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June 28, 2010

Local Government Energy Program
Energy Audit Report

Township of Livingston

Monmouth Court Community Center
25 Monmouth 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:

- Municipal Court
- Main Fire Department
- Northfield Fire Station
- 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 Monmouth Court Community Center located at 25 Monmouth 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 Monmouth Court Community Center located at 25 Monmouth Court was originally constructed in 1951. It is a two story free standing building with approximately 10,400 square feet of conditioned space. The building includes a gym, classrooms, a cafeteria, offices, and a game room. There are approximately 11 full time employees working in the building during normal operations with a fluctuating number of visitors and students in attendance. The first floor is typically open from 8:00 AM to 6:00 PM and the second floor is typically open from 8:00 AM to 5:00 PM.

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 fire stations, sanitation buildings, transportation structures, schools and community centers. The Program will subsidize 75% of the cost of the audit. If the net cost of the installed measures recommended by the audit, after applying eligible NJ SmartStart Buildings incentives, exceeds the remaining cost of the audit, then that additional 25% will also be paid by the program. The Board of Public Utilities (BPU's) Office of Clean Energy has assigned TRC Energy Services to administer the Program.

- 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 Monmouth Court Community Center located at 25 Monmouth Court was originally constructed in 1951. It is a two story free standing building with approximately 10,400 square feet of conditioned space. The building includes a gym, classrooms, a cafeteria, offices, and a game room. There are approximately 11 full time employees working in the building during normal operations with a fluctuating amount of visitors and students in attendance. The first floor is typically open from 8:00 AM to 6:00 PM and the second floor is typically open from 8:00 AM to 5:00 PM.

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 38,745 kWh or $6,591 worth of electricity at an approximate rate of $0.17/kWh and 12,477 therms or $16,752 worth of natural gas at an approximate rate of $1.343/therm. The joint energy consumption for the building, including both electricity and fossil fuel was 1,380 MMBTUs of energy that cost a total of $23,343.

SWA has entered energy information about the community 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 at this time, it is ineligible for Energy Star certification. 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 143.0 kBtu/sq ft yr compared to the national average of a public assembly building consuming 104.0 kBtu/sq ft yr. Implementing this report's recommended Energy Conservations Measures (ECMs) will reduce use by approximately 5.1 kBtu/ sq ft yr, which would decrease the building's energy use intensity to 137.9 kBtu/sq ft yr.

Recommendations

The Monmouth Court Community Center is fifty-eight years old, most HVAC equipment have exceeded their recommended useful life cycles. Additionally, much of the lighting is inefficient. In Appendix C, SWA has included a mechanical inventory list of equipment for the Monmouth Court Community 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 unit ventilators
- Replace H&V unit serving Gymnasium & Stage
- Replace toilet and janitor's closet exhaust fans
- Replace common area heating equipment
- Replace the condensate receiver tank in the steam tunnel
- Replace window air conditioners
- Upgrade Building Management System (BMS)
- Install premium motors when replacements are required
- Improve site drainage
- Insulate original and uninsulated exterior wall sections
- Insulate infectively and under insulated roof
- Perform window sill repairs
- Perform door frame repairs

Category II Recommendations: - Operations and Maintenance

- Replace steam traps
- Boiler room and building domestic water and heating piping insulation
- Use Energy Star labeled appliances
- Maintain and inspect all exterior wall surfaces
- Roof maintenance and inspection program
- Window air conditioner air sealing
- Window maintenance and inspection program
- Door weather-stripping maintenance program

Category III Recommendations: Energy Conservation Measures

At this time, SWA highly recommends a total of **3** Energy Conservation Measures (ECMs) for the Monmouth Court Community Center as summarized in the following Table 1. The total investment cost for these ECMs with incentives is **$3,276**. SWA estimates a first year savings of **$951** with a simple payback of **3.4 years**. SWA also recommends **4** ECMs with a 5-10 year payback that have a first year savings of **$1,244** as summarized in Table 2 and **1** End of Life Cycle ECM that has a first year savings of **$232** as summarized in Table 3.

The implementation of all the recommended ECMs would reduce the building electric usage by 10,610 kWh annually, or 27% of the building's current electric consumption and 173 therms or 1% of the buildings current gas consumption. SWA estimates that implementing these ECMs will reduce the carbon footprint of the Monmouth Court Community Center by **16,560 lbs of CO_2**, which is equivalent to removing approximately 2 cars from the roads each year or avoiding the need of 46 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 $0.02/kWh, which would have equated to $775 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 (ECMs) 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
1.2	Install (20) New CFL fixtures	1,293	0	1,293	3,124	0.7	0	1.0	19	400	5	2,000	3.2	55	11	17	529	4,280
1.3	Install (1) new LED exit sign	203	20	183	543	0.1	0	0.2	0	92	15	1,385	2.0	655	44	50	903	744
1.5	Install (9) new occupancy sensors	1,980	180	1,800	2,701	0.6	0	0.9	0	459	15	6,887	3.9	283	19	25	3,602	3,700
	TOTALS	**3,476**	**200**	**3,276**	**6,368**	**1.4**	**0**	**2**	**19**	**951**	**-**	**10,272**	**3.4**	**-**	**-**	**-**	**5,034**	**8,724**

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
1.1	Replace (42) T12 fixtures with T8 fixtures	9,003	1,260	7,743	2,277	0.5	0	0.7	274	811	15	12,165	9.5	57	4	6	1,800	3,120
1.4	Install (5) new PSMH fixtures	3,545	125	3,420	1,445	0.3	0	0.5	120	366	15	5,486	9.4	60	4	7	883	1,980
2.1	Replace (1) compact refrigerator with an 2.7 cu ft model in kind	99	0	99	95	0.0	0	0.0	0	12	12	121	8.0	23	2	7	24	130
2.2	Replace (1) refrigerator with an 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	**13,122**	**1,385**	**11,737**	**4,242**	**0.9**	**0**	**1.3**	**394**	**1,244**	**-**	**18,315**	**9.4**	**-**	**-**	**-**	**2,782**	**5,812**

