were found to be in acceptable condition with no signs of uncontrolled

moisture, air-leakage and/or other energy-comprising issues. No specific door problem spots were identified

2.3.6. Building Air Tightness

Building No. 1

Overall, the field auditors found the building to be adequately air-tight with no areas of suggested improvements. The air-tightness of buildings helps maximize all other implemented energy measures and investments, and minimize potentially costly long-term maintenance, repair and replacement expenses.

Building No. 2 *(Buildings No. 3 through 5 are constructed with similar features to Building No. 2 with notable exceptions as to size of building and types of spaces within each building)*

Overall, the field auditors found the building to be not adequately air-tight due the design and operation of the mechanical systems which include three exterior wall louvers with motorized dampers at either end of the building that are interlocked to the exhaust fans on the roof. Although the dampers keep the louvers closed when the fans are not in use, there is air-leakage at each louver and at each exhaust fan on the roof.

2.4. HVAC systems

2.4.1.Heating

Heating in Building #1 is provided by three (3) Lochinvar hot water boilers, each rated at 2,000 MBH and 93.5% efficiency. All boilers are equipped with hot water outdoor air reset control (OAR). These units, installed in 2005, feed hot water coils throughout the building. The majority of hot water coils are found in twenty-two (22) Trane air-handlers, most of which are also equipped with cooling coils. Hot water is also fed to radiators at the entrances and sixteen (16) Trane unit heaters in the garages. Heating is controlled by a building automation system (BAS).

(3) Lochinvar boilers

Buildings #2 through #5 are garages, which are not heated.

2.4.2.Cooling

A Trane air-cooled rotary scroll chiller, installed in 2005, provides all cooling for Building #1. This unit, rated at 90 tons and 9.9 EER (Energy Efficiency Ratio), distributes chilled water to fifteen (15) chilled water coils, located in fifteen (15) of the twenty-two (22) Trane air-handlers used for heating (the air-handlers that service the vestibule, Parts Department, Office 147/mechanical area, and garages do not have chilled water coils). Cooling is controlled by a building automation system (BAS).

Buildings #2 through #5 are garages, which are not cooled.

2.4.3. Ventilation

Trane chiller

Ventilation is provided by twenty-three (23) Cook exhaust fans, of which nineteen (19) are in use. Exhaust fan #23 services the mechanical room; the other operating exhaust fans service the air-handlers.

2.4.4. Domestic Hot Water

Lachimar water heater

Water for the kitchen and showers is heated by a Lachimar 300 MBH natural gas, high-efficiency water heater with a 100-gallon tank, installed in 2005. All thirteen (13) restroom sinks are equipped with instantaneous water heaters.

Category III Recommendations – ECM #4: Install a timer on the water heater to shut off the power at times when the building is not occupied.

2.5. Electrical systems

2.5.1. Lighting

A complete inventory of all interior and exterior light fixtures were examined and documented in Appendix A of this report including an estimated total lighting power consumption. The facility consists primarily of T8 Fluorescent fixtures with electronic ballasts in the office areas and metal halide fixtures in the garage and other high-bay areas.

Category III Recommendation - ECM #5: Recommend replacing the metal halide fixtures with highly efficient T5 high-bay fixtures and replacing all 32 Watt lamps in the T8 fixtures with 28 Watt energy saving lamps. These and various other lighting upgrades are outlined in Appendix A.

2.5.2. Appliances and Process

Appliances, such as refrigerators, that are over 10 years of age should be replaced with newer efficient models with the Energy Star label. For example, Energy Star refrigerators use as little as 315 kWh / yr. When compared to the average electrical consumption of older equipment, Energy Star equipment results in a large savings. Building management should select Energy Star label appliances and equipment when replacing: refrigerators, printers, computers, and copy machines, etc.

More information can be found in the "Products" section of the Energy Star website at: http://www.energystar.gov. The building is not currently equipped with energy vending miser devices for conserving energy usage by Drinks and Snacks vending machines. When equipped with the vending miser devices, vending machines use less energy and are comparable in daily energy performance to new ENERGY STAR qualified machines.

In this facility, there twenty-five (25) computers, three (3) fax machines, five (5) microwaves, two (2) coffee makers, one (1) toaster, one (1) toaster oven, three (3) refrigerators, four (4) vending machines, and one (1) ice maker. In this facility, some of the appliances found and noted in the attached equipment list were older than the 10 year threshold and should be considered for the Energy Star program.

Category III Recommendation – ECM #2: Install vending machine occupancy sensors on all vending machines, which will shut the power off when the vending machines are not being used.

Category III Recommendation – ECM #3: Even when idle, the average desktop computer system requires 56 W of electricity. Replace the surge protectors at all twenty-five (25) computers with SmartStrips, which will shut off the power to the computer system when the system is idle.

2.5.3.Elevators

There is one elevator in the building, which has a 20 HP motor. The elevator was found to be in good operating condition.

3. Building Systems Equipment List

Lakewood Department of Public Works - Main Facility							
Building System	Description	Locations	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Heating	Boiler #1: Hot water boiler w/ OAR, 2,000 MBH, 93.5% efficient	Mechanical room	Intelli-Fin by Lochinvar, M# M1BV2002, S# J05H00181169	Natural gas	Air-handlers, entrance radiators, unit heaters	2005	80%
	Circulation pump	Boiler-mounted	Armstrong, M# L2B 1050 BF, S# L005	Electricity	Boiler #1	2005	67%
Heating	Boiler #2: Hot water boiler w/ OAR, 2,000 MBH, 93.5% efficient	Mechanical room	Intelli-Fin by Lochinvar, M# M1BV2002, S# J05H00181171	Natural gas	Air-handlers, entrance radiators, unit heaters	2005	80%
	Circulation pump	Boiler-mounted	Armstrong, M# L2B 1050 BF, S# 1000	Electricity	Boiler #2	2005	67%
Heating	Boiler #3: Hot water boiler w/ OAR, 2,000 MBH, 93.5% efficient	Mechanical room	Intelli-Fin by Lochinvar, M# M1BV2002, S# J05H00181171	Natural gas	Air-handlers, entrance radiators, unit heaters	2005	80%
	Circulation pump	Boiler-mounted	Armstrong, M# L2B 1050 BF, S# 1005	Electricity	Boiler #3	2005	67%
Heating	Hot water expansion tank	Mechanical room	Taco, Cat.# CA 1200-1, S# F04072	None	Heating system	2005	75%
Heating	Pump #3: Hot water circulation, 120 CFM	Mechanical room, base-mounted	Taco, M# FJ1511E2FA3160B, S# EC13502/17	Electricity	Air-handlers, entrance radiators	2005	75%
	Motor, 7.5 HP, 1,750 RPM, 88.5% efficient, 79% PF, 208-230/460		Baldorm M# M3311T, S# F0506270323				72%
Heating	Pump #4: Hot water circulation, 120 CFM	Mechanical room, base-mounted	Taco, M# FJ1511E2FAJ1L00, S# EC13502A7	Electricity	Air-handlers, entrance radiators	2005	75%
	Motor, 7.5 HP, 1,750 RPM, 88.5% efficient, 79% PF, 208-230/460		Baldor, M# M3311T, S# F0510181223				72%

Heating	(10) hot water unit heaters, 21.7 MBH each	Mainrenance garage	Trane (nameplate not accessible)	Hot water	Garage	2005	62%
Heating	(4) hot water unit heaters, 21.7 MBH each	Tire storage	Trane (nameplate not accessible)	Hot water	Tire storage	2005	62%
Heating	(2) hot water unit heaters, 30.9 MBH each, 80% efficient	Truck vacuum	Trane (nameplate not accessible)	Hot water	Truck vacuum	2005	62%
Cooling	Chilled water expansion tank	Mechanical room	Taco, Cat.# PAX84-3	None	Chilled-water system	2005	75%
Cooling	Pump #1: Chilled water circulation, 129 CFM	Mechanical room, base-mounted	Taco	Electricity	Air-handlers, entrance radiators	2005	75%
	Motor, 10 HP, 3,450 RPM, 88.5% efficient, 91% PF, 208-230/460 V		Baldor, Cat.# M3312T, S# F0512091205				72%
Cooling	Pump #2: Chilled water circulation, 129 CFM	Mechanical room, base-mounted	Taco	Electricity	Air-handlers, entrance radiators	2005	75%
	Motor, 10 HP, 3,450 RPM, 88.5% efficient, 91% PF, 208-230/460 V		Baldor, Cat.# M3312T, S# F0511043980				72%
Cooling	Air-cooled rotary chiller, 90 tons, 9.9 EER	Outside	Trane, M# RTAA 0904 YR01 A3L0 BDPC, S# U05M03510	Electricity	Air-handlers	2005	79%
Heating/ Cooling	AHU-1: Air-handler; 1,250 supply CFM, 1,050 return CFM, 200 OA CFM, 3/4 HP motor; 42.2 MBH chilled water cooling coil, 48.6 MBH hot water coil	Ceiling	Trane, M# BCHC036G1	Electricity	Deputy director	2005	75%
Heating/ Cooling	AHU-2: Air-handler; 675 supply CFM, 475 return CFM, 200 OA CFM, 3/4 HP motor; 26.2 MBH chilled water cooling coil, 32.1 MBH hot water coil	Ceiling	Trane, M# BCHC018G1	Electricity	Conference room	2005	75%

Heating/ Cooling	AHU-3: Air-handler; 560 supply CFM, 410 return CFM, 150 OA CFM, 1/2 HP motor; 22.3 MBH chilled water cooling coil, 26.0 MBH hot water coil	Ceiling	Trane, M# BCHC018G1	Electricity	Plan room	2005	75%
Heating/ Cooling	AHU-4: Air-handler; 950 supply CFM, 710 return CFM, 240 OA CFM, 1/2 HP motor; 37.9 MBH chilled water cooling coil, 43.1 MBH hot water coil	Ceiling	Trane, M# BCHC036G1	Electricity	Lobby	2005	75%
Heating/ Cooling	AHU-5: Air-handler; 1,560 supply CFM, 1,330 return CFM, 230 OA CFM, 3/4 HP motor; 58.3 MBH chilled water cooling coil, 60.7 MBH hot water coil	Ceiling	Trane, M# BCHC072G1	Electricity	Secretary/ Receptionist	2005	75%
Heating/ Cooling	AHU-6: Air-handler; 1,800 supply CFM, 1,560 return CFM, 240 OA CFM, 1 HP motor; 62.3 MBH chilled water cooling coil, 145.2 MBH hot water coil	Ceiling	Trane, M# BCHC072G1	Electricity	Office 116	2005	75%
Heating/ Cooling	AHU-7: Air-handler; 1,800 supply CFM, 1,560 return CFM, 240 OA CFM, 1 HP motor; 62.3 MBH chilled water cooling coil, 145.2 MBH hot water coil	Ceiling	Trane, M# LPCAA08F	Electricity	Lunch area	2005	75%

