



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

293 Route 18, Suite 330
East Brunswick, NJ 08816

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

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**Local Government Energy Program
Energy Audit Report-FINAL**

***Township of Millburn
Millburn Par 3 building
335 White Oak Ridge Rd
Short Hills, NJ 07041***

Project Number: LGEA58



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EXECUTIVE SUMMARY

The Par 3 building is a one-story, 2,960 square feet building originally constructed in 1970. The following chart provides an overview of current energy usage in the building based on the analysis period of February 2009 through January 2010:

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	Joint Energy Consumption, MMBtu/yr
Current	21,455	-	5,586	27.0	73
Proposed	15,420	-	3,771	20.0	52
Savings	6,035	-	1,815	7.0	21
% Savings	28	-	32	28	28

There may be energy procurement opportunities for the Par 3 building to reduce annual utility costs. The Township of Millburn electric costs are \$2,367 higher, when compared to the average estimate NJ commercial utility rates.

SWA has also entered energy information about the Par 3 building in the U.S. Environmental Protection Agency's (EPA) *ENERGY STAR® Portfolio Manager* energy benchmarking system. The Par 3 building is comprised of a non-eligible ("Other") space type and as a result of being a "non-eligible" space type; a performance score could not be generated. Although a performance score could not be generated, the software was able to generate the site energy use intensity. Compared to a typical commercial building of similar size that uses 104.0kBtu/sqft-yr, the Township of Millburn Par 3 building uses 27.0 kBtu/sqft-yr.

Based on the current state of the building and its energy use, SWA recommends implementing various energy conservation measures from the savings detailed in Table 1. The measures are categorized by payback period in Table 2 below:

Table 2: Energy Conservation Measure Recommendations

ECMs	First Year Savings (\$)	Simple Payback Period (years)	Initial Investment, \$	CO2 Savings, lbs/yr
0-5 Year	1,229	1.0	1,217	8,464
5-10 Year	477	6.6	3,128	1,771
>10 year	109	10.7	1,171	571
Total	1,815	3.0	5,516	10,806

SWA estimates that implementing the recommended ECMs is equivalent to removing approximately 1 car from the roads each year or avoiding the need of 26 trees to absorb the annual CO₂ generated.

The recommended ECMs and the list above are cost-effective energy efficiency measures and building upgrades that will reduce operating expenses for the Township of Millburn. Based on the

requirements of the LGEA program, the Township of Millburn must commit to implementing some of these measures, and must submit paperwork to the Local Government Energy Audit program within one year of this report's approval to demonstrate that they have spent, net of other NJCEP incentives, at least 25% of the cost of the audit (per building). The minimum amount to be spent, net of other NJCEP incentives, is \$652.

Financial Incentives and Other Program Opportunities

There are various incentive programs that the Township of Millburn could apply for that could help lower the cost of installing ECMs. Please refer to Appendix F for details.

SWA recommends that the Township of Millburn implement all recommended Energy Conservation Measures at the Par 3 building. Based on the scope of work and the fact that the building is an all-electric building, SWA recommends that all recommendations are implemented at the same time, since each measure will include labor associated with a hired electrician. Completing all measures at one time will allow the project to cost share labor associated with each measure and ultimately reduce implementation costs for the Township of Millburn. SWA recommends that the Township of Millburn also first apply for additional incentive money through New Jersey's Office of Clean Energy program to reduce implementation costs. Once the Township of Millburn applies for the Direct Install program, it is advised that they also apply to the NJ SmartStart buildings program for additional funding opportunities beyond the Direct Install program. SWA also recommends that the Township of Millburn explore the Energy Efficiency and Conservation Block Grant Rebate Program which provides up to \$20,000 per local government toward energy saving measures.

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 38-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 Par 3 building at 335 White Oak Ridge Rd, Short Hills, NJ 07041. The process of the audit included facility visit on April 8, 2010, benchmarking and energy bills analysis, assessment of existing conditions, energy modeling, 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 Township of Millburn to make decisions regarding the implementation of the most appropriate and most cost-effective energy conservation measures for the Par 3 building.

