Steven Winter Associates, Inc.
Building Systems Consultants
www.swinter.com

293 Route 18 South, Suite 330
East Brunswick, NJ 08816

Telephone (866) 676-1972
Facsimile (203) 852-0741

October 15, 2012

Local Government Energy Program
Energy Audit Final Report

Collingswood Housing Authority

30 Washington Avenue
Collingswood, NJ 08108

Project Number: LGEA102

Table of Contents

EXECUTIVE SUMMARY

The Collingswood Housing Authority is a nine-story, 84,144 square foot, slab on grade, multi-family building built in 1977. The building was designed to be and still remains a housing authority, containing 95 apartment units, a common room, a laundry room, and administrative offices. Although the tenants are predominantly senior citizens, the facility is not equipped with medical equipment as most citizens do not require special attention. The upper levels have a much smaller roof and floor footprint compared to the lower levels of the building. The building has undergone several upgrades since it was completed. Upgrades include a roof replacement in 2002, T8 lighting installed in 2004, and an elevator replacement in 2009. The following chart provides a comparison of the current building energy usage based on the period from April 2011 through March 2012 with the proposed energy usage resulting from the installation of recommended Energy Conservation Measures (ECMs) excluding any renewable energy:

Table 1: State of Building—Energy Usage

	Electric Usage (kWh/yr)	Gas Usage (therms/yr)	Current Annual Cost of Energy ($)	Site Energy Use Intensity (kBtu/sq ft /yr)	Source Energy Use Intensity (kBtu/sq ft /yr)	Joint Energy Consumption (MMBtu/yr)
Current	616,200	33,956	$127,228	65.3	126	5,498
Proposed	466,545	19,937	$85,282	42.6	88	3,586
Savings	149,655	14,019	$41,947*	22.7	38	1913
% Savings	24.3%	41.3%	33.0%	34.8%	30.0%	34.8%
*Includes operation and maintenance savings						

SWA has entered energy information about the Collingswood Housing Authority facility into the U.S. Environmental Protection Agency's (EPA) Energy Star Portfolio Manager Energy Benchmarking system. The Site Energy Utilization Intensity (Site EUI) was calculated to be 65 kBtu/sqft/yr. Due to insufficient data of multifamily type buildings, the Collingswood Housing Authority cannot be compared against similar type buildings with similar characteristics.

Recommendations

Based on the current state of the building and its energy use, SWA recommends implementing the following Energy Conservation Measures:

Table 2: Energy Conservation Measure Recommendations

ECMs	First Year Savings ($)	Simple Payback Period	Initial Investment ($)	CO2 Savings (lbs/yr)
0-5 Year	$37,188	0.5	$18,539	404,336
5-10 Year	$4,759	6.3	$30,003	18,159
Total	$41,947	1.2	$48,542	422,495

Energy Conservation Measure Implementation
SWA recommends that Collingswood Housing Authority implement the following Energy Conservation Measures using an appropriate Incentive Program for reduced capital cost:

Recommended ECMs	Incentive Program (APPENDIX G for details)
Upgrade 123 incandescent lamps with a compact fluorescent lamps (CFL)	N/A
Retro-commissioning	N/A
Replace 1 fluorescent exit sign with an LED type	Direct Install, SmartStart
Permanently seal window unit air conditioners	N/A
Install 12 new occupancy sensors	Direct Install, SmartStart
Retrofit 16 high pressure sodium parking lot luminaires with LEDs	N/A
Upgrade 1 metal halide fixture with a pulse start metal halide fixture	Direct Install, SmartStart
Retrofit 15 T12 fixtures with electronic ballasts and T8 lamps	N/A

Appendix H contains an Energy Conservation Measures table

Environmental Benefits
SWA estimates that implementing the recommended ECMs is equivalent to removing approximately 35 cars from the roads each year or is equivalent of planting 1,029 trees to absorb CO_2 from the atmosphere.

In addition to these ECMs, SWA recommends:

- Capital Investment opportunities – measures that would contribute to reducing usage but require significant capital resources as well as long-tern financial planning
  - Replace existing heating hot water boilers with new cast iron boilers
  - Replace existing windows with Energy Star certified windows
  - Replace existing sliding doors with Energy Star certified sliding doors

- Operation and Maintenance (O&M) measures that would contribute to reducing energy usage at low or no cost:
  - Adjust water booster pump controls
  - Install water efficient fixtures and controls
  - Inspect and replace cracked/ineffective caulk
  - Inspect and maintain sealants at all windows for airtight performance
  - Inspect and maintain weather-stripping around all exterior doors and roof hatches
  - Investigate water consumption anomaly
  - Consider sealing the air handling unit outdoor air intake and installing a mechanical damper in the generator room
  - Purchase Energy Star® appliances when available
  - Use smart electric power strips
  - Create an energy educational program

SWA recommends that the Collingswood Housing Authority continue purchasing electricity and natural gas from third-party suppliers in order to reduce rate fluctuation and ultimately reduce the annual cost of energy for the building. Appendix D contains a complete list of third-party energy suppliers for building's service area.

INTRODUCTION

Launched in 2008, the Local Government Energy Audit (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 up to 100% of the cost of the audit. The Board of Public Utilities (BPUs) Office of Clean Energy has assigned TRC Energy Services to administer the Program.

Steven Winter Associates, Inc. (SWA) is a 40-year-old architectural/engineering research and consulting firm, with specialized expertise in green technologies and procedures that improve the safety, performance, and cost effectiveness of buildings. SWA has a long-standing commitment to creating energy-efficient, cost-saving and resource-conserving buildings. As consultants on the built environment, SWA works closely with architects, developers, builders, and local, state, and federal agencies to develop and apply sustainable, 'whole building' strategies in a wide variety of building types: commercial, residential, educational and institutional.

SWA performed an energy audit and assessment for the Collingswood Housing Authority at 30 Washington Avenue, Collingswood, NJ. The process of the audit included a facility visit on May 3rd, benchmarking and energy bill analysis, assessment of existing conditions, energy conservation measures and other recommendations for improvements. The scope of work includes providing a summary of current building conditions, current operating costs, potential savings, and investment costs to achieve these savings. The facility description includes energy usage, occupancy profiles and current building systems along with a detailed inventory of building energy systems, recommendations for improvement and recommendations for energy purchasing and procurement strategies.

The goal of this Local Government Energy Audit is to provide sufficient information to the Collingswood Housing Authority to make decisions regarding the implementation of the most appropriate and most cost-effective energy conservation measures for the building.

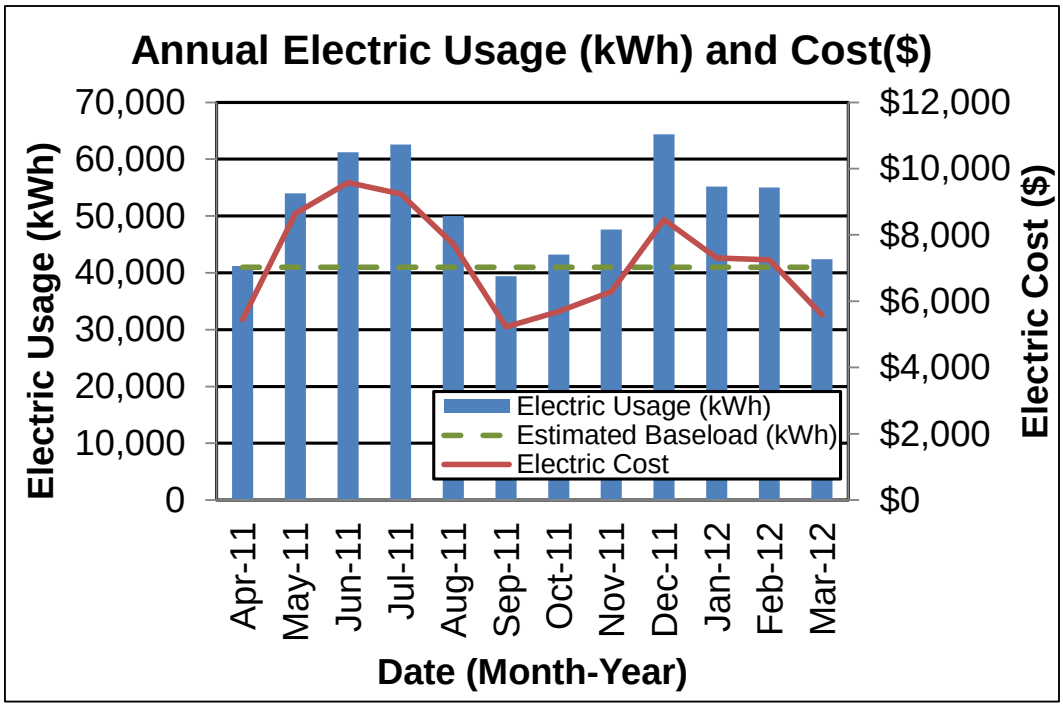
HISTORICAL ENERGY CONSUMPTION

Energy usage and cost analysis

SWA reviewed utility data from April 2010 through March 2012 that were received from the Collingswood Housing Authority, which includes electricity and natural gas consumption. A 12 month period of analysis from April 2011 through March 2012 was used for all calculations and for purposes of benchmarking the building.

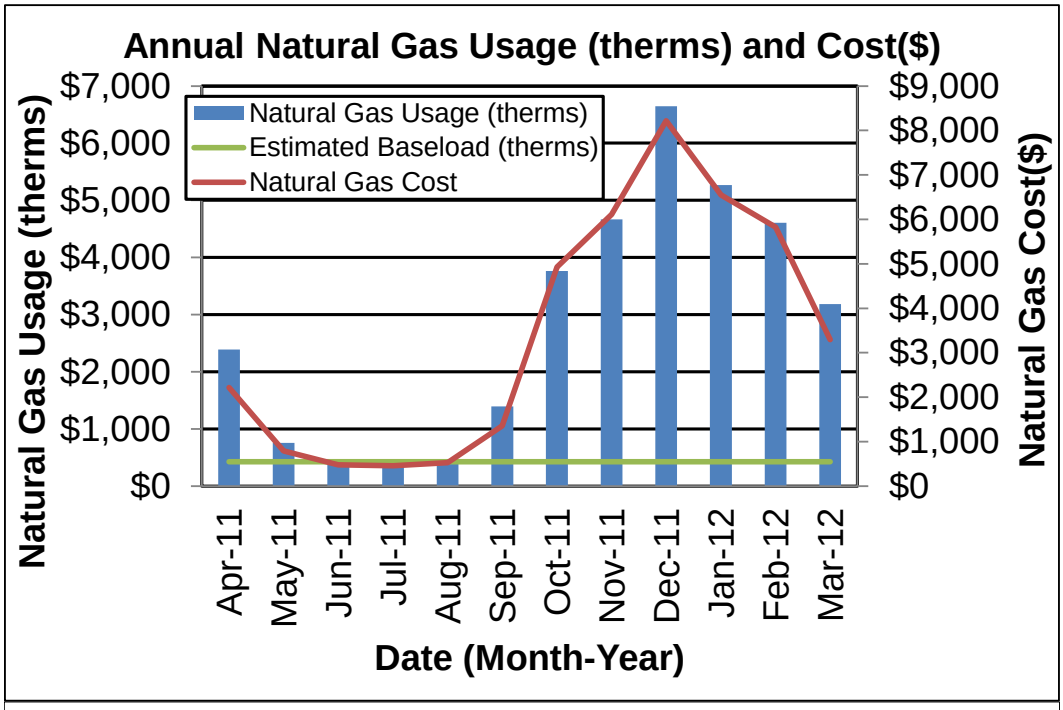
Electricity – The Collingswood Housing Authority is served by one electric meter. The building currently purchases electricity supplied by HESS, and is transmitted and distributed by Public Service Electric and Gas (PSE&G). Electricity was purchased at an average aggregated rate of $0.140/kWh and the building consumed 616,146 kWh, or $86,460 of electricity.

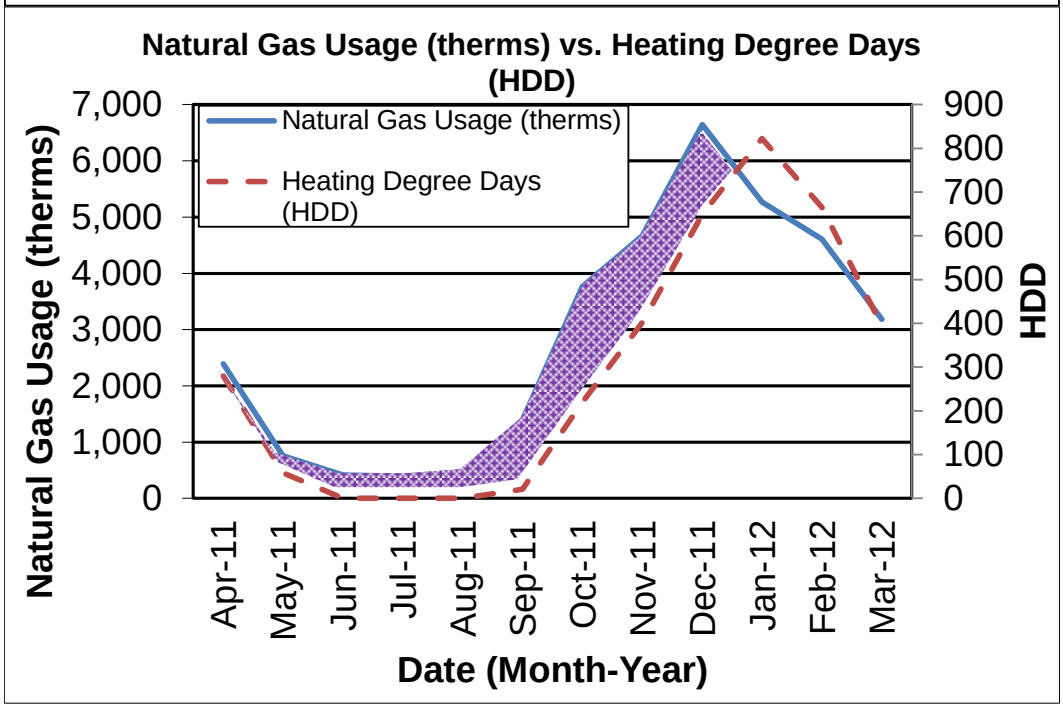
The chart below shows the monthly electric usage and costs. The dashed green line represents the approximate baseload or minimum electric usage required to operate the Collingswood Housing Authority. The baseline usage for the building is approximately 40,996 kWh (average of the lowest 3 months of usage). The chart also shows an unusual increase in electric consumption in the period between December and February. The cause of this increased consumption could not be determined from available billing data; however, SWA recommends building management investigate further.



Natural gas – The Collingswood Housing Authority is served by one meter for natural gas and currently purchases natural gas from both PSE&G, which is responsible for transmission and distribution and from Intelligent Energy which acts as a third party energy supplier. Natural gas was purchased at an average rate of $1.200/therm. The building consumed 33,956 therms, or $40,761 of natural gas, during the period of April 2011 through March 2012. Natural gas is only used for hot water heating and domestic hot water. The chart below shows the monthly natural gas usage and costs. The green line represents the approximate baseload or minimum natural

gas usage required to operate the Collingswood Housing Authority (average of the lowest 3 months of usage).





