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June 28, 2010

Local Government Energy Program
Energy Audit Report

Township of Livingston

Northland Pool and Recreation Center
3 Madison Court
Livingston, NJ 07039

Project Number: LGEA50

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INTRODUCTION

As an approved energy consulting firm under the Local Government Energy Audit Program (LGEA), Steven Winter Associates, Inc. (SWA) was selected to perform an energy audit and assessment for the Township of Livingston. The audit included a review of the following buildings located in the Township of Livingston for which separate energy audit reports are issued for each of the following referenced buildings:

- Municipal Court
- Main Fire Department
- Northfield Fire Department
- Circle Fire Station
- Township Garage
- Livingston Free Public Library
- Senior & Community Center
- Water Department
- Monmouth Court Community Center
- Well House No. 3, Building 1
- Well House No. 3, Building 2
- Well House No. 4
- Well House No. 9
- Well House No. 11
- Okner Field Concession Building
- Storage Shed
- Northland Pool and Recreation Center
- Sewage Treatment Plant
- Animal Shelter
- Pump House
- Booster Station
- Sewer Station

This report addresses the Northland Pool and Recreation Center located at 3 Madison Court, Livingston NJ. The current conditions and energy-related information were collected in order to analyze and suggest the implementation of building improvements and energy conservation measures.

The Northland Pool and Recreation Center located at 3 Madison Court was opened in 1965. The Recreation center is home to a main pool, children's pool, small pump house, below ground pump room, and main recreation center. The main recreation center is a single story free standing building with basement and approximately 8,700 square feet of conditioned space. The building includes meeting / game rooms, concession stand, offices, mechanical rooms, showers, locker rooms, and storage. The pool portion of the facility is open June 1st to September 1st from 10:00 AM to 8:00 PM. The main recreation center is open weekdays year round. There are approximately 15 employees on staff at the pool with a large fluctuating amount of visitors to the pool and recreation center.

The goal of this Local Government Energy Audit (LGEA) is to provide sufficient information to the Township of Livingston to make decisions regarding the implementation of the most appropriate and most cost effective energy conservation measures for the building.

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

- Section 1 and section 2 of the report cover a description and analysis of the building existing conditions.
- Section 3 provides a detail inventory of major electrical and mechanical systems in the building.
- Sections 4 through 5 provide a description of our recommendations.
- Appendices include further details and information supporting our recommendations.

EXECUTIVE SUMMARY

The Northland Pool and Recreation Center located at 3 Madison Court was opened in 1965. The Recreation center is home to a main pool, children's pool, small pump house, below ground pump room, and main recreation center. The main recreation center is a single story free standing building with basement and approximately 8,700 square feet of conditioned space. The building includes meeting / game rooms, concession stand, offices, mechanical rooms, showers, locker rooms, and storage. The pool portion of the facility is open June 1st to September 1st from 10:00 AM to 8:00 PM. The main recreation center is open weekdays year round. There are approximately 15 employees on staff at the pool with a large fluctuating amount of visitors to the pool and recreation center.

Based on the field visit performed by the SWA staff on January 25, 2010 and the results of a comprehensive energy analysis, this report describes the site's current conditions and recommendations for improvements. Suggestions for measures related to energy conservation and improved comfort are provided in the scope of work. Energy and resource savings are estimated for each measure that results in a reduction of heating, cooling, and electric usage.

Existing conditions

From March 2008 through February 2009, the period of analysis for this audit, the building consumed 127,120 kWh or $22,206 worth of electricity at an approximate rate of $0.175/kWh and 7,438 therms or $10,447 worth of natural gas at an approximate rate of $1.404/therm. The joint energy consumption for the building, including both electricity and fossil fuel was 1,178 MMBTUs of energy that cost a total of $32,653.

SWA has entered energy information about the recreation center in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. Currently, the building is not eligible to receive a performance rating because it is classified as an "other" space type which means that it is still ineligible for Energy Star. SWA encourages the Township of Livingston to continue entering utility data in *Energy Star Portfolio Manager* in order to track weather normalized source energy use over time.

The Site Energy Use Intensity is 139.5 kBtu/sq ft yr compared to the national average of "other" space type building consuming 104.0 kBtu/sq ft yr. Implementing this report's recommended Energy Conservations Measures (ECMs) will reduce use by approximately 9.7 kBtu/ sq ft yr, which would decrease the building's energy use intensity to 129.8 kBtu/sq ft yr.

Recommendations

The Northland Pool and Recreation Center is forty-five years old, and some of the HVAC equipment has exceeded their recommended useful life cycle and further, much of the lighting is inefficient. In

Appendix C, SWA has included a mechanical inventory list of equipment for the Northland Pool and Recreation Center. Based on the assessment of the building, SWA has separated the recommendations into three categories (See Section 4 for more details). These are summarized as follows:

Category I Recommendations: - Capital Improvements

- Replace common area heating equipment
- Replace the five (5) rooftop exhaust fans.
- Insulate original and uninsulated exterior wall sections.
- Install footing drains and slope perimeter grade away from building. SWA suggests investigating interior footing drain option.
- Install/ repair and maintain flashing to minimize uncontrolled wind driven and roof water run-off causing exterior wall damage.
- Install/ repair and maintain gutters, downspouts and downspout deflectors to minimize uncontrolled roof water run-off causing exterior wall damage.
- Install/ repair and maintain roof flashing.
- Properly seal and insulate window lintel to eliminate thermal break.
- Install/ repair pan or strip flashing and drip edge detail at window sill.
- Replace/ add/maintain caulk around window frames and sills.
- Replace missing or damaged weather-stripping.
- Install caulking and insulation around door lintels to prevent thermal bridging.

Category II Recommendations: - Operations and Maintenance

- Boiler room and attic piping insulation
- Water levels in the expansion tank and the integrity of the tank bladder should be checked to confirm proper operation.
- Tighten belts on exhaust fans.
- Install premium motors when replacements are required
- Use Energy Star labeled appliances
- Maintain and inspect all exterior wall surfaces with a focus on the condition of caulking, displaced brick or concrete blocks, signs of water damage and locations that correspond to areas of known infiltration.
- Maintain/ inspect all roof surfaces on a regular basis with a focus on the condition of the flashing, roofing membrane, drainage, signs of water pooling, signs of infiltration and locations that correspond to water damaged ceiling tiles.
- Maintain and inspect all exterior windows with a focus on the condition of the frames, water damage from the sills, air tight seal, and proper hardware operation.
- Maintain and inspect all doors with a focus on the condition of the weather-stripping, door frame, air tight seals and signs of water damage and infiltration.

Category III Recommendations: Energy Conservation Measures

At this time, SWA highly recommends a total of **5** Energy Conservation Measures (ECMs) for The Northland Pool and Recreation Center as summarized in the following Table 1. The total investment cost for these ECMs with incentives is **$3,928**. SWA estimates a first year savings of **$1,362** with a simple payback of **2.9 years**. SWA also recommends **7** ECMs with a 5-10 year payback that have

a total first year savings of **$3,324** as summarized in Table 2 and **2** End of Life Cycle ECMs that have a total first year savings of **$612** as summarized in Table 3.

The implementation of all the recommended ECMs would reduce the building electric usage by 24,652 kWh annually, or 19% of the building's current electric consumption. SWA estimates that implementing these ECMs will reduce the carbon footprint of The Northland Pool and Recreation Center by **33,979 lbs of CO_2**, which is equivalent to removing approximately 3 cars from the roads each year or avoiding the need of 111 trees to absorb the annual CO_2 produced. SWA also recommends that Township of Livingston contacts third party energy suppliers in order to negotiate a lower electricity rate. Comparing the current electric rate to average utility rates of similar type buildings in New Jersey, it may be possible to save up to $0.025/kWh, which would have equated to $3,178 for the past 12 months.

There are various incentives that Township of Livingston could apply for that could also help lower the cost of installing the ECMs. SWA recommends that the Township of Livingston apply for the NJ SmartStart program through the New Jersey Office of Clean Energy. This incentive can help provide technical assistance for the building in the implementation phase of any energy conservation project. A new NJ Clean Power program, Direct Install could also assist to cover up to 80% of the capital investment.

Renewable ECMs require application approval and negotiations with the utility and proof of performance. There is also a utility-sponsored loan program through PSE&G that would allow the building to pay for the installation of the PV system through a loan issued by PSE&G

The following three tables summarize the proposed Energy Conservation Measures (ECM) and their economic relevance.

Table 1 - Highly Recommended 0-5 Year Payback ECMs																		
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
2	Retrofit (2) cooler units with coolermiser devices	398	0	398	1,309	0.3	0	0.4	0	229	5	1,145	1.7	188%	38%	50	645	1,793
1.2	(13) New CFL fixtures to be installed	736	0	736	1,836	0.4	0	0.6	-3	318	5	1,589	2.3	116	23	33	711	2,515
3.1	replace (1) 25 Hp Main Pool pump motor with Premium Efficiency	1,600	130	1,470	2,688	0.6	0	1.1	0	470	20	9,408	3.1	540	27	32	5,528	3,683
1.5	(4) New occupancy sensors to be installed	880	80	800	1,288	0.3	0	0.4	0	225	15	3,381	3.5	323	22	27	1,852	1,765
1.3	(4) New LED exit sign fixtures to installed	604	80	524	329	0.1	0	0.1	63	120	15	1,806	4.4	245	16	22	893	451
	TOTALS	**4,218**	**290**	**3,928**	**7,450**	**1.7**	**0**	**2.6**	**60**	**1,362**	**60**	**17,329**	**2.9**	**-**	**-**	**-**	**9,629**	**10,207**

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

Table 2 - Recommended 5-10 Year Payback ECMs																		
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
3.2	replace (1) 1.5 Hp Main Pool Filter pump motor with Premium Efficiency	375	50	325	340	0.1	0	0.1	0	60	20	1,190	5.5	266	13	18	560	466
1.4	(4) New pulse start metal halide fixtures to be installed	2,836	100	2,736	1,077	0.2	0	0.4	212	401	15	6,016	6.8	120	8	12	1,983	1,476
1.1	(91) New T8 fixtures to be installed	19,594	1,365	18,229	13,020	2.7	0	4.3	352	2,630	15	39,457	6.9	116	8	12	12,723	17,837
3.3	replace (1) 5 Hp Umbrella Pump motor with Premium Efficiency	504	60	444	296	0.1	0	0.1	0	52	20	1,036	8.6	133	7	10	327	406
3.4	replace (1) 7.5 Hp Slide Pump motor with Premium Efficiency	692	90	602	408	0.1	0	0.2	0	71	20	1,428	8.4	137	7	10	460	559
6.1	Replace one (1) kitchen refrigerator with a 17 cu ft Energy Star model	475	0	475	425	0.1	0	0.1	0	55	12	543	8.6	14	1	6	75	582
6.2	Replace one (1) meeting room refrigerator with a 17 cu ft Energy Star model	475	0	475	425	0.1	0	0.1	0	55	12	543	8.6	14	1	6	75	582
	TOTALS	**24,951**	**1,665**	**23,286**	**15,991**	**3.4**	**0**	**5**	**564**	**3,324**	**-**	**50,213**	**7.0**	**-**	**-**	**-**	**16,203**	**21,908**

Table 3 - Recommended End of Life Cycle ECMs																		
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
3.5	replace (4) 3 Hp Children's Area Feature Pump motors with Premium Efficiency	1,996	240	1,756	936	0.2	0	0.4	0	164	20	3,276	10.7	87	4	7	681	1,282
5.1	replace 5 exhaust fans with premium efficiency units	16,000	200	15,800	275	0.1	0	0.0	400	448	10	481	35.3	-72	-7	6	75	582
	TOTALS	**17,996**	**440**	**17,556**	**1,211**	**0.3**	**0**	**0.4**	**400**	**612**	**30**	**3,757**	**28.7**	**-**	**-**	**-**	**756**	**1,864**

Note: For more details on End of Life Cycle ECMs and associated incremental cost for high efficiency equipment and performance see Section 4.