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
4	replace domestic water heater with 95% efficient unit	2,700	150	2,550	0	0.0	173	1.7	0	232	15	3,485	11.0	37	2	4	224	2,024

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
3	Install 44.1 kW PV rooftop system with incentives	341,775	44,100	297,675	38,905	44.0	0	12.8	0	29,414	25	165,346	10.1	70	3	6	89,678	53,300

1. HISTORIC ENERGY CONSUMPTION

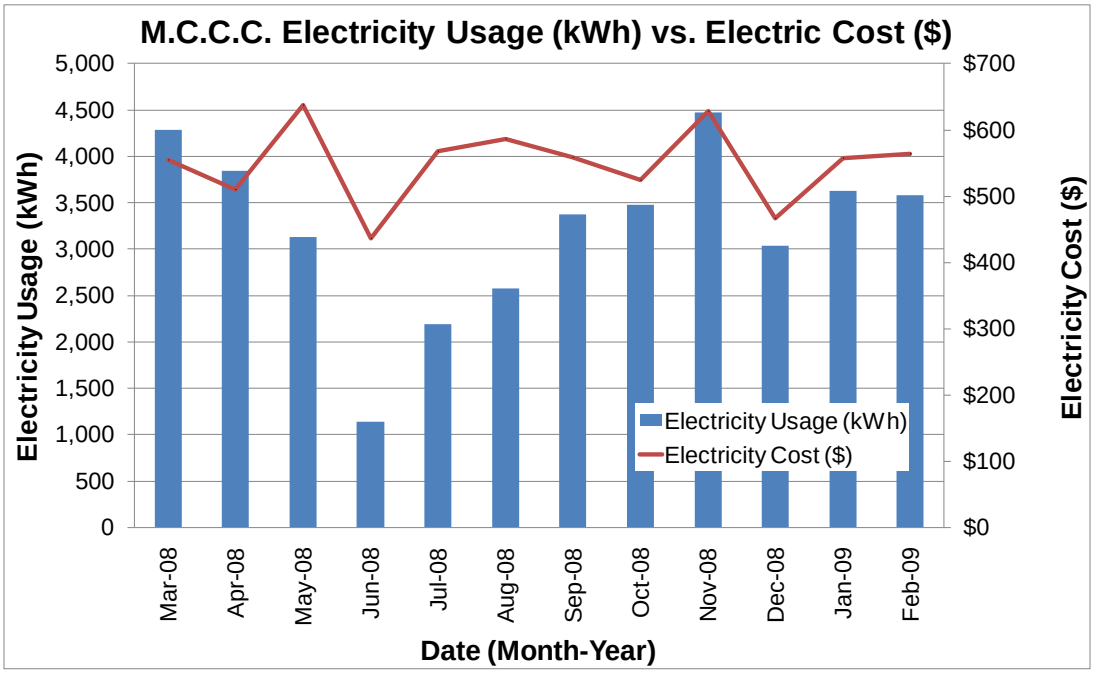
1.1. Energy usage, load profiles and cost analysis

SWA analyzed utility bills for the Monmouth Court Community Center for the 24 months between March 2007 to February 2009 with an analysis period of **March 2008 through February 2009**.

Electricity - The Monmouth Court Community Center buys electricity from PSE&G at **an average rate of $0.17/kWh** based on 12 months of utility bills from **March 2008 through February 2009**. The building purchased **approximately 38,745 kWh or $6,591 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 **16.4 kW** and an annual peak demand of **20.9 kW**.

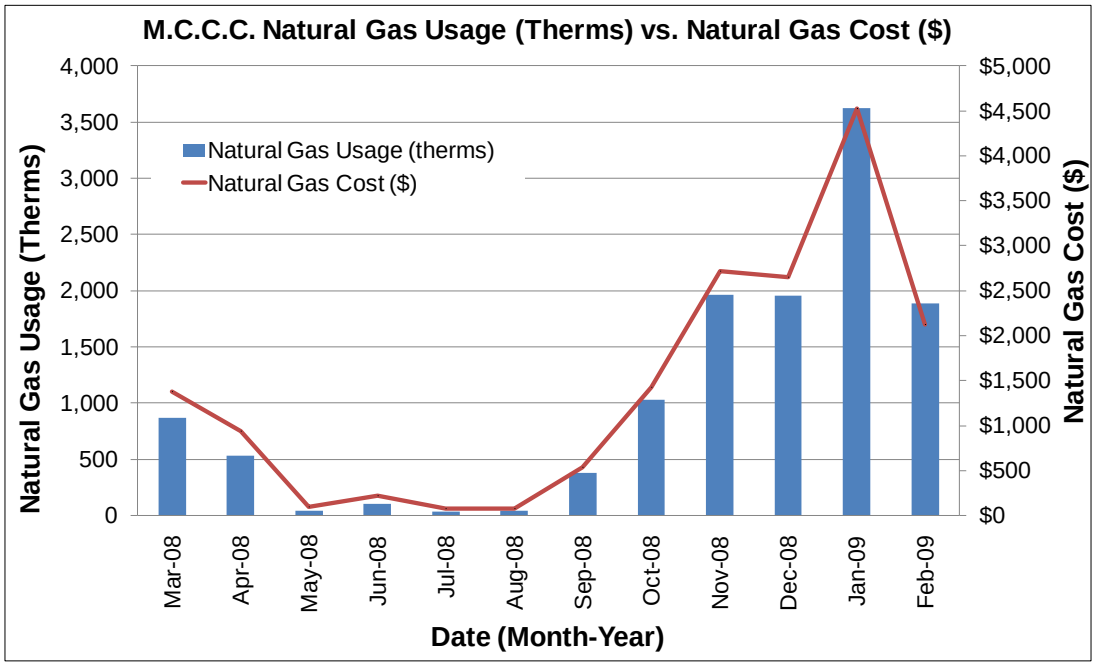
Natural gas – The Monmouth Court Community Center is currently served by one meter for natural gas. The building currently buys natural gas from PSE&G which acts as the transportation company and energy supplier at **an average aggregated rate of $1.343/therm** and purchased **approximately 12,477 therms or $16,752 worth of natural gas** in the 12 months from March 2008 to February 2009.