Heating/ Cooling	AHU-8: Air-handler; 2,400 supply CFM, 1,200 return CFM, 1,200 OA CFM, 1 1/2 HP motor; 120.0 MBH chilled water cooling coil, 81.0 MBH hot water coil	Ceiling	Trane, M# BCHC072G1	Electricity	Training room	2005	75%
Heating/ Cooling	AHU-9: Air-handler; 1,500 supply CFM, 1,020 return CFM, 480 OA CFM, 3/4 HP motor; 71.9 MBH chilled water cooling coil, 21.4 MBH hot water coil	Ceiling	Trane, M# BCHC018G1	Electricity	Electrical closet/ Computer	2005	75%
Heating	AHU-10: Air-handler; 550 supply CFM, 460 return CFM, 90 OA CFM, 1/2 HP motor; 19.9 MBH chilled water cooling coil, 99.6 MBH hot water coil	Ceiling	Trane, M# BCHC090G1	Electricity	Vestibule	2005	75%
Heating/ Cooling	AHU-11: Air-handler; 2,050 supply CFM, 1,420 return CFM, 630 OA CFM, 1 1/2 HP motor; 93.3 MBH chilled water cooling coil, 165.2 MBH hot water coil	Ceiling	Trane, M# LPCAA08F	Electricity	Locker room	2005	75%
Heating/ Cooling	AHU-12: Air-handler; 1,800 supply CFM, 0 return CFM, 1,800 OA CFM, 1 HP motor; 122.9 MBH chilled water cooling coil, 36.0 MBH hot water coil	Ceiling	Trane, M# BCHC036G1	Electricity	Corridor C	2005	75%

Heating/ Cooling	AHU-13: Air-handler; 900 supply CFM, 750 return CFM, 150 OA CFM, 1/2 HP motor; 34.9 MBH chilled water cooling coil, 63.2 MBH hot water coil	Ceiling	Trane, M# BCHC072G1	Electricity	Sign shop/storage	2005	75%
Heating/ Cooling	AHU-14: Air-handler; 1,500 supply CFM, 1,200 return CFM, 300 OA CFM, 3/4 HP motor; 52.5 MBH chilled water cooling coil, 55.9 MBH hot water coil	Ceiling	Trane, M# BCHC054G1	Electricity	Carpentry shop/storage	2005	75%
Heating/ Cooling	AHU-15: Air-handler; 1,400 supply CFM, 1,150 return CFM, 250 OA CFM, 3/4 HP motor; 48.8 MBH chilled water cooling coil, 66.5 MBH hot water coil	Ceiling	Trane, M# BCHC054G1	Electricity	Tire storage	2005	75%
Heating	AHU-16: Air-handler; 1,400 supply CFM, 1,000 return CFM, 400 OA CFM, 1/2 HP motor; 124.4 MBH hot water coil	Ceiling	Trane, M# BCHC090G1	Electricity	Parts Department	2005	75%
Heating	AHU-17: Air-handler; 2,400 supply CFM, 1,550 return CFM, 850 OA CFM, 1 HP motor; 97.9 MBH hot water coil	Ceiling	Trane, M# BCHC090G1	Electricity	Office 147/ mechanical area	2005	75%
Heating/ Cooling	AHU-18: Air-handler; 2,060 supply CFM, 1,455 return CFM, 605 OA CFM, 1 1/2 HP motor; 103.2 MBH chilled water cooling coil, 642.6 MBH hot water coil	Ceiling	Trane, M# LPCAA17F	Electricity	Garage	2005	75%

Heating	AHU-19: Air-handler; 7,000 supply CFM, 0 return CFM, 7,000 OA CFM, 3 HP motor; 642.6 MBH hot water coil	Ceiling	Trane, M# LPCAA17F	Electricity	Garage	2005	75%
Heating	AHU-20: Air-handler; 7,000 supply CFM, 0 return CFM, 7,000 OA CFM, 3 HP motor; 642.6 MBH hot water coil	Ceiling	Trane, M# LPCAA17F	Electricity	Garage	2005	75%
Heating	AHU-21: Air-handler; 3,500 supply CFM, 0 return CFM, 3,500 OA CFM, 3 HP motor; 321.3 MBH hot water coil	Ceiling	Trane, M# LPCAA06F	Electricity	Trauck wash garage/oil storage	2005	75%
Heating	AHU-22: Air-handler; 7,700 supply CFM, 0 return CFM, 7,700 OA CFM, 7 1/2 HP motor; 706.9 MBH hot water coil	Ceiling	Trane, M# LPCAA12F	Electricity	Truck wash, mach. vacuum	2005	75%
DHW	300 MBH water heater w/ 100 gallon tank	Mechanical room	Lachimar Efficiency Pac, M# RJ3100, S# K05J00095515	Natural gas	Showers, kitchen	2005	62%
	DHW pump w/ 1/6 HP, 3,600 RPM motor motor		Lochinvar, M# 110108-954, S# TP74PAB E168	Electricity	Water heater	2005	67%
DHW	(13) instantaneous water heaters	One at every restroom sink	Nameplate not accessible	Electricity	One at every restroom sink	2005	62%
Ventilation	EF-1: Exhaust fan; 7,770 RPM, 1 HP motor	Roof	Cook, M# 330 ACEB	Electricity	AHU 22	2005	75%
Ventilation	EF-2: Exhaust fan; 3,500 RPM, 1/2 HP motor	Roof	Cook, M# 210 ACEB	Electricity	AHU 21	2005	75%
Ventilation	EF-3: Exhaust fan; 10,500 RPM, 1 1/2 HP motor	Roof	Cook, M# 365 ACEB	Electricity	AHU 20, AHU 19, AHU 18	2005	75%
Ventilation	EF-4: Exhaust fan; 10,500 RPM, 1 1/2 HP motor	Roof	Cook, M# 365 ACEB	Electricity	AHU 20, AHU 19, AHU 18	2005	75%

Ventilation	EF-5: Exhaust fan; 600 RPM, 1/6 HP motor	Roof	Cook, M# 100 ACEB	Electricity	AHU 17	2005	75%
Ventilation	EF-6: Exhaust fan; 850 CFM, 1/6 HP motor	Roof	Cook, M# 120 ACEB	Electricity	AHU 16	2005	75%
Ventilation	EF-7: Exhaust fan400 CFM, 1/6 HP motor	Roof	Cook, M# 80 ACEB	Electricity	AHU 15	2005	75%
Ventilation	EF-8: Exhaust fan; 250 CFM, 1/6 HP motor	Roof	Cook, M# 70 ACEB	Electricity	AHU 14	2005	75%
Ventilation	EF-9: Exhaust fan; 300 CFM, 1/6 HP motor	Roof	Cook, M# 70 ACEB	Electricity	AHU 13	2005	75%
Ventilation	EF-10: Exhaust fan	n/a	n/a	n/a	(not in use)	n/a	n/a
Ventilation	EF-11: Exhaust fan; 1,800 CFM, 1/6 HP motor	Roof	Cook, M# 165 ACEB	Electricity	AHU 11	2005	75%
Ventilation	EF-12: Exhaust fan	n/a	n/a	n/a	(not in use)	n/a	n/a
Ventilation	EF-13: Exhaust fan; 480 CFM, 1/6 HP motor	Roof	Cook, M# 80 ACEB	Electricity	AHU 10	2005	75%
Ventilation	EF-14: Exhaust fan; 480 CFM, 1/6 HP motor	Roof	Cook, M# 80 ACEB	Electricity	AHU 8	2005	75%
Ventilation	EF 15: Exhaust fan; 230 CFM, 1/6 HP motor	Roof	Cook, M# 70 ACEB	Electricity	AHU 9	2005	75%
Ventilation	EF 16: Exhaust fan; 1,200 CFM, 1/6 HP motor	Roof	Cook, M# 135 ACEB	Electricity	AHU 7	2005	75%
Ventilation	EF 17: Exhaust fan; 240 CFM, 1/6 HP motor	Roof	Cook, M# 70 ACEB	Electricity	AHU 6	2005	75%
Ventilation	EF 18: Exhaust fan	n/a	n/a	n/a	(not in use)	n/a	n/a
Ventilation	EF 19: Exhaust fan; 150 CFM, 1/6 HP motor	Roof	Cook, M# 60 ACEB	Electricity	AHU 3	2005	75%
Ventilation	EF 20: Exhaust fan; 200 CFM, 1/6 HP motor	Roof	Cook, M# 70 ACEB	Electricity	AHU 2	2005	75%
Ventilation	EF 21: Exhaust fan; 75 CFM, 1/6 HP motor	Roof	Cook, M# 60 ACEB	Electricity	AHU 1	2005	75%
Ventilation	EF 22: Exhaust fan	n/a	n/a	n/a	(not in use)	n/a	n/a

Ventilation	EF 23: Exhaust fan; 660 CFM, 1/6 HP motor	Roof	Cook, M# 100 ACEB	Electricity	Mechanical room	2005	75%
Appliance	Microwave, 1.35 kW	Admin kitchen	Magic Chef, M# MCD990SC, S# DJ06404487	Electricity	Admin kitchen	2006	60%
Appliance	Coffee maker, 1.8 kW	Admin kitchen	Spring, M# 9805	Electricity	Admin kitchen	2007	70%
Appliance	Toaster, 800 W	Admin kitchen	Sunbeam, M# 6310	Electricity	Admin kitchen	Approx. 2005	50%
Appliance	Toaster oven, 1.2 kW	Admin kitchen	GE, M# 168955, S# A 4740 BV	Electricity	Admin kitchen	Approx. 2005	50%
Appliance	Refrigerator	Admin kitchen	Beverage-Air, M# BKV UCR27A	Electricity	Admin kitchen	Approx. 2005	74%
Appliance	(2) Snack vending machines, no miser	Lunch room	Seabreeze	Electricity	Lunch room	Approx. 2005	74%
Appliance	(2) Soda vending machines, no miser	Lunch room	Avanti	Electricity	Lunch room	Approx. 2005	74%
Appliance	Microwave, 1.35 kW	Lunch room	Magic Chef, M# MCD990SC, S# DJ06404486	Electricity	Lunch room	2006	60%
Appliance	Microwave, 1,500 W input, 650 W output	Lunch room	Tappan, M# 56-2473-10, S# 04059-35090737	Electricity	Lunch room	1985	0%
Appliance	Refrigerator	Lunch room	Beverage-Air, M# BKV ER34-1AS	Electricity	Lunch room	Approx. 2005	74%
Appliance	Ice maker	Lunch room	Hoshizaki, M# KM500MAH, S# R00718A	Electricity	Lunch room	Approx. 2005	74%
Appliance	Microwave, 1.6 kW input, 1.1 kW output	Lunch room	Emerson, M# MW8168B, S# 0 02 18158KN	Electricity	Lunch room	Approx. 2002	20%
Appliance	Refrigerator	Shop kitchen	Beverage-Air, M# BKV ER34-1AS	Electricity	Shop kitchen	Approx. 2005	74%
Appliance	Microwave	Shop kitchen	Quasar, M# MQS1075H, S# AW704500422	Electricity	Shop kitchen	1997	0%
Appliance	Coffee maker, 1 kW	Shop kitchen	Black & Decker	Electricity	Shop kitchen	Approx. 1990	0%

Note: *****The remaining useful life of a system (in %) is the relationship between the system manufactured and / or installed date and the standard life expectancy of similar equipment based on ASHRAE (2003), ASHRAE Handbook: HVAC Applications, Chapter 36.