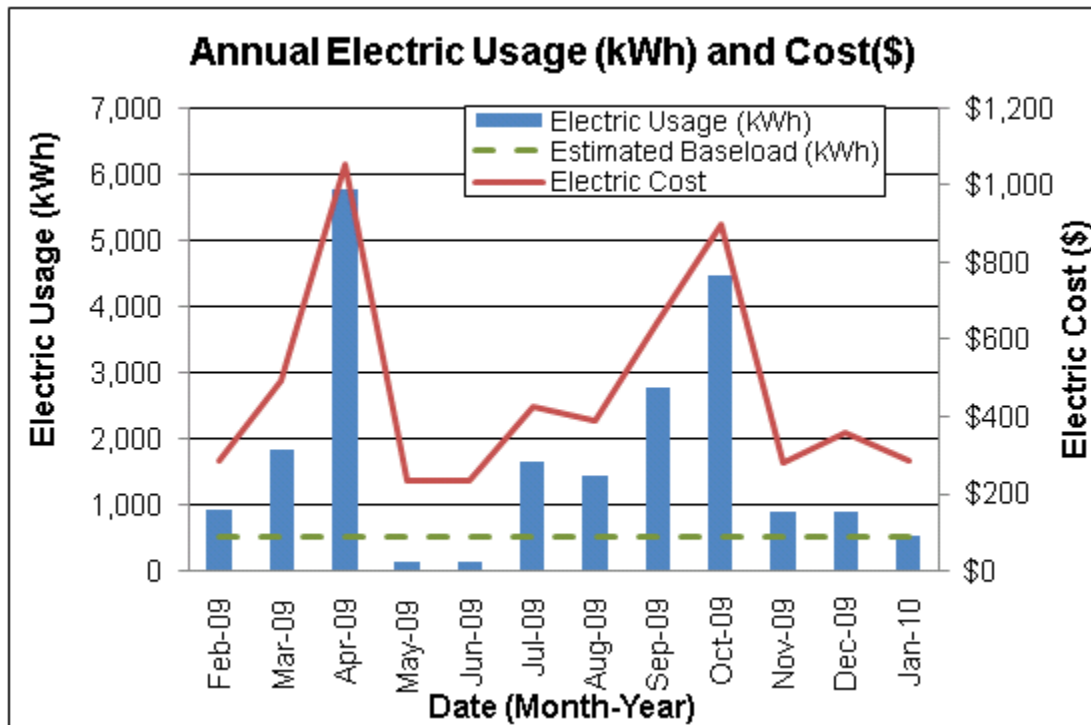
HISTORICAL ENERGY CONSUMPTION

1.1 Energy usage, load profile and cost analysis

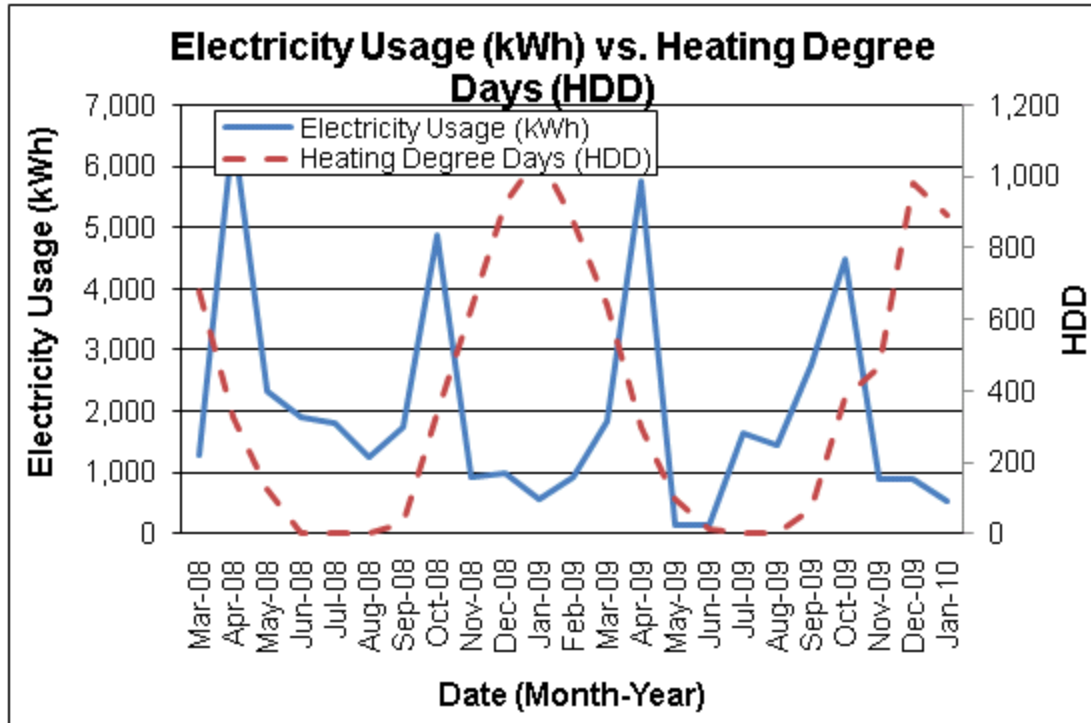
SWA reviewed utility bills from February 2008 through January 2010 that were received from the utility companies supplying the Par 3 building with electricity. A 12 month period of analysis from February 2009 through January 2010 was used for all calculations and for purposes of benchmarking the building.

Electricity - The Par 3 building is currently served by one electric meter. The Township currently buys electricity for the Par 3 building from JCP&L at an **average aggregated rate of \$0.260/kWh**. The Township purchased **approximately 21,455 kWh, or \$5,585 worth of electricity**, for the Par 3 building in the previous year. The average monthly demand was 40.7 kW and the annual peak demand was 42.9 kW.

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 Par 3 building.



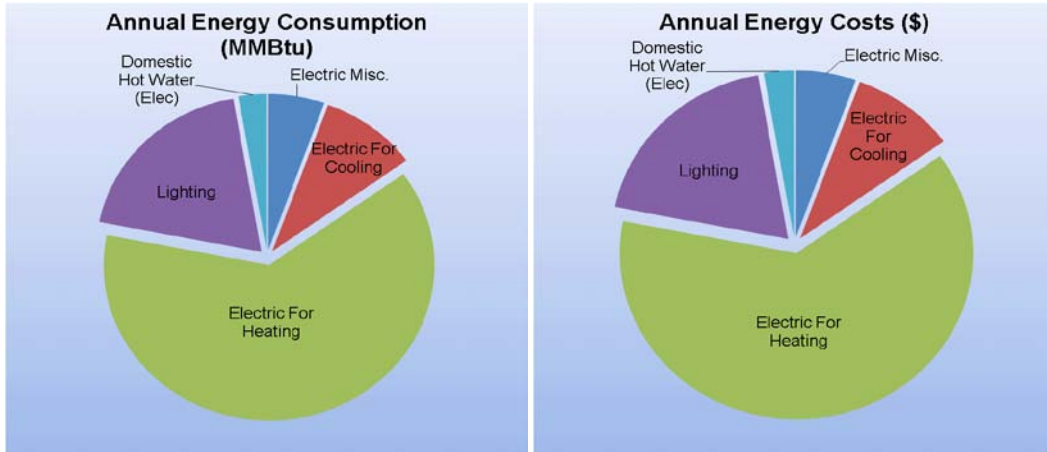
The chart above shows minimal kWh usage May and June 2009. There may have been a billing error during these summer months as the previous month had much higher usage. The peak usage occurred during shoulder months (April and October 2009) when electric heating and cooling was simultaneously being used in the building.



The chart above shows the monthly electric 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 the base temperature. SWA's analysis used a base temperature of 65 degrees Fahrenheit.

The following graphs, pie charts, and table show energy use for the Par 3 building based on utility bills for the 12 month period.