The following chart shows electricity use versus cost for the Monmouth Court Community Center based on utility bills for the 12 month period of March 2008 to February 2009.

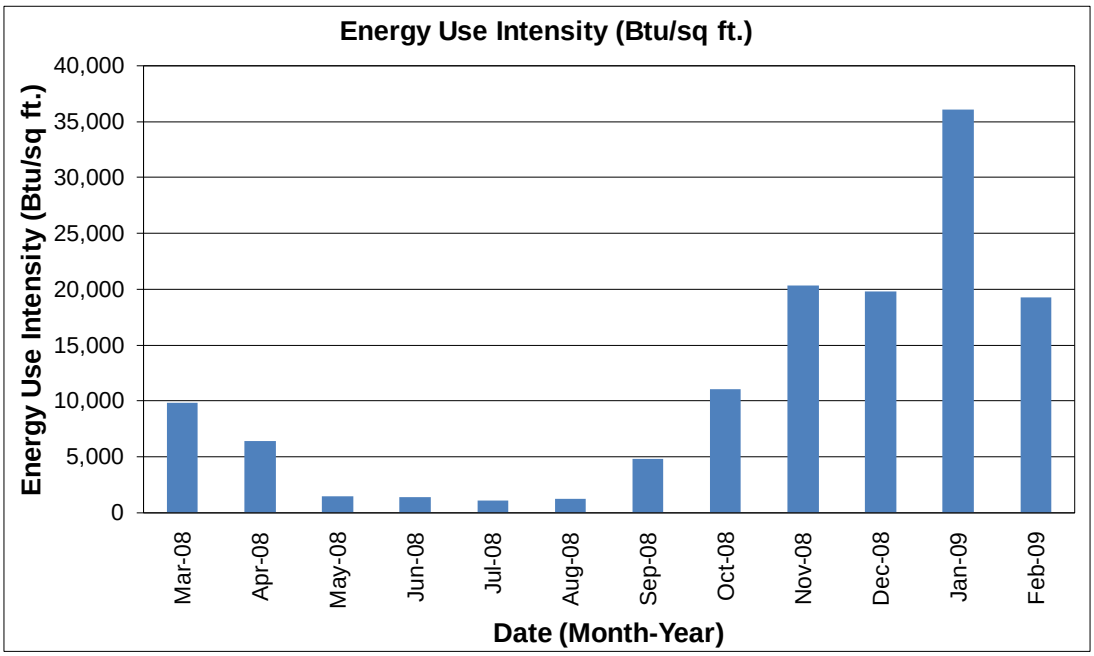


Electricity usage follows a trend that is expected for this building with usage peaking during the winter due to the electric heating equipment. There are also sharp drops in usage that correspond to known building closures in accordance with a normal school schedule. The cost of electricity fluctuates 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.