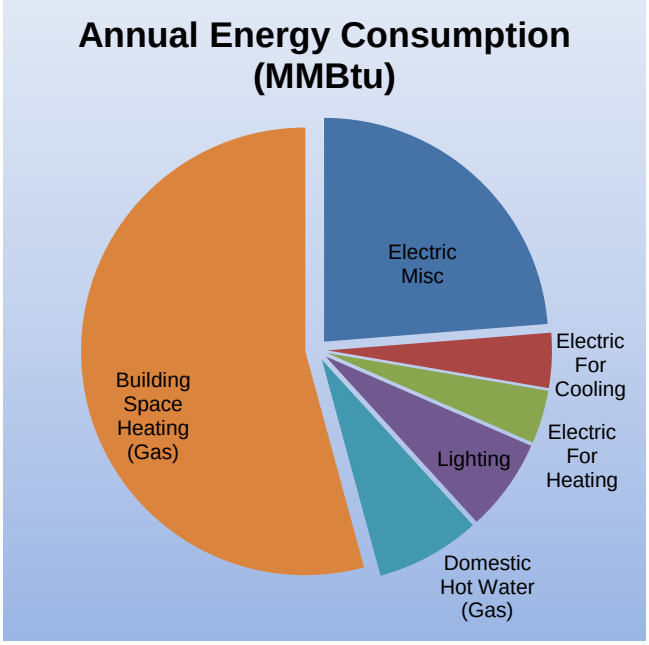
The chart above shows the monthly natural gas usage along with the heating degree days or HDD. Heating degree days is the difference of the average daily temperature and a base temperature, on a particular day. The heating degree days are zero for the days when the average temperature exceeds 65°F temperature. As expected, the natural gas consumption profile follows the HDD curve. The chart also shows a purple shaded area between the curves,

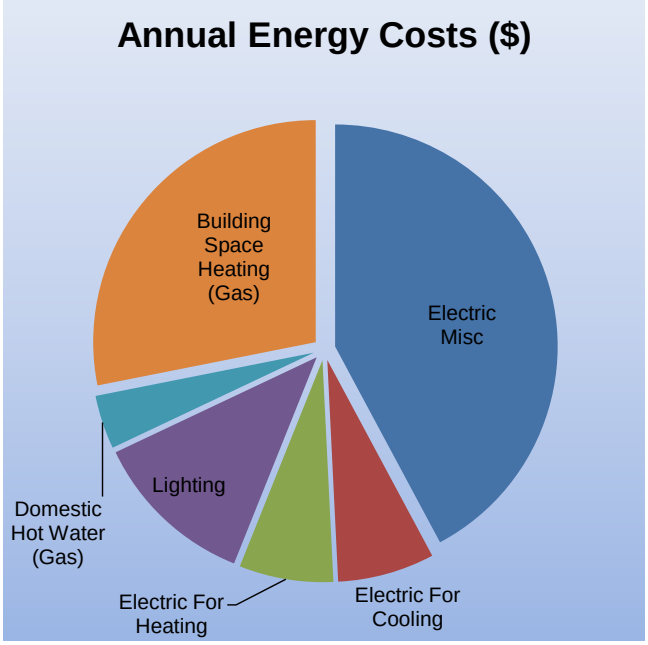
which could indicate excessive natural gas usage caused by inefficient heating, or a product of the nature of the occupancy at the Collingswood Housing Authority. Further analysis should be performed to identify the cause and correction.

The following graphs, pie charts, and table show energy use for Collingswood Housing Authority based on utility bills for the 12 month period. Note: electrical cost at $41/MMBtu of energy is over 3 times as expensive compared to natural gas at $12/MMBtu. Because electricity has a much higher cost than natural gas, the Collingswood Housing Authority should place priority on ECMs that reduce electric consumption, which would help reduce building operation costs.

Annual Energy Consumption / Costs					
	MMBtu	**% MMBtu**	**$**	**% $**	**$/MMBtu**
Electric Misc*	1,305	24%	$53,663	42%	41
Electric For Cooling	218	4%	$8,952	7%	41
Electric For Heating	212	4%	$8,699	7%	41
Lighting	368	7%	$15,146	12%	41
Domestic Hot Water (Gas)	735	13%	$8,821	7%	12
Building Space Heating (Gas)	2,661	48%	$31,940	25%	12
Totals	5,498	100%	$127,221	100%	
Total Electric Usage	2,102	38%	$86,460	68%	41
Total Gas Usage	3,396	62%	$40,761	32%	12
Totals	5,498	100%	$127,221	100%	

*Appliances and other miscellaneous equipment account for a significant portion of electrical usage within the building. Typically, appliances are referred to as “plug-load” equipment, since they are not inherent to the building’s systems, but rather plug into an electrical outlet. Equipment such as process motors, computers, computer servers, fish tank pumps, refrigerators, vending machines and printers all create an electrical load on the building that is hard to separate out from the rest of the building’s energy usage based on utility analysis.



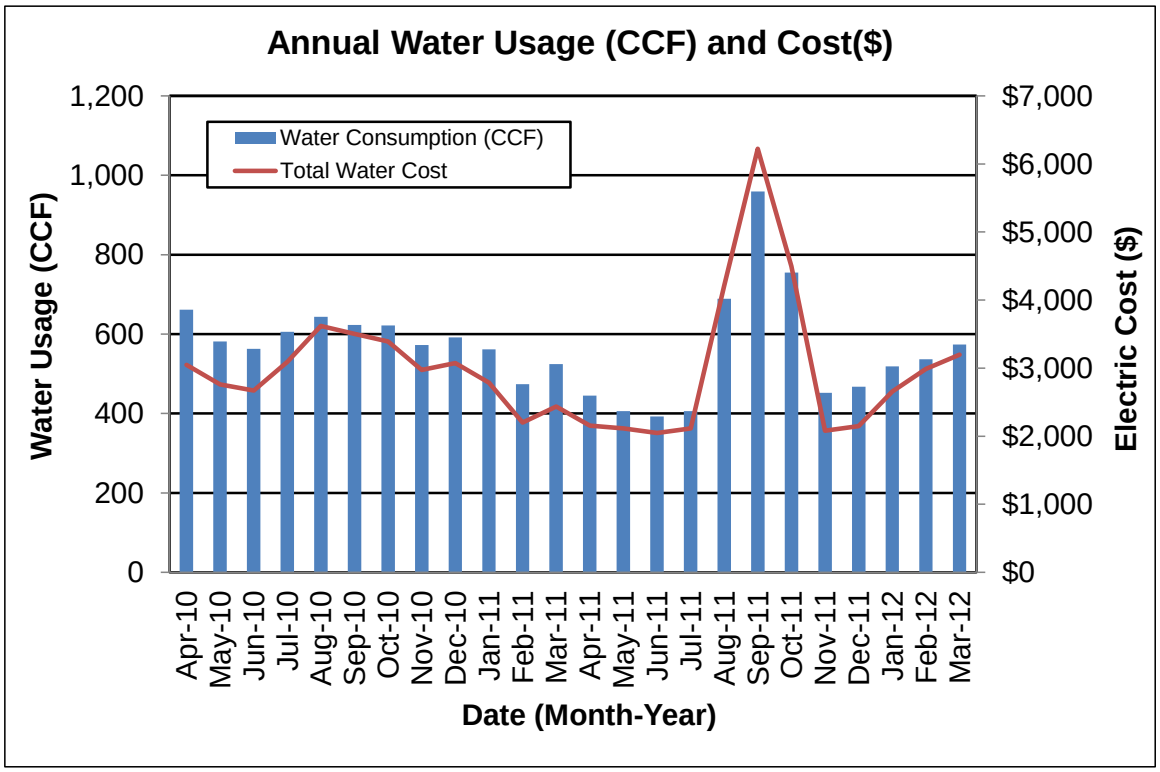


Water Usage

SWA reviewed water data from January 2010 through March 2012 that were received from the Collingswood Housing Authority, which includes water consumption, water charges, sewer charges, and water treatment charges. A 24 month period of analysis from April 2010 through March 2012 was used for all calculations and for purposes of analyzing the building.

The Collingswood Housing Authority is served by two water meters. One meter measures low flow consumption up to 20 gallons per minute, and the second meter measures water consumption for higher flow rates. The building currently purchases water supplied and distributed by the Borough of Collingswood Water and Sewer Department. Additionally, the Camden County Municipal Utilities Authority is responsible for treating the building's waste water. Water was purchased at an average rate of $4.128/CCF and the building consumed 8,825 CCF or $36,428 for the 12 month period between April 2011 and March 2012.

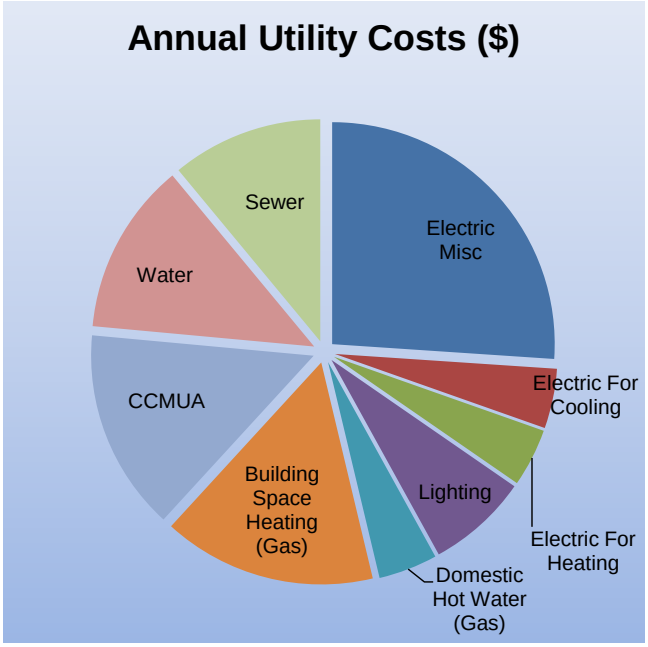
The chart below shows the monthly water usage and costs.



The chart above shows annual water consumption during the analyzed period and broken out to monthly periods. In August to October of 2011, the building experienced an unusual increase in water consumption. The cause of this increased consumption could not be determined from available billing data; however, SWA recommends building management investigate further.

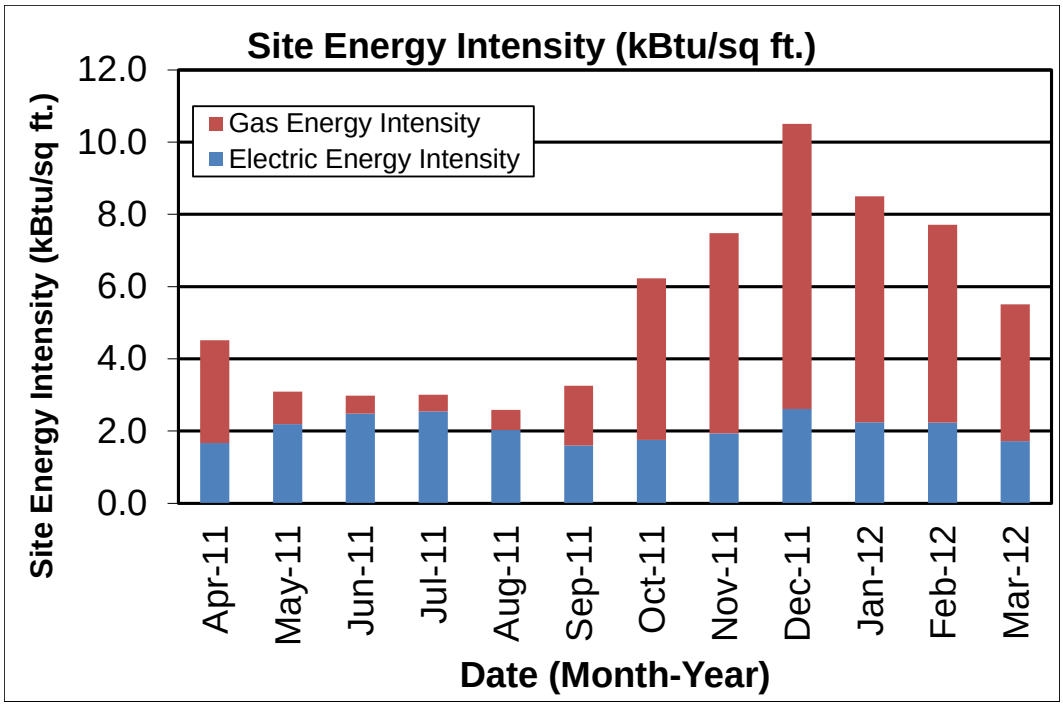
The following pie chart shows annual utility cost for the Collingswood Housing Authority based on utility bills for the 12 month period between April 2011 and March 2012. Note: electrical and water costs account for 42% and 38%, respectively. In addition to other building operation costs for electricity and natural gas, the Collingswood Housing Authority should implement operation and maintenance measures to reduce water consumption.

Annual Utility Costs				
		$	% $	$/MMBtu
Electric	Electric Misc	$53,663	26%	42%
	Electric For Cooling	$8,952	4%	
	Electric For Heating	$8,699	4%	
	Lighting	$15,146	7%	
Gas	Domestic Hot Water (Gas)	$8,821	4%	20%
	Building Space Heating (Gas)	$31,940	16%	
Water	CCMUA	$30,215	15%	38%
	Water	$25,819	13%	
	Sewer	$22,634	11%	
	Totals	$205,889	100%	100%



Energy Benchmarking

SWA has entered energy information about the Collingswood Housing Authority in the U.S. Environmental Protection Agency's (EPA) ENERGY STAR® Portfolio Manager energy benchmarking system. This housing facility is categorized as a "Multifamily Housing" space type. The Site Energy Utilization Intensity (Site EUI) was calculated to be 65 kBtu/sqft/yr. Due to insufficient data of multifamily type buildings, the Collingswood Housing Authority cannot be compared against similar type buildings with similar characteristics. See the ECM section for guidance on how to further reduce the building's energy intensity.



Per the LGEA program requirements, SWA has assisted the Collingswood Housing Authority create an ENERGY STAR® Portfolio Manager account and share the housing authorities information to allow future data to be added and tracked using the benchmarking tool. SWA has shared this Portfolio Manager account information with the Collingswood Housing Authority and TRC Energy Services (user name of "TRC-LGEA").