Annual Energy Consumption / Costs					
	MMBtu	% MMBtu	\$	% \$	\$/MMBtu
Electric Miscellaneous	4	5%	\$306	5%	77
Electric For Cooling	7	10%	\$536	10%	77
Electric For Heating	46	63%	\$3,520	63%	77
Lighting	14	19%	\$1,071	19%	77
Domestic Hot Water (Elec)	2	3%	\$153	3%	77
Totals	73	100%	\$5,586	100%	77

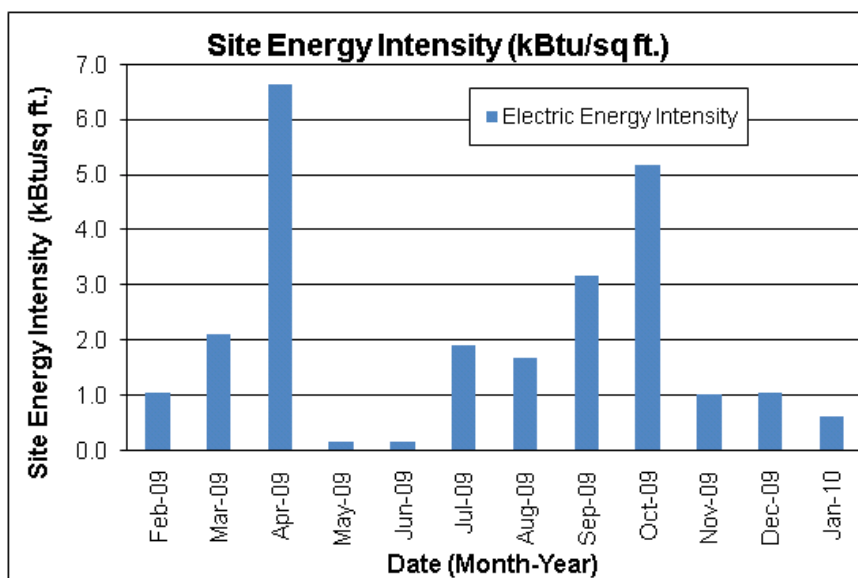


1.2. Energy benchmarking

SWA has entered energy information about the Par 3 building in the U.S. Environmental Protection Agency's (EPA) *ENERGY STAR® Portfolio Manager* energy benchmarking system. The building did not receive a performance rating due to its categorization as "Other" space type. SWA recommends the Township of Millburn continue to insert utility billing information as the building may receive a rating as the (EPA) *ENERGY STAR® Portfolio Manager* database grows.

Additionally, should the Township desire to reach beyond average there are other large scale and financially less advantageous improvements that can be made, such as envelope window, door and insulation upgrades that would help the building reach this goal.

The Site Energy Use Intensity is 27.0 kBtu/ft²-yr compared to the national average of "Other" building types consuming 104.0 kBtu/ft²-yr. See ECM section for guidance on how to improve the building's rating.



Per the LGEA program requirements, SWA has assisted the Township to create an *ENERGY STAR® Portfolio Manager* account and share the Par 3 building facilities information to allow future data to be added and tracked using the benchmarking tool. SWA has shared this Portfolio Manager account information with the Municipality (user name of “MillburnTownship” with a password of “MILLBURNTOWNSHIP”) and TRC Energy Services (user name of “TRC-LGEA”)

1.2.1. Tariff analysis

As part of the utility bill analysis, SWA evaluated the current utility rates and tariffs. Tariffs are typically assigned to buildings based on size and building type.

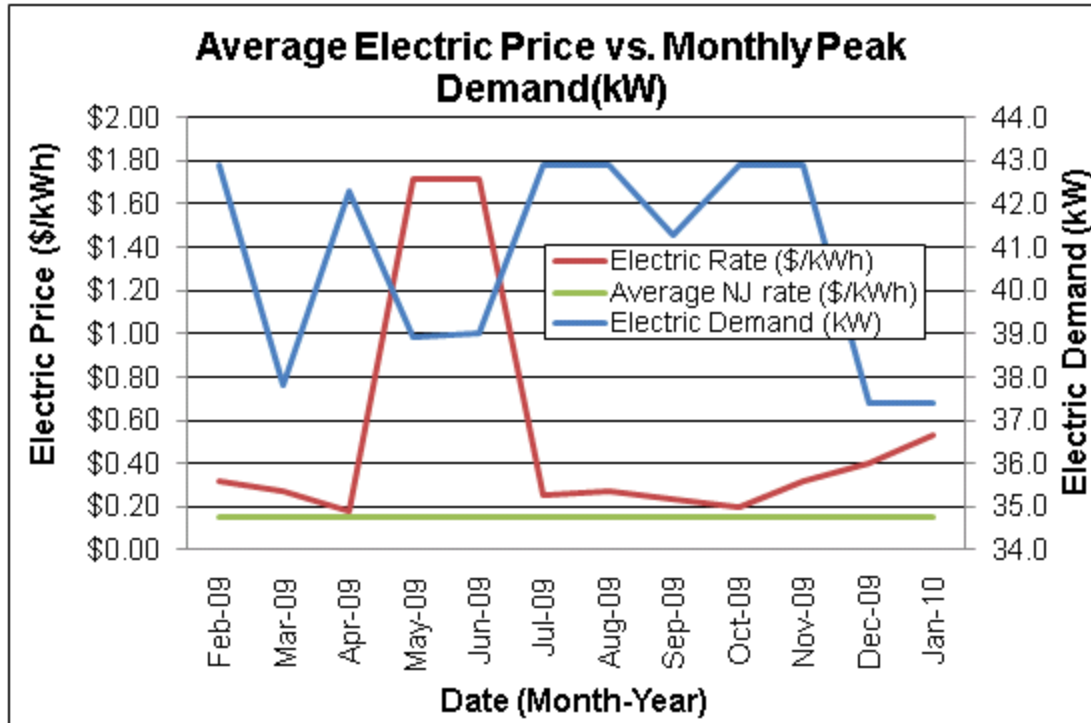
Tariff analysis is performed to determine if the rate that a municipality is contracted to pay with each utility provider is the best rate possible resulting in the lowest costs for electric provision. Typically, electricity prices also increase during the cooling months when electricity is used by the HVAC condensing units and air handlers.

The supplier charges a market-rate price based on use, and the billing does not break down demand costs for all periods because usage and demand are included in the rate. The building is direct metered and currently purchases electricity at a general service rate for usage with an additional charge for electrical demand factored into each monthly bill. These general service rates for electric charges are market-rate based on use. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year.

1.2.2. Energy Procurement strategies

Billing analysis is conducted using an average aggregated rate that is estimated based on the total cost divided by the total energy usage per utility per 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 the Township pays a rate of \$0.260/kWh for the Par 3 building. The Par 3 building annual electric utility costs are \$2,360 higher, when compared to the average estimated NJ commercial utility rates. Electric bill analysis shows fluctuations up to 89% over the most recent 12 month period.