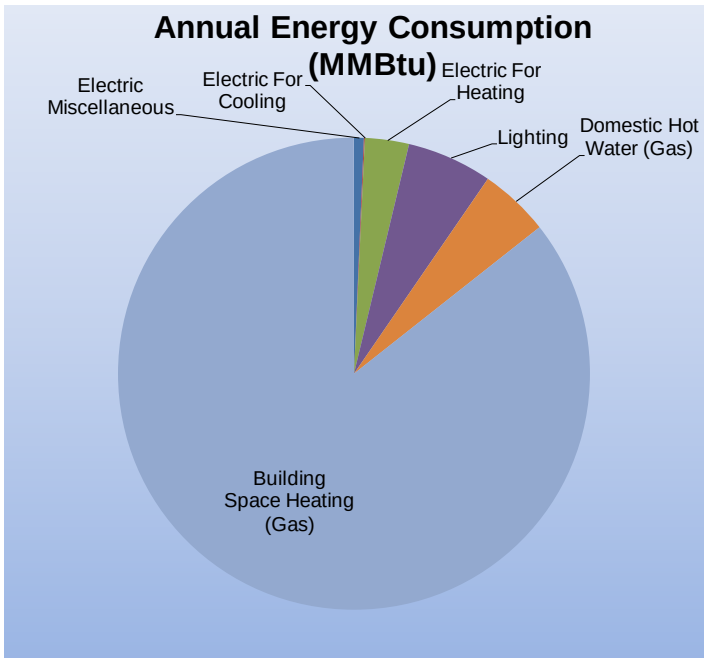


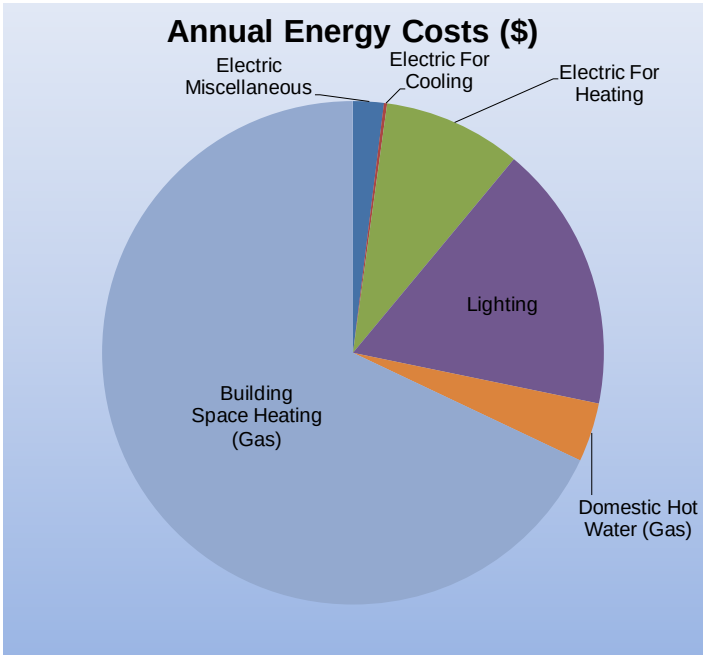
The following chart shows electric consumption in Btu/sq ft for the Monmouth Court Community Center based on utility bills for the 12 month period of March 2008 to February 2009.



The following table and pie chart show energy use for the Monmouth Court Community Center based on utility bills for the 12 month period of March 2008 to February 2009. Note: Electrical cost at $50/MMBTU of energy is almost 4 times as expensive to use as typical natural gas at $13/MMBTU.

March 2008 - February 2009 Annual Energy Consumption / Costs					
	MMBtu	% MMBtu	$	% $	$/MMBtu
Electric Miscellaneous	9	1%	$460	2%	50
Electric For Cooling	1	0%	$48	0%	50
Electric For Heating	42	3%	$2,072	9%	50
Lighting	80	6%	$4,011	17%	50
Domestic Hot Water (Gas)	66	5%	$886	4%	13
Building Space Heating (Gas)	1,182	86%	$15,866	68%	13
Totals	1,380	100%	$23,343	100%	
Total Electric Usage	132	10%	$6,591	28%	50
Total Gas Usage	1,248	90%	$16,752	72%	13
Totals	1,380	100%	$23,343	100%	

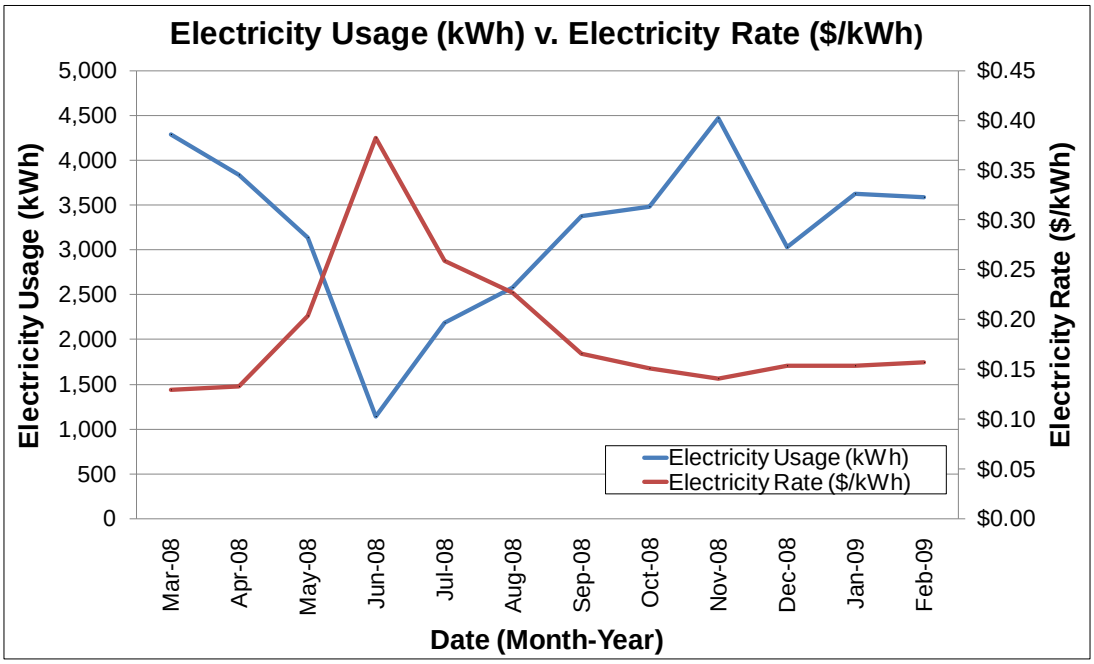




1.2. Utility Rate Analysis

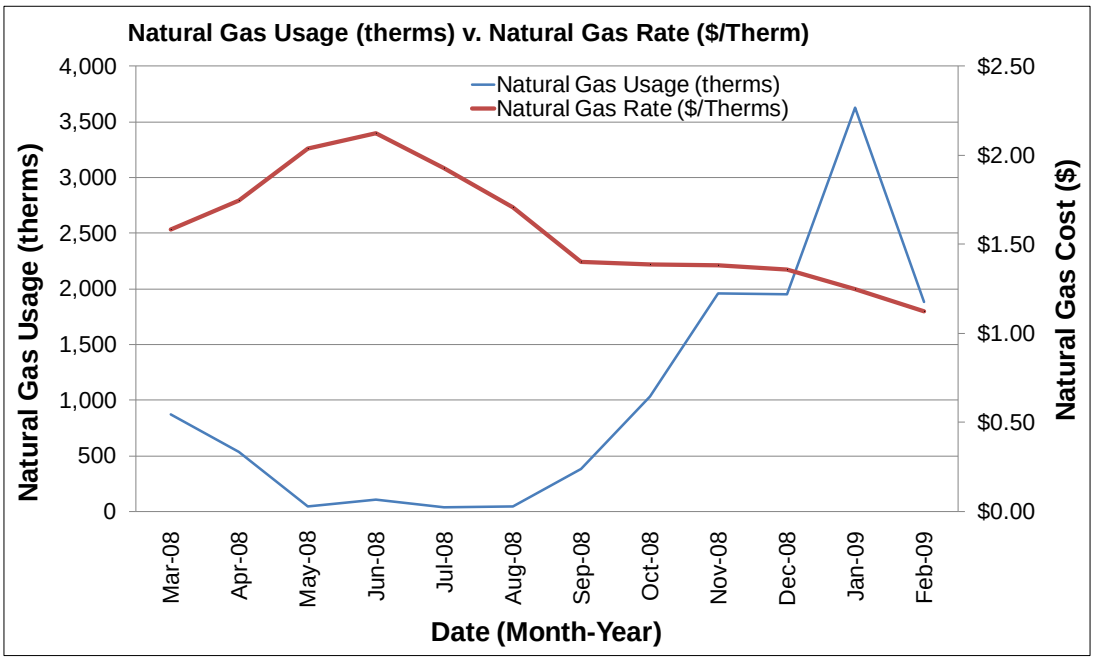
The Monmouth Court Community Center currently purchases electricity from PSE&G at a general service market rate for electricity use (kWh) including a separate (kW) demand charge that is factored into each monthly bill. The Monmouth Court Community Center currently pays an average rate of approximately $0.17/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.