Table 4 - Description of Renewable ECMs																		
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
4	install 25.1 kW PV rooftop system with incentives	194,215	25,000	169,215	23,100	25	0	9.1	0	17,843	25	101,063	9.5	82.1	3.3	7.3	65,921	31,647

1. HISTORIC ENERGY CONSUMPTION

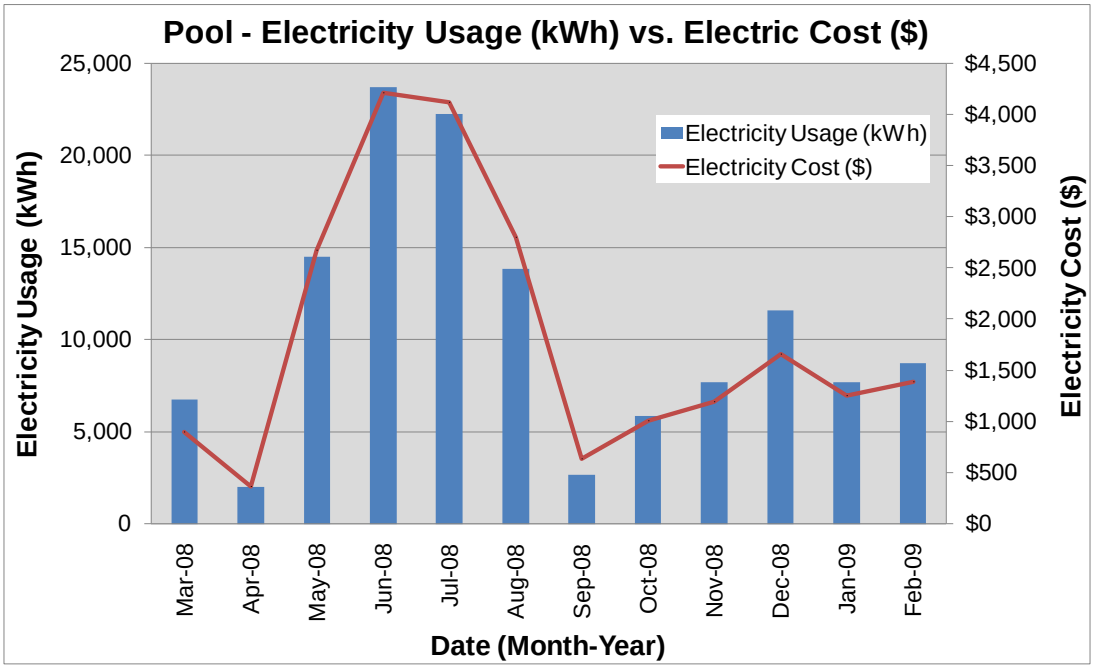
1.1. Energy usage, load profiles and cost analysis

SWA analyzed utility bills for the library for the 24 months between March 2007 to February 2009 with an analysis period between **March 2008 and February 2009**.

Electricity - The Northland Pool and Recreation Center buys electricity from PSE&G at **an average rate of $0.175/kWh** based on 12 months of utility bills from **March 2008 through February 2009**. The building purchased **approximately 127,120 kWh or $22,206 worth of electricity** during the analysis period and is currently charged for demand (kW) which has been factored into each monthly bill. The building had an average monthly demand of **28.2 kW** and an annual peak demand of **51.2 kW**.

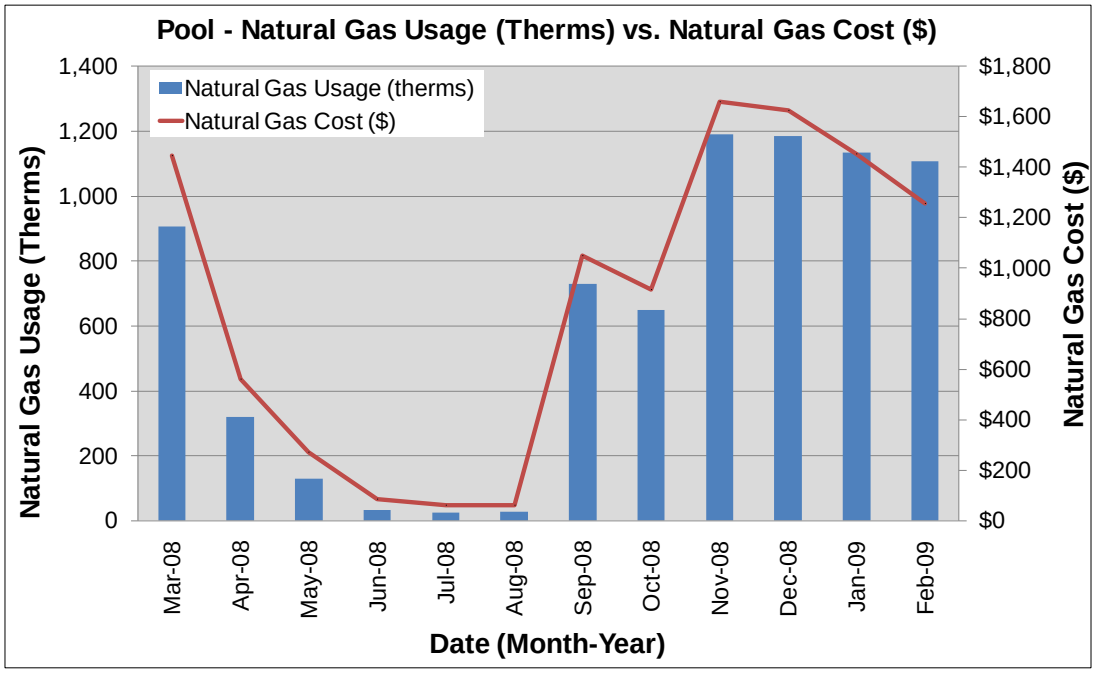
Natural gas – The Northland Pool and Recreation Center is currently served by two meters for natural gas. They currently buy natural gas from PSE&G which acts as the transportation company and energy supplier at **an average aggregated rate of $1.404/therm** and purchased **approximately 7,438 therms or $10,447 worth of natural gas** in the 12 months from March 2008 to February 2009.

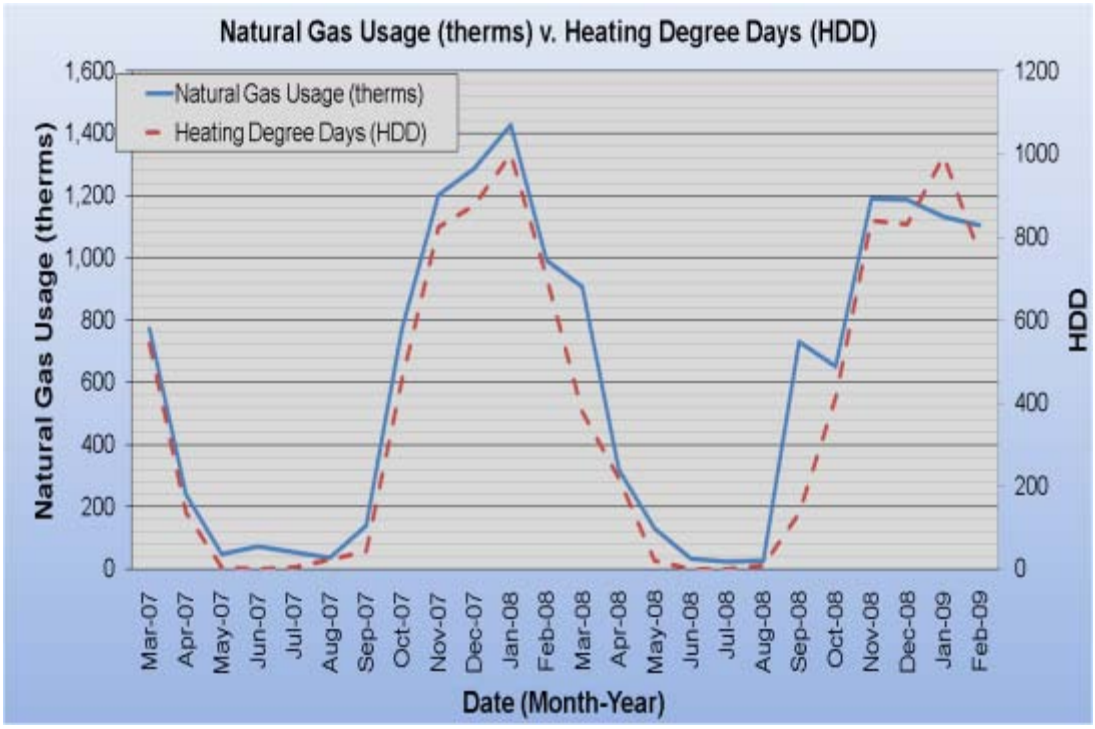
The following chart shows electricity use versus cost for the Northland Pool and Recreation Center based on utility bills for the 12 month period of March 2008 to February 2009.



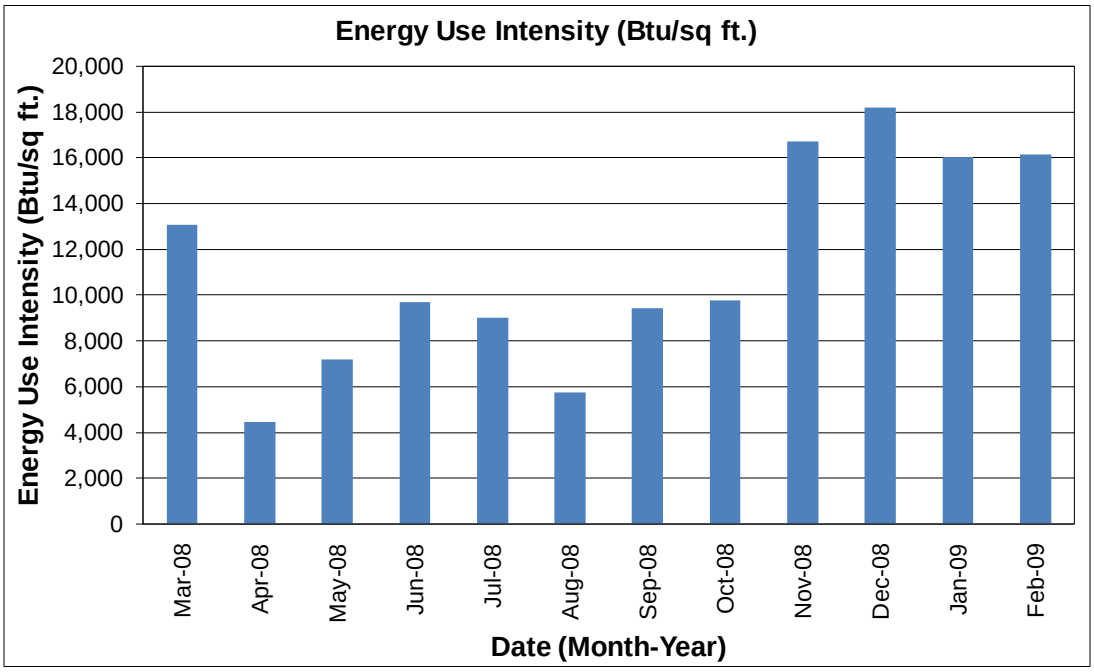
Electricity use follows a trend that is expected for this building with usage peaking during the summer due to the pool usage. The cost of electricity fluctuates as expected with usage peaking in the summer during the time of highest usage.