Utility rate fluctuations may have been caused by adjustments between estimated and actual meter readings; others may be due to unusual high and recent escalating energy costs.

SWA recommends that the Township further explore opportunities of purchasing electricity from third-party suppliers in order to reduce rate fluctuation and ultimately reduce the annual cost of energy for the Par 3 building. Appendix C contains a complete list of third-party energy suppliers for the Millburn 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 April 8, 2010, the following data was collected and analyzed.

2.1. Building Characteristics

The one story 2,960 square feet Millburn Par 3 building was originally constructed in 1970. The building contains a deck, restrooms, and an area for employees of the golf course.



Right Side Façade



Partial Front Façade (typ.)

2.2. Building occupancy profiles

The building occupancy is 2-3 employees from April 1st through November 1st from 7:30am to 7:30pm, 7 days per week.

2.3. Building envelope

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

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

2.3.1. Exterior Walls

The exterior wall envelope is mostly constructed of exterior grade plywood with no detectable insulation. Below grade foundation walls are poured concrete.

Exterior and interior wall surfaces were inspected during the field audit. A mold-like substance was found at the base of a gypsum board interior wall. The carpet flooring at the base of the wall was wet at the time of the audit. They were found to be in overall acceptable, age-appropriate condition with some signs of uncontrolled moisture, air-leakage and other energy-compromising issues.

The following specific interior wall/floor problem spots and areas were identified:



Mold-like substance found at base of interior wall



Wet carpet in corner of office area

2.3.2. Roof

The building's roof is a medium-pitch shed type over a wood structure, with an asphalt shingle finish. There is no detectable insulation.

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



Asphalt shingle roof in good condition

2.3.3. Base

The building's base is composed of a below grade garage floor and no detectable slab edge/perimeter insulation.

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, age appropriate condition with no signs of uncontrolled moisture, air-leakage and/or other energy-compromising issues.

2.3.4. Windows

The building contains vinyl framed, clear, double glazed windows. Windows are in good condition with no obvious signs of damage.

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 acceptable/age appropriate condition with no signs of uncontrolled moisture, air-leakage and/or other energy-compromising issues.



Typical window

2.3.5. Exterior doors

The building contains both a fiberglass type exterior doors and overhead type wood garage doors.

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 acceptable condition with no signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

2.3.6. Building air tightness

Overall the field auditors found the building to be not adequately air-tight with numerous 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.

2.4. Mechanical Systems

Heating Ventilation Air Conditioning

Equipment

The Par 3 building is heated with electric space heaters. The heaters are manually operated using dial thermostats, in excessive use during the shoulder months of April and October at the start and end of the golfing season. A comprehensive Equipment List can be found in Appendix A.



Electric heaters serving bathroom and office area

Cooling is provided by a through-wall air conditioner unit serving the office area. This Frigidaire unit is operated manually by the users during cooling season.



Frigidaire through-wall air conditioner unit

There are two exhaust fans serving the men's and women's restrooms. Each fan is operated by a switch near the entry doors. Generally, the building exhaust fans have an estimated 10% useful operating life left.

Distribution Systems

Heating is provided to the building spaces via electric heaters located in each room. Cooling is provided by a thru-wall AC unit that brings outside air through a filter and delivers conditioned air to the space.

Controls

The heating and cooling equipment is controlled by manual thermostats located on each piece of equipment. These dial thermostats typically have a low, high and off setting to control the temperature of the building space.



Control for electric heater in garage

Domestic Hot Water

The domestic hot water (DHW) for the Par 3 building is provided by an AO Smith ProMax ECS 40 200 electric water heater with 40 gal storage and 2 electric coil heating elements. The hot water tank closet location is close to the men's and women's restroom which it serves.



Water heater in closet

This heater has 50% estimated useful operating life remaining and appears in good condition. SWA was told by building maintenance personnel that all plumbing lines are drained as the building is prepped for winterization.

2.5. Electrical systems

Lighting

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

Interior Lighting - The Millburn Par 3 building currently consists of a mixture of efficient T8 bulbs with electronic ballasts, less efficient T12 bulbs with magnetic ballasts, compact fluorescent bulbs, and incandescent bulbs. SWA recommends replacing incandescent bulbs with compact fluorescent bulbs. SWA also recommends replacement of all T12 lamps and

magnetic ballasts with T8 lamps with electronic ballasts. Based on measurements of day light and artificial lighting levels for each space, there are not any vastly over-illuminated areas. SWA recommends delamping in office areas (front & back office areas).

SWA also recommends installing occupancy sensors in the office area, back room, and garage which may be intermittently used during the day and where payback on savings is justified. Typically, occupancy sensors have an adjustable time delay that shuts down the lights automatically if no motion or sound is detected within a set time period.

Exit Lights - Exit signs were found to be LED type fixtures. SWA does not recommend any changes to the exit signs at this time.

Exterior Lighting - SWA recommends replacing the metal halide lights with pulse start metal halides to decrease the energy usage for the same amount of light and longer useful life. The exterior lighting is controlled by photocell sensors. SWA suggests installing covers over the sensors during shoulder months when the building is not in use.

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, radio and dispatch equipment, refrigerators, vending machines, printers, etc. 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.

Vending Machines – The Par 3 building contains three separate vending machines; two refrigerated (“drink type”) vending machines and one non-refrigerated (“snack type”) vending machine.



Two refrigerated and one non-refrigerated vending machine

Elevators

The Par 3 building does not have an installed elevator.

Other electrical systems

There are not currently any other significant energy-impacting electrical systems installed at the Par 3 building. However, space heaters and dehumidifiers can impact the electrical load and should be used sparingly, on an as needed basis.

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 state and federal 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. Technology such as photovoltaic panels or wind turbines, use natural resources to generate electricity on the site. Geothermal systems offset the thermal loads in a building by using water stored in the ground as either a heat sink or heat source. Solar thermal collectors heat a specified volume of water, reducing the amount of energy required to heat water using building equipment. Cogeneration or CHP allows you to generate electricity locally, while also taking advantage of heat wasted during the generation process.

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 Par 3 building is not a good candidate for a Solar Panel installation. There is insufficient roof space for panels to reasonably supplement the power consumption of the building.

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.

Geothermal

The Par 3 building is not a good candidate for geothermal installation since it would require replacement of the entire existing HVAC system, which would not make financial sense for a building of this size.