SWA has created the Portfolio Manager information for Collingswood Housing Authority. This information can be accessed at:

URL:https://www.energystar.gov/istar/pmpam/
Username: CollingswoodHA
Password: CollingswoodHA

Tariff analysis

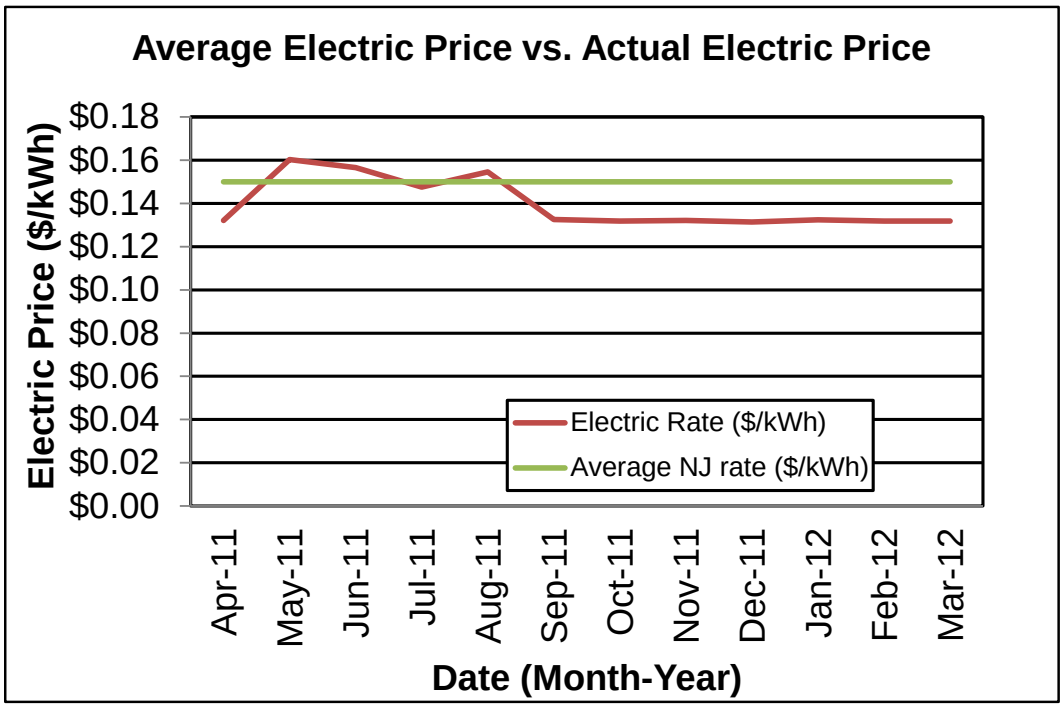
Tariff analysis can help determine if the municipality is paying the lowest rate possible for electric and gas service. Tariffs are typically assigned to buildings based on size and building type. Rate fluctuations are expected during periods of peak usage. Natural gas prices often increase during winter months since large volumes of natural gas is needed for heating equipment. Similarly, electricity prices often increase during the summer months when additional electricity is needed for cooling equipment.

As part of the utility bill analysis, SWA evaluated the current utility rates and tariffs for Collingswood Housing Authority. The Collingswood Housing Authority is currently paying a general service rate for natural gas including fixed costs such as meter reading charges. The electric use for the building is direct-metered and purchased at a general service rate with an additional charge for electrical demand factored into each monthly bill. The general service rate is a market-rate based on electric usage and electric demand. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year.

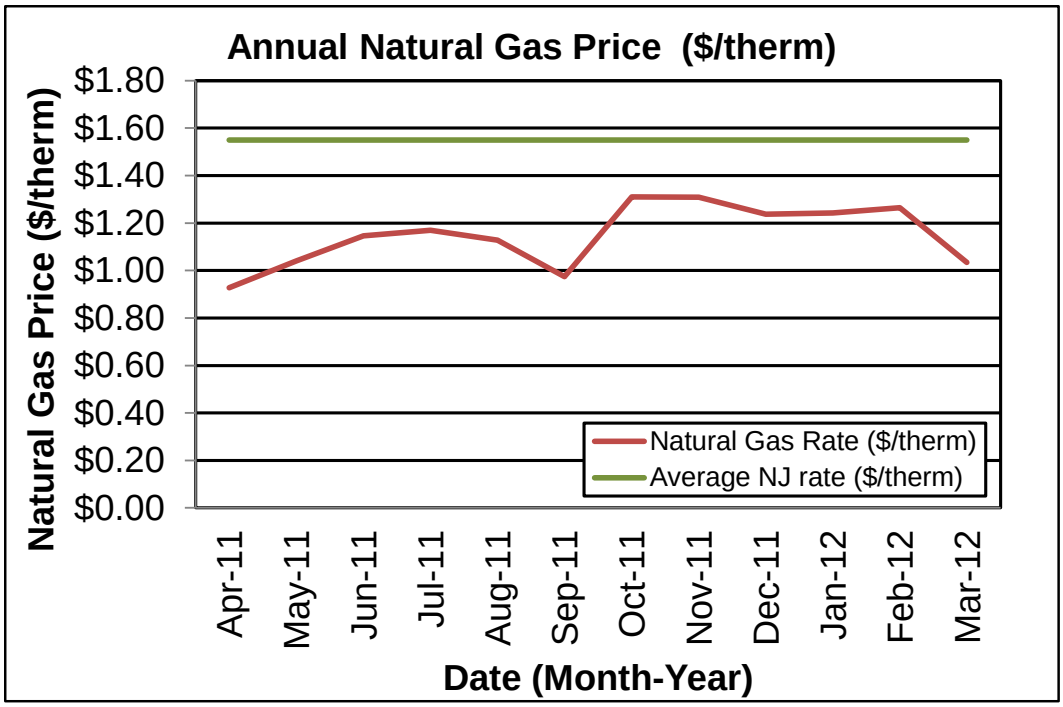
Energy Procurement strategies

Billing analysis was conducted using an average aggregated rate which is estimated based on the total cost divided by the total energy usage for each utility over a 12 month period. Average aggregated rates do not separate demand charges from usage, and instead provide a metric of inclusive cost per unit of energy. Average aggregated rates are used in order to equitably compare building utility rates to average utility rates throughout the state of New Jersey.

The average estimated NJ commercial utility rates for electric are $0.150/kWh, while Collingswood Housing Authority pays a rate of $0.140/kWh. Collingswood Housing Authority's annual electric utility costs are $5,962 lower, when compared to the average estimated NJ commercial utility rates. This shows the benefit of choosing a third-party supplier compared to solely having PSE&G supply and transport electricity. Electric bill analysis shows fluctuations up to 18% over the most recent 12 month period. Electric rate fluctuations in the winter and spring can be attributed to a combination of demand charges and market rate changes.



The average estimated NJ commercial utility rates for gas are $1.550/therm, while Collingswood Housing Authority pays a rate of $1.200/therm. The Collingswood Housing Authority's annual natural gas costs are $11,872 lower, when compared to the average estimated NJ commercial utility rates. Similar to electricity, this shows the benefit of a third-party supplier. Natural gas bill analysis shows fluctuations up to 29% over the most recent 12 month period.



SWA recommends that the Collingswood Housing Authority continue purchasing electricity and natural gas from third-party suppliers in order to reduce rate fluctuation and ultimately reduce the annual cost of energy for the building. Appendix D contains a complete list of third-party energy suppliers for building's service area.

EXISTING 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 a visit from SWA on Thursday, May 3, 2012, the following data was collected and analyzed.

Building Characteristics

The Collingswood Housing Authority is a nine-story, 84,144 square foot, slab on grade, multi-family building built in 1977. The building was designed to be and still remains a housing authority, containing 95 apartment units, a common room, a laundry room, and administrative offices. Although the tenants are predominantly senior citizens, the facility is not equipped with medical equipment as most citizens do not require special attention. The upper levels have a much smaller roof and floor footprint compared to the lower levels of the building. The building has undergone several upgrades since it was completed. Upgrades include a roof replacement in 2002, T8 lighting installed in 2004, and an elevator replacement in 2009.

Northwest Façade – Front Entrance

North Façade

South Façade

Southeast Façade

Building Occupancy Profiles

The housing authority's occupancy is approximately 102 tenants and 3 full-time employees, with building access 24 hours per day and 7 days per week. Office hours are from 9:00 AM to 4:30 PM Monday through Friday and 8:00 AM to 3:00 PM on the weekends.

Building Envelope

Due to unfavorable weather conditions, no exterior envelope infrared (IR) images were taken during the field audit. Ideal weather conditions include a minimum indoor/outdoor delta-T of 18°F, and no/low wind.

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 and on detailed visual analysis, as far as accessibility and weather conditions allowed at the time of the field audit.

Exterior Walls

The exterior wall envelope is mostly constructed of ribbed concrete block and some precast concrete accents, over a steel frame and with 1 inch of foam board insulation. Other areas are constructed of painted concrete masonry units (CMU) also over 1 inch of rigid insulation. The interior is mostly painted gypsum wallboard, painted CMU, and exposed CMU.

Note: Wall insulation levels could not be verified in the field, and are based on similar wall types, time of construction and on available construction plans.

Exterior and interior wall surfaces were inspected during the field audit. They were found to be in overall fair condition with a few signs of energy-compromising issues detected at the rear of the building.

The following specific exterior wall problem spots were identified:

Emergency generator room louver is not mechanically controlled (L); mechanical outside air damper does not fully close when the hot water heaters are not operating (R)

Roof

The building's roof is predominantly a flat, no parapet type over steel decking, and with a light-colored built-up asphalt finish. The roof was replaced approximately 10 years ago for

most roof surfaces; however the surfaces are showing signs of deterioration. Some roof areas appear to have a dark-colored EPDM finish.

Note: Roof insulation levels could not be verified in the field, and are based on similar wall types, time of construction and on available construction plans.

Roofs, related flashing, gutters and downspouts were inspected during the field audit. They were reported to be in overall fair condition, with a few signs of uncontrolled moisture, air-leakage or other energy-compromising issues on any roof areas.

The following specific roof problems were identified:

Dark-colored roof surface shows pooling water and effects cooling loads (L); pooling water near a down spout accelerates roof deterioration and may lead to leaking issues (R)

Base

The building's base is composed of a slab-on-grade floor with a perimeter footing with poured concrete foundation walls and slab edge/perimeter insulation.

Slab and perimeter insulation levels could not be verified in the field and are based on available drawings.

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 reported to be in good condition with no signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues neither visible on the interior nor exterior.

Windows

The building contains several different types of windows:

1. Double-hung type windows with a non-insulated aluminum frame, clear single glazing and no interior or exterior shading devices. The windows are located throughout the building and are original.

2. Fixed type windows with a non-insulated aluminum frame, clear single glazing and interior roller shades. The windows are located on the west façade and are original. The exterior side of the windows was retrofitted with fixed clear glazed windows, which provides an additional level of insulation.

Windows, shading devices, sills, related flashing and caulking were inspected as far as accessibility allowed for signs of moisture, air-leakage and other energy compromising issues. Overall, the windows were found to be in poor condition, with many signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

The following specific window problems were identified:

Clear single glazed window does not reduce solar radiation; the non-insulated aluminum frame acts as a thermal bridge

Exterior doors

The buildings contain several different types of exterior doors:

1. Double aluminum type exterior doors with an undetectable level of insulation and a non-insulated frame. They are located at the mechanical equipment room exit.

2. Metal exterior doors with an undetectable level of insulation and a non-insulated frame. They are located at each roof top access point.

3. Metal roll-up type door. This door is located in the maintenance room; however it is no longer used.

All exterior doors, thresholds, related flashing, caulking and weather-stripping were inspected for signs of moisture, air-leakage and other energy-compromising issues. Overall, the doors were found to be in fair condition with some signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

The following specific door problem spots were identified:

Deteriorating weather-stripping

Building air-tightness

Overall the field auditors found the building to not be reasonably air-tight with many areas of suggested improvements, as described in more detail earlier in this chapter.

The air tightness of buildings helps maximize all other implemented energy measures and investments, and minimizes potentially costly long-term maintenance, repair and replacement expenses.

Mechanical Systems

Heating Ventilating Air Conditioning

All spaces in the Collingswood Housing Authority are mechanically ventilated, heated and cooled. The building contains one air handling unit (AHU), hot water baseboards, unit heaters, and fan coil units.

Equipment

Heating – The Collingswood Housing Authority is heated by two direct gas-fired boilers, providing hot water to fan coil units, hot water base boards, and heating coils within the air handling unit. The boilers are Thermo-Pak models, each with a 2,980 MBH input capacity. The boilers were installed in 1977 and are located in the ground level mechanical equipment room. Hot water is distributed throughout the building via 7.5 HP pumps. The boiler plant typically operates between October 15th and May 15th annually.

Thermo-Pak Heating Hot Water Boilers

Typical fan coil unit found in apartment units (L) and typical electric wall heater (R)

Cooling and Ventilation – Cooling in the Collingswood Housing Authority is predominantly provided by window air conditioning (AC) units. The units are found in almost all apartments and are mounted on vertical sliding sash windows and in other cases within the frame of a fixed window without the glazing. The AC units mounted in the fixed type window are outfitted with a plywood or vinyl panel to cover the space between the AC and the window frame. Although the gaps between the panels and the frames are sealed with silicone caulking, the panels remain uninsulated. According to building staff, the AC units are typically left mounted throughout the year, as seasonal installation and removal is painstaking and time consuming.

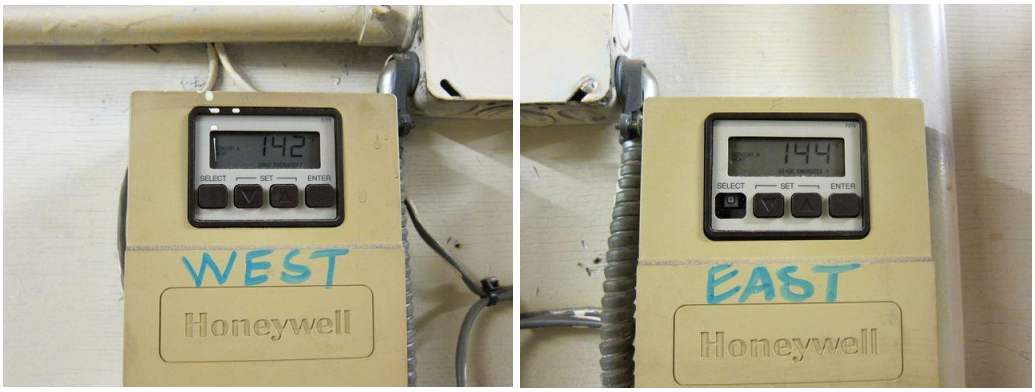
Other areas are cooled via split direct expansion (DX) cooling systems. These systems contain refrigerant lines which are connected to an outdoor condensing unit, where heat is rejected into the atmosphere. The indoor units are located in the laundry room, and a ceiling mounted air handling unit serving the common room. The elevator room also contains two split-DX units with the condensing units located on the rooftop. The laundry room and elevator room systems have a capacity of 1.5 Tons, and the common area handling unit has a capacity of 5 Tons.

Ventilation in the ground level offices and common areas is provided by the air handling unit located in the boiler room. The outdoor air intake of the unit is fixed, which means there is no mechanical damper to close and prevent air infiltration. Each apartment unit is exposed to an exterior wall and therefore is naturally ventilated.

Typical split-DX indoor unit (L) and typical apartment unit window AC installation (R). The light leaking on the side of the window AC indicates an air gap.

Controls

Heating hot water pumps are separated into two zones for the East and West sides of the building. Aquastats located on the boilers are connected to the burners allowing a low limit of 155°F and a high limit of 220°F. Hot water heating is supplied throughout the building at approximately 142-144°F. An outdoor temperature sensor shut boiler operation past 67°F. Outdoor air dampers for the boilers are mechanically controlled based on boiler operation. At the time of the visit, the dampers showed evidence of air leakage in the closed position. The ground level air handling unit is controlled by a programmable thermostat located in the common room and is set to a schedule.



Honeywell heating hot water boiler controls

Domestic Hot Water

Collingswood Housing Authority provides domestic hot water (DHW) to common area restrooms and to the apartment units via two 399,000 BTU/HR Rheem-Ruud gas-fired boilers. The boilers have a thermal efficiency of 80% and were installed in 2002. A mechanical louver is connected to the boiler controls, which open when the boilers are fired. The DHW is delivered throughout the building at 130°F, which is adequate for health and safety purposes yet reduces overconsumption of natural gas compared to a higher set point.