4. ENERGY CONSERVATION MEASURES

Based on the assessment of this building, SWA and BSG have separated the investment opportunities into three categories of recommendations:

1. Capital Improvements – Upgrades not directly associated with energy savings
2. Operations and Maintenance – Low Cost/No Cost Measures
3. Energy Conservation Measures – Higher cost upgrades with associated energy savings

Category I Recommendations: Capital Improvements:

Based on the findings of SWA/BSG's survey, no capital improvements changes are recommended, due to the age and condition of the building.

Category II: Operations & Maintenance:

Based on the findings of SWA/BSG's audit, the dampers that control the ventilation in Buildings 2-5 should be adjusted so they close tightly leaving no gaps.

Category III Recommendations: Energy Conservation Measures:

Summary Table

ECM #	Description
1	Vending Misers
2	Replace Surge Protectors with SmartStrips
3	DHW Time Optimization
4	403-kW Roof-Mounted PV System
5	Lighting Upgrades & Occupancy Sensors

ECM #1: Vending Misers

Description:

The average vending machine consumes 4,025 kWh of energy per year, most of which can be attributed to lighting and cooling, which run 24 hours-per-day. Installing occupancy sensors on the DPW's four (4) vending machines would activate the power to the vending machines when in use, and deactivate the power if the vending machines have not been used for more than 15 minutes. Vending machine lighting would remain off until the adjacent area is occupied again. The refrigeration unit will be shut down for a maximum two hours, in order to maintain a desirable temperature for the product.

Installation cost: $250 each, $1,000 total
Source of cost estimate: Similar Projects

Economics:

ECM #	ECM description	Source	Est. Installed Cost, $	Est. Incentives, $	Net Est. ECM Cost with Incentives, $	kWh, 1st Yr Savings	kW, Demand Reduction/Mo	Therms, 1st Yr Savings	kBtu/sq ft, 1st Yr Savings	Est. Operating Cost, 1st Yr Savings, $	Total 1st Yr Savings $	Life of Measure, Yrs	Est. Lifetime Energy Cost Savings, $	Simple Payback, Yrs	Lifetime Return on Investment, %	Annual Return on Investment, %	Internal Rate of Return, %	Net Present Value, $	CO_2 Reduced, lbs/yr
1	Vending Misers	Similar Projects	$1,000	$0	$1,000	6,440	1.70	0	0.44	$0.00	$1,095	10	$9,244	0.91	824%	82%	109%	$8,339	8,823

Assumptions:

The electric cost used in this ECM was $0.17/kWh, which was the DPW's average rate for the 12-month period ranging from July, 2009 through June, 2010. The average vending machine consumes 4,025 kWh per year. Energy savings for a vending machine in low-occupancy (under 68 hours per week) areas is approximately 40%.

Rebates/financial incentives:

NJ SmartStart – Direct Install program (Up to 60% of installed cost)

ECM #2: Replace Surge Protectors with SmartStrips

Description:

The computers at the DPW only operate, on average, for about 50 hours per week. Devices such as monitors, printers, and scanners, however, cause the average desktop computer system to have an idle wattage of 56 W. It is recommended that SmartStrips be purchased to replace each computer's surge protector, which would shut off the power supply when the computer system is idle.

Installation cost:

Estimated installed cost: $75 each, $1,575 total
Source of cost estimate: Vendor website

Economics:

ECM #	ECM description	Source	Est. Installed Cost, $	Est. Incentives, $	Net Est. ECM Cost with Incentives, $	kWh, 1st Yr Savings	kW, Demand Reduction/Mo	Therms, 1st Yr Savings	kBtu/sq ft, 1st Yr Savings	Est. Operating Cost, 1st Yr Savings, $	Total 1st Yr Savings $	Life of Measure, Yrs	Est. Lifetime Energy Cost Savings, $	Simple Payback, Yrs	Lifetime Return on Investment, %	Annual Return on Investment, %	Internal Rate of Return, %	Net Present Value, $	CO_2 Reduced, lbs/yr
2	Replace Surge Protectors with SmartStrips	Similar Projects	$1,575	$0	$1,575	8,597	2.26	0	0.59	$0	$1,461	10	$12,340	1.08	683%	68%	93%	$10,891	11,777

Assumptions:

The cost of electricity, taken from 12 months of the Municipal Building's electricity bills, is $0.17 per kWh. 25 surge protectors are recommended to be replaced with SmartStrips; at an average of 56.04 W of idle wattage per computer system for 118 idle hours per week, 8,597 kWh of electricity are saved per year.

Rebates/financial incentives:

No rebates or incentives available for SmartStrips at this time.

ECM #3: Domestic Hot Water Time Optimization

Description:

Domestic hot water is provided by a Lachinvar water heater with a 100-gallon tank, which is in good condition. This high-efficiency unit runs 24-hours per day, although the building is unoccupied more often than it is occupied. It is recommended that a timer be installed on the existing water heater, which will shut off the power to the unit during hours when the building is not occupied. The timer would be set to keep the water heater turned off between 6PM and 6AM on weekdays, and all day on weekends.

Installation cost:

Estimated installed cost: Installation: $1,000
Source of cost estimate: Vendor website

Economics:

ECM #	ECM description	Source	Est. Installed Cost, $	Est. Incentives, $	Net Est. ECM Cost with Incentives, $	kWh, 1st Yr Savings	kW, Demand Reduction/Mo	Therms, 1st Yr Savings	kBtu/sq ft, 1st Yr Savings	Est. Operating Cost, 1st Yr Savings, $	Total 1st Yr Savings $	Life of Measure, Yrs	Est. Lifetime Energy Cost Savings, $	Simple Payback, Yrs	Lifetime Return on Investment, %	Annual Return on Investment, %	Internal Rate of Return, %	Net Present Value, $	CO2 Reduced, lbs/yr
3	DHW Time Optimization	Similar Projects	$1,000	$0	$1,000	0	0.00	242.75	0.49	$0	$311	10	$2,624	3.22	162%	16%	29%	$1,650	2,840

Assumptions:

Using 12 months of the facility's energy bills, it was determined that the cost of gas is currently $1.25/therm.

To calculate the savings from installing the timer, a spreadsheet created by Rheem was used. The temperature rise of the heated water was set at 77°F on the spreadsheet, and the energy factor (a unit that specifies the efficiency of water heaters) is specified as 0.65 for gas units. Weight of water was set at 8.33 pounds/gal. Using this data, the BTUs of output heat used for heating the water were calculated by the following equation:

The actual BTUs purchased by each unit are calculated using these values and the energy factors:

Due to the fact that the timer would shut down the water heater during the 108 hours of the week that the building would not be occupied, the energy consumption by the unit after the installation of the timer would be — of what the unit currently uses.

Rebates/financial incentives:

No incentives available for DHW controls optimization.

ECM #4: 403-kW Roof-Mounted PV System

Description:

Currently, DPW does not use any renewable energy systems. Renewable energy systems, such as photovoltaic panels, can be mounted on the roof of the facility and can offset a significant portion of the purchased electricity for the building. Power stations generally have two separate electrical charges: usage and demand. Usage is the amount of electricity in kilowatt-hours that a building uses from month to month. Demand is the amount of electrical power that a building uses at any given instance in a month period. During the summer periods, when electric demand at a power station is high due to the amount of air conditioners, lights, equipment, etc. being used within the region, demand charges go up to offset the utility's cost to provide enough electricity at that given time. Photovoltaic systems not only offset the amount of electricity use by a building, but also reduce the building's electrical demand, resulting in a higher cost savings as well. SWA/BSG presents below the economics of installing a 403-kW PV system to offset electrical demand for the building and reduce the annual net electric consumption for the building. A system of 1,754 commercial multi-crystalline 230 watt panels would generate 462,430 kWh of electricity per year, or 51.5% of the DPW's annual electric consumption.

Installation cost:

Estimated installed cost: $2,823,940; SREC revenue included in "Total 1st Year Savings" (see section 5.2 for full description)
Source of cost estimate: Similar projects

Economics:

ECM #	ECM description	Source	Est. Installed Cost, $	Est. Incentives, $	Net Est. ECM Cost with Incentives, $	kWh, 1st Yr Savings	kW, Demand Reduction/Mo	Therms, 1st Yr Savings	kBtu/sq ft, 1st Yr Savings	Est. Operating Cost, 1st Yr Savings, $	Total 1st Yr Savings $	Life of Measure, Yrs	Est. Lifetime Energy Cost Savings, $	Simple Payback, Yrs	Lifetime Return on Investment, %	Annual Return on Investment, %	Internal Rate of Return, %	Net Present Value, $	CO_2 Reduced, lbs/yr
4	403-kW Roof-Mounted PV System	Similar Projects	$2,823,940	$0	$2,823,940	462,430	121.73	0.00	31.56	$0	$308,828	30	$5,899,627	9.14	109%	4%	10%	$3,229,225	633,529

Assumptions:
Cost of installation was estimated, using data from similar projects, at approximately $7,000 per kW. Annual energy savings were calculated via "PV Watts", an online tool on the website of the National Renewable Energy Laboratory.

Rebates/financial incentives:

This ECM is eligible for New Jersey's Solar Renewable Energy Certificates (SREC). SRECs are marketable certificates issued to the owner of a PV system for each 1,000 kWh (1MWh) of electricity generated. SRECs are sold or traded separately from the power generated; the income from the sale of the SREC can be used to offset the cost of the system by applying the revenue to a loan payment or debt service. The value of the SREC is market driven, and is controlled by the amount of the Solar Alternative Compliance Payment (SACP) which is set by the NJBPU. The SREC market is derived from New Jersey's Renewable Portfolio Standard (RPS), which requires that all licensed energy suppliers in the state invest in energy generated from renewable sources, with specific requirements for solar power. If a supplier does not invest by purchasing SRECs, the supplier must pay the SACP for a percentage of the total annual power produced. Since SRECs typically trade just below the SACP, there is an incentive for the supplier to buy SRECs. The SREC Program provides a

market for SRECs to be created and verified on the owner's behalf. The New Jersey Clean Energy program facilitates the sale of SRECs to New Jersey electric suppliers. PV system owners in New Jersey with a grid-connected PV system are eligible to participate in New Jersey's SREC Program.