In the above chart, electricity usage decreases during the summer. Occupancy generally decreases during the summer, since the building is used as a school and therefore the amount of cooling is much less than what is expected for the building during these months.

The Monmouth Court Community 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 is one gas meter that provides natural gas service to the Monmouth Court Community Center currently. The average aggregated rate (supply and transport) for the meter is approximately $1.343/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 for domestic hot water. 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 community 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 at this time, it is ineligible for Energy Star certification. 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 143.0 kBtu/sq ft yr compared to the national average of a public assembly building consuming 104.0 kBtu/sq ft yr. Implementing this report's recommended Energy Conservations Measures (ECMs) will reduce use by approximately 5.1 kBtu/ sq ft yr, which would decrease the building's energy use intensity to 137.9 kBtu/sq ft yr.

Per the LGEA program requirements, SWA has assisted the Township of Livingston to create an *Energy Star Portfolio Manager* account and has shared the building facility information to allow future data to be added and tracked using the benchmarking tool. SWA is sharing this Portfolio Manager Site information with TRC Energy Services. As per requirements, the account information is provided below:

Username: LivingstonTownship
Password: Livingston
Project Name: Township of Livingston - Monmouth Court Community 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 - Monmouth Court Community Center

Building ID: 2050708
For 12-month Period Ending: February 28, 2009[1]
Date SEP becomes ineligible: N/A
Date SEP Generated: March 12, 2010

Facility	**Facility Owner**	**Primary Contact for this Facility**
Township of Livingston - Monmouth Court Community Center 25 Monmouth 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: 1951
Gross Floor Area (ft²): 10,400

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

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	139,012
Natural Gas (kBtu)[4]	1,352,818
Total Energy (kBtu)	1,491,830

Energy Intensity[5]	
Site (kBtu/ft²/yr)	143
Source (kBtu/ft²/yr)	181

Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	93

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	-15%
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.

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

EPA Form 5900-16

2. FACILITY AND SYSTEMS DESCRIPTION

2.1. Building Characteristics

The Monmouth Court Community Center located at 25 Monmouth Court was originally constructed in 1951. It is a two story free standing building with approximately 10,400 square feet of conditioned space. The building includes a gym, classrooms, a cafeteria, offices, and a game room.

Partial West Façade


Partial East Façade


Partial South Façade


Partial North Façade

2.2. Building Occupancy Profiles

There are approximately 11 full time employees working in the building during normal operations with a fluctuating number of visitors and students in attendance. The first floor is typically open from 8:00 AM to 6:00 PM and the second floor is typically open from 8:00 AM to 5:00 PM. The primary use of this building is as a pre-K and alternative high school therefore the building follows the typical schedule of a school which closes during the summer.

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 CMU (Concrete Masonry Unit) with no detectable/assumed insulation. The interior is mostly tiled and painted gypsum wallboard.

Note: Wall 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 exterior and interior wall surfaces were inspected. They were found to be in overall good condition with some signs of uncontrolled moisture, air-leakage and/or other energy-compromising issues located mostly at the sides of the building.

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

Signs of water damage at perimeter walls due to / ineffective site drainage and un-caulked/un-sealed exterior wall penetrations

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

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

2. 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 with the next major renovation.

3. Maintain and inspect all exterior wall surfaces with a focus on the condition of caulking, displaced masonry, and signs of water damage and locations that correspond to areas of known infiltration.

2.3.2. Roof

The building's roof is a 3-tier hipped roof over a wood structure with an asphalt shingle finish. It is not known when the last roof replacement occurred. 2 inches of roof insulation were recorded. It is not known when the last roof replacement occurred.

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 to be in overall age appropriate condition with some signs of water pooling, uncontrolled moisture, air-leakage and other energy-compromising issues mostly detected on flat roof areas.

The following 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. Add insulation to ineffectively and under-insulated roof/ ceiling sections. SWA suggests applying closed-cell spray-foam (R-30 min.) to the underside of the metal decking with the next major renovation.

2. Maintain/inspect all roof surfaces on a regular basis.

2.3.3. Base

The building's base is composed of a slab-on-grade floor with a perimeter footing with poured concrete 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 to be in good condition with no signs of uncontrolled moisture, air-leakage and/or other energy-compromising issues neither visible on the interior nor exterior.

2.3.4. Windows

The building contains several different types of windows

1. Fixed type windows with an insulated aluminum frame, clear double glazing and no interior or exterior shading devices. The windows are located throughout the building.
2. Unit (double hung) type windows with an insulated aluminum frame, clear double glazing, interior roller shades and storm windows. The windows are located throughout the building.
3. There are single glazed sidelight and transom units installed in the door systems and glass window panels in some of the doors.