Domestic hot water heaters

Electrical systems

Lighting

See attached lighting schedule in Appendix C for a complete inventory of lighting throughout the building including estimated power consumption and proposed lighting recommendations.

Interior Lighting - The interior lighting at the Collingswood Housing Authority is predominantly made up of electronically ballasted T8 lamped fixtures and wall mounted fixtures with compact fluorescent lamps. Similar wall mounted fixtures are still equipped with inefficient incandescent lamps. The hallways currently have T8 lamped fixtures. The apartment units also have ceiling mounted T8 lamped fixtures. Based on measurements of lighting levels for each space, there are no over-illuminated areas.

Typical recessed T8 lighting fixture (L); and wall mounted incandescent lamped fixture (R)

Exit Lights - Exit signs were found to be LED types.

Typical old (L) LED exit signs

Exterior Lighting - The exterior lighting surveyed during the building audit was found to be a combination of wall pack metal halides and wall mounted compact fluorescent lamps (CFLs). A timer in the emergency generator room controls several exterior lights. Other exterior lights are controlled by photocells scattered throughout the exterior of the building. 16 150 watt pole mounted high pressure sodium luminaires are used to illuminate the parking lot, and are controlled by photocells.

150 watt high pressure sodium parking lot lights

Appliances and process

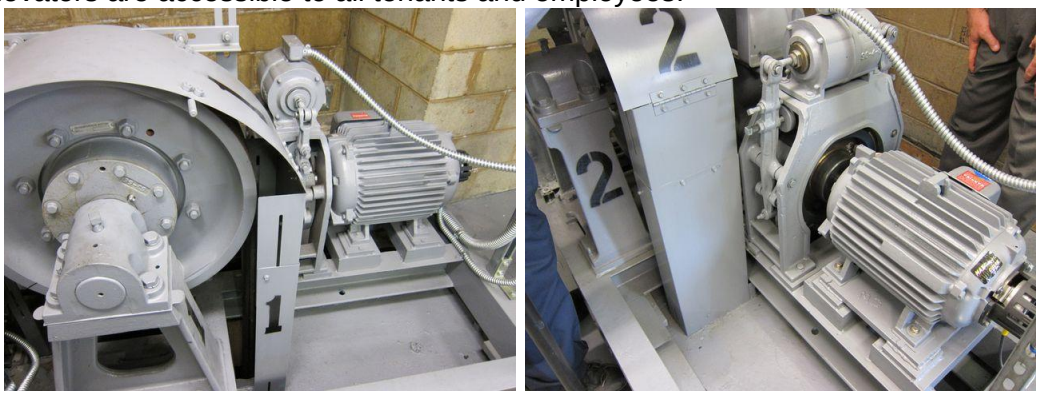
SWA has conducted a general survey of larger, installed equipment. Appliances and other miscellaneous equipment account for a significant portion of electrical usage within the building. Typically, appliances are referred to as “plug-load” equipment, since they are not inherent to the building’s systems, but rather plug into an electrical outlet. Equipment such as process motors, computers, computer servers, fish tank pumps, refrigerators, vending machines and printers all create an electrical load on the building that is hard to separate out from the rest of the building’s energy usage based on utility analysis.

Installed at Collingswood Housing Authority are several washing machines and dryers located in the laundry room. The ground level also has a refrigerator and electric stove, located in the common area kitchen, which are infrequently used. The premise also has an irrigation or sprinkler system installed which operates on a schedule, and is equipped with a water sensor to disable the system when precipitation occurs. No Energy Star appliances were found during the site visit.

Washing and drying machines (L); kitchen refrigerator (R)

Elevators

Collingswood Housing Authority has two motorized elevators providing access to all floors. The elevators are accessible to all tenants and employees.



Elevator motors located in the elevator bulkhead

Other electrical systems

There are not currently any other significant energy-impacting electrical systems installed at Collingswood Housing Authority other than a 90 kW diesel emergency generator. This Onan Genset emergency generator is operated once per week as a functional test for 30 minutes.

90 kW Onan emergency generator

RENEWABLE AND DISTRIBUTED ENERGY MEASURES

Renewable energy is defined as any power source generated from sources which are naturally replenished, such as sunlight, wind and geothermal. Technology for renewable energy is improving and the cost of installation is decreasing due to both demand and the availability of government-sponsored funding. Renewable energy reduces the need for using either electricity or fossil fuel, therefore lowering costs by reducing the amount of energy purchased from the utility company. Solar photovoltaic panels and wind turbines use natural resources to generate electricity. Geothermal systems offset the thermal loads in a building by using water stored in the ground as either a heat sink or heat source. Cogeneration or Combined Heat and Power (CHP) allows for heat recovery during electricity generation.

Existing systems

Currently there are no renewable energy systems installed in the building.

Evaluated Systems

Solar Photovoltaic

Photovoltaic panels convert light energy received from the sun into a usable form of electricity. Panels can be connected into arrays and mounted directly onto building roofs, as well as installed onto built canopies over areas such as parking lots, building roofs or other open areas. Electricity generated from photovoltaic panels is generally sold back to the utility company through a net meter. Net-metering allows the utility to record the amount of electricity generated in order to pay credits to the consumer that can offset usage and demand costs on the electric bill. In addition to generation credits, there are incentives available called Solar Renewable Energy Credits (SRECs) that are subsidized by the state government. Specifically, the New Jersey State government pays a market-rate SREC to facilities that generate electricity in an effort to meet state-wide renewable energy requirements.

Based on utility analysis and a study of roof conditions, the Collingswood Housing Authority is not a good candidate for a photovoltaic installation. The roof above the 8th floor has obstructed sun light from the 9th floor and elevator bulkhead.

Solar Thermal Collectors

Solar thermal collectors are not cost-effective for this building and would not be recommended due to the insufficient and intermittent use of domestic hot water throughout the building to justify the expenditure.

Wind

Collingswood Housing Authority is not a good candidate for wind power generation due to insufficient wind conditions in this area of New Jersey.

Geothermal

Collingswood Housing Authority is not a good candidate for geothermal installation since it would require replacement of the entire existing HVAC system, as well as extensive installation of geothermal wells and pumping equipment.

Combined Heat and Power

Collingswood Housing Authority is not a good candidate for CHP installation and would not be cost-effective due to the size and operations of the building. Typically, CHP is best suited for buildings with a constant electrical baseload to accommodate the electricity generated, as well as a means for using waste heat generated.

PROPOSED ENERGY CONSERVATION MEASURES

Energy Conservation Measures (ECMs) are recommendations determined for the building based on improvements over current building conditions. ECMs have been determined for the building based on installed cost, as well as energy and cost-savings opportunities.

Recommendations: Energy Conservation Measures

#	Energy Conservation Measures
ECM 1	**Upgrade 123 incandescent lamps with a compact fluorescent lamps (CFL)**
ECM 2	**Retro-commissioning**
ECM 3	**Replace 1 fluorescent exit sign with an LED type**
ECM 4	**Permanently seal window unit air conditioners**
ECM 5	**Install 12 new occupancy sensors**
ECM 6	**Retrofit 16 high pressure sodium parking lot luminaires with LEDs**
ECM 7	**Upgrade 1 metal halide fixture with a pulse start metal halide fixture**
ECM 8	**Retrofit 15 T12 fixtures with electronic ballasts and T8 lamps**

In order to clearly present the overall energy opportunities for the building and ease the decision of which ECM to implement, SWA calculated each ECM independently and did not incorporate slight/potential overlaps between some of the listed ECMs (i.e. lighting change influence on heating/cooling.

ECM #1: Upgrade 123 incandescent lamps with a compact fluorescent lamps (CFL)

The building is equipped with fixtures containing inefficient incandescent lamps. SWA recommends that the incandescent lamps be replaced with more efficient compact fluorescent lamps (CFL). These lamps are predominantly found in tenant apartments, but are also found in the ground level track lighting fixtures. CFLs are capable of providing equivalent or better light output while using less power when compared to incandescent, halogen and Metal Halide fixtures. CFL bulbs produce the same lumen output with less wattage than incandescent bulbs and last up to five times longer. The labor for the recommended installations is evaluated using prevailing electrical contractor wages. The building owner may decide to perform this work with in-house resources from the Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor.

Installation cost:

Estimated installed cost: $1,710 (includes $492 of labor)
Source of cost estimate: RS *Means; Published and established costs, NJ Clean Energy Program*

Economics:

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 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
$1,710	19,585	13	0	0.8	$788	$3,530	5	$17,651	0.5	932%	186%	206%	$13,920	35,067

Assumptions: SWA calculated the savings for this measure using measurements taken on the day of the field visit and using the billing analysis.

Rebates/financial incentives:

- There currently are no incentives for this measure at this time.

Please see APPENDIX G for more information on Incentive Programs.

ECM #2: Retro-commissioning

Retro-commissioning, or existing building commissioning, is a systematic building investigation process for improving and optimizing a building's operation and maintenance. The process focuses on the building's energy consumption by analyzing equipment such as the HVAC mechanical equipment, related controls and consumption patterns derived from utility and other usage information. Retro-commissioning may not necessarily emphasize bringing the building back to its original intended design specifications if the retro-commissioning team finds that the original specifications no longer apply to existing equipment or building needs. The process may result in recommendations for capital improvements, but its primary intent is to optimize the building systems by equipment tune-up, improved operation and maintenance, and diagnostic testing.

The retro-commissioning process involves obtaining documentation about the facility equipment and its current operation as well as multiple site visits for further review of operating parameters and conditions with the maintenance staff. All major energy consuming systems are diagnosed to determine system operation. The retro-commissioning process can also identify potential capital intensive improvements that can be made to further reduce energy usage and utility cost. Often, the savings associated with the low cost improvements can be used to lower the implementation cost associated with the capital-intensive measures and make the overall package more economically viable.

The goals of RCx include:

- Finding opportunities to reduce energy costs through readily implemented changes to the operation of the building.
- Evaluating set points of equipment and systems with the intent of bringing them to a proper operational state.
- Improving indoor environmental quality (IEQ) thereby reducing occupant complaints and reducing staff time spent on complaint calls.
- Improving equipment reliability through enhanced operation and maintenance procedures.

Project cost:

Estimated project cost: $16,829
Source of cost estimate: Similar projects

Economics:

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 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
$16,829	29,982	0	3,505	5.4	$0	$8,414	3	$25,243	2.0	50	17	23	$6,668	92,317

Assumptions: SWA calculated the estimated ECM cost at $0.20/sqft, which is typical of buildings of this size and type.

Rebates/financial incentives:

- There currently are no incentives for this measure at this time.

Please see APPENDIX G for more information on Incentive Programs.

ECM #3: Replace 1 fluorescent exit sign with an LED type

SWA observed that the building contains one fluorescent exit sign in the office area. SWA recommends replacing the sign with an LED type. Replacing existing exit signs with LED exit signs can result in lower kilowatt-hour consumption, as well as lower maintenance costs. Since exit signs operate 24 hours per day, they can consume large amounts of energy. In addition, older exit signs require frequent maintenance due to the short life span of the lamps that light them. LED exit sign last at least 5 years. In addition, LED exit signs offer better fire code compliance because they are maintenance free in excess of 10 years. LED exit signs are usually brighter than comparable incandescent or fluorescent signs, and have a greater contrast with their background due to the monochromatic nature of the light that LEDs emit. The building owner may decide to perform this work with in-house resources from the Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor.

Installation cost:

Estimated installed cost: $141 (includes $72 of labor)
Source of cost estimate: RS Means, Published and established costs, NJ Clean Energy Program, Energy Star Savings Calculator

Economics:

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 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
$141	101	0	0	0.0	$33	$47	15	$707	3.0	403	27	33	$401	180

Assumptions: SWA calculated the savings for this measure using measurements taken on the day of the field visit and using the billing analysis.

Rebates/financial incentives:

- NJ Clean Energy – SmartStart – LED exit sign ($10-20 per fixture) – Maximum incentive amount of $20.

Please see APPENDIX G for more information on Incentive Programs.

ECM #4: Permanently seal window unit air conditioners

Most dwelling units at the Collingswood Housing Authority are cooled by window air conditioning units with fixed plywood panels that serve as the only barrier between the living space and the exterior. Air-leakage pathways exist both through and around the air conditioners. The panels themselves have an R-value less than 1.0, so while they impede air flow, they do not protect against heat transfer. Additionally, the units are not removed in the winter time, which results not only in increased natural gas and electricity usage required to heat and cool the space, but also in air that is unfiltered. Unfiltered air contains dust and particulates that impact cleanliness and indoor environmental quality (IEQ). Images in the building description section show a noticeable gap between the plywood panels and window frame of a typical unit.

In April of 2011, SWA engineers prepared a report entitled “There Are Holes in Our Walls” for Urban Green Council2[1]. The report provides a comprehensive study on the impact of room air conditioners on building envelope performance. The study found that the average room air conditioner installed without a permanent seal, similar to the installation at the Collingswood Housing Authority, resulted in a leakage area of six (6) square inches and a resultant infiltration of 13 cubic feet of air per minute. SWA recommends permanently installing all window air conditioning units in order to reduce energy consumption and improve tenant comfort and indoor environmental quality.

Project cost:
Estimated project cost: $9,500
Source of cost estimate: Similar projects

Economics:

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 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
$9,500	83	0	2,061	2.5	$0	$2,485	10	$24,852	3.8	162%	16%	23%	$11,129	22,863

Assumptions:

Number of units	95	Dwelling Units
Gap area per unit	6	in²
Pressure difference	5	Pa or 0.02" wc
Estimated air infiltration per unit	13	CFM
Gas boiler efficiency	80	%
AC unit efficiency (EER)	9.8	Btu/h*W
Heating load lost due to infiltration	182.52	BTU/H
Cooling load lost due to infiltration	99.45	BTU/H
Space temperature heating set-point	68	°F
Space temperature cooling set-point	75	°F

[1] http://www.urbangreencouncil.org/HolesInOurWalls

Rebates/financial incentives:

- There currently are no incentives for this measure at this time.

Please see APPENDIX G for more information on Incentive Programs.

ECM #5: Install 12 new occupancy sensors

The building contains several areas that could benefit from the installation of occupancy sensors. These areas consisted of various common rooms, bathrooms and offices that are used sporadically throughout the day and could show energy savings by having the lights turn off after a period of no occupancy. Typically, occupancy sensors have an adjustable time delay that shuts down the lights automatically if no motion is detected within a set time period. Advanced ultra-sonic lighting sensors include sound detection as a means to controlling lighting operation.

Installation cost:

Estimated installed cost: $2,400 (includes $720 of labor)
Source of cost estimate: RS *Means; Published and established costs, NJ Clean Energy Program*

Economics:

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 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
$2,400	2,834	0	0	0.1	$0	$397	15	$5,951	6.0	148%	10%	14%	$2,198	5,074

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis.

Rebates/financial incentives:

- NJ Clean Energy – SmartStart – Wall-mounted Occupancy Sensors ($20 per control)
    - Maximum Incentive Amount: $720
- NJ Clean Energy – Direct Install (Up to 70% of installed costs)

Please see APPENDIX G for more information on Incentive Programs.

ECM #6: Retrofit 16 high pressure sodium parking lot luminaires with LEDs

The exterior lighting is made up of inefficient metal halide fixtures. Aside from having higher energy consumption, these fixtures require frequent lamp and ballast replacements. SWA is recommending LED lamps replacement lamps. For the proposed retrofit, the scope of work involves removing the existing light and ballast and replacing with an LED lamp and ballast. The existing poles and fixtures would be left in tact at the same quantity and height. By retrofitting the existing fixtures, the cost of materials and labor can be reduced. LED technology has advanced greatly in the past 10 years and has long operating lifespans. LED lighting uses considerably less energy than metal halide lights.