The NJBPU has stated its intention to continue to operate a program of rebates and SRECs, On September 12, 2007, the NJBPU approved an SREC only pilot incentive program. The program set the SACP at an initial value of $711, decreasing annually for an eight (8) year period. SRECs would be generated for fifteen (15) years (referred to as the Qualification Life), and have a two (2) year trading life. The NJBPU believes that to achieve an internal rate of return of twelve (12) percent, the target SREC price would be $611, reducing by three (3) percent per year for the same eight (8) year period that the SACP is set.

ECM #5: Lighting Upgrades & Occupancy Sensors

Description:

Lighting at DPW Building #1 primarily consists of energy-efficient fixtures with T8 lamps and electronic ballasts in the office areas and metal halide fixtures in the high-bay areas. SWA/BSG recommends replacing the metal halide fixtures with high-efficiency T5 high-bay fixtures and replacing the 32 watt lamps in the T8 fixtures with 28 watt lamps.

Recommended lighting upgrades are detailed in Appendix A.

Installation cost:

	Lighting (Only)	Sensors (Only)	Complete Lighting Upgrade
Cost	$99,745.00	$10,400.00	$110,145.00
Rebate	$21,200.00	$910.00	$22,110.00
Net Cost	$78,545.00	$9,490.00	$88,035.00
Savings (kWh)	27,776	31,991	53,512
Savings ($)	$4,721.89	$5,438.48	$9,097.11
Payback	16.6	1.7	9.7

Source of cost estimate: Empirical Data

Economics (without incentives):

ECM #	ECM description	Source	Est. Installed Cost, $	Est. Incentives, $	Net Est. ECM Cost with Incentives, $	kWh, 1st Yr Savings	kW, Demand Reduction/Mo	Therms, 1st Yr Savings	kBtu/sq ft, 1st Yr Savings	Est. Operating Cost, 1st Yr Savings, $	Total 1st Yr Savings $	Life of Measure, Yrs	Est. Lifetime Energy Cost Savings, $	Simple Payback, Yrs	Lifetime Return on Investment, %	Annual Return on Investment, %	Internal Rate of Return, %	Net Present Value, $	CO2 Reduced, lbs/yr
5	Lighting Upgrades	Empirical Data	$99,745	$21,200	$78,545	27,776	7.31	0.00	1.90	$0	$4,722	15	$55,563	16.63	-29%	-2%	-1%	-$22,175	38,053
	Occupancy Sensors		$10,400	$910	$9,490	31,991	8.42	0.00	2.18	$0	$5,438	10	$45,921	1.74	384%	38%	57%	$36,901	43,828

Assumptions:

The electric cost used in this ECM was $0.17/kWh, which was the facilities' average rate for the 12-month period from July, 2009 through June, 2010. The replacements for each lighting fixture, the costs to replace or retrofit each one, and the rebates and wattages for each fixture are located in Appendix A.

Rebates/financial incentives:

The New Jersey SmartStart offers rebates for upgrading lighting fixtures and installing lighting controls. The total rebate this ECM qualifies for is $22,110.

BSG/SWA has reviewed several funding options for the purposes of subsidizing the costs for installing the energy conservation measures noted within this report.

Although funding options are constantly changing and updating this project may benefit from enrolling in a number of alternative programs such as the; The NJ SmartStart program with Technical Assistance, alternate funding by applying for financing and competitive grants through the United States Department of Energy as well as local utility incentive programs in an effort to offset a portion of the cost of ECM implementation.

The Smart Start program offers reimbursement incentives for various equipment purchases, and lighting incentives. The benefits and requirements of this program can be found at:

http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings

Financial assistance is also available through the United States Department of Energy in the form of; Grants, Cooperative Research and development agreements, small business innovation research, and Loan Guarantee Programs. Further information for these programs is available at:

http://www1.eere.energy.gov/financing/types_assistance.html

Local Utility incentives such as a Direct Install Program, offer incentives that can provide up to 80% subsidy of the cost to install particular ECM's. As each utility company has different guidelines and incentives it is important to contact your local utility authority for eligibility in these programs.

Additional funding may also be found through the following funding methods:

- Energy Savings Improvement Program (ESIP) – Public Law 2009, Chapter 4 authorizes government entities to make energy related improvements to their facilities and par for the costs using the value of energy savings that result from the improvements.

- Municipal Bonds – Municipal bonds are a bond issued by a city or other local government, or their agencies. 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 contractor of up to fifteen (15) years for 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.

BSG/SWA 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.

5. RENEWABLE AND DISTRIBUTED ENERGY MEASURES

5.1. Existing systems

There are currently no existing renewable energy systems.

5.2. Solar Photovoltaic

As a result of our study, the roof of the John J. Franklin Public Works Complex building has been identified as conducive for the application of a Photovoltaic (PV) system.

Based on the goal of generating as much of the building's electric load as possible utilizing renewable energy while meeting the limitations of usable space available, a PV system with a design capacity of 403 kW was selected. The total annual generating capacity of the system is 462,430 kWh as estimated using PV WATTS calculator provided by the Department of Energy (DOE), National Renewable Energy Laboratory (NREL).

(Type comments here to appear on printout; maximum 1 row of 80 characters.)

Station Identification	
City:	Atlantic_City
State:	New_Jersey
Latitude:	39.45° N
Longitude:	74.57° W
Elevation:	20 m
PV System Specifications	
DC Rating:	403.4 kW
DC to AC Derate Factor:	0.770
AC Rating:	310.6 kW
Array Type:	Fixed Tilt
Array Tilt:	10.0°
Array Azimuth:	208.0°
Energy Specifications	
Cost of Electricity:	11.2 ¢/kWh

Results			
Month	Solar Radiation (kWh/m²/day)	AC Energy (kWh)	Energy Value ($)
1	2.51	24064	2695.17
2	3.27	28851	3231.31
3	4.26	40498	4535.78
4	5.18	46558	5214.50
5	5.85	53342	5974.30
6	6.12	51835	5805.52
7	6.05	52299	5857.49
8	5.51	47862	5360.54
9	4.80	41043	4596.82
10	3.69	33092	3706.30
11	2.58	22920	2567.04
12	2.17	20065	2247.28
Year	4.34	462430	51792.16

This proposed PV system would include 1,754 flat, crystalline PV modules installed on the roof. The system is based on commonly used 230 Watt PV modules, and one (1) inverter for conversion to AC power.

The proposed system would generate approximately 51 percent of the electric power consumed annually by the John J. Franklin Public Works Complex building. It is noted this system would supplement the utility power supply since PV electricity production is based on weather and the system size is limited to 51 percent. The estimated cost of construction would be approximately $2,823,940 for this system. The system that is being recommended would not meet the qualifications for an upfront incentive through the New Jersey Clean Energy Program because the system size is over 50 kW. The approximate annual savings would be $308,828, which would make the approximate payback 9 years

PV System – John J. Franklin Public Works Complex		
	Savings	**Cost**
Estimated Cost Of Construction		$2,823,940
REIP Incentive		$0
Township Investment		$2,823,940
First Year Electric Energy Savings	$78,613	
Estimated Annual SREC Revenue	$231,215	
Annual Maintenance		$1000
First Year Savings	$308,828	
Simple Payback Analysis	Approximately 9 Years	

If the Client is interested in moving forward, a structural analysis of the roofs must be performed to confirm they will support the addition of PV modules.

5.3. Solar Thermal Collectors

Solar thermal collectors are feasible for this location based on the shading and amount of roof area available with unobstructed southern exposure. Installation of a solar thermal hot water heat system would reduce the space available for photovoltaic modules and would be redundant to the current domestic hot water system.

5.4. Combined Heat and Power

Combined Heat Power is not applicable to this project because of the lack of available resources and the demand for heat and hot water is being met by the high efficiency boilers currently in place

5.5. Geothermal

Geothermal is not applicable to this project. A geothermal system would require the existing heating distribution system to be removed and replaced with a heat pump system. Large underground vertical or horizontal loop systems would need to be installed beneath the existing concrete pad and asphalt. These modifications to the existing heat distribution system would be extremely disruptive to the use of the building and the surrounding neighborhood in addition to the high cost of such an installation and retrofit.