Combined Heat and Power

The Par 3 building 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 high electrical baseload to accommodate the electricity generated, as well as a means for using waste heat generated. Typical applications include buildings with an absorption chiller, where waste heat would be used efficiently.

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

ECM#	Description of 0-5 Year Payback ECMs
1	Install 3 Vending Miser devices
2	Install programmable thermostats for electric heaters
Description of 5-10 Year Payback ECMs	
2	Install 2 new CFL lamps
3	Install 5 new Pulse Start Metal Halide fixtures
4	Install 3 new Occupancy Sensors
Description of Recommended > 10 Year Payback ECMs	
5	Install 8 new T8 fluorescent fixtures

ECM#1: *Install 3 Vending Miser devices*

Description:

The Par 3 building has two drinks vending machines and one snacks vending machine. Energy vending miser devices are now available for conserving energy with these machines. There is not a need to purchase new machines to reduce operating costs and greenhouse gas emissions. When equipped with the vending miser devices, refrigerated beverage vending machines or coolers use less energy and are comparable in daily energy performance to new ENERGY STAR® qualified machines. Vending miser devices incorporate innovative energy-saving technology into small plug-and-play devices that installs in minutes, either on the wall or on the vending machine. Vending miser devices use a Passive Infrared Sensor (PIR) to: Power down the machine when the surrounding area is vacant; Monitor the room's temperature; Automatically repower the cooling system at one- to three-hour intervals, independent of sales; Ensure the product stays cold. Snacks vending miser devices power down display lighting only since these machines do not include refrigeration.

Installation cost:

Estimated installed cost: \$497 (includes \$60 labor)

Source of cost estimate: Vendor

ECM	Net est. cost with incentives, \$	kWh, 1st year savings	kW, demand reduction	therms, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, \$	Total 1st year savings, \$	Life of measure, years	Est. lifetime energy cost savings, \$	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, \$	CO ₂ reduced, lbs/year
1	497	3,262	4.7	0	3.8	0	848	10	8,481	0.6	16	2	2	6,664	5,841

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA assumes energy savings based on the daily operation of 84 hours per week. The savings estimates are based on 84 hours per week, 52 weeks per year; however, the building is operated seasonally and it is recommended that the vending machines are turned off completely when the building is not operated in order to maximize energy savings. Vending Miser calculations can be found in Appendix H of this report.

Rebates/financial incentives:

- *None*

Please see Appendix F for more information on Incentive Programs

ECM#2: Install programmable thermostats for electric heaters

Description:

The Par 3 building contains 6 electric heaters, which includes 2 heaters that are located in the garage area. These electric heaters are currently operated manually by dial thermostats located on each unit. The building is operated seasonally; however billing analysis shows that approximately 13,482 kWh were used for electric heating. SWA recommends that the electric heaters are connected to programmable thermostats to limit the amount of unnecessary heating occurs based on thermostats being left on during the golf season.

Installation cost:

Estimated installed cost: \$720 (includes \$120 labor)

Source of cost estimate: *RS Means; Published and established costs, NJ Clean Energy Program*

ECM	Net est. cost with incentives, \$	kWh, 1st year savings	kW, demand reduction	therms, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, \$	Total 1st year savings, \$	Life of measure, years	Est. lifetime energy cost savings, \$	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, \$	CO ₂ reduced, lbs/year
2	720	1,465	2.5	0	1.7	0	381	10	3,809	1.9	4	0	1	2,496	2,623

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA assumes energy savings based on the daily operation of 84 hours per week and a reduction of approximately 10% of excessive heating usage.

Rebates/financial incentives:

- None

Please see Appendix F for more information on Incentive Programs

ECM#3: Install 2 new CFL lamps

Description:

The Par 3 building contains 2 light fixtures that contained incandescent lamps. CFL lamps are capable of producing the same light levels while reducing related electricity consumption by 2/3. SWA recommends that the Township of Millburn always use CFL lamps as opposed to incandescent bulbs.

Installation cost:

Estimated installed cost: \$25 (includes \$10 labor)

Source of cost estimate: *RS Means; Published and established costs, NJ Clean Energy Program*

ECM	Net est. cost with incentives, \$	kWh, 1st year savings	kW, demand reduction	therms, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, \$	Total 1st year savings, \$	Life of measure, years	Est. lifetime energy cost savings, \$	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, \$	CO ₂ reduced, lbs/year
3	25	4	0.0	0	0.0	3	4	10	40	6.2	1	0	0	9	7

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. The replacements for each lighting fixture, the costs to replace or retrofit each one, and the rebates and wattages for each fixture are located in Appendix B.

Rebates/financial incentives:

- None

Please see Appendix F for more information on Incentive Programs

ECM#4: Install 5 new Pulse Start Metal Halide fixtures

Description:

The Par 3 building contains 5 Probe Start Metal Halide light fixtures used for exterior lighting that are operated by photocell sensors. . SWA recommends replacing these probe start metal halide lights with pulse start metal halides to decrease the energy usage for the same amount of light and longer useful life. SWA suggests installing covers over the sensors during shoulder months when the building is not in use, if exterior lighting is not needed for security purposes.

Installation cost:

Estimated installed cost: \$25 (includes \$10 labor)

Source of cost estimate: *RS Means; Published and established costs, NJ Clean Energy Program*

ECM	Net est. cost with incentives, \$	kWh, 1st year savings	kW, demand reduction	therms, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, \$	Total 1st year savings, \$	Life of measure, years	Est. lifetime energy cost savings, \$	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, \$	CO ₂ reduced, lbs/year
4	2,503	713	1.2	0	0.8	217	402	15	6,036	6.2	1	0	0	2,232	1,277

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. The replacements for each lighting fixture, the costs to replace or retrofit each one, and the rebates and wattages for each fixture are located in Appendix B.

Rebates/financial incentives:

- *NJ Clean Energy – SmartStart – Metal Halide with Probe Start (\$25 per fixture); Maximum incentive amount is \$100*

Please see Appendix F for more information on Incentive Programs

ECM#5: *Install 3 new Occupancy Sensors*

Description:

All interior lighting at the Par 3 building is operated via switches, located near the entrance of each room. SWA identified 3 areas; the office area, the back room and the garage which may all benefit from the installation of passive infrared sensors. Typically, occupancy sensors have an adjustable time delay that shuts down the lights automatically if no motion or sound is detected within a set time period.