Installation cost:

Estimated installed cost: $26,425 (includes $5,714 of labor)
Source of cost estimate: RS *Means; Published and established costs, NJ Clean Energy Program*

Economics:

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 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
$26,425	6,679	2	0	0.3	$3,305	$4,240	15	$63,601	6.2	141	9	14	$22,740	11,958

Assumptions: SWA calculated the savings for this measure using measurements taken during the field audit and using the billing analysis.

Rebates/financial incentives:
There are currently no incentives for this measure

Please see APPENDIX G for more information on Incentive Programs.

ECM #7: Upgrade 1 metal halide fixture with a pulse start metal halide fixture

The existing lighting contains one standard probe start Metal Halide (MH) lamped fixture. SWA recommends replacing the higher wattage MH fixtures with pulse start MH lamps which offer the advantages of standard probe start MH lamps, but minimize the disadvantages. They produce higher light output both initially and over time, operate more efficiently, produce whiter light, and turn on and re-strike faster. Due to these characteristics, energy savings can be realized via one-to-one substitution of lower-wattage systems, or by taking advantage of higher light output and reducing the number of fixtures required in the space. The labor for the recommended installations is evaluated using prevailing electrical contractor wages. The building owner may decide to perform this work with in-house resources from the Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor.

Installation cost:

Estimated installed cost: $688 (includes $150 of labor)
Source of cost estimate: RS Means, Published and established costs, NJ Clean Energy Program

Economics:

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 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
$688	464	0	0	0.0	$6	$71	15	$1,061	9.7	54%	4%	6%	$141	831

Assumptions: SWA calculated the savings for this measure using measurements taken during the field audit and using the billing analysis.

Rebates/financial incentives:

- This measure does not qualify for a rebate or other financial incentives at this time.

Please see APPENDIX G for more information on Incentive Programs.

ECM #8: Retrofit 15 T12 fixtures with electronic ballasts and T8 lamps

The existing lighting contains inefficient T12 fluorescent fixtures with magnetic ballasts, scattered throughout the ground floor. SWA recommends retrofitting each existing fixture with more efficient T8 fluorescent fixtures and electronic ballasts. T8 fixtures with electronic ballasts provide equivalent or better light output while reducing energy consumption by 30% when compared to T12 fixtures with magnetic ballasts. T8 fixtures also provide better lumens for less wattage when compared to incandescent, halogen and Metal Halide fixtures. Retrofitting existing fixtures allows the school to keep the existing reflectors and diffusers, and only replaces the electronic components suitable for T8 lamps. The labor for the recommended installations is evaluated using prevailing electrical contractor wages. The building owner may decide to perform this work with in-house resources from the Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor.

Installation cost:

Estimated installed cost: $410 (includes $245 of labor)
Source of cost estimate: RS Means; Published and established costs, NJ Clean Energy Program

Economics:

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 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
$350	69	0	0	0.0	$26	$36	15	$537	9.8	54%	4%	6%	$70	123

Assumptions: SWA calculated the savings for this measure using measurements taken on the day of the field visit and using the billing analysis. Existing T12 fixtures have 34 watt lamps and are to be replaced with 32 watt T8 lamps, along with a ballast replacement.

Rebates/financial incentives:

- NJ Clean Energy – Direct Install program (Up to 70% of installed costs)
- NJ Clean Energy – SmartStart program – T8 fixtures with electronic ballasts ($10 per fixture – Maximum incentive amount is $150

Please see APPENDIX G for more information on Incentive Programs.

Proposed Further Recommendations

Capital Improvements

Capital Improvements are recommendations for the building that may not be cost-effective at the current time, but that could yield a significant long-term payback. Capital improvements may also constitute equipment that is currently being operated beyond its useful lifetime. These recommendations should typically be considered as part of a long-term capital improvement plan. Capital improvements should be considered if additional funds are made available, or if the installed costs can be shared with other improvements, such as major building renovations. SWA recommends the following capital improvements for the Collingswood Housing Authority.

- Replace the existing hot water boilers with new cast iron boilers – During the field audit, SWA inspected the existing heating equipment, which consists of two cast iron boilers. The expected service life of a hot water boiler is 20 years, which the existing boilers have exceeded. SWA recommends replacing the existing boilers with newer energy efficient models. The demolition and installation costs are estimated to be $100,645.

- Replace existing windows with Energy Star certified windows – The entire building is currently outfitted with windows that have single glazing, no low-E coating and are original to the building. Newer Energy Star certified windows provide better insulation and reduce solar gain with a low-E coating. SWA recommends replacing the windows with double or triple glazing, low-E coating and an insulated frame, which will reduce the heating and cooling loads. Ideally the windows should be Energy Star certified, which meets strict requirements for energy saving performance. The project is estimated to cost $52,718.

- Replace existing sliding doors with Energy Star certified doors – Each apartment unit currently has sliding doors that have single glazing, no low-E coating and are original to the building. Newer Energy Star certified doors provide better insulation and reduce solar gain with a low-E coating, thus improving tenant comfort. SWA recommends replacing the doors with double or triple glazing, low-E coating and an insulated frame, which will reduce the heating and cooling loads. Ideally the doors should be Energy Star certified, which meets strict requirements for energy saving performance. The project is estimated to cost $188,942.

Operations and Maintenance

Operations and Maintenance measures consist of low/no cost measures that are within the capability of the current building staff to handle. These measures typically require little investment, and they yield a short payback period. These measures may address equipment settings or staff operations that, when addressed will reduce energy consumption and/or maintenance costs.

- Adjust booster pump controls – The two existing 7 ½ HP domestic cold water pumps are controlled by a Taco constant pressure module, however the pumps are reportedly running continuously. Because the pumps operate continuously, excess electric consumption adds to building operation costs, and increases water and sewer costs. By adjusting the pump controls, the pumps will only operate when the system demands domestic cold water, thus reducing electric, water and sewer costs.

- Install water-efficient fixtures and controls – Building staff can easily install faucet aerators and/or low-flow fixtures to reduce water consumption. There are many retrofit options, which can be installed now or incorporated as equipment is replaced. Routine maintenance practices that identify and quickly address water leaks are a low-cost way to save water and energy. Retrofitting with more efficient water-consumption fixtures/appliances will reduce energy consumption for water heating, while also decreasing water/sewer bills.

Recommended flow and flush rates		
Residential Lavatory Faucet	0.5	gpm
Residential Shower	1.75	gpm
Residential Water Closet	1.28	gpf
Residential Kitchen Faucet	1.5	gpm
Public Lavatory Faucet	0.5	gpm
Public Water Closet	1.28	gpf

*gpm=gallons per minute, gpf=gallons per flush

- Inspect and replace cracked/ineffective caulk.

- Inspect and maintain sealants at all windows for airtight performance. Seal all wall penetrations between the generator room and the interior conditioned space.

- Inspect and maintain weather-stripping around all exterior doors.

- Investigate water consumption anomaly. The water utility data shows an increase in water consumption and charges. This may have been caused by a billing error, water leaks or for some other reason. SWA recommends the Collingswood Housing Authority investigate the cause of this for better understanding.

- Consider sealing the air handling unit outdoor air intake if the space it serves remains unoccupied. However, if the space is occupied, the outdoor air intake should remain open in order to supply fresh air. The Collingswood Housing Authority should also consider installing a mechanical damper in the emergency generator room. The current outdoor air intake is a fixed louver, which allows air infiltration into conditioned space. By installing a mechanical damper based on emergency generator operation, outside air can be provided to the required spaces as needed.

- SWA recommends that the building considers purchasing the most energy-efficient equipment, including ENERGY STAR® labeled appliances, when equipment is installed or replaced. More information can be found in the “Products” section of the ENERGY STAR® website at: http://www.energystar.gov.

- Use smart power electric strips - in conjunction with occupancy sensors to power down computer equipment when left unattended for extended periods of time.

- Create an energy educational program - that teaches how to minimize energy use. The U.S. Department of Energy offers free information for hosting energy efficiency educational programs and plans. For more information please visit: http://www1.eere.energy.gov/education/.

APPENDIX A: EQUIPMENT LIST

Building System	Description	Location	Model#	Fuel	Space served	Year Equip Installed	Remaining useful life %
Heating	Fan Forced Wall Heater, 4000 Watts	Common Room	Model #CWH3404B	Electric	Common Room	2007	67%
Heating	Fan Forced Wall Heater, 2000 Watts	Common Room	Model #CWH3404B	Electric	Common Room	2007	67%
Heating/ Cooling	Cold water distribution pump motor, 7 1/2 HP, 3450 RPM, NEMA Nom. Eff. 84%	Boiler Room	Baldor, Cat #WCM3219T, Spec. #36H454Y804	Electric	Boiler Room	2006	60%
Heating/ Cooling	Cold water distribution pump motor, 7 1/2 HP, 3450 RPM, NEMA Nom. Eff. 84%	Boiler Room	Baldor, Cat #WCM3219T, Spec. #36H454Y805	Electric	Boiler Room	2006	60%
DHW	Hot water heater, 100 gal., 399,900 BTUH, 363.5 GPH Recovery, 80% Thermal Efficiency	Boiler Room	Rheem-Ruud Universal, Model #G100-400A, Serial #URNG 0401G02724	Gas	Boiler Room	2002	50%
DHW	Hot water heater, 100 gal., 399,900 BTUH, 363.5 GPH Recovery, 80% Thermal Efficiency	Boiler Room	Rheem-Ruud Universal, Model #G100-400A, Serial #URNG 0502G05078	Gas	Boiler Room	2002	50%
Heating	Thermo-Pak, Hot Water Boiler, 2,980 BTU/HR	Boiler Room	Thermo-Pak, Model #0W-F3000Serial #2X144	Gas	East side	1977	0%
Heating	Burner motor, 1 HP, 3450 RPM, 3 Phase	Boiler Room	Leland Faraday, Model #8-182421-20, Stock #M-5115E	Electric	East side	N/A	N/A
Heating	Thermo-Pak, Hot Water Boiler, 2,980 BTU/HR	Boiler Room	Thermo-Pak, Model #0W-F3000Serial #2X145	Gas	West side	1977	0%
Heating	Burner motor, 1 HP, 3450 RPM, 3 Phase	Boiler Room	Leland Faraday, Model #8-182421-20, Stock #M-5115E	Electric	West side	N/A	N/A
Heating	Air Handling Unit, M-6,	Boiler Room	Trane, Serial #k77C15800	Gas	Common Room	2006	60%
Cooling	Condensing Unit, 1/10 HP, R-22, 2 Ton	Exterior	Gibson, Model #JS5BU-024K, Serial #JSA060402911	Electric	Laundry Room	2006	60%
Cooling	Condensing Unit, 1/3 HP, R-22, 5 Ton	Exterior	Rheem, Model #RAKB-060CAZ, Serial #7011-M1705 07936	Electric	Common Room	2005	53%
Cooling	Split-DX unit, Indoor Unit, 1 Phase, 1.5 Ton	Elevator Room	Fujitsu, Model #ASU18CL, Serial #DCA014843	Electric	Elevator Room	2005	53%
Cooling	Split-DX unit, Indoor Unit, 1 Phase, 1.5 Ton	Elevator Room	Fujitsu, Model #ASU18CL, Serial #DCA014717	Electric	Elevator Room	2005	53%
Cooling	Split-DX Unit, Outdoor Unit, 1.5 Ton, R410A, SEER 19.0	Exterior	Fujitsu, Model #AOU18CL, Serial #DCN013913	Electric	Elevator Room	2005	53%
Cooling	Split-DX Unit, Outdoor Unit, 1.5 Ton, R410A, SEER 19.0	Exterior	Fujitsu, Model #AOU18CL, Serial #DCN013945	Electric	Elevator Room	2005	53%
Cooling	Split-DX unit, Indoor Unit, 1 Phase, 1.5 Ton, 13 SEER, 22,500 BTU, R-4120a	Laundry Room	LG, Model #LSN242CE	Electric	Laundry Room	2005	53%

Note: The remaining useful life of a system (in %) is an estimate based on the system date of built and existing conditions derived from visual inspection.