The following is a chart of the natural gas annual load profile for the building versus natural gas costs, peaking in the coldest months of the year and a chart showing natural gas consumption following the “heating degree days” curve.



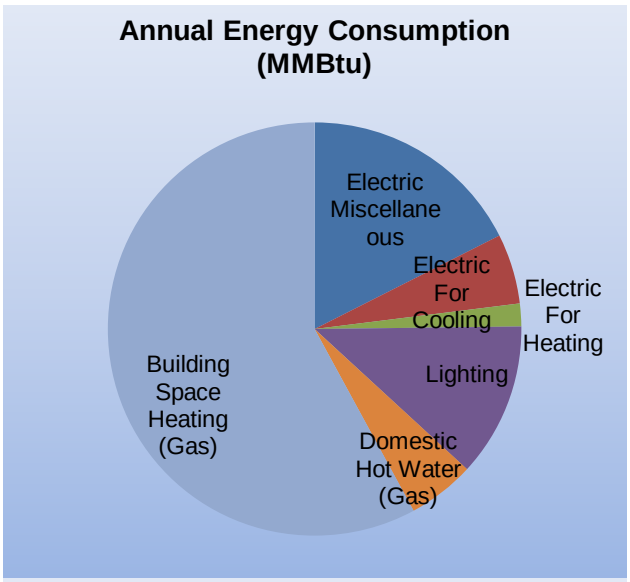


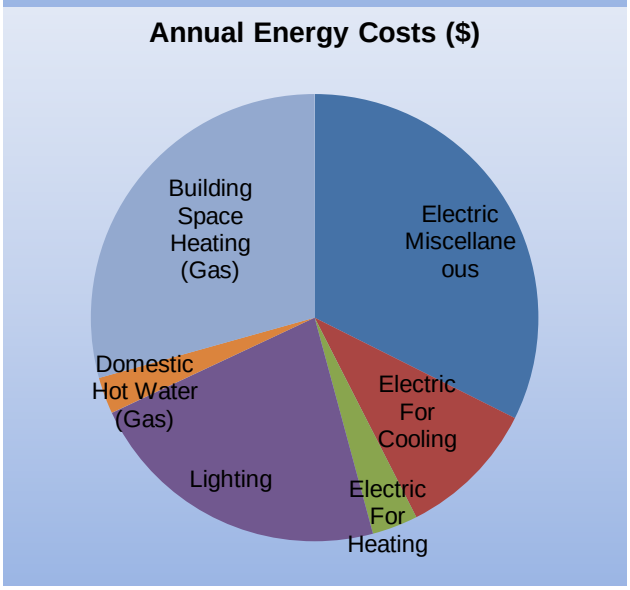
The following chart shows electric consumption in Btu/sq ft for the Northland Pool and Recreation Center based on utility bills for the 12 month period of March 2008 to February 2009.



The following table and chart pies show energy use for the Northland Pool and Recreation Center based on utility bills for the 12 month period of March 2008 to February 2009. Note: Electrical cost at $51/MMBTU of energy is almost more than 4 times as expensive to use as typical natural gas at $14/MMBTU.

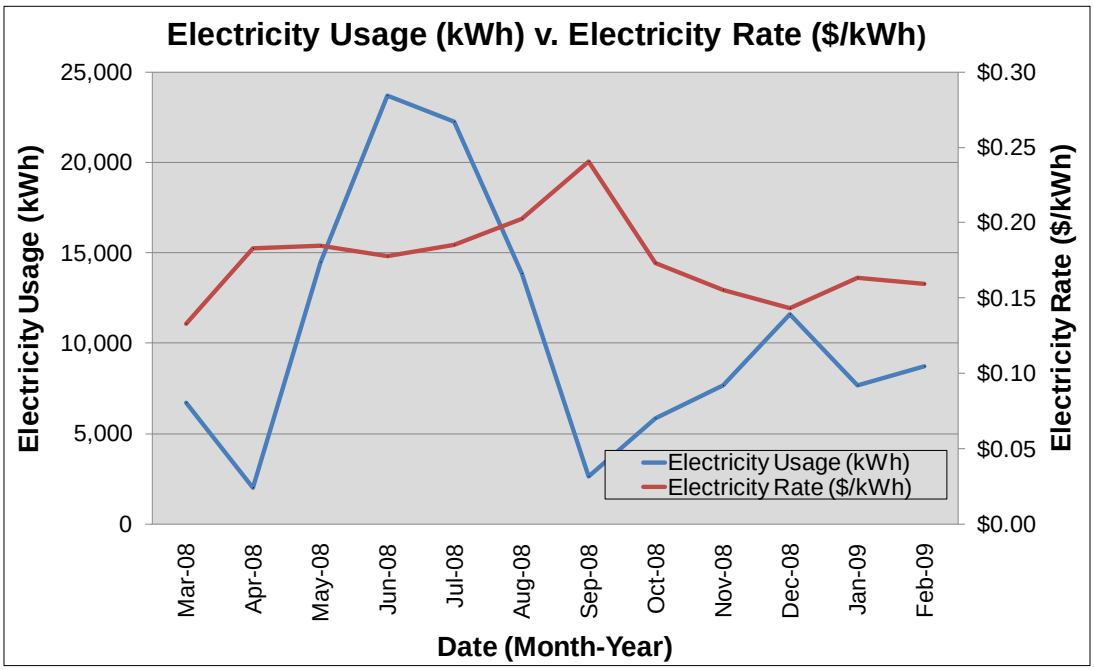
March 2008 - February 2009 Annual Energy Consumption / Costs					
	MMBtu	% MMBtu	$	% $	$/MMBtu
Electric Miscellaneous	207	18%	$10,581	32%	51
Electric For Cooling	64	5%	$3,298	10%	51
Electric For Heating	21	2%	$1,076	3%	51
Lighting	142	12%	$7,251	22%	51
Domestic Hot Water (Gas)	62	5%	$866	3%	14
Building Space Heating (Gas)	682	58%	$9,581	29%	14
Totals	1,178	100%	$32,653	100%	
Total Electric Usage	434	37%	$22,206	68%	51
Total Gas Usage	744	63%	$10,447	32%	14
Totals	1,178	100%	$32,653	100%	



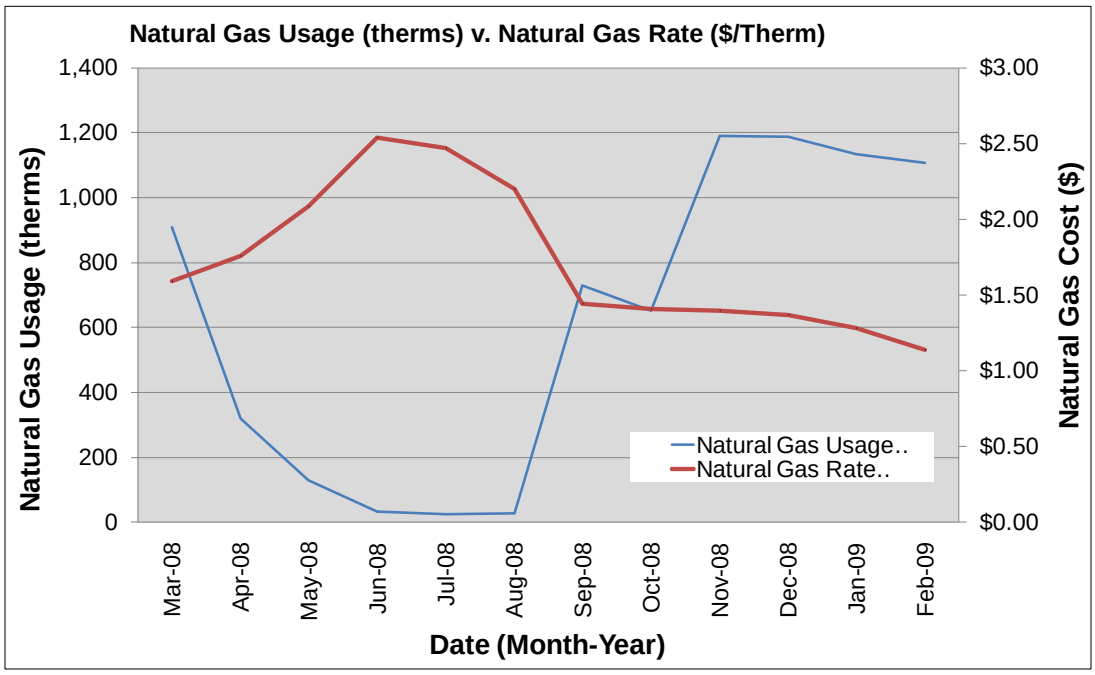


1.2. Utility Rate Analysis

The Northland Pool and Recreation Center currently purchases electricity from PSE&G at a general service market rate for electricity use (kWh) including a separate (kW) demand charge that is factored into each monthly bill. The Northland Pool and Recreation Center currently pays an average rate of approximately $0.175/kWh based on the 12 months of utility bills of March 2008 to February 2009. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year. The electric rate does not show large fluctuations throughout the year except for an anticipated rise in the summer time. Based on these observations this appears to be the appropriate rate for the building.



The Northland Pool and Recreation Center currently purchases natural gas from PSE&G which acts as the transportation company and energy supplier at a general service market rate for natural gas (therms). There are two gas meter that provides natural gas service to the Northland Pool and Recreation Center currently. The average aggregated rate (supply and transport) for the meter is approximately $1.404/therm based on 12 months of utility bills March 2008 to February 2009. The suppliers' general service rate for natural gas charges a market-rate price based on use and the buildings billing does not breakdown demand costs for all periods. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year. Typically, the natural gas prices increase during the summer months when natural gas is only used by the hot water boilers. The high gas price per therm fluctuations in the summer may be due to low use caps for the non-heating months. Thus the building pays for fixed costs such as meter reading charges during the summer months.



1.3. Energy benchmarking

SWA has entered energy information about the recreation center in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. Currently, the building is not eligible to receive a performance rating because it is classified as a recreation center which means that it is still ineligible for Energy Star. SWA encourages the Township of Livingston to continue entering utility data in *Energy Star Portfolio Manager* in order to track weather normalized source energy use over time.

The Site Energy Use Intensity is 139.0 kBtu/sq ft yr compared to the national average of a an "other" space type building consuming 104.0 kBtu/sq ft yr. Implementing this report's recommended Energy Conservations Measures (ECMs) will reduce use by approximately 9.7 kBtu/ sq ft yr, which would decrease the building's energy use intensity to 129.8 kBtu/sq ft yr.

Username: LivingstonTownship
Password: Livingston
Project Name: Township of Livingston - Northland Pool and Recreation Center

Also, below is a statement of energy performance generated based on historical energy consumption from the Portfolio Manager Benchmarking tool.

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Township of Livingston - Northland Pool

Building ID: 2051002
For 12-month Period Ending: February 28, 2009[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: March 24, 2010

Facility	**Facility Owner**	**Primary Contact for this Facility**
Township of Livingston - Northland Pool 3 Madison Court Livingston, NJ 07039	Township of Livingston 357 South Livingston Avenue Livingston, NJ 07039	Richard Calbi 357 South Livingston Avenue Livingston, NJ 07039

Year Built: 1965
Gross Floor Area (ft²): 8,700

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

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	446,344
Natural Gas (kBtu)[4]	767,005
Total Energy (kBtu)	1,213,349

Energy Intensity[5]	
Site (kBtu/ft²/yr)	139
Source (kBtu/ft²/yr)	264

Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	109

Electric Distribution Utility
Public Service Elec & Gas Co

National Average Comparison	
National Average Site EUI	104
National Average Source EUI	213
% Difference from National Average Source EUI	24%
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.