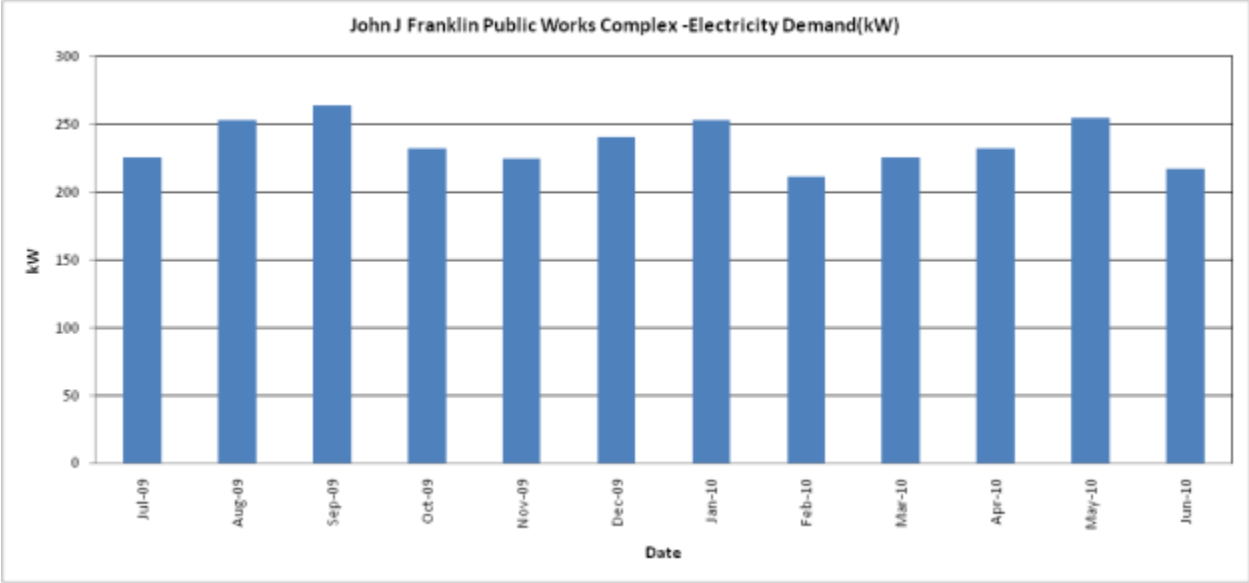
5.6. Wind

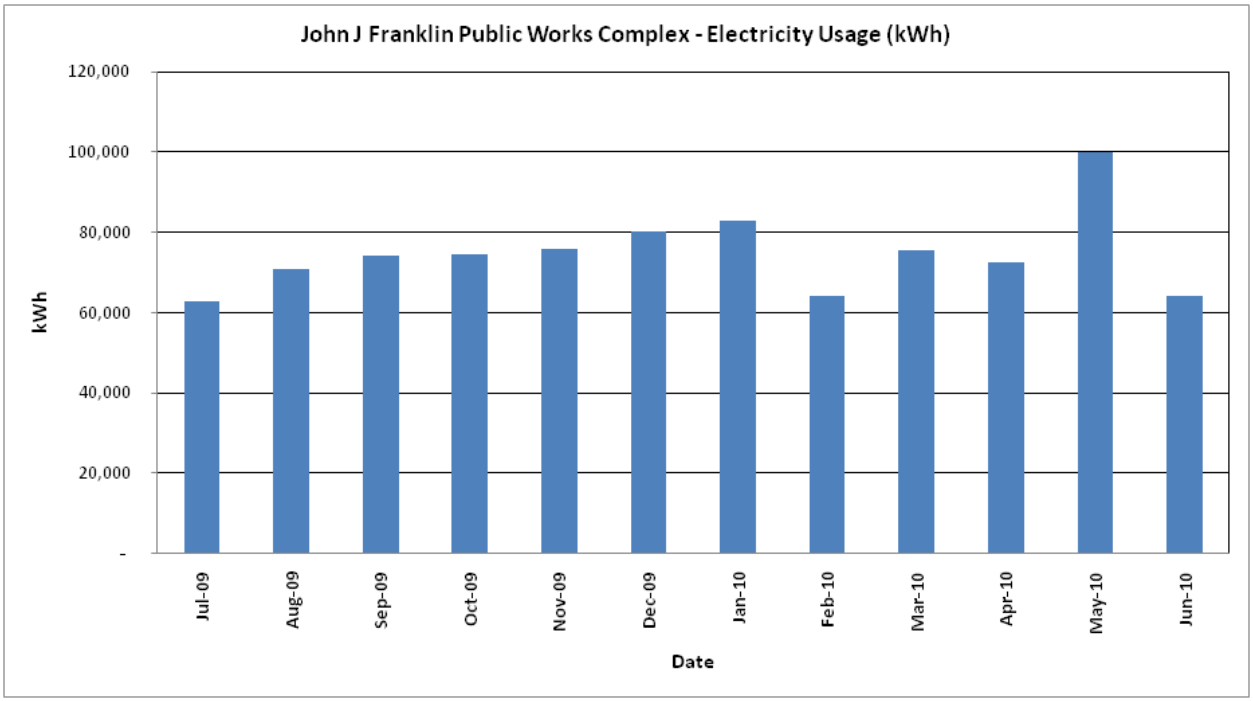
Wind power production is not appropriate for this location because required land is not available for the wind turbine. Also, the available wind energy resource is very low.

6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

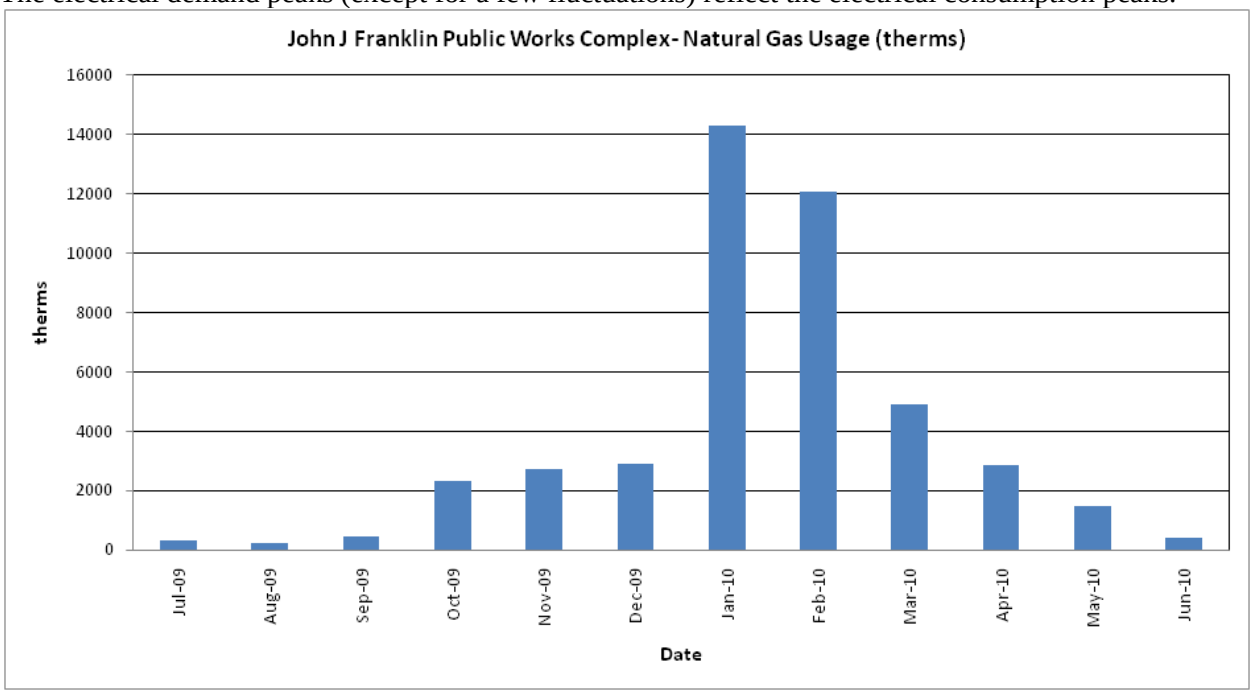
6.1. Energy Purchasing

The average electrical peak demand for the previous year was 236.3 kW and the maximum peak demand was 264.3 kW. The electric and gas load profiles for this project are presented in the following charts. The first chart shows electric demand (in kW) for the previous 12 months and the other two charts show electric and gas usage (in kWh), respectively.





The electrical demand peaks (except for a few fluctuations) reflect the electrical consumption peaks.



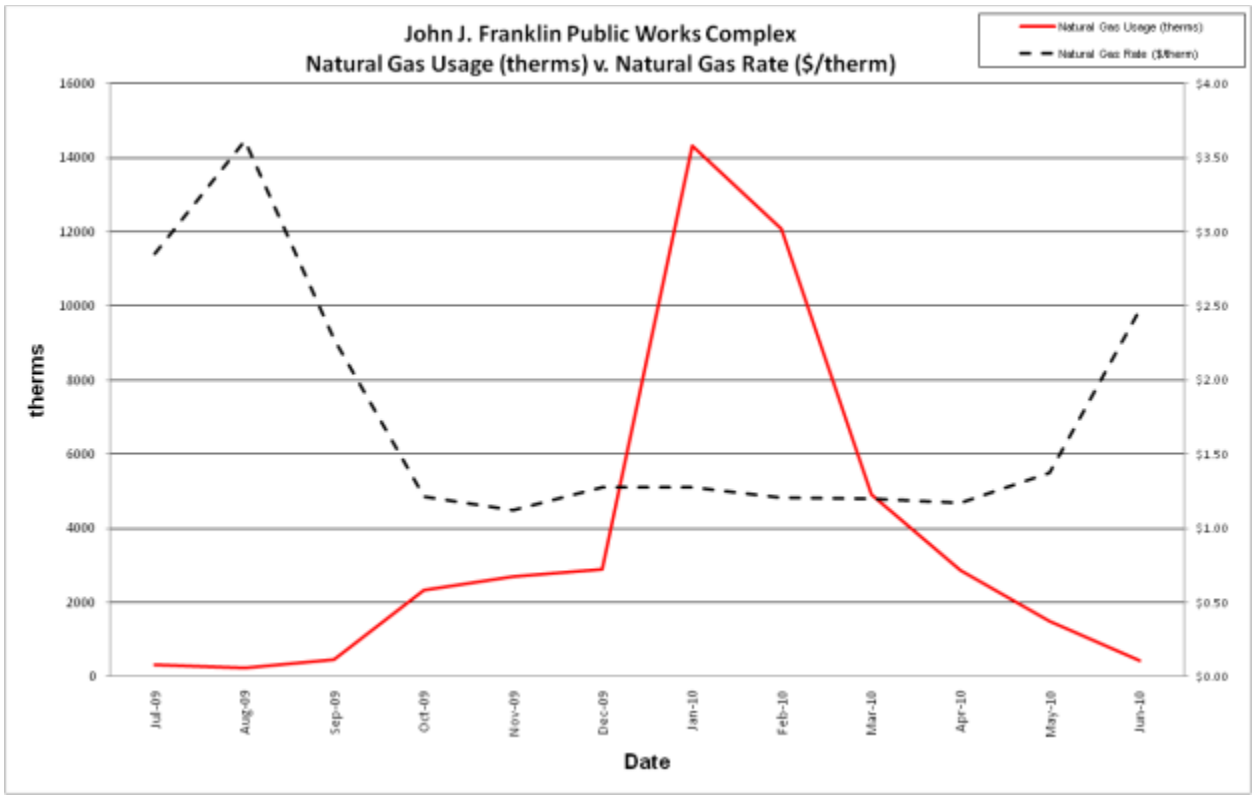
The natural gas usage shows that the most natural gas is consumed in the winter months, meaning the majority of natural gas use in this building is for heating.