Appendix B: Lighting Study

Location			Existing Fixture Information												Retrofit Information												Annual Savings		
Marker	Floor	Room Identification	Fixture Type	Ballast	Lamp Type	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Controls	Operational Hours per Day	Operational Days per Year	Ballast Wattage	Total Watts	Energy Use kWh/year	Category	Fixture Type	Lamp Type	Ballast	Controls	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Operational Hours per Day	Operational Days per Year	Ballast Watts	Total Watts	Energy Use kWh/year	Fixture Savings (kWh)	Controls Savings (kWh)	Total Savings (kWh)
1	1	Bathroom (121)	Wall Mounted	S	Inc	1	2	60	Sw	4	261	0	120	125	CFL	Wall Mounted	CFL	S	OS	1	2	20	3	261	0	40	31	84	10	94
2	1	Office (110)	Recessed Parabolic	E	4'T8	3	4	32	Sw	9	261	20	444	1,043	C	Recessed Parabolic	4'T8	E	OS	3	4	32	7	261	20	444	782	0	261	261
3	1	Social Service (111)	Recessed Parabolic	E	4'T8	2	3	32	Sw	7.5	261	15	222	435	C	Recessed Parabolic	4'T8	E	OS	2	3	32	6	261	15	222	326	0	109	109
4	1	General Office (118)	Recessed Parabolic	E	4'T8	5	3	32	Sw	7.5	261	15	555	1,086	C	Recessed Parabolic	4'T8	E	OS	5	3	32	6	261	15	555	815	0	272	272
5	1	Main Office (122)	Recessed	S	Inc	2	1	60	Sw	7.5	261	0	120	235	CFL	Recessed	CFL	S	Sw	2	1	20	8	261	0	40	78	157	0	157
6	1	Maintenance Room (122)	Ceiling Suspended	E	8'T8	4	2	59	Sw	2	261	14	528	276	C	Ceiling Suspended	8'T8	E	OS	4	2	59	2	261	14	528	207	0	69	69
7	1	Maintenance Room (122)	Ceiling Suspended	E	4'T8	2	1	32	Sw	2	261	5	74	39	N/A	Ceiling Suspended	4'T8	E	Sw	2	1	32	2	261	5	74	39	0	0	0
8	1	Office (112)	Exit Sign	E	Fl.	1	1	15	N	24	365	2	17	145	LEDex	Exit Sign	LED	E	N	1	1	5	24	365	1	6	48	96	0	96
9	1	Corridor (112)	Recessed Parabolic	E	4'T8	6	2	32	Sw	24	365	10	444	3,889	N/A	Recessed Parabolic	4'T8	E	Sw	6	2	32	24	365	10	444	3889	0	0	0
10	1	Corridor (112)	Exit Sign	S	LED	1	1	5	N	24	365	1	6	48	N/A	Exit Sign	LED	S	N	1	1	5	24	365	1	6	48	0	0	0
11	1	Bathroom Men	Ceiling Mounted	E	4'T8	1	2	32	Sw	24	365	10	74	648	C	Ceiling Mounted	4'T8	E	OS	1	2	32	18	365	10	74	486	0	162	162
12	1	Bathroom Women	Ceiling Mounted	E	4'T8	1	2	32	Sw	9	365	10	74	243	C	Ceiling Mounted	4'T8	E	OS	1	2	32	7	365	10	74	182	0	61	61
13	1	Common Room (110)	Recessed Parabolic	E	4'T8	16	2	32	Sw	9	365	10	1,184	3,889	C	Recessed Parabolic	4'T8	E	OS	16	2	32	7	365	10	1184	2917	0	972	972
14	1	Common Room (110)	Recessed Parabolic	E	4'T8	2	2	32	Sw	9	365	10	148	486	N/A	Recessed Parabolic	4'T8	E	Sw	2	2	32	9	365	10	148	486	0	0	0
15	1	Common Room (110)	Exit Sign	S	LED	2	1	5	N	24	365	1	11	96	N/A	Exit Sign	LED	S	N	2	1	5	24	365	1	11	96	0	0	0
16	1	Storage Rm (114)	Ceiling Mounted	E	8'T8	2	1	59	Sw	2	365	7	132	96	N/A	Ceiling Mounted	8'T8	E	Sw	2	1	59	2	365	7	132	96	0	0	0
17	1	Kitchen (107)	Recessed Parabolic	E	4'T8 U-Shaped	6	2	32	Sw	9	365	10	444	1,459	C	Recessed Parabolic	4'T8 U-Shaped	E	OS	6	2	32	7	365	10	444	1094	0	365	365
18	1	Laundry Room (116)	Recessed Parabolic	E	4'T8	5	3	32	Sw	8	365	15	555	1,621	C	Recessed Parabolic	4'T8	E	OS	5	3	32	6	365	15	555	1215	0	405	405
19	1	Vestibule (114)	Recessed Parabolic	E	4'T8	1	2	32	Sw	16	365	10	74	432	N/A	Recessed Parabolic	4'T8	E	Sw	1	2	32	16	365	10	74	432	0	0	0
20	1	Vestibule (114)	Exit Sign	S	LED	1	1	5	N	24	365	1	6	48	N/A	Exit Sign	LED	S	N	1	1	5	24	365	1	6	48	0	0	0
21	1	Trash Room (104)	Ceiling Suspended	E	4'T8	2	2	32	Sw	8	365	10	148	432	N/A	Ceiling Suspended	4'T8	E	Sw	2	2	32	8	365	10	148	432	0	0	0
22	1	Ante-room (116)	Ceiling Suspended	E	4'T8	2	2	32	Sw	9	365	10	148	486	C	Ceiling Suspended	4'T8	E	OS	2	2	32	7	365	10	148	365	0	122	122
23	1	Mechanical Equipment Room (105)	Ceiling Suspended	E	4'T8	12	2	32	Sw	2	365	10	888	648	N/A	Ceiling Suspended	4'T8	E	Sw	12	2	32	2	365	10	888	648	0	0	0
24	1	Janitor's Room (105)	Ceiling Suspended	E	4'T8	2	2	32	Sw	2	365	10	148	108	C	Ceiling Suspended	4'T8	E	OS	2	2	32	2	365	10	148	81	0	27	27
25	1	Generator Room (126)	Ceiling Suspended	M	4'T12	4	2	40	Sw	1	365	24	416	152	T8 Kit	Ceiling Suspended	4'T8	E	Sw	4	2	32	1	365	10	296	108	44	0	44
26	Ext	Exterior	Wall Mounted	S	MH	1	1	200	PC	12	365	56	256	1,121	PSMH	Wall Mounted	PSMH	S	PC	1	1	125	12	365	25	150	657	464	0	464
27	BH	Elevator Mech. Rm	Ceiling Suspended	M	8'T12	2	1	80	Sw	1	365	20	200	73	T8 Kit	Ceiling Suspended	8'T8	E	Sw	2	1	59	1	365	7	132	48	25	0	25
28	BH	Elevator Mech. Rm	Ceiling Mounted	E	4'T8	4	2	32	Sw	1	365	10	296	108	N/A	Ceiling Mounted	4'T8	E	Sw	4	2	32	1	365	10	296	108	0	0	0
29	BH	Corridor (103)	Wall Mounted	E	4'T8	8	2	32	N	24	365	10	592	5,186	N/A	Wall Mounted	4'T8	E	N	8	2	32	24	365	10	592	5186	0	0	0
30	1	Kitchen (101)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
31	1	Bathroom (101)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
32	1	Kitchen (102)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
33	1	Bathroom (102)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
34	1	Kitchen (103)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
35	1	Bathroom (103)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
36	1	Kitchen (104)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
37	1	Bathroom (104)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
38	1	Kitchen (105)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
39	1	Bathroom (105)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
40	2	Kitchen (201)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
41	2	Bathroom (201)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
42	2	Kitchen (202)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
43	2	Bathroom (202)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
44	2	Kitchen (203)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
45	2	Bathroom (203)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
46	2	Kitchen (204)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
47	2	Bathroom (204)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
48	2	Kitchen (205)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
49	2	Bathroom (205)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
50	2	Kitchen (206)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
51	2	Bathroom (206)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
52	2	Kitchen (207)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
53	2	Bathroom (207)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
54	2	Kitchen (208)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
55	2	Bathroom (208)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
56	2	Kitchen (209)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
57	2	Bathroom (209)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
58	2	Walk-in Closet (209)	Wall Mounted	S	Inc	1	1	60	Sw	1	365	0	60	22	CFL	Wall Mounted	CFL	S	Sw	1	1	20	1	365	0	20	7	15	0	15
59	2	Kitchen (210)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
60	2	Bathroom (210)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
61	2	Kitchen (211)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
62	2	Bathroom (211)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
63	2	Kitchen (212)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
64	2	Bathroom (212)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
65	2	Walk-in Closet (212)	Wall Mounted	S	Inc	1	1	60	Sw	1	365	0	60	22	CFL	Wall Mounted	CFL	S	Sw	1	1	20	1	365	0	20	7	15	0	15
66	3	Kitchen (301)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
67	3	Bathroom (301)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
68	3	Kitchen (302)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
69	3	Bathroom (302)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175

Location			Existing Fixture Information												Retrofit Information												Annual Savings		
Marker	Floor	Room Identification	Fixture Type	Ballast	Lamp Type	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Controls	Operational Hours per Day	Operational Days per Year	Ballast Wattage	Total Watts	Energy Use kWh/year	Category	Fixture Type	Lamp Type	Ballast	Controls	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Operational Hours per Day	Operational Days per Year	Ballast Watts	Total Watts	Energy Use kWh/year	Fixture Savings (kWh)	Controls Savings (kWh)	Total Savings (kWh)
70	3	Kitchen (303)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
71	3	Bathroom (303)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
72	3	Kitchen (304)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
73	3	Bathroom (304)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
74	3	Kitchen (305)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
75	3	Bathroom (305)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
76	3	Kitchen (306)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
77	3	Bathroom (306)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
78	3	Kitchen (307)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
79	3	Bathroom (307)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
80	3	Kitchen (308)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
81	3	Bathroom (308)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
82	3	Kitchen (309)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
83	3	Bathroom (309)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
84	3	Walk-in Closet (309)	Wall Mounted	S	Inc	1	1	60	Sw	1	365	0	60	22	CFL	Wall Mounted	CFL	S	Sw	1	1	20	1	365	0	20	7	15	0	15
85	3	Kitchen (310)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
86	3	Bathroom (310)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
87	3	Kitchen (311)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
88	3	Bathroom (311)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
89	3	Kitchen (312)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
90	3	Bathroom (312)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
91	3	Walk-in Closet (312)	Wall Mounted	S	Inc	1	1	60	Sw	1	365	0	60	22	CFL	Wall Mounted	CFL	S	Sw	1	1	20	1	365	0	20	7	15	0	15
92	4	Kitchen (401)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
93	4	Bathroom (401)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
94	4	Kitchen (402)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
95	4	Bathroom (402)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
96	4	Kitchen (403)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
97	4	Bathroom (403)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
98	4	Kitchen (404)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
99	4	Bathroom (404)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
100	4	Kitchen (405)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
101	4	Bathroom (405)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
102	4	Kitchen (406)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
103	4	Bathroom (406)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
104	4	Kitchen (407)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
105	4	Bathroom (407)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
106	4	Kitchen (408)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
107	4	Bathroom (408)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
108	4	Kitchen (409)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
109	4	Bathroom (409)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
110	4	Walk-in Closet (409)	Wall Mounted	S	Inc	1	1	60	Sw	1	365	0	60	22	CFL	Wall Mounted	CFL	S	Sw	1	1	20	1	365	0	20	7	15	0	15
111	4	Kitchen (410)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
112	4	Bathroom (410)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
113	4	Kitchen (411)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
114	4	Bathroom (411)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
115	4	Kitchen (412)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
116	4	Bathroom (412)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
117	4	Walk-in Closet (412)	Wall Mounted	S	Inc	1	1	60	Sw	1	365	0	60	22	CFL	Wall Mounted	CFL	S	Sw	1	1	20	1	365	0	20	7	15	0	15
118	5	Kitchen (501)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
119	5	Bathroom (501)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
120	5	Kitchen (502)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
121	5	Bathroom (502)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
122	5	Kitchen (503)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
123	5	Bathroom (503)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
124	5	Kitchen (504)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
125	5	Bathroom (504)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
126	5	Kitchen (505)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
127	5	Bathroom (505)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
128	5	Kitchen (506)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
129	5	Bathroom (506)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
130	5	Kitchen (507)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
131	5	Bathroom (507)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
132	5	Kitchen (508)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
133	5	Bathroom (508)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
134	5	Kitchen (509)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
135	5	Bathroom (509)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
136	5	Walk-in Closet (509)	Wall Mounted	S	Inc	1	1	60	Sw	1	365	0	60	22	CFL	Wall Mounted	CFL	S	Sw	1	1	20	1	365	0	20	7	15	0	15
137	5	Kitchen (510)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
138	5	Bathroom (510)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
139	5	Kitchen (511)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0

Location			Existing Fixture Information												Retrofit Information												Annual Savings		
Marker	Floor	Room Identification	Fixture Type	Ballast	Lamp Type	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Controls	Operational Hours per Day	Operational Days per Year	Ballast Wattage	Total Watts	Energy Use kWh/year	Category	Fixture Type	Lamp Type	Ballast	Controls	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Operational Hours per Day	Operational Days per Year	Ballast Watts	Total Watts	Energy Use kWh/year	Fixture Savings (kWh)	Controls Savings (kWh)	Total Savings (kWh)
140	5	Bathroom (511)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
141	5	Kitchen (512)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
142	5	Bathroom (512)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
143	5	Walk-in Closet (512)	Wall Mounted	S	Inc	1	1	60	Sw	1	365	0	60	22	CFL	Wall Mounted	CFL	S	Sw	1	1	20	1	365	0	20	7	15	0	15
144	6	Kitchen (601)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
145	6	Bathroom (601)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
146	6	Kitchen (602)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
147	6	Bathroom (602)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
148	6	Kitchen (603)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
149	6	Bathroom (603)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
150	6	Kitchen (604)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
151	6	Bathroom (604)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
152	6	Kitchen (605)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
153	6	Bathroom (605)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
154	6	Kitchen (606)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
155	6	Bathroom (606)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
156	6	Kitchen (607)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
157	6	Bathroom (607)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
158	6	Kitchen (608)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
159	6	Bathroom (608)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
160	6	Kitchen (609)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
161	6	Bathroom (609)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
162	6	Walk-in Closet (609)	Wall Mounted	S	Inc	1	1	60	Sw	1	365	0	60	22	CFL	Wall Mounted	CFL	S	Sw	1	1	20	1	365	0	20	7	15	0	15
163	6	Kitchen (610)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
164	6	Bathroom (610)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
165	6	Kitchen (611)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
166	6	Bathroom (611)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
167	6	Kitchen (612)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
168	6	Bathroom (612)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
169	6	Walk-in Closet (612)	Wall Mounted	S	Inc	1	1	60	Sw	1	365	0	60	22	CFL	Wall Mounted	CFL	S	Sw	1	1	20	1	365	0	20	7	15	0	15
170	7	Kitchen (701)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
171	7	Bathroom (701)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
172	7	Kitchen (702)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
173	7	Bathroom (702)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
174	7	Kitchen (703)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
175	7	Bathroom (703)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
176	7	Kitchen (704)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
177	7	Bathroom (704)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
178	7	Kitchen (705)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
179	7	Bathroom (705)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
180	7	Kitchen (706)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
181	7	Bathroom (706)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
182	7	Kitchen (707)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
183	7	Bathroom (707)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
184	7	Kitchen (708)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
185	7	Bathroom (708)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
186	7	Kitchen (709)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
187	7	Bathroom (709)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
188	7	Walk-in Closet (709)	Wall Mounted	S	Inc	1	1	60	Sw	1	365	0	60	22	CFL	Wall Mounted	CFL	S	Sw	1	1	20	1	365	0	20	7	15	0	15
189	7	Kitchen (710)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
190	7	Bathroom (710)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
191	7	Kitchen (711)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
192	7	Bathroom (711)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
193	7	Kitchen (712)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
194	7	Bathroom (712)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
195	7	Walk-in Closet (712)	Wall Mounted	S	Inc	1	1	60	Sw	1	365	0	60	22	CFL	Wall Mounted	CFL	S	Sw	1	1	20	1	365	0	20	7	15	0	15
196	8	Kitchen (801)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
197	8	Bathroom (801)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
198	8	Kitchen (802)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
199	8	Bathroom (802)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
200	8	Kitchen (803)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
201	8	Bathroom (803)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
202	8	Kitchen (804)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
203	8	Bathroom (804)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
204	8	Kitchen (805)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
205	8	Bathroom (805)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
206	8	Kitchen (806)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
207	8	Bathroom (806)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
208	8	Kitchen (807)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
209	8	Bathroom (807)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175