Installation cost:

Estimated installed cost: \$600 (includes \$60 labor)

Source of cost estimate: *RS Means; Published and established costs, NJ Clean Energy Program*

ECM	Net est. cost with incentives, \$	kWh, 1st year savings	kW, demand reduction	therms, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, \$	Total 1st year savings, \$	Life of measure, years	Est. lifetime energy cost savings, \$	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, \$	CO ₂ reduced, lbs/year
5	600	272	0.4	0	0.3	0	71	10	707	8.5	0	0	0	-3	487

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. The replacements for each lighting fixture, the costs to replace or retrofit each one, and the rebates and wattages for each fixture are located in Appendix B.

Rebates/financial incentives:

- *NJ Clean Energy – SmartStart – Wall-mounted Occupancy Sensors (\$20 per sensor) - Maximum incentive amount is \$60*

Please see Appendix F for more information on Incentive Programs

ECM#6: Install 8 new T8 fluorescent fixtures

Description:

On the days of the site visits, SWA completed a lighting inventory of the Par 3 building (see Appendix B). The existing lighting at the Millburn Par 3 building consists of a mixture of efficient T8 bulbs with electronic ballasts, less efficient T12 bulbs with magnetic ballasts, compact fluorescent bulbs, and incandescent bulbs. SWA recommends replacement of all T12 lamps and magnetic ballasts with T8 lamps with electronic ballasts. Based on measurements of day light and artificial lighting levels for each space, there are not any vastly over-illuminated areas. SWA recommends delamping in office areas (front & back office areas).

Installation cost:

Estimated installed cost: \$1,171 (includes \$240 labor)

Source of cost estimate: *RS Means; Published and established costs, NJ Clean Energy Program*

ECM	Net est. cost with incentives, \$	kWh, 1st year savings	kW, demand reduction	therms, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, \$	Total 1st year savings, \$	Life of measure, years	Est. lifetime energy cost savings, \$	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, \$	CO ₂ reduced, lbs/year
6	1,171	319	0.5	0	0.4	26	109	15	1,634	10.7	0	0	0	111	571

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. The replacements for each lighting fixture, the costs to replace or retrofit each one, and the rebates and wattages for each fixture are located in Appendix B.

Rebates/financial incentives:

- *NJ Clean Energy – SmartStart – T8 fluorescent fixtures (\$15 per sensor); Maximum incentive amount is \$120*

Please see Appendix F 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. 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 Par 3 building:

- Insulate original un-insulated exterior wall sections of office area. SWA suggests inserting blown insulation, such as cellulose, into wall cavities (either from interior or exterior) for a minimum R19 insulation.
- Install ceiling insulation in office area, to achieve minimal building code requirements. SWA recommends installing R30 to the ceiling at minimum.
- Replace un-insulated original garage overhead doors when time for replacement with insulated garage doors, weather-stripped to create a tight seal
- Replace restroom exhaust fans – SWA observed that the restroom exhaust fans are currently operating beyond their useful lifetime. The exhaust fans are currently operating and would not be cost-effective to replace; however, SWA recommends replacing these exhaust fans with newer, more efficient exhaust fans as they fail.
- Replace all electric heaters – SWA observed that all 6 electric heaters are original to the building (1970) and are currently operating beyond their useful lifetime. SWA recommends replacing these heaters with new units as they fail.
- When replacement is warranted, install ENERGY STAR® correctly sized window/wall air conditioner units

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 or costs.

- Mold-like substance at base of interior gypsum wall board should be investigated and possible cause of water infiltration into wall cavities should be investigated.
- Clean and maintain gutters, downspouts and downspout deflectors to minimize uncontrolled roof water run-off causing exterior wall damage.
- Maintain/inspect all roof surfaces on a regular basis. SWA recommends investigating the roof for leaks, deteriorating roof finishes and damaged or compromised roof and valley flashing. Inspect and maintain all roof surfaces on a regular basis.

- Maintain caulk around window frames, sills, and seal around perimeter of air conditioner window/wall units. Maintain sealants and caulks at all windows for airtight performance. The perimeter of all window frames should also be regularly inspected, and any missing or deteriorated caulking should be re-caulked to provide an unbroken seal around the window frames.
- Maintain weather-stripping around all exterior doors. Doors and vestibules should be observed annually for deficient weather-stripping and replaced as needed.
- Overgrown ground vegetation should be trimmed to not touch or block exterior wall surfaces from access, ventilation and sunlight. For best practice, SWA recommends plants minimum installation distance to be no less than 24” from the building. This will help to maintain a better distance between root systems potentially causing damage to foundation walls.
- Perform and maintain air-sealing - Penetrations in the thermal envelope should be sealed with caulk or spray foam. Areas to investigate include HVAC, plumbing, and electrical penetrations, chimney and duct chases and around windows and doors. Air sealing will help to reduce energy loss of expensive conditioned air and prevent rodents or pests from entry into the building.
- Provide water-efficient fixtures and controls - Adding controlled on/off timers on all lavatory faucets is a cost-effective way to reduce domestic hot water demand and save water. Building staff can also easily replace 2.2gpm faucet aerators with 0.5gpm 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.
- 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>.
- Maintain downspouts and cap flashing - Slope perimeter grade away from building to maximize site drainage. SWA recommends round downspout elbows to minimize clogging.
- 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 their energy use. The US 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

Inventory

Building System	Description	Model #	Fuel	Location	Space Served	Date Installed	Estimated Remaining Useful Life %
Heating	wall insert electric heater	Singer	Electric	Office area	Office	1970	0%
Heating	wall insert electric heater	Singer	Electric	Office area	Office	1970	0%
Heating	wall mounted electric heater	Singer	Electric	Office area	Office	1970	0%
Heating	ceiling mounted electric heater	Singer	Electric	Garage area	Garage area	1970	0%
Heating	ceiling mounted electric heater	Singer	Electric	Garage area	Garage area	1970	0%
Heating	ceiling mounted electric heater	Singer	Electric	Garage area	Garage area	1970	0%
Cooling	AC wall unit	Frigidaire	Electric	Office area	Par 3 building	2005	60%
Ventilation	exhaust fan for bathrooms	NA	Electric	Restroom ceilings	Restrooms	2002	20%
Domestic Hot Water	40 gal storage, 2 coils, 4,500 Watt upper and 4,500 Watt lower, 80% est. eff.	AO Smith ProMax ECS 40 200	Electric	Closet near restroom	Par 3 building	2005	50%
Lighting	See details - Appendix B	-	Electric	See details - Appendix B	Par 3 building	-	70%