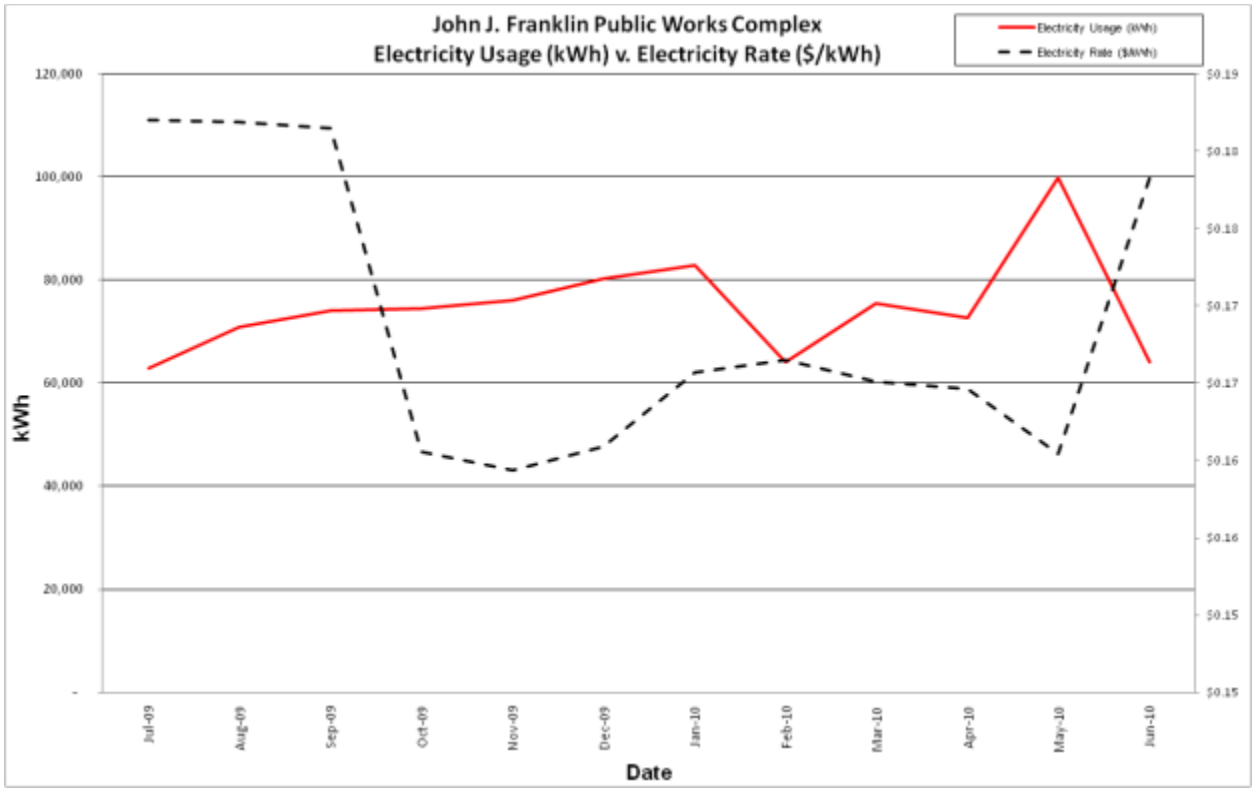
6.2. Tariff analysis

Currently, natural gas is provided via one gas meter with New Jersey Natural Gas serving as transmission and supply provider. The general service rate for natural gas charges a market-rate price based on use and the John J. Franklin Public Works Complex billing data does not breakdown demand costs for all periods. Typically, the natural gas prices increase during the cooling months when natural gas is less of a demand.

The John J. Franklin Public Works Complex is direct-metered (via one meter) and currently purchases electricity from Jersey Central Power& Light at a general service rate. The general service rate for electric charges are market-rate based on use and the Public Works Complex billing does show a breakdown of demand costs. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year. Typically, the electricity prices increase during the cooling months when electricity is used by the HVAC condensing units and air handlers.

The following charts compare the utility consumption and utility rates for the natural gas and electricity over the previous 12 month period.


John J. Franklin Public Works Complex
Natural Gas Usage (therms) v. Natural Gas Rate ($/therm)
Natural Gas Usage (therms)
Natural Gas Rate ($/therm)
therms
16000
14000
12000
10000
8000
6000
4000
2000
0
$4.00
$3.50
$3.00
$2.50
$2.00
$1.50
$1.00
$0.50
$0.00
Jul-09
Aug-09
Sep-09
Oct-09
Nov-09
Dec-09
Jan-10
Feb-10
Mar-10
Apr-10
May-10
Jun-10
Date


John J. Franklin Public Works Complex
Electricity Usage (kWh) v. Electricity Rate ($/kWh)
Electricity Usage (kWh)
Electricity Rate ($/kWh)
kWh
120,000
100,000
80,000
60,000
40,000
20,000
-
$0.19
$0.18
$0.18
$0.17
$0.17
$0.16
$0.16
$0.15
$0.15
Jul-09
Aug-09
Sep-09
Oct-09
Nov-09
Dec-09
Jan-10
Feb-10
Mar-10
Apr-10
May-10
Jun-10
Date

6.3. Energy Procurement strategies

Billing analysis shows large price fluctuations of over the course of the year for the John J. Franklin Public Works Complex natural gas account. Selecting third party suppliers could reduce the cost associated with energy procurement. Customers that have a large variation in monthly billing rates can often reduce the costs associated with energy procurement by selecting a third party energy supplier. Contact the NJ Energy Choice Program for further information on Energy Services Companies (ESCOs) that can act as third party energy suppliers. Appendix B contains a complete list of third party energy suppliers.

SWA/BSG also recommends that Lakewood contact third party energy suppliers in order to negotiate a lower electricity rate. Comparing the current electric rate to average utility rates of similar type buildings in New Jersey, which are approximately $0.15/kWh, it may be possible to save up to $ 0.02/kWh, which would have equated to approximately $16,400 for the past 12 months. Lakewood already purchases natural gas for lower rate than the average rate of $1.45/therm.

7. METHOD OF ANALYSIS

7.1. Assumptions and methods

Energy modeling method:	Spreadsheet-based calculation methods
Cost estimates:	RS Means 2009 (Facilities Maintenance & Repair Cost Data) RS Means 2009 (Building Construction Cost Data) RS Means 2009 (Mechanical Cost Data) Note: Cost estimates also based on utility bill analysis and prior experience with similar projects.

7.2. Disclaimer

This engineering audit was prepared using the most current and accurate fuel consumption data available for the site. The estimates that it projects are intended to help guide the owner toward best energy choices. The costs and savings are subject to fluctuations in weather, variations in quality of maintenance, changes in prices of fuel, materials, and labor, and other factors. Although we cannot guarantee savings or costs, we suggest that you use this report for economic analysis of the building and as a means to estimate future cash flow.

THE RECOMMENDATIONS PRESENTED IN THIS REPORT ARE BASED ON THE RESULTS OF ANALYSIS, INSPECTION, AND PERFORMANCE TESTING OF A SAMPLE OF COMPONENTS OF THE BUILDING SITE. ALTHOUGH CODE-RELATED ISSUES MAY BE NOTED, SWA STAFF HAVE NOT COMPLETED A COMPREHENSIVE EVALUATION FOR CODE-COMPLIANCE OR HEALTH AND SAFETY ISSUES. THE OWNER(S) AND MANAGER(S) OF THE BUILDING(S) CONTAINED IN THIS REPORT ARE REMINDED THAT ANY IMPROVEMENTS SUGGESTED IN THIS SCOPE OF WORK MUST BE PERFORMED IN ACCORDANCE WITH ALL LOCAL, STATE, AND FEDERAL LAWS AND REGULATIONS THAT APPLY TO SAID WORK. PARTICULAR ATTENTION MUST BE PAID TO ANY WORK WHICH INVOLVES HEATING AND AIR MOVEMENT SYSTEMS, AND ANY WORK WHICH WILL INVOLVE THE DISTURBANCE OF PRODUCTS CONTAINING MOLD, ASBESTOS, OR LEAD.

LIGHTING ANALYSIS

Lakewood Township
Public Works
1 America Ave

BIRDSALL SERVICES GROUP
ENGINEERS & CONSULTANTS

Upgrade Code	Upgrade Description	Existing Fixture	Existing Watts	Proposed Fixture	Proposed Watts	Lighting Total # of Upgrades	Lighting Cost per Upgrade ($)	Lighting SmartStart Rebate per Upgrade
1	4' fixture with (2) 4' T8 Lamps / replace the (2) 32w lamps with 28w energy saving lamps	2L4' T8/ELEC	61	2L4' T8/ELEC LO	55	51	$25.00	$0.00
2	2x2 fixture with (2) u-tube lamps / replace the (2) 32w u-tube lamps with energy saving lamps	2L22"	62	2L22" LO	55	44	$25.00	$0.00
3	Recessed 2x4 fixture with (3) 4' T8 lamps / replace the (3) 32w lamps with 28w energy saving lamps	3L4' T8/ELEC	89	3L4' T8/ELEC LO	79	24	$30.00	$0.00
4	400W Metal Halide / replace with a T5 fixture with 6 high output lamps	400W MH/Ballast	445	6F54T5 HO	358	54	$450.00	$100.00
5	2x4 fixture with (2) 4' T8 lamps / replace the (2) 32w lamps with 28w energy saving lamps	2L4' T8/ELEC	61	2L4' T8/ELEC LO	55	4	$25.00	$0.00
6	Recessed 2x4 fixture with (2) 4' T8 lamps / replace the (2) 32w lamps with 28w energy saving lamps	2L4' T8/ELEC	61	2L4' T8/ELEC LO	55	6	$25.00	$0.00
7	Recessed 2x4 fixture with (2) 4' T8 lamps / replace the (2) 32w lamps with 28w energy saving lamps	3L4' T8/ELEC	89	3L4' T8/ELEC LO	79	24	$25.00	$0.00
8	Recessed 2x2 fixture with a FB031 Compact Fluorescent Lamp	FBO31	62	No Upgrade	62	9	$0.00	$0.00
9	Ceiling Mounted fixture with (1) 2' T8 Lamp	(1) FO17T8/ELEC	18	No Upgrade	18	2	$0.00	$0.00
10	Ceiling Mounted open channel fixture with (1) 4' T8 Lamp	1L4' T8/ELEC	31	No Upgrade	31	2	$0.00	$0.00
11	Recessed 2x4 fixture with (2) 4' T8 lamps / replace the (2) 32w lamps with 28w energy saving lamps	2L4' T8/ELEC	61	2L4' T8/ELEC LO	55	16	$25.00	$0.00
12	Bld 2. - 400W Metal Halide / replace with a T5 fixture with 6 high output lamps	400W MH/Ballast	445	6F54T5 HO	358	40	$450.00	$100.00
13	Bld 3. - 400W Metal Halide / replace with a T5 fixture with 6 high output lamps	400W MH/Ballast	445	6F54T5 HO	358	36	$450.00	$100.00
14	Bld 4. - 400W Metal Halide / replace with a T5 fixture with 6 high output lamps	400W MH/Ballast	445	6F54T5 HO	358	42	$450.00	$100.00
15	Bld 5. - 400W Metal Halide / replace with a T5 fixture with 6 high output lamps	400W MH/Ballast	445	6F54T5 HO	358	40	$450.00	$100.00

Summary

	Lighting (Only)	Sensors (Only)	Complete Lighting Upgrade
Cost	$99,745.00	$10,400.00	$110,145.00
Rebate	$21,200.00	$910.00	$22,110.00
Net Cost	$78,545.00	$9,490.00	**$88,035.00**
Savings (kWh)	27,776	31,991	**53,512**
Savings ($)	$4,721.89	$5,438.48	**$9,097.11**
Payback	16.6	1.7	**9.7**