Certifying Professional
N/A

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

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

EPA Form 5900-16

2. FACILITY AND SYSTEMS DESCRIPTION

2.1. Building Characteristics

The Northland Pool and Recreation Center located at 3 Madison Court was opened in 1965. The Recreation center is home to a main pool, children's pool, small pump house, below ground pump room, and main recreation center. The main recreation center is a single story free standing building with basement and approximately 8,700 square feet of conditioned space. The building includes meeting / game rooms, concession stand, offices, mechanical rooms, showers, locker rooms, and storage.


Partial South Façade


Partial East Façade


Partial North Façade


Partial West Façade


Children's Pool Pump House


Underground Rear Pump Room

2.2. Building Occupancy Profiles

The pool portion of the facility is open June 1st to September 1st from 10:00 AM to 8:00 PM. The main recreation center is open weekdays year round. There are approximately 15 employees on staff at the pool with a large fluctuating amount of visitors to the pool and recreation center.

2.3. Building Envelope

Due to unfavorable weather conditions (min. 18 deg. F delta-T in/ outside & no/ low wind) no exterior envelope infrared (IR) images were taken during the field audit. Thermal imaging/ infrared (IR) technology helps to identify energy compromising problem areas in a non-invasive way.

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 exposed concrete block with no insulation.

The exterior wall envelope is mostly constructed of painted concrete block with 0 inches of detectable/ assumed insulation. Other areas are constructed of exposed brick masonry units with 0 inches of detectable/ assumed insulation. Other areas are constructed of stucco over concrete block with 0 inches of detectable/ assumed insulation. The interior is mostly unfinished.

Note: Wall insulation levels could not be visually verified in the field by non-destructive methods.

During the field audit exterior and interior wall surfaces were inspected. They were found/ reported to be in overall good/ age appropriate condition with only a few signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues located mostly at the front and sides of the building.

The following specific exterior wall problem spots and areas were identified:

Signs of uncontrolled roof water runoff on walls due to missing/ defective roof flashing and missing gutters and downspouts as well as water damage at surface transitions, shifted concrete block and water damage due to poor site drainage.

In light of the exterior wall conditions mentioned above SWA has the following recommendation:

1. Insulate original and un-insulated exterior wall sections. SWA suggests applying 2" XPS rigid foam boards to the interior and covering it with gypsum wallboard or other preferred interior finish.
2. Install footing drains and slope perimeter grade away from building. SWA suggests investigating interior footing drain option.
3. Install/ repair and maintain flashing to minimize uncontrolled wind driven and roof water run-off causing exterior wall damage.
4. Install/ repair and maintain gutters, downspouts and downspout deflectors to minimize uncontrolled roof water run-off causing exterior wall damage.
5. Maintain and inspect all exterior wall surfaces with a focus on the condition of caulking, displaced brick or concrete blocks, signs of water damage and locations that correspond to areas of known infiltration.

2.3.2. Roof

The building's roof is predominantly a flat multitier, no parapet type over steel decking with a dark-colored EPDM single membrane finish. It was recently installed. 2-1/2 inches of foam board roof insulation are assumed.

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

During the field audit roofs, related flashing, gutters and downspouts were inspected. They were found/ reported to be in overall good/ age appropriate condition with no signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues detected on all roof areas.

The following typical surfaces and specific roof problem spots and areas were identified:

Missing/ ineffective flashing

In light of the exterior wall conditions mentioned above SWA has the following recommendation;

1. Install/ repair and maintain roof flashing.

2. Maintain/ inspect all roof surfaces on a regular basis with a focus on the condition of the flashing, roofing membrane, drainage, signs of water pooling, signs of infiltration and locations that correspond to water damaged ceiling tiles.

2.3.3. Base

The building's base is composed of a below-grade basement with a slab floor with a perimeter footing with concrete block foundation walls and no detectable slab edge/ perimeter insulation.

Slab/ perimeter insulation levels could not be verified in the field or on construction plans and are based upon similar wall types and time of construction.

The building's base and its perimeter were inspected. Judging from signs of uncontrolled moisture or water presence and other energy compromising issues, overall the base was found/ reported to be in good/ age appropriate condition with no signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues neither visible on the interior nor exterior.

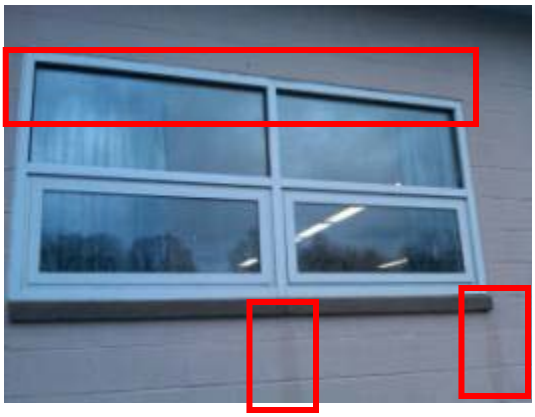
2.3.4. Windows

The building contains basically two different types of windows

1. Unit (fixed and hopper) type windows with a non-insulated aluminum frame, clear double glazing and interior roller shades. The windows are located throughout the building and were installed within the last ten years

2. Double-hung type windows with a non-insulated aluminum frame, tinted tempered single glazing and no interior or exterior shading devices. The windows are located on the rear of the building. These windows seem to be about ten to fifteen years old and are secured by mesh fencing.

The following specific window problem spots and typical installations were identified:



Missing window sill and drip-edge detail cracked/ aged caulk around frame/ sill on the exterior and exposed window lintels that act as thermal bridges.

In light of the exterior wall conditions mentioned above SWA has the following recommendation;

1. Replace/ add/maintain caulk around window frames and sills.

2. Properly seal and insulate window lintel to eliminate thermal break.

3. Install/ repair pan or strip flashing and drip edge detail at window sill.

4. Maintain and inspect all exterior windows with a focus on the condition of the frames, water damage from the sills, air tight seal, and proper hardware operation.

2.3.5. Exterior doors

The building contains several different types of exterior doors.

1. Overhead aluminum type exterior door. They are located on the side of the building and was installed at least ten years ago.

2. Solid metal type exterior door. They are located on either side of the building.

3. Solid metal type exterior door with glass panels. They are located on either side of the building.

All exterior doors, thresholds, related flashing, caulking and weather-stripping were inspected. Based on signs of moisture, air-leakage and other energy compromising issues, overall the doors were found/ reported to be in acceptable/ age appropriate condition with only a few signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

The following typical doors and specific door problem spots and areas were identified:

Examples of typical doors and problems such as deteriorated weather-stripping and exposed door lintels that are sources of thermal bridging.

In light of the exterior wall conditions mentioned above SWA has the following recommendation;

1. Replace missing or damaged weather-stripping.
2. Install caulking and insulation around door lintels to prevent thermal bridging.
3. Maintain and inspect all doors with a focus on the condition of the weather-stripping, door frame, air tight seals and signs of water damage and infiltration.

2.3.6. Building air-tightness

Overall the field auditors found the building to be reasonably air-tight with only a few areas of suggested improvements, as described in more detail earlier in this chapter.

In addition to all the above mentioned findings SWA recommends air sealing, caulking and/ or insulating around all structural members, recessed lighting fixtures, electrical boxes and chimney walls that are part of or penetrate the exterior envelope and where air-leakage can occur.

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

2.4. HVAC Systems

2.4.1. General

The Northland Pool and Recreation Center consists of one main level, a basement and storage level, lower basement, a pool pump room, and another small pool pump house. The main building has several multi-purpose rooms, a lifeguard/first aid room, and kitchen/snack bar area. These areas are used during the summer months. In the basement is a two-story tall storage room which leads farther down into the basement. Behind the building is the pool facility. Below the pool at the rear of the property is the main pump room which houses the pool's pump, filtration, and chlorine systems. Adjacent to the pool's children's area is a small pump house that contains the pumps and equipment for the pool's special water features.

2.4.2. Heating

The main building is heated via a Weil-McLain 'Series 2' gas fired boiler. This boiler was recently replaced in 2008 and provides 421,200 btuh of output. It has an estimated remaining life of 95%. There are two (2) fractional horsepower hot water circulating pumps serving the building. Domestic hot water is produced by the boiler and stored in two Weil-McLain hot water storage tanks, believed to have been installed in 2008 with the new boiler. The heating hot water serves wall mounted radiators along the perimeter walls of the building. In the storage room in the basement, two hydronic hot water unit heaters are mounted up towards the ceiling at each end of the space. Although the heaters are estimated to be approximately 0-25% remaining of their expected useful life, no complaints were mentioned about the ability of the heaters to heat the space. The gun range, since abandoned, has no heating. The main pool pump room is heated by a single 10kw electric unit heater that has an estimated remain life of 50%. The smaller pump house for the pool's water features has no heating.

Gas-fired boiler in boiler room

Radiators throughout the building, hydronic heaters in basement, and electric unit heater in pool's main pump house

2.4.3. Cooling

None of the buildings have cooling.

2.4.4. Ventilation

The main building is served by several roof mounted exhaust fans. The snack bar/kitchen area is served by two exhaust fans, the large multi-purpose rooms on either side of the building are served by three exhaust fans, and the toilet rooms are served by a single

exhaust fan. All the fans appears to be at, or nearing, their useful life expectancy. SWA recommends replacing all the exhaust fans of the main building with models using premium efficiency motors.

The main pool pump house is served by two sidewall exhaust fans, both installed circa 2005 with 75% of expected life remaining. The small water feature pump house is ventilated via a propeller type exhaust fan mounted in the sloped roof of the building. The fan appears to be at 50% of its life expectancy.

Rooftop Exhaust Fans

2.4.5. Domestic Hot Water

The domestic hot water for the main building is produced by the boiler and stored in the two (2) domestic hot water storage tanks as described in section 2.4.2 above. There is no domestic hot water for the two pool pump houses.

2.4.6. Pool Equipment

Below the pool is the main pump room which houses the pool's pump, filtration, and chlorine systems. This room contains a 25 horsepower Main Pool Pump and a 1-1/2 horsepower

Main Filter Pump and the Main Pool Filter. It was reported that these pumps operate 24 hours per day, 7 days per week from approximately May 15 to September 15 each year. In addition, this room contains the pumps for the water features adjacent to the main pool. These pumps include 7-1/2 horsepower Slide Pump and a 5 horsepower Umbrella Pump. The feature pumps operate from 10:00 AM until 8:00 PM from June 1 until September 1. The pumps are in fair to good condition. It should be noted that the presence of the pool chemicals makes this room a corrosive environment for the steel pumps and pump motors, so the expected service life of this equipment should be considered to be shorter than in a typical commercial or municipal application.

Adjacent to the pool's children's area is a small pump house that contains the pumps and equipment for the special water features in the children's area. This pump house contains four (4) 3 horsepower pumps. According to Water Department personnel, these pumps operate from 10:00 AM until 8:00 PM from June 1 until September 1. These pumps are plastic, which is more suitable for the chemically treated water than the steel equipment in the Main Pool Pump Room. This equipment is in good condition.

All pool equipment utilizes standard efficiency motors. SWA recommends that TEFC type premium efficiency motors are utilized to realize an increase in operating efficiency.