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

Windows with exposed lintels and signs of water damage at sills and storm windows and improper seals surrounding through-the-wall air conditioners.

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

1. Openings around window air conditioning units need airtight gaskets for optimal all year performance. Insulated hoods should be installed during winter months if removing the units is not an option.

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

3. Maintain and inspect all exterior windows with a focus on the condition of the frames, properly operating hardware, airtight seals and window sills.

2.3.5. Exterior doors

The building contains several different types of exterior doors:

1. Wood type exterior door with glass panels. They are located on either side of the building and are original/have never been replaced.
2. Solid metal type exterior door. They are located on either side of the building and were installed recently.
3. Fiberglass type exterior door with glass panels. They are located on either side of the building and were recently installed.

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

The following specific door problem spots and areas were identified:


Damaged and aged door frames, missing/worn weather stripping

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

1. Replace and maintain weather stripping around all exterior doors and roof hatches.
2. Maintain and inspect all doors with a focus on the condition of the weather-stripping, door frame, air tight seal and signs of water damage and infiltration.
3. Replace and repair damaged door frames.

2.3.6. Building air-tightness

Overall the field auditors found the building to be reasonably air-tight, considering the building's use and occupancy, 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 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 Monmouth Court Community Center consists of two main levels as well as a multi-purpose gymnasium/stage at the end of one of the building wings. The lower level has various offices and classrooms, as well as a faculty lounge area. The upper level consists of various office and recreation rooms. Both levels are heated by a boiler supplying hot water to various radiators and unit ventilators. Several rooms throughout the building are cooled by through-the-wall air conditioning units. The gym/stage area receives conditioning from an air handling unit located in the attic space above the stage.

2.4.2 Heating

The entire building is heated via a Weil-McLain gas fired boiler. This boiler was installed circa 1997 and provides 1,632,000 Btuh of output. It has an estimated remaining life of 55%. Hot water is supplied to radiators in several offices/rooms (both levels), wall mounted hydronic heaters in the toilet and stairwell areas (both levels) and to several unit ventilators in various rooms throughout the building. Heating is controlled by wall mounted thermostats in each of the larger main rooms of the building. The control system is pneumatic type which is original to the building.

Gas fired boiler in Mechanical Room

Typical Unit Ventilator

Typical radiators throughout the building

The gymnasium/stage area is served by a hot water heating and ventilating (H&V) unit located in the attic space above the stage. The unit is in fair to poor condition and is beyond it expected useful life. Due to the relative age of the unit, SWA recommends that the unit be replaced in kind.

Air Handling Unit above stage area

2.4.3 Cooling

Various offices and rooms are provided with cooling via thru-the-wall air conditioning units. In general, this equipment is in fair to poor condition and is not Energy Star rated. This equipment should be replaced with Energy Star window air conditioners, assuming another means of ventilation is provided to the unventilated areas of the building. Otherwise, split system HVAC equipment should be provided as a method of also introducing ventilation air. The added benefit of split systems is closing up the window penetration, which could be a significant cause of outside air infiltration and wasted energy.

Thru-the-wall air conditioner

2.4.4 Ventilation

Ventilation is provided to the classrooms via unit ventilators located below the windows. The Gymnasium & Stage are ventilated by the Nesbitt heating & ventilating unit located in the attic space above. Except for the rooms serviced by the through the window air conditioners the remainder of the building is not provided with mechanical ventilation. In addition, it appeared that the toilet and janitor's closet exhaust fans were not operating. Replacement of these units should be with

equipment containing premium efficiency motors and in coordination with the next roof replacement. However, since the equipment is not operating now, this measure will not yield energy savings. Furthermore, since any fans required would be fractional horsepower, they would not qualify for NJ Clean Energy program rebates.

2.4.5 Domestic Hot Water

The domestic hot water for the building is provided by a gas-fired, 75 gallon, 75 MBH tank-type water heater, located in the mechanical room. This heater serves the lavatories in the toilet rooms, a janitor's sink and some sinks in the Café. This water heater is from 1988 and has far exceeded its expected life span. SWA recommends replacing this unit with a direct vent, high efficiency domestic water heater. See ECM #4 for more information.

Domestic Hot Water heater

2.5. Electrical systems

2.5.1. Lighting

Interior Lighting – The Monmouth Court Community Center contains mostly inefficient lighting. There is primarily inefficient lighting such as the existing 2', and 4' T12 fixtures with magnetic ballasts, halogen fixtures and screw in incandescent fixtures however; there are also some T8 fixtures and CFL's that should remain. SWA recommends replacing the T12 lights with T8 electronic ballast fixtures and both the incandescent and halogen fixtures with CFLs. 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 and SWA recommends that the LED exit signs should remain and that the fluorescent types should be replaced with LED exit signs.

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

2.5.2. Appliances

SWA performed a basic survey of appliances installed at the Monmouth Court Community Center and has determined that it would be cost-effective to replace 2 of the refrigerators, the Welbilt and Kenmore units. 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, and 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 and ice-makers be plugged in to power strips and turned off each evening just as the lights are turned off. Monmouth Court Community 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 Monmouth Court Community 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 Community Center.