Variables:

$0.17	Avg. Electric Rate ($/kWh)
	Avg. Demand Rate ($/kW)
2080	Operating Hours/Year
8	Operating Hours/Work Day

Assumptions:

25%	Occupancy Sensor Savings (Avg)
40%	Occupancy Sensor Savings(>Avg)

Notes:

Seq. #	Upgrade Code	Room/Area	Hrs/ Work Day	Hrs/ Year	Existing Fixture	Existing Qty.	Existing Watts	Existing Foot Candles	Proposed Fixture	Proposed Qty.	Proposed Watts	kW Reduction	Lighting Energy Savings, kWh	Lighting Cost ($)	Lighting Savings ($)	Lighting Payback (yrs)	Controls Type	Controls Qty.	Occupancy Sensors (ONLY) Energy Savings, kWh	Occupancy Sensors (ONLY) Cost ($)	Occupancy Sensors (ONLY) Savings ($)	Occupancy Sensors (ONLY) Payback (yrs)	SmartStart Rebate Lighting	SmartStart Rebate Sensors	Lighting & Occupancy Sensors Energy Savings, kWh	Lighting & Occupancy Sensors Post-Rebate Cost ($)	Lighting & Occupancy Sensors Savings ($)	Lighting & Occupancy Sensors Payback (yrs)
		Totals:					106693				86999	19.694	27776	$99,745.00	$4,721.89	21.1			31991	$10,400.00	$5,438.48	1.9	$21,200.00	$910.00	53512	$88,035.00	$9,097.11	9.7
1	1	Boiler Room	2	520	2L4' T8/ELEC	9	549		2L4' T8/ELEC LO	9	495	0.054	28	$225.00	$4.77	47.1			0	$0.00	$0.00		$0.00	$0.00	28	$225.00	$4.77	47.1
2	2	Side Foyer	24	6240	2L22"	1	62		2L22" LO	1	55	0.007	44	$25.00	$7.43	3.4			0	$0.00	$0.00		$0.00	$0.00	44	$25.00	$7.43	3.4
3	2	Hallway	12	3120	2L22"	14	868		2L22" LO	14	770	0.098	306	$350.00	$51.98	6.7			0	$0.00	$0.00		$0.00	$0.00	306	$350.00	$51.98	6.7
4	2	Employee Entrance Lobby	12	3120	2L22"	7	434		2L22" LO	7	385	0.049	153	$175.00	$25.99	6.7			0	$0.00	$0.00		$0.00	$0.00	153	$175.00	$25.99	6.7
5	2	Employee Entrance Foyer	12	3120	2L22"	1	62		2L22" LO	1	55	0.007	22	$25.00	$3.71	6.7			0	$0.00	$0.00		$0.00	$0.00	22	$25.00	$3.71	6.7
6	3	Supervisor Office	8	2080	3L4' T8/ELEC	20	1780		3L4' T8/ELEC LO	20	1580	0.2	416	$600.00	$70.72	8.5			0	$0.00	$0.00		$0.00	$0.00	416	$600.00	$70.72	8.5
7	3	Plan Room	4	1040	3L4' T8/ELEC	4	356		3L4' T8/ELEC LO	4	316	0.04	42	$120.00	$7.07	17.0			0	$0.00	$0.00		$0.00	$0.00	42	$120.00	$7.07	17.0
8	4	Carpenter Shop	8	2080	400W MH/Ballast	4	1780		6F54T5 HO	4	1432	0.348	724	$1,800.00	$123.05	14.6	OSRH	1	926	$400.00	$157.35	2.5	$400.00	$35.00	1468	$1,765.00	$249.64	7.1
9	4	Carpenter Garage	8	2080	400W MH/Ballast	4	1780		6F54T5 HO	4	1432	0.348	724	$1,800.00	$123.05	14.6	OSRH	1	926	$400.00	$157.35	2.5	$400.00	$35.00	1468	$1,765.00	$249.64	7.1
10	4	Mechanics Garage	8	2080	400W MH/Ballast	27	12015		6F54T5 HO	27	9666	2.349	4886	$12,150.00	$830.61	14.6	OSRH	3	6248	$1,200.00	$1,062.13	1.1	$2,700.00	$105.00	9912	$10,545.00	$1,685.08	6.3
11	5	Small Engine Repair Area	8	2080	2L4' T8/ELEC	2	122		2L4' T8/ELEC LO	2	110	0.012	25	$50.00	$4.24	11.8			0	$0.00	$0.00		$0.00	$0.00	25	$50.00	$4.24	11.8
12	6	Shop Break Area	8	2080	2L4' T8/ELEC	4	244		2L4' T8/ELEC LO	4	220	0.024	50	$100.00	$8.49	11.8			0	$0.00	$0.00		$0.00	$0.00	50	$100.00	$8.49	11.8

					Existing				Proposed				Lighting						Occupancy Sensors (ONLY)						Lighting & Occupancy Sensors			
																	Controls						SmartStart Rebate							
Seq. #	Upgrade Code	Room/Area	Hrs/ Work Day	Hrs/ Year	Fixture	Qty.	Watts	Foot Candles	Fixture	Qty.	Watts	kW Reduction	Energy Savings, kWh	Cost ($)	Savings ($)	Payback (yrs)	Type	Qty.	Energy Savings, kWh	Cost ($)	Savings ($)	Payback (yrs)	Lighting	Sensors	Energy Savings, kWh	Post-Rebate Cost ($)	Savings ($)	Payback (yrs)
13	6	Shop Foreman's Office	8	2080	2L4' T8/ELEC	2	122		2L4' T8/ELEC LO	2	110	0.012	25	$50.00	$4.24	11.8			0	$0.00	$0.00		$0.00	$0.00	25	$50.00	$4.24	11.8
14	2	Parts Deliveries Office	8	2080	2L22"	4	248		2L22" LO	4	220	0.028	58	$100.00	$9.90	10.1			0	$0.00	$0.00		$0.00	$0.00	58	$100.00	$9.90	10.1
15	2	Police Mechanic	8	2080	2L22"	4	248		2L22" LO	4	220	0.028	58	$100.00	$9.90	10.1			0	$0.00	$0.00		$0.00	$0.00	58	$100.00	$9.90	10.1
16	4	Tire Storage	4	1040	400W MH/Ballast	6	2670		6F54T5 HO	6	2148	0.522	543	$2,700.00	$92.29	29.3	OSRH	1	694	$400.00	$118.01	3.4	$600.00	$35.00	1101	$2,465.00	$187.23	13.2
17	2	Hallway	12	3120	2L22"	7	434		2L22" LO	7	385	0.049	153	$175.00	$25.99	6.7			0	$0.00	$0.00		$0.00	$0.00	153	$175.00	$25.99	6.7
18	2	Hallway	12	3120	2L22"	1	62		2L22" LO	1	55	0.007	22	$25.00	$3.71	6.7			0	$0.00	$0.00		$0.00	$0.00	22	$25.00	$3.71	6.7
19	2	Hallway	12	3120	2L22"	3	186		2L22" LO	3	165	0.021	66	$75.00	$11.14	6.7			0	$0.00	$0.00		$0.00	$0.00	66	$75.00	$11.14	6.7
20	4	Sign Shop	8	2080	400W MH/Ballast	6	2670		6F54T5 HO	6	2148	0.522	1086	$2,700.00	$184.58	14.6	OSRH	1	1388	$400.00	$236.03	1.7	$600.00	$35.00	2203	$2,465.00	$374.46	6.6
21	1	Sign Storage/Sallyport	8	2080	2L4' T8/ELEC	6	366		2L4' T8/ELEC LO	6	330	0.036	75	$150.00	$12.73	11.8			0	$0.00	$0.00		$0.00	$0.00	75	$150.00	$12.73	11.8
22	1	Sign Shop Upstairs	8	2080	2L4' T8/ELEC	7	427		2L4' T8/ELEC LO	7	385	0.042	87	$175.00	$14.85	11.8			0	$0.00	$0.00		$0.00	$0.00	87	$175.00	$14.85	11.8
23	2	Hallway	12	3120	2L22"	2	124		2L22" LO	2	110	0.014	44	$50.00	$7.43	6.7			0	$0.00	$0.00		$0.00	$0.00	44	$50.00	$7.43	6.7
24	7	Lunch Room	8	2080	3L4' T8/ELEC	24	2136		3L4' T8/ELEC LO	24	1896	0.24	499	$600.00	$84.86	7.1			0	$0.00	$0.00		$0.00	$0.00	499	$600.00	$84.86	7.1
25	8	Women's Restroom	8	2080	FBO31	2	124		No Upgrade	2	124	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
26	9		8	2080	(1) FO17T8/ELEC	2	36		No Upgrade	2	36	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
27	8	Women's Lockerroom	8	2080	FBO31	1	62		No Upgrade	1	62	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
28	8	Men's Lockeroom/Restroom	8	2080	FBO31	4	248		No Upgrade	4	248	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
29	10		8	2080	1L4' T8/ELEC	2	62		No Upgrade	2	62	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
30	11		8	2080	2L4' T8/ELEC	16	976		2L4' T8/ELEC LO	16	880	0.096	200	$400.00	$33.95	11.8			0	$0.00	$0.00		$0.00	$0.00	200	$400.00	$33.95	11.8
31	8	Men's Shower	8	2080	FBO31	2	124		No Upgrade	2	124	0	0	$0.00	$0.00				0	$0.00	$0.00		$0.00	$0.00	0	$0.00	$0.00	
32	4	Parts Storage	16	4160	400W MH/Ballast	7	3115		6F54T5 HO	7	2506	0.609	2533	$3,150.00	$430.68	7.3	OSRH	1	3240	$400.00	$550.73	0.7	$700.00	$35.00	5140	$2,815.00	$873.75	3.2
33	1		8	2080	2L4' T8/ELEC	29	1769		2L4' T8/ELEC LO	29	1595	0.174	362	$725.00	$61.53	11.8			0	$0.00	$0.00		$0.00	$0.00	362	$725.00	$61.53	11.8
34	5		8	2080	2L4' T8/ELEC	2	122		2L4' T8/ELEC LO	2	110	0.012	25	$50.00	$4.24	11.8			0	$0.00	$0.00		$0.00	$0.00	25	$50.00	$4.24	11.8
35	13	Recycling Garage	4	1040	400W MH/Ballast	20	8900		6F54T5 HO	20	7160	1.74	1810	$9,000.00	$307.63	29.3	OSRH	2	2314	$800.00	$393.38	2.0	$2,000.00	$70.00	3671	$7,730.00	$624.10	12.4
36	13	Sanitation Garage	4	1040	400W MH/Ballast	16	7120		6F54T5 HO	16	5728	1.392	1448	$7,200.00	$246.11	29.3	OSRH	2	1851	$800.00	$314.70	2.5	$1,600.00	$70.00	2937	$6,330.00	$499.28	12.7
37	12	Street Sweep Garage	4	1040	400W MH/Ballast	20	8900		6F54T5 HO	20	7160	1.74	1810	$9,000.00	$307.63	29.3	OSRH	2	2314	$800.00	$393.38	2.0	$2,000.00	$70.00	3671	$7,730.00	$624.10	12.4
38	12	Truck Storage	4	1040	400W MH/Ballast	20	8900		6F54T5 HO	20	7160	1.74	1810	$9,000.00	$307.63	29.3	OSRH	2	2314	$800.00	$393.38	2.0	$2,000.00	$70.00	3671	$7,730.00	$624.10	12.4
39	14	Garage- Small Truck	4	1040	400W MH/Ballast	17	7565		6F54T5 HO	17	6086	1.479	1538	$7,650.00	$261.49	29.3	OSRH	2	1967	$800.00	$334.37	2.4	$1,700.00	$70.00	3121	$6,680.00	$530.49	12.6
40	14	Dry Storage (Rec)	1	260	400W MH/Ballast	5	2225		6F54T5 HO	5	1790	0.435	113	$2,250.00	$19.23	117.0	OSRH	1	145	$400.00	$24.59	16.3	$500.00	$35.00	229	$2,115.00	$39.01	54.2
41	14	Dumptruck Storage	4	1040	400W MH/Ballast	15	6675		6F54T5 HO	15	5370	1.305	1357	$6,750.00	$230.72	29.3	OSRH	2	1736	$800.00	$295.04	2.7	$1,500.00	$70.00	2753	$5,980.00	$468.08	12.8
42	14	Storage	1	260	400W MH/Ballast	5	2225		6F54T5 HO	5	1790	0.435	113	$2,250.00	$19.23	117.0	OSRH	1	145	$400.00	$24.59	16.3	$500.00	$35.00	229	$2,115.00	$39.01	54.2
43	15	Road Department Garage	6	1560	400W MH/Ballast	20	8900		6F54T5 HO	20	7160	1.74	2714	$9,000.00	$461.45	19.5	OSRH	2	3471	$800.00	$590.07	1.4	$2,000.00	$70.00	5507	$7,730.00	$936.16	8.3
44	15	Commuity Transportation	4	1040	400W MH/Ballast	20	8900		6F54T5 HO	20	7160	1.74	1810	$9,000.00	$307.63	29.3	OSRH	2	2314	$800.00	$393.38	2.0	$2,000.00	$70.00	3671	$7,730.00	$624.10	12.4