Filter Pump in Main Pool Pump Room

2.5. Electrical systems

2.5.1. Lighting

Interior Lighting – The Northland Pool and Recreation Center contains mostly inefficient lighting. There is primarily inefficient lighting such as the existing 4' T12 fixtures with magnetic ballasts, halogens and screw in incandescent fixtures however; there are also some T8 fixtures that should remain. SWA recommends replacing the T12 lights with T8 electronic ballast fixtures and the halogen and incandescent fixtures with CFL's as well as installing 4 new occupancy sensors to reduce electricity usage. See attached lighting schedule in Appendix A for a complete lighting inventory throughout the building and estimated power consumption.

Exit Lights - Exit signs were found to be LED and fluorescent type. SWA recommends that the fluorescent type exit signs should be replaced with LED units.

Exterior Lighting - The exterior lighting surveyed during the building audit was found to be a combination of metal halide, incandescent, high pressure sodium and halogen. SWA recommends replacing the metal halides and high pressure sodium's with pulse start metal halides and installing CFLs in place of the incandescent and halogens.

2.5.2. Appliances

SWA performed a basic survey of appliances installed at the Northland Pool and Recreation Center and has determined that it would be cost-effective to retrofit all existing reach in coolers with Coolermiser™ devices, and replace two of the three refrigerators with Energy Star replacements. The two refrigerators that should be replaced are the Frigidair and Magic Chef units, the General Electric unit should remain. Appliances, such as refrigerators, that are over 10 years of age should be replaced with newer efficient models with the Energy Star label. For example, Energy Star refrigerators use as little as 315 kWh / yr. When compared to the average electrical consumption of older equipment, Energy Star equipment results in a large savings. Building management should select Energy Star label appliances and equipment when replacing: refrigerators, printers, computers, copy machines, etc. More information can be found in the "Products" section of the Energy Star website at: http://www.energystar.gov.

Computers left on in the building consume a lot of energy. A typical desk top computer uses 65 to 250 watts and uses the same amount of energy when the screen saver is left on. Televisions in meeting areas use approximately 3-5 watts of electricity when turned off. SWA recommends all computers and all appliances (i.e. coffee makers, televisions, etc) except refrigerators, freezers and ice makers be plugged into power strips and turned off each evening just as the lights are turned off. The Northland Pool and Recreation Center computers are generally programmed for the power save mode, to shut down after a period of time that they have not been used.

2.5.3. Elevators

The Northland Pool and Recreation Center does not have any elevators installed on the premises.

2.5.4. Process and others electrical systems

There is currently no significant process and other electrical systems installed at the recreation center.

3. EQUIPMENT LIST - Inventory

Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Heating	Hot Water Boiler, 85% efficiency	Boiler / Electrical Room	Weil-McLain: Series 2 M# LGB-5 520MBH in	Natural Gas	Building	2008	95%
Domestic Hot Water	(2) Hot Water Storage Tanks	Boiler / Electrical Room	Weil-McLain Plus (no nameplate)	-	Building	2008	95%
Heating	Hot Water Supply Pump	Boiler / Electrical Room	Bell & Gossett 1/2HP	Electric	Building	2008	95%
Heating	(2) Hot Water Circulation Pumps	Boiler / Electrical Room	Taco 1/25HP ea.	Electric	Building	2008	95%
Heating	Hot Water Storage Tanks Supply Pump	Boiler / Electrical Room	Taco 1/8HP	Electric	Building	2008	95%
Heating	Finned-tube radiators	Throughout Building	(no nameplate)	Electric	Building	Est. 1960	0% beyond useful life
Refriger.	Tall Glass-door Merchandiser	Kitchen / Concession area	Beverage-Air M# MT27 S# 6759386 115V 1ph 9.9A 18oz. R134A refrigerant	Electric	Kitchen / Concession Stand	2009	95%
Refriger.	(2) Ice Cream chests	Kitchen / Concession area	Caravell M# 404-895 115V 1ph 4.5A 7.4oz. R134A refrigerant ea.	Electric	Kitchen / Concession Stand	1999	10-20%

Refriger.	Tall Glass-door Merchandiser	Kitchen / Concession area	True M# GDM-12 S# 1-3676969 115V 1ph 5A R134A refrigerant	Electric	Kitchen / Concession Stand	2004	40-50%

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Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Refriger.	Reach-in Freezer Chest	Kitchen / Concession area	(nameplate inaccessible) (only used during the summer)	Electric	Kitchen / Concession Stand	Est. 2000	50%
Refriger.	Residential Refrigerator	Kitchen / Concession area	Magic Chef M# RB19GA-3A S# GP 35810398 115V 1ph 4.5A 5.5oz. R12 refrigerant	Electric	Kitchen / Concession Stand	1998	10-20%
Refriger.	(2) Residential Refrigerators	Multi-purpose Room	Frigidaire (no nameplate) General Electric M# TBX24ZAXBRAA S# HM517625 115V 1ph 7A 6oz. R134A refrigerant	Electric	Multi-purpose room	Est. 1990s Est. 2005	0-10% 50-75%
Ventilation	(2) Exhaust Fans	Roof above Concession Stand	Jenn-Air M# 183 BCR A 115V 1ph 5.4A ea. ¼ HP	Electric	Kitchen / Concession Stand	Est. 1980s	0%
Ventilation	(3) Exhaust Fans	Roof above multi-purpose rooms	Jenn-Air M# 242 BCR A 115V 1ph 5.4A ea.¼ HP	Electric	Multi-purpose rooms	Est. 1980s	0%
Ventilation	Exhaust Fan	Roof	(no nameplate) Est. fractional HP	Electric	Toilet rooms	Est. 1980s	0%

Heating	(2) Hydronic Unit Heaters	Basement Storage	Modine (nameplate inaccessible)	Electric	Basement Storage	Est. 1965	0%
Plumbing	Submerged Sewer Ejector Pump	Basement Storage	(nameplate inaccessible)	Electric	Basement Storage	Est 2000s	50-75%

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Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life
Filtration (Pool)	Filtration Pump	Pool Pump & Filter Room	Gusher Pumps M# PCL3X4-8BSFH-CC-A S# 789-570 1-1/2HP (runs 24/7 when pools open)	Electric	Pool	Est 1990	10-20%
Filtration (Pool)	Pool Supply Pump	Pool Pump & Filter Room	25HP (runs 24/7 when pools open)	Electric	Pool	Est. 2000	25-50%
Filtration(Pool)	Slide water feature Supply Pump	Pool Pump & Filter Room	Berkeley7-1/2HP(runs 10am-8pm June to September)	Electric	Slide water feature	Est. 2000	25-50%
Filtration (Pool)	Umbrella water feature Supply Pump	Pool Pump & Filter Room	Gusher Pumps - 5HP (runs 10am-8pm June to September)	Electric	Umbrella water feature	Est. 2000	25-50%
Heating	Electric Unit Heater	Pool Pump & Filter Room	Dayton M# 3UF88 - 208V 10KW	Electric	Pool Pump & Filter room	Est. 2005	75%
Ventilation	(2) Sidewall Exhaust fans	Pool Pump & Filter Room	Dayton 1/12HP ea.	Electric	Pool Pump & Filter room	2005	75%
Filtration (Pool)	(4) Water Supply pumps	Pool Feature pump house	Purex Triton: WhisperFlo M# WFK-12C S# 1-20-D00 - 3HP ea. (runs 10am-8pm June to September)	Electric	Pool features and kid's play area	2000	50%
Ventilation	Propeller Exhaust Fan	Pool Feature pump house	(nameplate inaccessible)	Electric	Pool Feature pump house	2000	20%

Lighting	See details - Appendix A	building	-	Electric	Building		

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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.

4. ENERGY CONSERVATION MEASURES

Based on the assessment of the Administration Building, SWA has separated the investment opportunities into three recommended categories:

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

Category I Recommendations: - Capital Improvements

- Replace common area heating equipment - such as finned tube radiation and hydronic unit heaters in the toilet rooms, multipurpose rooms, basement storage and corridors and other areas mentioned above. This equipment is in fair condition, but age and wear have reduced the heat transfer capacity. This equipment should be replaced with more modern equipment suited for the intended use. These changes cannot be justified based on energy savings alone. This is a replacement in kind recommendation which offers negligible energy savings.

- Replace the five (5) rooftop exhaust fans. These fans are beyond their useful lives and in need of replacement. It is recommended that these fans are replaced with equipment with premium efficiency motors. According to the Water Department personnel, the rooms that utilize the fans operate for about 5-10 hours per week, or about 300-500 hours per year. The fans are estimated to be fractional horsepower or 1 horsepower each. Based on low operating hours and the small size of the motors, it is estimated that the payback for this measure would be far greater than 15 years.

- Insulate original and uninsulated exterior wall sections. SWA suggests applying 2" XPS rigid foam boards to the interior and covering it with gypsum wallboard or other preferred interior finish.

- Install footing drains and slope perimeter grade away from building. SWA suggests investigating interior footing drain option.

- Install/ repair and maintain flashing to minimize uncontrolled wind driven and roof water run-off causing exterior wall damage.

- Install/ repair and maintain gutters, downspouts and downspout deflectors to minimize uncontrolled roof water run-off causing exterior wall damage.

- Install/ repair and maintain roof flashing.

- Properly seal and insulate window lintel to eliminate thermal break.

- Install/ repair pan or strip flashing and drip edge detail at window sill.

- Replace/ add/maintain caulk around window frames and sills.

- Replace missing or damaged weather-stripping.
- Install caulking and insulation around door lintels to prevent thermal bridging.

Category II Recommendations: - Operations and Maintenance

- Boiler room and attic piping insulation - Insulate un-insulated hot water piping in the Boiler Room and in attic spaces to efficiently deliver heat where required and provide personnel protection.
- Water levels in the expansion tank and the integrity of the tank bladder should be checked to confirm proper operation.
- Tighten belts on exhaust fans – tightening belts on belt-driven exhaust fans can maximize overall efficiency of the equipment.
- Install premium motors when replacements are required - Select NEMA Premium motors when replacing motors that have reached the end of their useful operating lives. The pumps in the Boiler Room are all relatively new, so they were not considered for upgrade at this time.
- Use Energy Star labeled appliances - such as Energy Star refrigerators that should replace older energy inefficient equipment.
- Maintain and inspect all exterior wall surfaces with a focus on the condition of caulking, displaced brick or concrete blocks, signs of water damage and locations that correspond to areas of known infiltration.
- Maintain/ inspect all roof surfaces on a regular basis with a focus on the condition of the flashing, roofing membrane, drainage, signs of water pooling, signs of infiltration and locations that correspond to water damaged ceiling tiles.
- Maintain and inspect all exterior windows with a focus on the condition of the frames, water damage from the sills, air tight seal, and proper hardware operation.
- Maintain and inspect all doors with a focus on the condition of the weather-stripping, door frame, air tight seals and signs of water damage and infiltration.