Location			Existing Fixture Information												Retrofit Information												Annual Savings		
Marker	Floor	Room Identification	Fixture Type	Ballast	Lamp Type	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Controls	Operational Hours per Day	Operational Days per Year	Ballast Wattage	Total Watts	Energy Use kWh/year	Category	Fixture Type	Lamp Type	Ballast	Controls	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Operational Hours per Day	Operational Days per Year	Ballast Watts	Total Watts	Energy Use kWh/year	Fixture Savings (kWh)	Controls Savings (kWh)	Total Savings (kWh)
210	8	Kitchen (808)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
211	8	Bathroom (808)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
212	8	Kitchen (809)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
213	8	Bathroom (809)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
214	8	Walk-in Closet (809)	Wall Mounted	S	Inc	1	1	60	Sw	1	365	0	60	22	CFL	Wall Mounted	CFL	S	Sw	1	1	20	1	365	0	20	7	15	0	15
215	8	Kitchen (810)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
216	8	Bathroom (810)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
217	8	Kitchen (811)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
218	8	Bathroom (811)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
219	8	Kitchen (812)	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
220	8	Bathroom (812)	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
221	8	Walk-in Closet (812)	Wall Mounted	S	Inc	1	1	60	Sw	1	365	0	60	22	CFL	Wall Mounted	CFL	S	Sw	1	1	20	1	365	0	20	7	15	0	15
222	9	Kitchen	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
223	9	Bathroom	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
224	9	Walk-in Closet	Wall Mounted	S	Inc	1	1	60	Sw	1	365	0	60	22	CFL	Wall Mounted	CFL	S	Sw	1	1	20	1	365	0	20	7	15	0	15
225	9	Kitchen	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
226	9	Bathroom	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
227	9	Walk-in Closet	Wall Mounted	S	Inc	1	1	60	Sw	1	365	0	60	22	CFL	Wall Mounted	CFL	S	Sw	1	1	20	1	365	0	20	7	15	0	15
228	9	Kitchen	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
229	9	Bathroom	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
230	9	Walk-in Closet	Wall Mounted	S	Inc	1	1	60	Sw	1	365	0	60	22	CFL	Wall Mounted	CFL	S	Sw	1	1	20	1	365	0	20	7	15	0	15
231	9	Kitchen	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
232	9	Bathroom	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
233	9	Kitchen	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
234	9	Bathroom	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
235	9	Kitchen	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
236	9	Bathroom	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
237	9	Kitchen	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
238	9	Bathroom	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
239	9	Kitchen	Ceiling Mounted	E	4'T8	1	2	32	Sw	6	365	10	74	162	N/A	Ceiling Mounted	4'T8	E	Sw	1	2	32	6	365	10	74	162	0	0	0
240	9	Bathroom	Wall Mounted	S	Inc	1	3	60	Sw	4	365	0	180	263	CFL	Wall Mounted	CFL	S	Sw	1	3	20	4	365	0	60	88	175	0	175
241	Park	Exterior	Pole Mounted Off Building	S	HPS	16	1	150	PC	12	365	30	2,880	12,614	LED	Pole Mounted Off Building	LED	S	PC	16	1	77	12	365	8	1355	5936	6679	0	6679
242	Ext	Path Lighting	Ceiling Mounted	S	Inc	6	2	60	PC	12	365	0	720	3,154	CFL	Ceiling Mounted	CFL	S	PC	6	2	20	12	365	0	240	1051	2102	0	2102
243	Str	Staircase	Wall Mounted	E	4'T8	20	2	32	T	12	365	10	1,480	6,482	N/A	Wall Mounted	4'T8	E	T	20	2	32	12	365	10	1480	6482	0	0	0
244	Str	Staircase	Wall Mounted	E	4'T8	20	2	32	N	24	365	10	1,480	12,965	N/A	Wall Mounted	4'T8	E	N	20	2	32	24	365	10	1480	12965	0	0	0
Totals:						374	563	11,382				1,344	40,541	101,453						374	563	6,515			1,263	25,751	71,726	26,893	2,834	29,727

Rows Highlighed Yellow Indicate an Energy Conservation Measure is recommended for that space

Proposed Lighting Summary Table			
Total Gross Floor Area (SF)	84,144		
Average Power Cost ($/kWh)	0.1400		
Exterior Lighting	**Existing**	**Proposed**	**Savings**
Exterior Annual Consumption (kWh)	4,275	1,708	**2,567**
Exterior Power (watts)	976	390	**586**
Total Interior Lighting	**Existing**	**Proposed**	**Savings**
Annual Consumption (kWh)	97,178	70,018	**27,160**
Lighting Power (watts)	39,565	25,361	**14,204**
Lighting Power Density (watts/SF)	0.47	0.30	**0.17**
Estimated Cost of Fixture Replacement ($)	2,265		
Estimated Cost of Controls Improvements ($)	2,400		
Total Consumption Cost Savings ($)	**4,900**		

LEGEND			
Lamp Type		**Controls**	
CFL	Compact Fluorescent	T	Autom. Timer
Inc	Incadescent	BL	Bi-Level
LED	Light Emitting Diode	Ct	Contact
MH	Metal Halide	M	Daylight & Motion
MV	Mercury Vapor	DLSw	Daylight & Switch
PSMH	Pulse Start Metal Halide	DL	Daylight Sensor
HPS	High Pressure Sodium	DSw	Delay Switch
LPS	Low Pressure Sodium	D	Dimmer
Fl	Fluorescent	MS	Motion Sensor
4'T8	4 Feet long T8 Linear Lamp	MSw	Motion& Switch
4'T8 U-shaped	4 Feet long T8 U-shaped Lamp	N	None
4'T5	4 Feet long T5 Linear Lamp	OS	Occupancy Sensor
Ballast Type		OSCM	Occupancy Sensor Ceiling Mounted
E	Electronic	PC	Photocell
M	Magnetic	Sw	Switch
S	Self		

APPENDIX C: UPCOMING EQUIPMENT PHASEOUTS

LIGHTING:

- As of **July 1, 2010** magnetic ballasts most commonly used for the operation of T12 lamps are no longer being produced for commercial and industrial applications.

- As of **January 1, 2012** 100 watt incandescent bulbs have been phased out in accordance with the Energy Independence and Security Act of 2007.

- Starting **July 2012** many non energy saver model T12 lamps will be phased out of production.

- As of **January 1, 2013** 75 watt incandescent bulbs will be phased out in accordance with the Energy Independence and Security Act of 2007.

- As of **January 1, 2014** 60 and 40 watt incandescent bulbs will be phased out in accordance with the Energy Independence and Security Act of 2007.

- Energy Independence and Security Act of 2007 incandescent lamp phase-out exclusions:
  1. Appliance lamp (e.g. refrigerator or oven light)
  2. Black light lamp
  3. Bug lamp
  4. Colored lamp
  5. Infrared lamp
  6. Left-hand thread lamp
  7. Marine lamp
  8. Marine signal service lamp
  9. Mine service lamp
  10. Plant light lamp
  11. Reflector lamp
  12. Rough service lamp
  13. Shatter-resistant lamp (including a shatter-proof lamp and a shatter-protected lamp)
  14. Sign service lamp
  15. Silver bowl lamp
  16. Showcase lamp
  17. 3-way incandescent lamp
  18. Traffic signal lamp
  19. Vibration service lamp
  20. Globe shaped “G” lamp (as defined in ANSI C78.20-2003 and C79.1-2002 with a diameter of 5 inches or more
  21. T shape lamp (as defined in ANSI C78.20-2003 and C79.1-2002) and that uses not more than 40 watts or has a length of more than 10 inches
  22. A B, BA, CA, F, G16-1/2, G-25, G30, S, or M-14 lamp (as defined in ANSI C79.1-2002 and ANSI C78.20-2003) of 40 watts or less
  23. Candelabra incandescent and other lights not having a medium Edison screw base.

- When installing compact fluorescent lamps (CFLs), be advised that they contain a very small amount of mercury sealed within the glass tubing and EPA guidelines concerning

cleanup and safe disposal of compact fluorescent light bulbs should be followed. Additionally, all lamps to be disposed should be recycled in accordance with EPA guidelines through state or local government collection or exchange programs instead.

HCFC (Hydrochlorofluorocarbons):

- As of **January 1, 2010,** no production and no importing of R-142b and R-22, except for use in equipment manufactured before January 1, 2010, in accordance with adherence to the Montreal Protocol.

- As of **January 1, 2015,** No production and no importing of any HCFCs, except for use as refrigerants in equipment manufactured before January 1, 2010.

- As of **January 1, 2020** No production and no importing of R-142b and R-22.

APPENDIX D: THIRD PARTY ENERGY SUPPLIERS

http://www.state.nj.us/bpu/commercial/shopping.html

Third Party Electric Suppliers for PSEG Service Territory	Telephone & Web Site
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com
American Powernet Management, LP 437 North Grove St. Berlin, NJ 08009	(877) 977-2636 www.americanpowernet.com
BOC Energy Services, Inc. 575 Mountain Avenue Murray Hill, NJ 07974	(800) 247-2644 www.boc.com
Commerce Energy, Inc. 4400 Route 9 South, Suite 100 Freehold, NJ 07728	(800) 556-8457 www.commerceenergy.com
ConEdison Solutions 535 State Highway 38 Cherry Hill, NJ 08002	(888) 665-0955 www.conedsolutions.com
Constellation NewEnergy, Inc. 900A Lake Street, Suite 2 Ramsey, NJ 07446	(888) 635-0827 www.newenergy.com
Credit Suisse, (USA) Inc. 700 College Road East Princeton, NJ 08450	(212) 538-3124 www.creditsuisse.com
Direct Energy Services, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com
FirstEnergy Solutions 300 Madison Avenue Morristown, NJ 07926	(800) 977-0500 www.fes.com
Glacial Energy of New Jersey, Inc. 207 LaRoche Avenue Harrington Park, NJ 07640	(877) 569-2841 www.glacialenergy.com
Metro Energy Group, LLC 14 Washington Place Hackensack, NJ 07601	(888) 536-3876 www.metroenergy.com
Integrys Energy Services, Inc. 99 Wood Ave, South, Suite 802 Iselin, NJ 08830	(877) 763-9977 www.integrysenergy.com
Liberty Power Delaware, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(866) 769-3799 www.libertypowercorp.com
Liberty Power Holdings, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(800) 363-7499 www.libertypowercorp.com

Pepco Energy Services, Inc. 112 Main St. Lebanon, NJ 08833	(800) 363-7499 www.pepco-services.com
PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 www.pplenergyplus.com
Sempra Energy Solutions 581 Main Street, 8th Floor Woodbridge, NJ 07095	(877) 273-6772 www.semprasolutions.com
South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037	(800) 756-3749 www.southjerseyenergy.com
Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 07928	(800) 225-1560 www.spragueenergy.com
Strategic Energy, LLC 55 Madison Avenue, Suite 400 Morristown, NJ 07960	(888) 925-9115 www.sel.com
Suez Energy Resources NA, Inc. 333 Thornall Street, 6th Floor Edison, NJ 08837	(888) 644-1014 www.suezenergyresources.com
UGI Energy Services, Inc. 704 East Main Street, Suite 1 Moorestown, NJ 08057	(856) 273-9995 www.ugienergyservices.com

Third Party Gas Suppliers for PSEG Service Territory	Telephone & Web Site
Cooperative Industries 412-420 Washington Avenue Belleville, NJ 07109	(800) 628-9427 www.cooperativenet.com
Direct Energy Services, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com
Dominion Retail, Inc. 395 Highway 170, Suite 125 Lakewood, NJ 08701	(866) 275-4240 www.retail.dom.com
Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701	(800) 805-8586 www.gesc.com
UGI Energy Services, Inc. 704 East Main Street, Suite 1 Moorestown, NJ 08057	(856) 273-9995 www.ugienergyservices.com
Great Eastern Energy 116 Village Riva, Suite 200 Princeton, NJ 08540	(888) 651-4121 www.greateastern.com
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com

Hudson Energy Services, LLC 545 Route 17 South Ridgewood, NJ 07450	(877) 483-7669 www.hudsonenergyservices.com
Intelligent Energy 2050 Center Avenue, Suite 500 Fort Lee, NJ 07024	(800) 724-1880 www.intelligentenergy.org
Keil & Sons 1 Bergen Blvd. Fairview, NJ 07002	(877) 797-8786 www.systrumenergy.com
Metro Energy Group, LLC 14 Washington Place Hackensack, NJ 07601	(888) 536-3876 www.metroenergy.com
MxEnergy, Inc. 510 Thornall Street, Suite 270 Edison, NJ 08837	(800) 375-1277 www.mxenergy.com
NATGASCO (Mitchell Supreme) 532 Freeman Street Orange, NJ 07050	(800) 840-4427 www.natgasco.com
Pepco Energy Services, Inc. 112 Main Street Lebanon, NJ 08833	(800) 363-7499 www.pepco-services.com
PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 www.pplenergyplus.com
Sempra Energy Solutions 581 Main Street, 8th Floor Woodbridge, NJ 07095	(877) 273-6772 www.semprasolutions.com
South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037	(800) 756-3749 www.southjerseyenergy.com
Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 07928	(800) 225-1560 www.spragueenergy.com
Stuyvesant Energy LLC 10 West Ivy Lane, Suite 4 Englewood, NJ 07631	(800) 646-6457 www.stuyfuel.com
Woodruff Energy 73 Water Street Bridgeton, NJ 08302	(800) 557-1121 www.woodruffenergy.com

APPENDIX E: GLOSSARY AND METHOD OF CALCULATIONS

Net ECM Cost: The net ECM cost is the cost experienced by the customer, which is typically the total cost (materials + labor) of installing the measure minus any available incentives. Both the total cost and the incentive amounts are expressed in the summary for each ECM.

Annual Energy Cost Savings (AECS): This value is determined by the audit firm based on the calculated energy savings (kWh or Therm) of each ECM and the calculated energy costs of the building.

Lifetime Energy Cost Savings (LECS): This measure estimates Housing Authority the energy cost savings over the lifetime of the ECM. It can be a simple estimation based on fixed energy costs. If desired, this value can factor in an annual increase in energy costs as long as the source is provided.

Simple Payback: This is a simple measure that displays how long the ECM will take to break-even based on the annual energy and maintenance savings of the measure.

ECM Lifetime: This is included with each ECM so that the owner can see how long the ECM will be in place and whether or not it will exceed the simple payback period. Additional guidance for calculating ECM lifetimes can be found below. This value can come from manufacturer's rated lifetime or warranty, the ASHRAE rated lifetime, or any other valid source.

Operating Cost Savings (OCS): This calculation is an annual operating savings for the ECM. It is the difference in the operating, maintenance, and / or equipment replacement costs of the existing case versus the ECM. In the case where an ECM lifetime will be longer than the existing measures (such as LED lighting versus fluorescent) the operating savings will factor in the cost of replacing the units to match the lifetime of the ECM. In this case or in one where one-time repairs are made, the total replacement / repair sum is averaged over the lifetime of the ECM.

Return on Investment (ROI): The ROI is expresses the percentage return of the investment based on the lifetime cost savings of the ECM. This value can be included as an annual or lifetime value, or both.

Net Present Value (NPV): The NPV calculates the present value of an investment's future cash flows based on the time value of money, which is accounted for by a discount rate (assumes bond rate of 3.2%).

Internal Rate of Return (IRR): The IRR expresses an annual rate that results in a break-even point for the investment. If the owner is currently experiencing a lower return on their capital than the IRR, the project is financially advantageous. This measure also allows the owner to compare ECMs against each other to determine the most appealing choices.

Gas Rate and Electric Rate ($/therm and $/kWh): The gas rate and electric rate used in the financial analysis is the total annual energy cost divided by the total annual energy usage for the 12 month billing period studied. The graphs of the monthly gas and electric rates reflect the total monthly energy costs divided by the monthly usage, and display how the average rate fluctuates throughout the year. The average annual rate is the only rate used in energy savings calculations.