3. EQUIPMENT LIST - Inventory

Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Domestic Hot Water	Water Heater	Boiler Room	Ruud M# GL75-75B S# 1088403717 75MBH input 75 gal.	Natural Gas	Building	1988	0% unit is beyond expected useful life
Domestic Hot Water	Water Heater Feed Pump	Boiler Room	Bell & Gossett Series 100AB (remaining nameplate illegible) Est. fractional horsepower	Electric	Water Heater	Est. 1997	35%
Heating	Cast Iron Sectional Hot Water Boiler	Boiler Room	Weil-McLain: Model 88 Series 1 M# 788 S# CHB199855 7 sections, 79.6% efficiency 2049MBH input 1632MBH output	Natural Gas	Building	1997	55%
Heating	Boiler Burner	Boiler Room	Power Flame M# WCR2-G-15 S# 099467903 2049MBH max 115V 1ph 12.4A 1/2HP General Electric Motor M# 5KC36JN268GX S# VPL00061 115V 7.8A 3450RPM	Nat. Gas Electric	Hot Water Boiler	1994	20%
Pneumatic Controls	Air Compressor	Boiler Room	Leland-Faraday 208V 3.4FLA 1HP 1725RPM	Electric	Building	1984 (Tank) 2009 (compressor motors)	0% (tank) 95% (motors)
Pneumatic Controls	Compressed Air Dryer	Boiler Room	Speedaire M# 3YA49 S# GR510A1150910078 115V 1ph 3.2MCA 3.9MOCP	Electric	Building	2009	95%

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Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Storm	Duplex Sump Pump	Boiler Room Crawl Space	Leland Faraday M# BVC-4520 S#12565 (2) @ 1/3 HP ea.	Electric	Building	2008	95%
Heating	Duplex Condensate Pump Set and Receiver	Boiler Room Crawl Space	National Pump No Model # (2)@ ½ HP ea.	Electric	Building	2005 (Pumps & Motors) Est. 1990s (Receiver)	75% (Pumps & Motors) 0% (Receiver
Refriger.	Residential Refrigerator	Boiler Room	Kenmore (no nameplate)	Electric	Boiler Room	Est. 1980s	0%
Heating / Ventilation	Air Handling Unit	Attic space above Stage	Nesbitt M# 53934 S# B30-1-AH	Electric	Gymnasium / Stage	1951	0%
Refriger.	Residential Refrigerator	Café	Whirlpool: Kirkland Signature M# SS25AFXLQ00 S# SM1835692 115V 1ph 6.5A 5oz. R134A refrigerant	Electric	Café	2002	40%
Cooling	(3+) Window Air Conditioning Units	Various rooms throughout building	Various makes and models	Electric	Various rooms throughout building	Varies	0-25%
Heating / Ventilation	(7) Unit Ventilators	Classrooms & Cafe	Nesbitt (no nameplate)	Electric	Classrooms & Cafe	1951	0%
Heating	(2) Steam Radiators	Various rooms throughout building	(no nameplate)	Domestic Hot Water	Various rooms throughout building	1951	0%
Heating	(10+) Steam Wall-mounted Unit Heaters	Toilet rooms and stairwells throughout building	(no nameplate)	Domestic Hot Water	Toilet rooms and stairwells throughout building	1951	0%
Lighting	See details - Appendix A	building	-	Electric	Building		

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 unit ventilators – There are 7 Nesbitt steam unit ventilators originally installed in the building. All of these units are well beyond their expected service life. Considering the increased maintenance repair costs and that replacement parts are difficult to find, SWA recommends replacement of this equipment. There is better control offered by the newer, electronically controlled units, although energy savings are negligible.

  The 7 Nesbitt unit ventilators are operating beyond their useful operating lives. SWA evaluated replacement of all 7 units with new. The updated fan coils should be double-inlet forward curved of centrifugal variety; have a maximum speed of 1,000 rpm with permanent split capacitor motors. The fan housing should be constructed of heavy gauge metal to help reduce air noise during operation. Wheel motors are to be premium efficiency, single speed, and permanent split capacitor with overload protection. Each fan should be equipped with a three speed switch for air balancing. An ultra-low leak, blade type outside air damper will ensure low leakage of the outside air when the equipment is not operating. The unit shall have a solid-state defrost control system and two separate filters. The provided air-to-air heat exchanger should be designed to support two air streams in a counter-flow direction. The heat exchanger matrix shall permit less than one percent of cross contamination between the air streams. The heat exchanger shall have an effectiveness of approximately 80% with equal airflow. The proposed unit will not be that much more energy efficient than the existing unit. The estimated budget installed cost of 7 new fan coil ventilators is $65,000. The recommended enhancements over the replacement in kind (with pneumatic controlled units) will offer negligible energy savings.

- Replace H&V unit serving Gymnasium & Stage - The steam heating only ventilation system for the Gymnasium & Stage is beyond its expected service life. SWA recommends that this equipment is replaced in kind as part of a capital improvement project, and that it is designed to provide code minimum ventilation rates. The Monmouth Court Community Center may wish to consider providing DX cooling as part of this system to make the room more functional in warm weather, but should recognize that this will increase energy usage versus providing a heating and ventilation system only. If cooling is desired, it is strongly recommended that a system is provided that utilizes a heat recovery wheel for pretreatment of the outside air. This is a replacement in kind recommendation which offers negligible energy savings.

- Replace toilet and janitor's closet exhaust fans - the toilet and janitor's closet exhaust fans were not operating. Replacement of these units should be with equipment containing premium efficiency motors. However, since the equipment is not operating now, this measure will not yield energy savings. Furthermore, since any fans required would be

fractional horsepower, they would not qualify for NJ Clean Energy program rebates. Replacement cost for (5) fractional horsepower exhaust fans with minor ductwork and wiring updates is about $3,000.

- Replace common area heating equipment - such as cast iron radiators and cabinet unit heaters in the offices, toilet rooms, vestibules and corridors. 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. However, replacement is strongly recommended. This is a replacement in kind recommendation which offers negligible energy savings.

- Replace the condensate receiver tank in the steam tunnel. This receiver is in fair to poor condition, and the Monmouth Court Community Center should consider replacement as part of a capital improvement plan. This is a replacement in kind that offers negligible energy savings.