Category III Recommendations: Energy Conservation Measures

ECM#	Description of Highly Recommended 0-5 Year Payback ECMs
1.2	(13) New CFL fixtures to be installed
1.3	(4) New LED exit sign fixtures to installed
1.5	(4) New occupancy sensors to be installed

2	Retrofit (2) cooler units with coolermiser devices
3.1	Replace (1) 25 Hp Main Pool pump motor with Premium Efficiency
	Description of Recommended 5-10 Year Payback ECMs
1.1	(91) New T8 fixtures to be installed
1.4	(4) New pulse start metal halide fixtures to be installed
3.2	Replace (1) 1.5 Hp Main Pool Filter pump motor with Premium Efficiency
3.3	Replace (1) 5 Hp Umbrella Pump motor with Premium Efficiency
3.4	Replace (1) 7.5 Hp Slide Pump motor with Premium Efficiency
6.1	Replace one (1) kitchen refrigerator with an 17 cu ft Energy Star model
6.2	Replace one (1) meeting room refrigerator with 17 cu ft Energy Star model
	Description of Recommended End of Life Cycle ECMs
3.5	Replace (4) 3 Hp Children's Area Feature Pump motors with Premium Efficiency
5.1	replace 5 exhaust fans with premium efficiency units
	Description of Renewable ECMs
4	Install 25.1 kW PV rooftop system with incentives

ECM#1: *Building Lighting Upgrades*

Description:

On the days of the site visits, SWA completed a lighting inventory of the Northland Pool and Recreation Center (see Appendix A). The Northland Pool and Recreation Center currently consists of mostly inefficient lighting with T12 fluorescent fixtures with magnetic ballasts, halogen and incandescent fixtures. Based on measurements of lighting levels for each space, there are not any vastly over-illuminated areas. SWA recommends replacing the following inefficient fixtures with more energy efficient types: T12 lamps should be replaced with T8 electronically ballasted lamps and halogens and incandescent lamps should be replaced with compact fluorescent. SWA recommends installing 4 occupancy sensors in areas that are occupied only part of the day and payback on savings are justified, such as the meeting rooms and locker rooms. Typically, occupancy sensors have an adjustable time delay that shuts down the lights automatically if no motion is detected within a set time period. Advance micro-phonic lighting sensors include sound detection as a mean to control lighting operation. See attached lighting schedule in Appendix A for a complete inventory of lighting throughout the building and estimated power consumption. The exterior lighting surveyed during the building audit was found to be a mix of metal halide, HPS, halogen and incandescent fixtures. Exterior lighting is controlled by automatic timers. SWA recommends replacing the Metal Halide and HPS lamps with pulse start Metal Halide lamps, and halogen and incandescent fixtures with CFL's. Pulse-start metal halide (MH) lamps 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. SWA is not recommending at this time any upgrades to the exterior timers. The labor in all these installations was evaluated using prevailing electrical contractor wages. The Township of Livingston may decide to perform this work with in-house resources on a scheduled, longer timeline than otherwise performed by a contractor.

Installation cost:

Estimated installed cost: $23,026 (this includes $6,678 in labor cost)
Source of cost estimate: RS *Means; Published and established costs*

Economics:

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
1.1	(91) New T8 fixtures to be installed	19,594	1,365	18,229	13,020	2.7	N/A	4.3	352	2,630	15	39,457	6.9	116	8	12	12,723	17,837
1.2	(13) New CFL fixtures to be installed	736	0	736	1,836	0.4	N/A	0.6	-3	318	5	1,589	2.3	116	23	33	711	2,515
1.3	(4) New LED exit sign fixtures to installed	604	80	524	329	0.1	N/A	0.1	63	120	15	1,806	4.4	245	16	22	893	451
1.4	(4) New pulse start metal halide fixtures to be installed	2,836	100	2,736	1,077	0.2	N/A	0.4	212	401	15	6,016	6.8	120	8	12	1,983	1,476
1.5	(4) New occupancy sensors to be installed	880	80	800	1,288	0.3	N/A	0.4	0	225	15	3,381	3.5	323	22	27	1,852	1,765
	Totals	**24,651**	**1,625**	**23,026**	**17,550**	**3.7**	**0**	**5.8**	**624**	**3,695**	**-**	**52,248**	6.2	**-**	**-**	**-**	**18,162**	**24,044**

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA also assumed an aggregated 10% failure rate in addition to the standard life cycle.

Rebates / Financial Incentives:
NJ Clean Energy - $15 per T8 fixture, $20 per LED fixture, $25 per PSMH fixture, $20 per occupancy sensor.

Options for Funding ECM:
This project may benefit from applying for a grant from the State of New Jersey - American Recovery and Reinvestment Act Energy Efficiency and Conservation Block Grant (EECBG) Program to offset a portion of the cost of implementation.

http://www.state.nj.us/recovery/infrastructure/eecbg_program_criteria.html

ECM#2: *Retrofit Two Existing Cooler Units with Coolermisers*

Description:

A simple plug and play device a Coolermiser is Compatible with all glass-front coolers that contain non-perishable goods, CoolerMiser's Passive Infrared Sensor (PIR) help the unit save power. This unit is to be installed on the two existing cooler units that are only used during the summer when the pool is open.

Installation Cost:

Estimated installed cost: $398 (Includes $40 of labor)
Source of cost estimate: *Manufacturers info*

Economics (with no incentives):

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
2	Retrofit (2) cooler units with coolermiser devices	398	0	398	1,309	0.3	N/A	0.4	0	229	5	1,145	1.7	188%	38%	50	645	1,793

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. Average weekly operating hours = 17.

Rebates/financial incentives:
NJ Clean Energy – None available for this ECM

Options for funding the ECM: *This project may benefit from enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.*
http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings

ECM#3: *Install Premium Efficiency Motors on Pool Pumps*

Description:

Below the pool is the main pump room which houses the pool's pump, filtration, and chlorine systems. The Main Pool Pump Room contains a 25 horsepower Main Pool Pump and a 1-1/2 horsepower Main Filter Pump. In addition, this room contains the pumps for the water features adjacent to the main pool. These pumps include 7-1/2 horsepower Slide Pump and a 5 horsepower Umbrella Pump. This pump house adjacent to the pool's children's area contains four (4) 3 horsepower pumps for the special water features in the children's area. The pumps are in fair to good condition. These pumps utilize standard efficiency motors. SWA recommends that TEFC type premium efficiency motors are utilized to realize an increase in operating efficiency and provide some protection to the corrosive environment presented by the pool chemicals.

Installation cost:

Estimated installed cost: $5,170 (Includes 2,068 in labor)
Source of cost estimate: Similar projects and DOE Motor Master International selection & savings analysis

Economics (with incentives):

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 energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
3.1	replace (1) 25 Hp Main Pool pump motor with Premium Efficiency	1,600	130	1,470	2,688	0.6	0	1.1	0	470	20	9,408	3.1	540	27	32	5,528	3,683
3.2	replace (1) 1.5 Hp Main Pool Filter pump motor with Premium Efficiency	375	50	325	340	0.1	0	0.1	0	60	20	1,190	5.5	266	13	18	560	466
3.3	replace (1) 5 Hp Umbrella Pump motor with Premium Efficiency	504	60	444	296	0.1	0	0.1	0	52	20	1,036	8.6	133	7	10	327	406

Continued Next Page

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 energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
3.4	replace (1) 7.5 Hp Slide Pump motor with Premium Efficiency	692	90	602	408	0.1	0	0.2	0	71	20	1,428	8.4	137	7	10	460	559
3.5	replace (4) 3 Hp Children's Area Feature Pump motors with Premium Efficiency	1,996	240	1,756	936	0.2	0	0.4	0	164	20	3,276	10.7	87	4	7	681	1,282
	Totals	**5,167**	**570**	**4,597**	**4,668**	**1.1**	**0**	**1.9**	**0**	**817**	**-**	**16,338**	**6.3**	**-**	**-**	**-**	**7,556**	**6,396**

Assumptions: SWA calculated the savings for this measure using nameplate data taken and using the billing analysis. The DOE Motor Master International selection and calculator was based on information from Water Department personnel that the Main Pool Pump and Main Filter Pump both operate 24 hours per day, 7 days per week from approximately May 15 to September 15 each year. It was also reported that the feature pumps in the Main Pump Room and in the Children's Area Pump Room operate from 10:00 AM until 8:00 PM from June 1 until September 1. Based on this information, SWA estimated that the Main Pool and Main Pool Filter Pumps operate for approximately 2,880 hours per year, and the feature pumps operate for approximately 920 hours per year.

Rebates/financial incentives:

NJ Clean Energy – Premium three-phase motors ($45-$700 per motor)
Maximum incentive amount is $570.

Options for funding ECM:
This project may benefit from enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.
http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings

ECM#4: *Install 25.1 kW PV system*

Description:

Currently the Northland Pool & Recreation Center does not use any renewable energy systems. Renewable energy systems such as photovoltaic panels, can be mounted on the building roofs, and can offset a portion of the purchased electricity for the building. Power stations generally have two separate electrical charges: usage and demand. Usage is the amount of electricity in kilowatt-hours that a building uses from month to month. Demand is the amount of electrical power that a building uses at any given instance in a month period. During the summer periods, when electric demand at a power station is high due to the amount of air conditioners, lights, equipment, etc… being used within the region, demand charges go up to offset the utility's cost to provide enough electricity at that given time. Photovoltaic systems not only offset the amount of electricity use by a building, but also reduce the building's electrical demand, resulting in a higher cost savings as well. It is recommended at this time that the Township further review installing a 25.1 kW PV system at Northland Pool & Recreation Center to offset electrical demand and reduce the annual net electric consumption for the building, and review guaranteed incentives from NJ rebates to justify the investment. The Northland Pool & Recreation Center may consider applying for a grant and/or engage a PV generator/leaser who would install the PV system and then sell the power at a reduced rate. PSE&G provides the ability to buy SREC's at $600/MWh or best market offer.

The front portion of the peaked roof faces southwest and has several possible locations for portions of a 25.1 kW PV installation . A commercial crystalline 230 watt panel has 17.5 square feet of surface area (13.1 watts per square foot). A 25.1 kW system needs approximately 108.0 panels which would take up approximately 1,900 square feet. The installation of a renewable Solar Photovoltaic power generating system could serve as a good educational tool and exhibit for the community.

Installation cost:

Estimated installed cost: $169,215(Includes $77,486 in labor)
Source of cost estimate: Similar Projects

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 energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
4	install 25.1 kW PV rooftop system with incentives	194,215	25,000	169,215	23,100	25	N/A	9.1	0	17,843	25	101,063	9.5	82.1	3.3	7.3	65,921	31,647

Assumptions: SWA estimated the cost and savings of the system based on past PV projects. SWA projected physical dimensions based on a typical Polycrystalline Solar Panel (230 Watts, model #ND-U230C1). PV systems are sized based on Watts and physical dimensions for an array will differ with the efficiency of a given solar panel (W/sq ft).

Rebates/financial incentives:
NJ Clean Energy - Renewable Energy Incentive Program, Incentive based on $1.00 / watt Solar PV application for systems 50kW or less. Incentive amount for this application is $25,000 for the proposed option.

http://www.njcleanenergy.com/renewable-energy/programs/renewable-energy-incentive-program

NJ Clean Energy - Solar Renewable Energy Certificate Program. Each time a solar electric system generates 1000kWh (1MWh) of electricity, a SREC is issued which can then be sold or traded separately from the power. The buildings must also become net-metered in order to earn SRECs as well as sell power back to the electric grid. A total annual SREC credit of $13,800 has been incorporated in the above costs, however it requires proof of performance, application approval and negotiations with the utility.

Options for funding ECM:
This project may benefit from enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.

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

ECM#5: Replace Exhaust Fans with High Efficiency Units

Description:

The building rooftop exhaust fans are in fair condition and should be considered for replacement. SWA recommends replacement of five (5) building roof exhaust fans that are operating near the end of their useful lives. Since it was reported that the Multipurpose Rooms are used for 5-10 hours per week year round, SWA estimated 500 annual hours runtime for the fans. The motors are small, in the 1 horsepower range, and replacement units will have small energy savings over the existing.