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 Men	Recessed Parabolic	M	8'T12	1	2	80	OS	6	210	20	180	227	T8	Recessed Parabolic	8'T8	E	OS	1	2	59	6	210	7	125	158	69	0	69
2	1	Bathroom Women	Recessed Parabolic	M	8'T12	1	2	80	OS	6	210	20	180	227	T8	Recessed Parabolic	8'T8	E	OS	1	2	59	6	210	7	125	158	69	0	69
3	1	Water Heater Closet	Ceiling Mounted	S	CFL	1	1	23	Sw	0.25	210	0	23	1	N/A	Ceiling Mounted	CFL	S	Sw	1	1	23	0	210	0	23	1	0	0	0
4	1	Exterior	Spotlight	S	MH	4	1	70	PC	9	365	20	358	1,177	PSMH	Spotlight	PSMH	S	PC	4	1	70	9	210	14	336	635	464	0	542
5	1	Front Desk	Recessed Parabolic	E	4'T8	1	4	32	Sw	8	210	5	133	223	C	Recessed Parabolic	4'T8	E	OS	1	2	32	6	210	5	69	97	108	29	137
6	1	Back Room	Recessed Parabolic	E	4'T8	5	4	32	Sw	8	210	5	665	1,117	C	Recessed Parabolic	4'T8	E	OS	5	2	32	6	210	5	345	435	538	145	683
7	1	Front Desk	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
8	Ext	Outside Garage	Spotlight	S	MH	1	1	150	PC	9	365	42	192	631	PSMH	Spotlight	PSMH	S	PC	1	1	150	9	210	30	180	340	249	0	291
9	Bsmt	Garage	Parabolic Ceiling Mounted	M	8'T12	5	2	80	Sw	3	210	20	900	567	T8	Parabolic Ceiling Mounted	8'T8	E	OS	5	2	59	2	210	7	625	295	173	98	272
10	Bsmt	Storage Closet	Ceiling Mounted	S	Inc	2	1	60	Sw	0.25	210	0	120	6	CFL	Ceiling Mounted	CFL	S	Sw	2	1	20	0	210	0	40	2	4	0	4
11	Bsmt	Staircase	Parabolic Wall Mounted	M	8'T12	1	1	80	Sw	1	210	20	100	21	T8	Parabolic Wall Mounted	8'T8	E	Sw	1	1	59	1	210	7	66	14	7	0	7
Totals:						23	20	692				152	2,857	4,246						23	16	568			83	1,940	2,173	1,681	272	2,073

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

Legend

Fixture Type		Lamp Type		Control Type		Ballast Type		Retrofit Category	
Ceiling Suspended	Recessed	CFL	3'T12	8'T5	Autom. Timer (T)	S (Self)	N/A (None)		
Exit Sign	Sconce	Inc	3'T12 U-Shaped	8'T5 U-Shaped	Bi-Level (BL)	E (Electronic)	T8 (Install new T8)		
High Bay	Spotlight	LED	3'T5	8'T8	Contact (Ct)	M (Magnetic)	T5 (Install new T5)		
Parabolic Ceiling Mounted	Track	HPS	3'T5 U-Shaped	8'T8 U-Shaped	Daylight & Motion (M)		CFL (Install new CFL)		
Parabolic Ceiling Suspended	Vanity	MH	3'T8	Circline - T5	Daylight & Switch (DLSw)		LEDex (Install new LED Exit)		
Pendant	Wall Mounted	MV	3'T8 U-Shaped	Circline - T8	Daylight Sensor (DL)		LED (Install new LED)		
Recessed Parabolic	Wall Suspended	1T12	4'T5	Circline - T12	Delay Switch (DSw)		D (Delamping)		
Ceiling Mounted	Wallpack	1T12 U-Shaped	4'T5 U-Shaped	Fl.	Dimmer (D)		C (Controls Only)		
Chandelier		1T5	6'T12	Hal	Motion Sensor (MS)		PSMH (Install new Pulse-Start Metal Halide)		
Equipment / Fume Hood		1T5 U-Shaped	6'T12 U-Shaped	Induction	Motion & Switch (MSw)				
Flood		1T8	6'T5	Infrared	None (N)				
Landscape		1T8 U-Shaped	6'T5 U-Shaped	LPS	Occupancy Sensor (OS)				
Low Bay		2T12 U-Shaped	6'T8	Mixed Vapor	Occupancy Sensor - CM (OSCM)				
Parabolic Wall Mounted		2T5	6'T8 U-Shaped	Neon	Photocell (PC)				
Pole Mounted		2T5 U-Shaped	8'T12	Quartz Halogen	Switch (Sw)				
Pole Mounted Off Building		2T8 U-Shaped	8'T12 U-Shaped						

APPENDIX C: THIRD PARTY ENERGY SUPPLIERS

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

Third Party Electric Suppliers for JCPL Service Territory	Telephone & Web Site
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.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
Constellation NewEnergy, Inc. 900A Lake Street, Suite 2 Ramsey, NJ 07446	(888) 635-0827 www.newenergy.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
Integritys Energy Services, Inc. 99 Wood Ave, South, Suite 802 Iselin, NJ 08830	(877) 763-9977 www.integritysenergy.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
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

APPENDIX D: 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 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 measure (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 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:

	A	B	C	D	E	F	G	H	I
1									
2									
3					Year	Cash Flow			
4					0	\$ (5,000.00)	← Investment Cost		
5					1	\$ 850.00	} Cash Flow: Annual Energy Cost Savings + Annual Maintenance Savings		
6					2	\$ 850.00			
7					3	\$ 850.00			
8					4	\$ 850.00			
9					5	\$ 850.00			
10					6	\$ 850.00			
11					7	\$ 850.00			
12					8	\$ 850.00			
13					9	\$ 850.00			
14					10	\$ 850.00			
15									
16					IRR	11.03%	← Formula: =IRR(F4:F14) =NPV(0.03,F5:F14)+F4		
17					NPV	\$2,250.67			