Appendix B: Third Party Energy Suppliers (ESCOs)

JCP&L SERVICE TERRITORY
Last Updated: 08/26/10

***CUSTOMER CLASS - R – RESIDENTIAL C – COMMERCIAL I –INDUSTRIAL**
*****GREEN POWER MARKETER**

Supplier	Telephone & Web Site	*Customer Class
Champion Energy Services, LLC 72 Avenue L Newark, NJ 07105	(877) 653-5090 www.championenergyservices.com	**C/I** **ACTIVE**
Community Energy, Inc.*** 51 Sandbrook Headquarters Road Stockton, NJ 08559	(877) NJWIND-1 (877) 659–4631 www.CommunityEnergyInc.com	**R/C/I** **ACTIVE**
Constellation NewEnergy, Inc. 900A Lake Street, Suite 2 Ramsey, NJ 07446	(888) 635-0827 www.newenergy.com	**C/I** **ACTIVE**
Constellation Energy 900A Lake Street, Suite 2 Ramsey, NJ 07446	(877) 997-9995 www.home.newenergy.com	**R** **ACTIVE**
Direct Energy Business, LLC 120 Wood Avenue Suite 611 Iselin, NJ 08830	(888) 925-9115 www.directenergybusiness.com	**C/I** **ACTIVE**
Direct Energy Services, LLC 120 Wood Avenue Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com	**C/I** **ACTIVE**
Dominion Retail, Inc. **d/b/a Dominion Energy Solutions** 395 Route 70, Suite 125 Lakewood, NJ 08701	(866) 645-9802 www.dom.com/products	**R/C/I** **ACTIVE**
FirstEnergy Solutions Corp. 300 Madison Avenue Morristown, NJ 07962	(800) 977-0500 www.fes.com	**C/I** **ACTIVE**

Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701	(800) 805-8586 www.gesc.com	**R/C/I** **ACTIVE**
GDF SUEZ Energy Resources NA, Inc. 333 Thornall Street Sixth Floor Edison, NJ 08837	(866) 999-8374 www.gdfsuezenergyresources.com	**C/I** **ACTIVE**
Gexa Energy New Jersey LLC 651 Jernee Mill Road Sayreville, NJ 08872	(866) 961-9399 www.gexaenergy.com	**C/I** **ACTIVE**
Glacial Energy of New Jersey, Inc. 75 Route 15 Building E Lafayette, NJ 07848	(888) 452-2425 www.glacialenergy.com	**C/I** **ACTIVE**
Green Mountain Energy Company*** 3000 Atrium Way Mount Laurel, NJ 08054	(800) 810-7300 www.greenmountain.com	**R/C/I** **ACTIVE**
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com	**C/I** **ACTIVE**
Integrys Energy Services, Inc. 99 Wood Ave, South, Suite 802 Iselin, NJ 08830	(877) 763-9977 www.integrysenergy.com	**C/I** **ACTIVE**
Liberty Power Delaware, LLC 3000 Atrium Way Suite 273 Mt. Laurel, NJ 08054	(866) 769-3799 www.libertypowercorp.com	**C/I** **ACTIVE**
Liberty Power Holdings, LLC 3000 Atrium Way Suite 273 Mt. Laurel, NJ 08054	(866) 769-3799 www.libertypowercorp.com	**C/I** **ACTIVE**
Linde Energy Services 575 Mountain Avenue Murray Hill, NJ 07974	(800) 247-2644	**C/I**

	www.linde.com	**ACTIVE**
Palmco Power NJ, LLC One Greentree Centre 10000 Lincoln Drive East, Suite 201 Marlton, NJ 08053	(877) 726-5862 www.PalmcoEnergy.com	**C/I** **ACTIVE**
Pepco Energy Services, Inc. 112 Main St. Lebanon, NJ 08833	(800) ENERGY-9 (363-7499) www.pepco-services.com	**C/I** **ACTIVE**
PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 www.pplenergyplus.com	**C/I** **ACTIVE**
Sempra Energy Solutions The Mac-Cali Building 581 Main Street, 8th Floor Woodbridge, NJ 07095	(877) 273-6772 www.semprasolutions.com	**C/I** **ACTIVE**
South Jersey Energy Company 1 South Jersey Plaza Route 54 Folsom, NJ 08037	(800) 800-266-6020 www.southjerseyenergy.com	**R/C/I** **ACTIVE**
Sterling Planet, Inc.*** 58 Otto Avenue Beverly, NJ 08010	(877) 457-2306 www.sterlingplanet.com	**R/C/I** **ACTIVE**
UGI Energy Services, Inc. 224 Strawbridge Drive Suite 107 Moorestown, NJ 08057	(856) 273-9995 www.ugienergyservices.com	**C/I** **ACTIVE**
Verde Energy USA, Inc. 50 East Palisades Avenue Englewood, NJ 07631	(800) 388-3862 www.lowcostpower.com	**R/C/I** **ACTIVE**
Viridian Energy 2001 Route 46, Waterview Plaza Suite 310 Parsippany, NJ 07054	(866) 663-2508 www.viridian.com	**R/C/I** **ACTIVE**

NJ NATURAL GAS CO. SERVICE TERRITORY
Last Updated: 08/26/10

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

Supplier	Telephone & Web Site	*Customer Class
Colonial Energy, Inc. 3975 Fair Ridge Dr. Suite T 10 N Fairfax, Va. 22033	845-429-3229 www.colonialgroupinc.com	C/I ACTIVE
Cooperative Industries 412-420 Washington Avenue Belleville, NJ 07109	800-6-BUYGAS (6-289427) www.cooperativenet.com	C/I ACTIVE
Direct Energy Services, LLP 120 Wood Avenue, Suite 611 Iselin, NJ 08830	866-547-2722 www.directenergy.com	R/C/I INACTIVE
Dominion Retail, Inc. **d/b/a Dominion Energy Solutions** 395 Route 70, Suite 125 Lakewood, NJ 08701	866-275-4240 www.dom.com/products	R/C/I ACTIVE
Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701	800-805-8586 www.gesc.com	R/C/I ACTIVE
UGI Energy Services, Inc. **d/b/a/ GASMARK** 224 Strawbridge Drive, Suite 107 Moorestown, NJ 08057	856-273-9995 www.ugienergyservices.com	C/I ACTIVE
Hess Energy, Inc. One Hess Plaza Woodbridge, NJ 07095	800-437-7872 www.hess.com	C/I ACTIVE
Intelligent Energy 2050 Center Avenue, Suite 500 Fort Lee, NJ 07024	800-724-1880 www.intelligentenergy.org	R/C/I ACTIVE
Metromedia Energy, Inc. 6 Industrial Way Eatontown, NJ 07724	877-750-7046 www.metromediaenergy.com	C/I ACTIVE
MxEnergy, Inc. 510 Thornall Street, Suite 270Edison, NJ 08837	800-375-1277	R/C/I

	www.mxenergy.com	**ACTIVE**
NATGASCO (Mitchell Supreme) 532 Freeman Street Orange, NJ 07050	800-840-4GAS www.natgasco.com	**C** **ACTIVE**
NJ Gas & Electric 1 Bridge Plaza, Fl. 2 Fort Lee, NJ 07024	866-568-0290 www.NJGandE.com	**R/C** **ACTIVE**
Palmco Energy NJ, LLC One Greentree Centre 10000 Lincoln Drive East Suite 201 Marlton, NJ 08053	877-726-5862 www.PalmcoEnergy.com	**C/I** **ACTIVE**
Pepco Energy Services, Inc. 112 Main Street Lebanon, NJ 08833	800-363-7499 www.pepco-services.com	**C/I** **ACTIVE**
PPL EnergyPlus, LLC 811 Church Road - Office 105 Cherry Hill, NJ 08002	800-281-2000 www.pplenergyplus.com	**C/I** **ACTIVE**
South Jersey Energy Company 1 South Jersey Plaza, Route 54 Folsom, NJ 08037	800-266-6020 www.southjerseyenergy.com	**R/C/I** **ACTIVE**
Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 07928	800-225-1560 www.spragueenergy.com	**C/I** **ACTIVE**
Woodruff Energy 73 Water Street Bridgeton, NJ 08302	800-557-1121 www.woodruffenergy.com	**R/C/I** **ACTIVE**