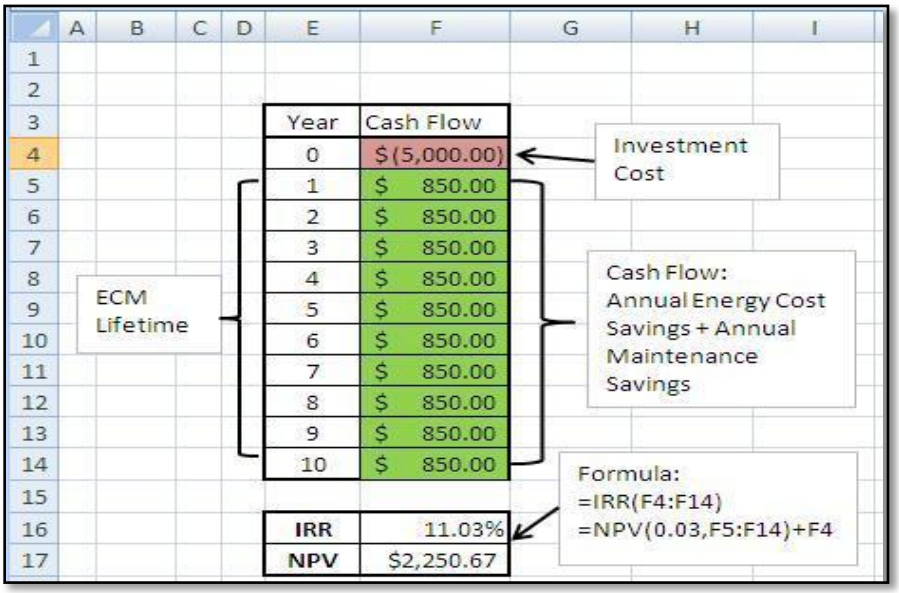
Calculation References

Term	Definition
ECM	Energy Conservation Measure
AOCS	Annual Operating Cost Savings
AECS	Annual Energy Cost Savings
LOCS*	Lifetime Operating Cost Savings
LECS	Lifetime Energy Cost Savings
LCS	Lifetime Cost Savings
NPV	Net Present Value
IRR	Internal Rate of Return
DR	Discount Rate
Net ECM Cost	Total ECM Cost – Incentive
LECS	AECS X ECM Lifetime
AOCS	LOCS / ECM Lifetime
LCS	LOCS+LECS
Simple Payback	Net ECM Cost / (AECS + AOCS)
Lifetime ROI	(LECS + LOCS – Net ECM Cost) / Net ECM Cost
Annual ROI	(Lifetime ROI / Lifetime) = [(AECS + OCS) / Net ECM Cost – (1 / Lifetime)]

* The lifetime operating cost savings are all avoided operating, maintenance, and/or component replacement costs over the lifetime of the ECM. This can be the sum of any annual operating savings, recurring or bulk (i.e. one-time repairs) maintenance savings, or the savings that comes from avoiding equipment replacement needed for the existing measure to meet the lifetime of the ECM (e.g. lighting change outs).

Excel NPV and IRR Calculation

In Excel, function =IRR (values) and =NPV (rate, values) are used to quickly calculate the IRR and NPV of a series of annual cash flows. The investment cost will typically be a negative cash flow at year 0 (total cost - incentive) with years 1 through the lifetime receiving a positive cash flow from the annual energy cost savings and annual maintenance savings. The calculations in the example below are for an ECM that saves $850 annually in energy and maintenance costs (over a 10 year lifetime) and takes $5,000 to purchase and install after incentives:



Solar PV ECM Calculation

There are several components to the calculation:

Costs:	Material of PV system including panels, mounting and net-metering + Labor
Energy Savings:	Reduction of kWh electric cost for life of panel, 25 years Solar Renewable Energy Credits (SRECs) – Market-rate incentive. Calculations assume $608/Megawatt hour consumed per year for a maximum of 15 years; added to annual energy cost savings for a period of 15 years. (Megawatt hour used is rounded to nearest 1,000 kWh)
Assumptions:	A Solar Pathfinder device is used to analyze site shading for the building and determine maximum amount of full load operation based on available sunlight. When the Solar Pathfinder device is not implemented, amount of full load operation based on available sunlight is assumed to be 1,180 hours in New Jersey.

Total lifetime PV energy cost savings =
kWh produced by panel * [$/kWh cost * 25 years + $608/Megawatt hour /1000 * 15 years]

ECM and Equipment Lifetimes

Determining a lifetime for equipment and ECM's can sometimes be difficult. The following table contains a list of lifetimes that the NJCEP uses in its commercial and industrial programs. Other valid sources are also used to determine lifetimes, such as the DOE, ASHRAE, or the manufacturer's warranty.

Lighting is typically the most difficult lifetime to calculate because the fixture, ballast, and bulb can all have different lifetimes. Essentially the ECM analysis will have different operating cost savings (avoided equipment replacement) depending on which lifetime is used.

When the bulb lifetime is used (rated burn hours / annual burn hours), the operating cost savings is just reflecting the theoretical cost of replacing the existing case bulb and ballast over the life of the recommended bulb. Dividing by the bulb lifetime will give an annual operating cost savings.

When a fixture lifetime is used (e.g. 15 years) the operating cost savings reflects the avoided bulb and ballast replacement cost of the existing case over 15 years minus the projected bulb and ballast replacement cost of the proposed case over 15 years. This will give the difference of the equipment replacement costs between the proposed and existing cases and when divided by 15 years will give the annual operating cost savings.

New Jersey Clean Energy Program Commercial Equipment Life Span

Measure	Life Span
Commercial Lighting — New	15
Commercial Lighting — Remodel/Replacement	15
Commercial Custom — New	18
Commercial Chiller Optimization	18
Commercial Unitary HVAC — New - Tier 1	15
Commercial Unitary HVAC — Replacement - Tier 1	15
Commercial Unitary HVAC — New - Tier 2	15
Commercial Unitary HVAC — Replacement Tier 2	15
Commercial Chillers — New	25
Commercial Chillers — Replacement	25
Commercial Small Motors (1-10 HP) — New or Replacement	20
Commercial Medium Motors (11-75 HP) — New or Replacement	20
Commercial Large Motors (76-200 HP) — New or Replacement	20
Commercial VSDs — New	15
Commercial VSDs — Retrofit	15
Commercial Comprehensive New Construction Design	18
Commercial Custom — Replacement	18
Industrial Lighting — New	15
Industrial Lighting — Remodel/Replacement	15
Industrial Unitary HVAC — New - Tier 1	15
Industrial Unitary HVAC — Replacement - Tier 1	15
Industrial Unitary HVAC — New - Tier 2	15
Industrial Unitary HVAC — Replacement Tier 2	15
Industrial Chillers — New	25
Industrial Chillers — Replacement	25
Industrial Small Motors (1-10 HP) — New or Replacement	20
Industrial Medium Motors (11-75 HP) — New or Replacement	20
Industrial Large Motors (76-200 HP) — New or Replacement	20
Industrial VSDs — New	15
Industrial VSDs — Retrofit	15
Industrial Custom — Non-Process	18
Industrial Custom — Process	10
Small Commercial Gas Furnace — New or Replacement	20
Small Commercial Gas Boiler — New or Replacement	20
Small Commercial Gas DHW — New or Replacement	10
C&I Gas Absorption Chiller — New or Replacement	25
C&I Gas Custom — New or Replacement (Engine Driven Chiller)	25
C&I Gas Custom — New or Replacement (Gas Efficiency Measures)	18
O&M savings	3
Compressed Air (GWh participant)	8

APPENDIX F: STATEMENT OF ENERGY PERFORMANCE FROM ENERGY STAR®

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Collingswood Housing Authority

Building ID: 3134336
For 12-month Period Ending: March 31, 2012[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: June 15, 2012

Facility
Collingswood Housing Authority
30 Washington Avenue
Collingswood, NJ 08108

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 1977
Gross Floor Area (ft^2): 84,144

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

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	2,102,474
Natural Gas (kBtu)[4]	3,395,649
Total Energy (kBtu)	5,498,123

Energy Intensity[4]	
Site ($kBtu/ft^2/yr$)	65
Source ($kBtu/ft^2/yr$)	126

Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	478

Electric Distribution Utility
Public Service Electric & Gas Co

National Median Comparison	
National Median Site EUI	
National Median Source EUI	
% Difference from National Median Source EUI	
Building Type	Multifamily Housing

Stamp of Certifying Professional

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

Certifying Professional
N/A

Meets Industry Standards[5] **for Indoor Environmental Conditions:**	
Ventilation for Acceptable Indoor Air Quality	**N/A**
Acceptable Thermal Environmental Conditions	**N/A**
Adequate Illumination	**N/A**

Notes:
1. Application for the ENERGY STAR must be submitted to EPA within 4 months of the Period Ending date. Award of the ENERGY STAR is not final until approval is received from EPA.
2. The EPA Energy Performance Rating is based on total source energy. A rating of 75 is the minimum to be eligible for the ENERGY STAR.
3. Values represent energy consumption, annualized to a 12 month period.
4. Values represent energy intensity, annualized to a 12 month period.
5. Based on Meeting ASHRAE Standard 62 for ventilation for acceptable indoor air quality, ASHRAE Standard 55 for thermal comfort, and IESNA Lighting Handbook for lighting quality.

EPA Form 5900-16

APPENDIX G: INCENTIVE PROGRAMS

New Jersey Clean Energy Pay for Performance

The NJ Clean Energy Pay for Performance (P4P) Program relies on a network of Partners who provide technical services to clients. LGEA participating clients who are not receiving Direct Energy Efficiency and Conservation Block Grants are eligible for P4P. SWA is an eligible Partner and can develop an Energy Reduction Plan for each project with a whole-building traditional energy audit, a financial plan for funding the energy measures and an installation construction schedule.

The Energy Reduction Plan must define a comprehensive package of measures capable of reducing a building's energy consumption by 15+%. P4P incentives are awarded upon the satisfactory completion of three program milestones: submittal of an Energy Reduction Plan prepared by an approved Program Partner, installation of the recommended measures, and completion of a Post-Construction Benchmarking Report. The incentives for electricity and natural gas savings will be paid based on actual savings, provided that the minimum 15% performance threshold savings has been achieved.

Energy Provider Incentives

- **South Jersey Gas** - Offers financing up to $100,000 on the customer's portion of project cost through private lender. In addition to available financing, it provides matching incentive on gas P4P incentives #2 and #3 up to $100,000 (not to exceed total project cost).

For further information, please see: http://www.njcleanenergy.com/commercial-industrial/programs/pay-performance/existing-buildings .

Direct Install 2011 Program*

Direct Install is a division of the New Jersey Clean Energy Programs' Smart Start Buildings. It is a turn-key program for small to mid-sized facilities to aid in upgrading equipment to more efficient types. It is designed to cut overall energy costs by upgrading lighting, HVAC, and other equipment with energy efficient alternatives. The program pays **up to 70%** of the retrofit costs, including equipment cost and installation costs. Each project is limited to $75,000 in incentives.

Eligibility:

- Existing small and mid-sized commercial and industrial facilities with peak electrical demand **below 150 kW** within 12 months of applying (the 150 kW peak demand threshold has been waived for local government entities who receive and utilize their Energy Efficiency and Conservation Block Grant in conjunction with Direct Install)
- Must be located in New Jersey
- Must be served by one of the state's public, regulated or natural gas companies

Energy Provider Incentives

- **South Jersey Gas** – Program offers financing up to $25,000 on customer's 40% portion of the project and combines financing rate based on portion of the project devoted to gas

and electric measures. All gas measures financed at 0%, all electric measures financed at normal rate. Does not offer financing on projects that only include electric measures.
- **Atlantic City Electric –** Provides a free audit, and additional incentives up to 20% of the current incentive up to a maximum of $5,000 per customer.

For the most up to date information on contractors in New Jersey who participate in this program, go to: http://www.njcleanenergy.com/commercial-industrial/programs/direct-install or visit the utility web sites.

Smart Start

New Jersey's SmartStart Building Program is administered by New Jersey's Office of Clean Energy. The program also offers design support for larger projects and technical assistance for smaller projects. If your project specifications do not fit into anything defined by the program, there are even incentives available for custom projects.

There are a number of improvement options for commercial, industrial, institutional, government, and agricultural projects throughout New Jersey. Alternatives are designed to enhance quality while building in energy efficiency to save money. Project categories included in this program are New Construction and Additions, Renovations, Remodeling and Equipment Replacement.

Energy Provider Incentives
- **South Jersey Gas –** Program to finance projects up to $25,000 not covered by incentive
- **New Jersey Natural Gas** – Will match SSB incentives on gas equipment
  PSE&G - Provides funding for site-specific uses of emerging technology. The incentives are determined on a case by case basis.

For the most up to date information on how to participate in this program, go to: http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings.

Renewable Energy Incentive Program*

The Renewable Energy Incentive Program (REIP) provides incentives that reduce the upfront cost of installing renewable energy systems, including solar, wind, and sustainable biomass. Incentives vary depending upon technology, system size, and building type. Current incentive levels, participation information, and application forms can be found at the website listed below.

Solar Renewable Energy Credits (SRECs) represent all the clean energy benefits of electricity generated from a solar energy system. SRECs can be sold or traded separately from the power, providing owners a source of revenue to help offset the cost of installation. All solar project owners in New Jersey with electric distribution grid-connected systems are eligible to generate SRECs. Each time a system generates 1,000 kWh of electricity an SREC is earned and placed in the customer's account on the web-based SREC tracking system.

For the most up to date information on how to participate in this program, go to: http://www.njcleanenergy.com/renewable-energy/home/home.

Combined Heat and Power (CHP)

Energy Provider Incentives

- South Jersey Gas - Provides additional incentive of $1.00/watt up to $1,000,000 on top of NJCEP incentive.

Utility Sponsored Programs

Check with your local utility companies for further opportunities that may be available.

Energy Efficiency and Conservation Block Grant Rebate Program

The Energy Efficiency and Conservation Block Grant (EECBG) Rebate Program provides supplemental funding up to $20,000 for eligible New Jersey local government entities to lower the cost of installing energy conservation measures. Funding for the EECBG Rebate Program is provided through the American Recovery and Reinvestment Act (ARRA).

For the most up to date information on how to participate in this program, go to: http://njcleanenergy.com/EECBG.

Other Federal and State Sponsored Programs

Other federal and state sponsored funding opportunities may be available, including BLOCK and R&D grant funding. For more information, please check http://www.dsireusa.org/.

*Subject to availability. Incentive program timelines might not be sufficient to meet the 25% in 12 months spending requirement outlined in the LGEA program.

APPENDIX H: ENERGY CONSERVATION MEASURES

ECM #	ECM description	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 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	Upgrade (123) Incandescent to CFL	1,710	none at this time	1,710	19,585	13	0	0.8	788	3,530	5	17,651	0.5	932	186	206	13,920	35,067
2	Retro-commissioning	16,829	none at this time	16,829	29,982	0	3,505	5.4	0	8,414	3	25,243	2.0	50	17	23	6,668	92,317
3	Replace 1 incandescent/fluorescent Exit sign with LED type	151	10	141	101	0	0	0.0	33	47	15	707	3.0	403	27	33	401	180
4	Permanently seal window unit air conditioners	9,500	none at this time	9,500	83	0	2,061	2.5	0	2,485	10	24,852	3.8	162	16	23	11,129	22,863
5	Install 12 occupancy sensors	2,640	240	2,400	2,834	0	0	0.1	0	397	15	5,951	6.0	148	10	14	2,198	5,074
6	Retrofit 16 high pressure sodium parking lot luminaires with LEDs	26,425	none at this time	26,425	6,679	2	0	0.3	3,305	4,240	15	63,601	6.2	141	9	14	22,740	11,958
7	1 New PSMH fixtures to be installed with incentives	713	25	688	464	0	0	0.0	6	71	15	1,061	9.7	54	4	6	141	831
8	6 New T8 fixtures to be installed with incentives	410	60	350	69	0	0	0.0	26	36	15	537	9.8	54	4	6	70	123

Assumptions: Discount Rate: 3.2%; Energy Price Escalation Rate: 0%
Note: A 0.0 electrical demand reduction/month indicates that it is very low/negligible

APPENDIX I: METHOD OF ANALYSIS

Assumptions and tools

Cost estimates:	RS Means 2009 (Facilities Maintenance & Repair Cost Data) RS Means 2009 (Building Construction Cost Data) RS Means 2009 (Mechanical Cost Data) Published and established specialized equipment material and labor costs Cost estimates also based on utility bill analysis and prior experience with similar projects

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.