Installation cost:

Estimated installed cost: $15,800 (Includes $6,400 in labor)
Source of cost estimate: Similar projects

Economics (with incentives):

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 energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
5.1	replace 5 exhaust fans with premium efficiency units	16,000	200	15,800	275	0.1	0	0.0	400	448	10	481	35.3	-72	-7	6	75	582
5.2	incremental cost to replace 5 exhaust fans with premium efficiency units	1,875	200	1,675	275	0.5	0	0.0	400	448	10	481	3.7	168	17	20	1,948	377

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. Since it was reported that the Multipurpose Rooms are used for 5-10 hours per week year round, SWA estimated 500 annual hours runtime for the fans

Rebates/financial incentives:

NJ Clean Energy - Premium three-phase motors ($45-$700 per motor)
Maximum incentive amount is $200.

Options for funding the ECM: *This project may benefit from enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.*

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

ECM#6: *Replace Old Refrigerator with an Energy Star Model*

Description:

On the day of the site visit, SWA observed that there were two old refrigerators that were 17 cu. ft. model in the first floor kitchen and meeting room which were not Energy Star rated (using approximately 773 kWh/yr). Appliances, such as refrigerators, that are over 10 years of age should be replaced with newer efficient models with the Energy Star label. Two of the three refrigerators at The recreation center building, the Magic Chef and Frigidaire fall under this criteria and should be replaced. SWA recommends the replacement of the existing refrigerators with a 17 cu. ft. top freezer refrigerator ENERGY STAR®, or equivalent. Besides saving energy, the replacement will also keep their surroundings cooler. When compared to the average electrical consumption of older equipment, Energy Star equipment results in large savings. Look for the Energy Star label when replacing appliances and equipment, including: window air conditioners, refrigerators, printers, computers, copy machines, etc. More information can be found in the "Products" section of the Energy Star website at: http://www.energystar.gov.

Installation cost:

Estimated installed cost: $475 (Includes $75 in labor cost)
Source of cost estimate: *Manufacturer and Store established costs*

Economics:

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 energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
6.1	Replace one (1) kitchen refrigerator with a~~n~~ 17 cu ft Energy Star model	475	0	475	425	0.1	0	0.1	0	55	12	543	8.6	14	1	6	75	582
6.2	Replace one (1) meeting room refrigerator with a~~n~~ 17 cu ft Energy Star model	475	0	475	425	0.1	0	0.1	0	55	12	543	8.6	14	1	6	75	582
	Totals	**950**	**0**	**950**	**850**	**0**	**0**	**0**	**0**	**110**	**12**	**1,086**	8.6	**-**	**-**	**6**	**150**	**1,164**

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

Rebates/financial incentives: *NJ Clean Energy - There aren't any incentives at this time offered by the state of NJ for this energy conservation measure.*

Options for Funding ECM:
This project may benefit from applying for a grant from the State of New Jersey - American Recovery and Reinvestment Act Energy Efficiency and Conservation Block Grant (EECBG) Program to offset a portion of the cost of implementation.
http://www.state.nj.us/recovery/infrastructure/eecbg_program_criteria.html

5. Renewable and Distributed Energy Systems

5.1. Existing Systems

There aren't currently any existing renewable energy systems.

5.2. Wind

A Wind system is not applicable for this building because the area does not have winds of sufficient velocity to justify installing a wind turbine system.

5.3. Solar Photovoltaic

Please see the above recommended ECM # 4

5.4. Solar Thermal Collectors

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

5.5. Combined Heat and Power

CHP is not applicable for this building because of insufficient domestic water use.

5.6. Geothermal

Geothermal is not applicable for this building because it would not be cost effective considering the size of the existing HVAC *systems*

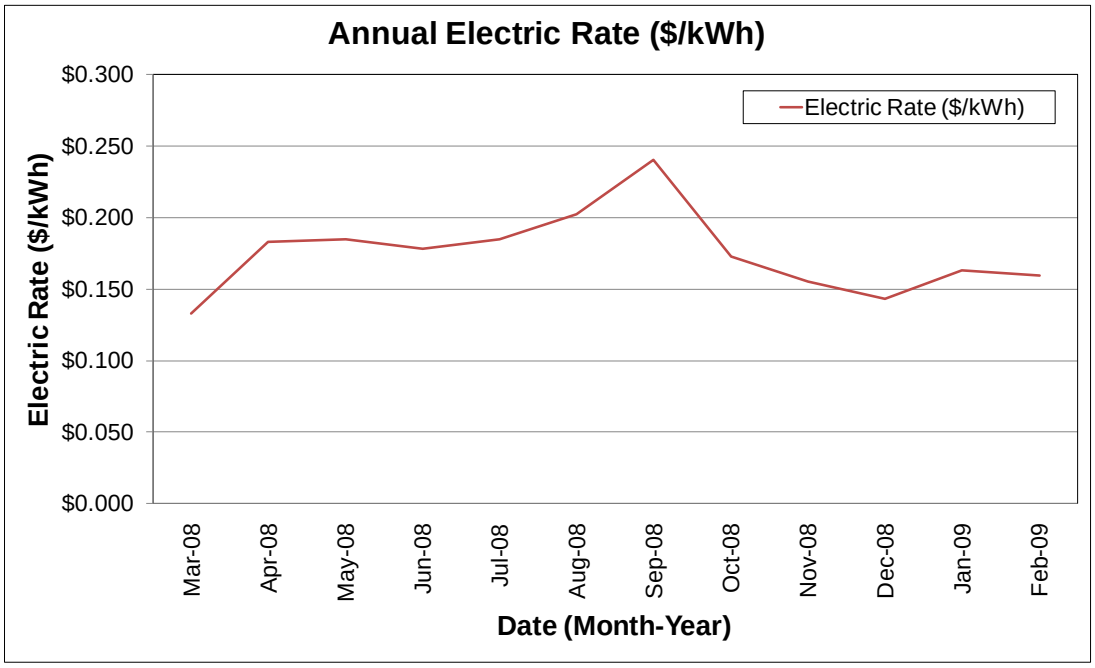
6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

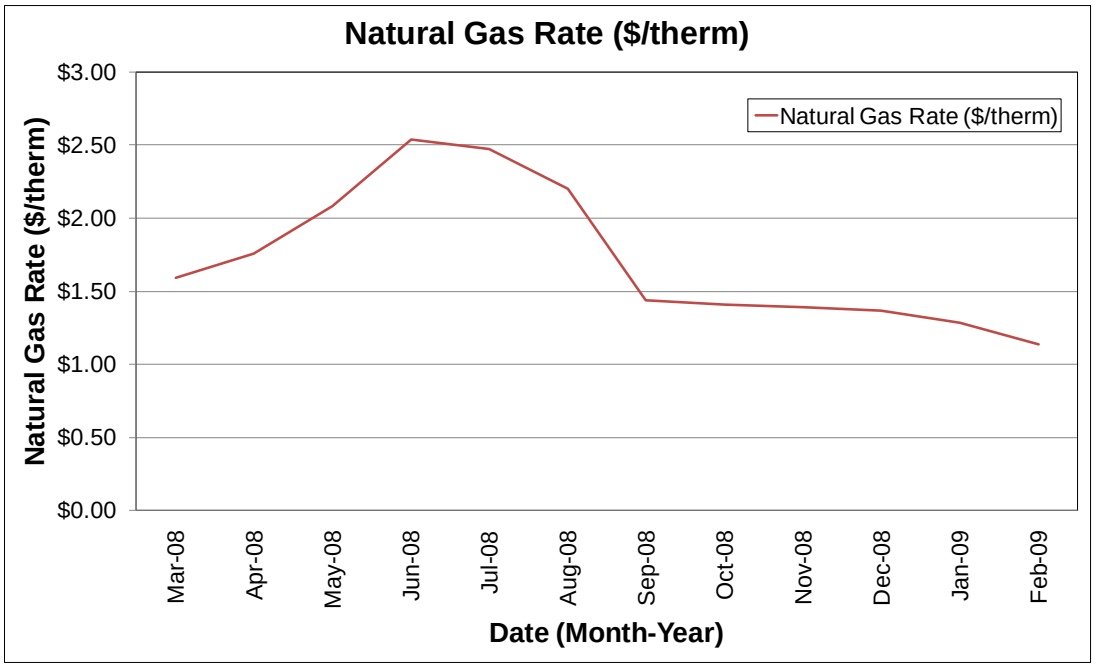
6.1. Energy Purchasing

The Northland Pool and Recreation Center receives electricity purchased via one incoming meter directly for the Northland Pool and Recreation Center from PSE&G without an ESCO. An Energy Services Company (ESCO) is a consultancy group that engages in a performance based contract with a client firm to implement measures which reduce energy consumption and costs in a technically and financially viable manner. SWA analyzed the utility rate for electricity supply over an extended period. Electric bill analysis shows fluctuations of 45% over the 12 month period between March 2008 and February 2009. Natural gas is also purchased via two incoming meter directly from PSE&G as well. Natural gas bill analysis shows fluctuations of up to 55% over the 12 month period between March 2008 and February 2009. The high gas price per therm fluctuations in the summer may be due to low use caps for the non-heating months. Thus the building pays for fixed costs such as meter reading charges during the summer months.

Currently, New Jersey commercial buildings of similar type pay $0.150/kWh for electricity and $1.55/therm for natural gas. The electricity rate for the pool is $0.175/kWh, which means there is a potential cost savings of $3,178 per year. The natural gas rate is $1.404 which means that they are already paying below market rate. A large cost savings

potential for electricity exists, however this involves contacting third party suppliers and negotiating utility rates. SWA recommends that the Township of Livingston further explore opportunities of purchasing electricity from third party energy suppliers in order to reduce rate fluctuation and ultimately reduce the annual cost of energy for The Northland Pool and Recreation Center. Appendix B contains a complete list of third party energy suppliers for the Township of Livingston service area. The Township of Livingston may want to consider partnering with other school districts, municipalities, townships and communities to aggregate a substantial electric and natural gas use for better leveraging in negotiations with ESCOs and of improving the pricing structures. This sort of activity is happening in many parts of the country and in New Jersey.





6.2. Energy Procurement strategies

Also, the Northland Pool and Recreation Center would not be eligible for enrollment in a Demand Response Program, because there isn't the capability at this time to shed a minimum of 150 kW electric demand when requested by the utility during peak demand periods, which is the typical threshold for considering this option.