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
Incentive 1:	NJ Renewable Energy Incentive Program (REIP), for systems of size 50kW or less, \$1/Watt incentive subtracted from installation cost
Incentive 2:	Solar Renewable Energy Credits (SRECs) – Market-rate incentive. Calculations assume \$600/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 + \$600/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 & Industrial Lifetimes

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 E: STATEMENT OF ENERGY PERFORMANCE FROM ENERGY STAR®

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE Township of Millburn - Par 3

Building ID: 2243850
For 12-month Period Ending: January 31, 2010¹
Date SEP becomes ineligible: N/A

Date SEP Generated: April 15, 2010

Facility Township of Millburn - Par 3 335 White Oak Ridge Road Short Hills, NJ 07041	Facility Owner N/A	Primary Contact for this Facility N/A
Year Built: 1970		
Gross Floor Area (ft²): 2,960		

Energy Performance Rating² (1-100) N/A

Site Energy Use Summary³

Electricity - Grid Purchase(kBtu)	80,833
Natural Gas - (kBtu) ⁴	0
Total Energy (kBtu)	80,833

Energy Intensity⁵

Site (kBtu/ft ² /yr)	27
Source (kBtu/ft ² /yr)	91

Emissions (based on site energy use)

Greenhouse Gas Emissions (MtCO ₂ e/year)	12
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Electric Distribution Utility

FirstEnergy - Jersey Central Power & Lt Co

National Average Comparison

National Average Site EUI	104
National Average Source EUI	213
% Difference from National Average Source EUI	-57%
Building Type	Other

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.

Meets Industry Standards⁶ for Indoor Environmental Conditions:

Ventilation for Acceptable Indoor Air Quality	N/A
Acceptable Thermal Environmental Conditions	N/A
Adequate Illumination	N/A

Certifying Professional
N/A

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

The government estimates the average time needed to fill out this form is 6 hours (includes the time for entering energy data, PE facility inspection, and notarizing the SEP) and welcomes suggestions for reducing this level of effort. Send comments (referencing OMB control number) to the Director, Collection Strategies Division, U.S. EPA (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460.

EPA Form 5900-16

APPENDIX F: 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.

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

Direct Install 2010 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 60%** of the retrofit costs, including equipment cost and installation costs.

Eligibility:

- Existing small and mid-sized commercial and industrial facilities with peak electrical demand **below 200 kW** within 12 months of applying
- Must be located in New Jersey
- Must be served by one of the state's public, regulated or natural gas companies
 - Electric: Atlantic City Electric, Jersey Central Power & Light, Orange Rockland Electric, PSE&G
 - Natural Gas: Elizabethtown Gas, New Jersey Natural Gas, PSE&G, South Jersey Gas

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>

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.

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>.

Utility Sponsored Programs

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

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/>.

APPENDIX G: ENERGY CONSERVATION MEASURES

Energy Conservation Measures																			
ECM #	ECM description	Cost Source	Est. installed cost, \$	Est. incentives, \$	Net est. cost with incentives, \$	kWh, 1st year savings	kW, demand reduction	therms, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, \$	Total 1st year savings, \$	Life of measure, years	Est. lifetime energy cost savings, \$	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, \$	CO ₂ reduced, lbs/year
1	Install 3 VendingMiser devices	Vendor	497	0	497	3,262	4.7	0	3.8	0	848	10	8,481	0.6	16	2	2	6,664	5,841
2	Install programmable thermostats for electric heaters	RS Means	720	0	720	1,465	2.5	0	1.7	0	381	10	3,809	1.9	4	0	1	2,496	2,623
3	Install 2 new CFL lamps	RS Means	25	0	25	4	0.0	0	0.0	3	4	10	40	6.2	1	0	0	9	7
4	Install 5 new Pulse Start Metal Halide fixtures	RS Means	2,628	125	2,503	713	1.2	0	0.8	217	402	15	6,036	6.2	1	0	0	2,232	1,277
5	Install 3 new Occupancy sensors	RS Means	660	60	600	272	0.4	0	0.3	0	71	10	707	8.5	0	0	0	-3	487
6	Install 8 new T8 fluorescent fixtures	RS Means	1,291	120	1,171	319	0.5	0	0.4	26	109	15	1,634	10.7	0	0	0	111	571
TOTALS			5,821	305	5,516	6,035	9.3	0	7.0	246	1,815	-	20,708	3.0	-	-	-	11,510	10,806

APPENDIX H: VENDING MISER CALCULATION TOOL



EnergyMisers

[VendingMiser®](#)
 [CoolerMiser™](#)
 [SnackMiser™](#)
 [PlugMiser™](#)
 [VM2iQ®](#)
 [CM2iQ®](#)

Savings Calculator

Please replace the default values in the table below with your location's unique information and then click on the "calculate savings" button.

Note: To calculate for CoderMiser, use the equivalent VendingMiser results. To calculate for PlugMiser, use the equivalent SnackMiser results.

Energy Costs (\$0.000 per kWh)	\$0.260
Facility Occupied Hours per Week	84
Number of Cold Drink Vending Machines	2
Number of Non-refrigerated Snack Machines	1
Power Requirements of Cold Drink Machine (Watts; 400 typical)	400
Power Requirements of Snack Machine (Watts; 80 typical)	80
VendingMiser® Sale Price (for cold drink machines)	\$199.00
SnackMiser™ Sale Price (for snack machines)	\$99.00

Results of your location's projected savings with VendingMiser® installed:

	Current	Projected	Total Savings	% Savings
COLD DRINK MACHINES				
kWh	6989	4077	2912	42%
Cost of Operation	\$1,817.09	\$1,059.97	\$757.12	42%
SNACK MACHINES				
kWh	699	349	349	50%
Cost of Operation	\$181.71	\$90.85	\$90.85	50%

Location's Total Annual Savings

	Current	Projected	Total Savings	% Savings
kWh	7688	4426	3262	42%
Cost of Operation	\$1,998.80	\$1,150.82	\$847.97	42%

Total Project Cost Break Even (Months)

\$497 7.03

Estimated Five Year Savings on ALL Machines = \$4,239.87

APPENDIX I: METHOD OF ANALYSIS

Assumptions and tools

Energy modeling tool: Established/standard industry assumptions
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.