7. METHOD OF ANALYSIS

7.1. Assumptions and tools

Energy modeling tool:	Established / standard industry assumptions, DOE e-Quest
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

7.2. Disclaimer

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

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

Appendix A: Lighting Study of the Northland Pool and Recreation Center

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	Hallway	Recessed	N	Hal	3	1	90	S	10	230	23	339	780	CFL	Recessed	CFL	N	S	3	1	30	10	230	0	90	207	573	0	573
2	1	Hallway	Exit Sign	N	LED	1	1	5	N	24	365	1	6	53	N/A	Exit Sign	LED	N	N	1	1	5	24	365	1	6	53	0	0	0
3	1	Meeting Rm	Exit Sign	N	Fl.	1	1	15	N	24	365	2	17	149	LEDex	Exit Sign	LED	N	N	1	1	5	24	365	1	6	53	96	0	96
4	1	Meeting Rm	Recessed	M	4'T12	32	2	40	S	10	230	15	3,040	6,992	T8	Recessed	4'T8	E	OS	32	2	32	8	92	6	2240	1546	4666	515	5446
5	1	Meeting Rm	Exit Sign	N	LED	1	1	5	S	24	365	1	6	53	N/A	Exit Sign	LED	N	S	1	1	5	24	365	1	6	53	0	0	0
6	1	Kitchen	Parabolic	M	4'T12	4	2	40	S	10	230	15	380	874	T8	Parabolic	4'T8	E	S	4	2	32	10	92	6	280	258	583	0	616
7	1	Kitchen	Exit Sign	N	LED	1	1	5	N	24	365	1	6	53	N/A	Exit Sign	LED	N	N	1	1	5	24	365	1	6	53	0	0	0
8	1	Storage Rm	Screw-in	N	Inc	1	1	60	N	10	230	0	60	138	CFL	Screw-in	CFL	N	N	1	1	20	10	230	0	20	46	92	0	92
9	1	Kitchen	Screw-in	N	Inc	1	1	60	N	10	230	0	60	138	CFL	Screw-in	CFL	N	N	1	1	20	10	230	0	20	46	92	0	92
10	1	Office	Parabolic	M	4'T12	2	2	40	S	10	230	15	190	437	T8	Parabolic	4'T8	E	S	2	2	32	10	92	6	140	129	292	0	308
11	1	Men's Locker Room	Parabolic	M	4'T12	13	2	40	S	10	230	15	1,235	2,841	T8	Parabolic	4'T8	E	OS	13	2	32	8	92	6	910	628	1896	209	2213
12	1	Men's Locker Room	Exit Sign	N	Fl.	1	1	15	N	24	365	2	17	149	LEDex	Exit Sign	LED	N	N	1	1	5	24	365	1	6	53	96	0	96
13	1	Meeting Rm	Parabolic	M	4'T12	22	2	40	S	10	230	15	2,090	4,807	T8	Parabolic	4'T8	E	OS	22	2	32	8	92	6	1540	1063	3208	354	3744
14	1	Storage Rm	Parabolic	M	4'T12	1	1	40	N	2	230	15	55	25	T8	Parabolic	4'T8	E	N	1	1	32	2	92	3	35	6	18	0	19
15	1	Meeting Rm	Exit Sign	N	Fl.	1	1	15	N	24	365	2	17	149	LEDex	Exit Sign	LED	N	N	1	1	5	24	365	1	6	53	96	0	96
16	1	Meeting Rm	Exit Sign	N	LED	1	1	5	N	24	365	1	6	53	N/A	Exit Sign	LED	N	N	1	1	5	24	365	1	6	53	0	0	0
17	1	Storage Rm	Screw-in	N	Inc	1	1	60	N	2	230	0	60	28	CFL	Screw-in	CFL	N	N	1	1	20	2	230	0	20	9	18	0	18
18	1	Women's Locker Roo	Parabolic	M	4'T12	13	2	40	S	10	230	15	1,235	2,841	T8	Parabolic	4'T8	E	OS	13	2	32	8	92	6	910	628	1896	209	2213
19	1	Women's Locker Roo	Exit Sign	N	Fl.	1	1	15	N	10	365	2	17	62	LEDex	Exit Sign	LED	N	N	1	1	5	10	365	1	6	22	40	0	40
20	1	Bathroom	2'U-shape	E	4'T8	1	2	32	OS	10	230	6	70	161	C	2'U-Shape	4'T8	E	S	1	2	32	10	230	6	70	161	0	0	0
21	1	Bathroom Men	Parabolic	E	2'T8	1	2	17	S	10	230	3	37	85	N/A	Parabolic	2'T8	E	S	1	2	17	10	230	3	37	85	0	0	0
22	1	Nurse's Station	Parabolic	E	4'T12	1	2	40	S	10	230	15	95	219	T8	Parabolic	4'T8	E	S	1	2	32	10	92	6	70	64	146	0	154
23	1	staff Locker Room	Parabolic	E	4'T12	1	2	40	S	10	230	15	95	219	T8	Parabolic	4'T8	E	S	1	2	32	10	92	6	70	64	146	0	154
24	1	Hallway	Parabolic	E	4'T12	1	2	40	S	10	230	15	95	219	T8	Parabolic	4'T8	E	S	1	2	32	10	92	6	70	64	146	0	154
25	1	Hallway	Exit Sign	N	LED	1	1	5	N	24	365	1	6	53	N/A	Exit Sign	LED	N	N	1	1	5	24	365	1	6	53	0	0	0
26	1	Boiler Rm	Parabolic	M	4'T12	1	2	34	S	2	230	15	83	38	T8	Parabolic	4'T8	E	S	1	2	32	2	92	6	70	13	24	0	25
27	B	Storage Rm	Screw-in	N	Inc	3	1	100	S	2	230	0	300	138	CFL	Screw-in	CFL	N	S	3	1	35	2	230	0	105	48	90	0	90
28	GF	Pool Pump Room	Screw-in	N	Inc	2	1	100	S	2	230	0	200	92	CFL	Screw-in	CFL	N	S	2	1	35	2	230	0	70	32	60	0	60
29	GF	Rear Pump Room	Parabolic	E	4'T8	7	2	32	S	2	230	6	490	225	N/A	Parabolic	4'T8	E	S	7	2	32	2	230	6	490	225	0	0	0
30	Ext	Exterior	Exterior	N	HPS	2	1	170	T	12	365	38	416	1,822	PSMH	Exterior	PSMH	N	T	2	1	125	12	365	27	304	1332	491	0	491
31	Ext	Exterior	Exterior	N	MH	2	1	175	T	12	365	44	438	1,918	PSMH	Exterior	PSMH	N	T	2	1	125	12	365	27	304	1332	587	0	587
32	Ext	Exterior	Exterior	N	Hal	2	3	90	T	12	365	14	568	2,488	CFL	Exterior	CFL	N	T	2	3	60	12	365	0	360	1577	911	0	911
33	Ext	Exterior	Recessed	N	Inc	2	1	100	T	12	365	0	200	876	N/A	Recessed	CFL	N	T	2	1	100	12	365	0	200	876	0	0	0
34	Ext	Exterior	Exterior	N	HPS	3	2	250	T	12	365	128	1,878	8,226	N/A	Exterior	HPS	N	T	3	2	250	12	365	128	1878	8226	0	0	0
35	Ext	Parking	Exterior	N	HPS	3	1	250	T	12	365	63	939	4,113	N/A	Exterior	HPS	N	T	3	1	250	12	365	63	939	4113	0	0	0
Totals:						134	51	2,105				501	14,746	41,509						134	51	1,548			330	11,295	23,220	16,262	1,288	18,289
Rows Highlighed Yellow Indicate an Energy Conservation Measure is recommended for that space																													

Legend

Fixture Type	Lamp Type	Control Type	Ballast Type	Retrofit Category
Exit Sign	LED	N (None)	N/A (None)	N/A (None)
Screw-in	Inc (Incandescent)	S (Switch)	E (Electronic)	T8 (Install new T8)
Pin	1'T5	OS (Occupancy Sensor)	M (Magnetic)	T5 (Install new T5)
Parabolic	2'T5	T (Timer)		CFL (Install new CFL)
Recessed	3'T5	PC (Photocell)		LEDex (Install new LED Exit)
2'U-shape	4'T5	D (Dimming)		LED (Install new LED)
Circline	2'T8	DL (Daylight Sensor)		D (Delamping)
Exterior	3'T8	M (Microphonic Sensor)		C (Controls Only)
	4'T8			PSMH (Install new Pulse-Start Metal Halide)
	6'T8			
	8'T8			
	2'T12			
	3'T12			
	4'T12			
	6'T12			
	8'T12			
	CFL (Compact Fluorescent Lightbulb)			
	Hal (Halogen)			
	MV (Mercury Vapor)			
	MH (Metal Halide)			
	HPS (High Pressure Sodium			
	FL (Fluorescent)			

Appendix B: CoolingMiser Savings

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 CoolerMiser, use the equivalent VendingMiser results. To calculate for PlugMiser, use the equivalent SnackMiser results.

Energy Costs ($0.000 per kWh)	.175
Facility Occupied Hours per Week	17
Number of Cold Drink Vending Machines	2
Number of Non-refrigerated Snack Machines	0
Power Requirements of Cold Drink Machine (Watts; 400 typical)	100
Power Requirements of Snack Machine (Watts; 80 typical)	0
VendingMiser® Sale Price (for cold drink machines)	199
SnackMiser™ Sale Price (for snack machines)	0

Calculate Savings!

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

COLD DRINK MACHINES	Current	Projected	Total Savings	% Savings
kWh	1747	439	1309	75%
Cost of Operation	$305.76	$76.74	$229.02	75%

SNACK MACHINES	Current	Projected	Total Savings	% Savings
kWh	0	0	0	NaN%
Cost of Operation	$0	$0	$0	NaN%

Location's Total Annual Savings

	Current	Projected	Total Savings	% Savings
kWh	1747	439	1308	75%
Cost of Operation	$305.76	$76.74	$229.02	75%

Total Project Cost	Break Even (Months)
$398	20.85

Estimated Five Year Savings on ALL Machines = $1,145.08

Appendix C: Third Party Energy Suppliers (ESCOs)

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

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

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

Appendix D: Glossary and Method of Calculations

Glossary of ECM Terms

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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 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.

Calculation References

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

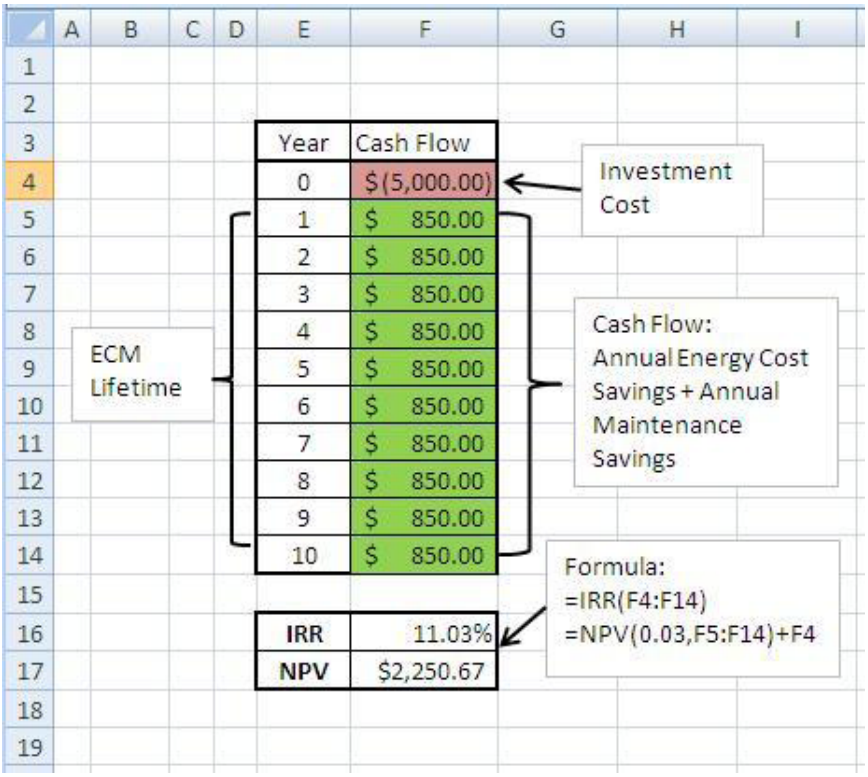
Net ECM Cost = Total ECM Cost – Incentive
LECS = AECS X ECM Lifetime
AOCS = LOCS / ECM Lifetime
LCS = LOCS+LECS

Note: 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).

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
It is easiest to calculate the NPV and IRR using a spreadsheet program like Excel.

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:



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.

NJCEP C & I Lifetimes

Measure	Measure Life
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