- Replace window air conditioners – Replacement the existing window air conditioners should be considered with more modern, energy efficient systems. The window air conditioners should be replaced with split systems to allow for closing up of the existing window penetrations. These upgrades cannot be justified by energy savings alone but will result in a decrease in energy usage versus the existing equipment. In addition, the existing systems utilize R-22 refrigerant, which is not an ozone-friendly refrigerant. Newer systems should be specified with R-410A refrigerant.

- Upgrade Building Management System (BMS) - Currently, the building is controlled by an antiquated, pneumatic temperature control system. This system should be replaced by a more modern Direct Digital system. The BMS should be expanded and upgraded to control the current steam unit ventilators and also equipment replaced as part of the capital improvement recommendations. This upgrade will result in energy savings via improved temperature control and by the elimination of the air compressor. The approximate cost for the new system is approximately $90,000.

- Install premium motors when replacements are required - Select NEMA Premium motors when replacing motors that have reached the end of their useful operating lives.

- Improve site drainage - install footing drains and slope perimeter grade away from building. SWA suggests investigating interior footing drain option.

- 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 with the next major renovation.

- Insulate infectively and under insulated roof - Add insulation to ineffectively and under-insulated roof/ceiling sections. SWA suggests applying closed-cell spray-foam (R-30 min.) to the underside of the metal decking with the next major renovation.

- Window sill repairs - install/repair pan or strip flashing and drip edge detail at window sill.

- Door frame repair - replace and repair damaged/aged door frames.

Category II Recommendations: - Operations and Maintenance

- Replace steam traps - on steam heating system supply piping throughout the building. These traps are subject to corrosion and blockages and are often the source of operations and maintenance issues within the system. In addition, these traps should be inspected and maintained on a regular basis.

- Boiler room and building domestic water and heating piping insulation - Insulate un-insulated steam and domestic hot water piping in the Boiler Room and throughout the building to efficiently deliver heat where required and provide personnel protection.

- Use Energy Star labeled appliances - such as Energy Star refrigerators and microwave ovens that should replace older energy inefficient equipment.

- Maintain and inspect all exterior wall surfaces – Maintain and inspect all exterior wall surfaces with a focus on the condition of caulking, displaced masonry, and signs of water damage and locations that correspond to areas of known infiltration.

- Roof maintenance and inspection program – biannually maintain/inspect all roof surfaces on a regular basis.

- Window air conditioner air sealing - openings around window air conditioning units need airtight gaskets for optimal all year performance. Insulated hoods should be installed during winter months if removing the units is not an option.

- Window maintenance and inspection program – biannually maintain and inspect all exterior windows with a focus on the condition of the frames, properly operating hardware, airtight seal and window sill.

- Door weather-stripping maintenance program - replace and maintain weather stripping around all exterior doors and roof hatches and biannually inspect all doors with a focus on the condition of the weather-stripping, door frame, air tight seal 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	Install (20) New CFL fixtures
1.3	Install (1) new LED exit sign
1.5	Install (9) new occupancy sensors
	Description of Recommended 5-10 Year Payback ECMs
1.1	Replace (42) T12 fixtures with T8 fixtures
1.4	Install (5) new PSMH fixtures
2.1	Replace (1) compact refrigerator with an 2.7 cu ft model in kind

2.2	Replace one (1) garage refrigerator with an 17 cu ft Energy Star model
	Description of Recommended End of Life Cycle ECMs
4	replace domestic water heater with 95% efficient unit
	Description of Renewable ECMs
3	Install 44.1 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 Monmouth Court Community Center (see Appendix A). The Monmouth Court Community Center Building currently consists of mostly inefficient lighting. There is primarily inefficient lighting such as the existing 2', and 4' T12 fixtures with magnetic ballasts, halogen fixtures and screw in incandescent fixtures however; there are also some T8 fixtures and CFL's that should remain. SWA recommends replacing the T12 lights with T8 electronic ballast fixtures and both the incandescent and halogen fixtures with CFL's. Based on measurements of lighting levels for each space, there are not any vastly over-illuminated areas. SWA recommends installing 9 occupancy sensors in areas that are occupied only part of the day and payback on savings are justified, such as the lounge areas, workshops and roads department office in the southern corner of the building. 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 lamp fixtures, and incandescent fixtures. Exterior lighting is controlled by photocell sensors. SWA recommends replacing the Metal Halide lamps with pulse start Metal Halide lamps and incandescent with CFLs. 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 photocells. 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 from its facility staff on a scheduled, longer timeline than otherwise performed by a contractor.

Installation cost:

Estimated installed cost: $14,439 (Includes $4,902 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 energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
1.1	Replace (42) T12 fixtures with T8 fixtures	9,003	1,260	7,743	2,277	0.5	0	0.7	274	811	15	12,165	9.5	57	4	6	1,800	3,120
1.2	Install (20) New CFL fixtures	1,293	0	1,293	3,124	0.7	0	1.0	19	400	5	2,000	3.2	55	11	17	529	4,280
1.3	Install (1) new LED exit sign	203	20	183	543	0.1	0	0.2	0	92	15	1,385	2.0	655	44	50	903	744
1.4	Install (5) new PSMH fixtures	3,545	125	3,420	1,445	0.3	0	0.5	120	366	15	5,486	9.4	60	4	7	883	1,980
1.5	Install (9) new occupancy sensors	1,980	180	1,800	2,701	0.6	0	0.9	0	459	15	6,887	3.9	283	19	25	3,602	3,700
	Totals	**16,024**	**1,585**	**14,439**	**10,091**	**2.2**	**0**	**3.3**	**413**	**2,128**	**-**	**27,922**	**6.8**	**-**	**-**	**-**	**7,718**	**13,824**

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 - $30 per T8 fixture, $20 per LED fixture, $25 per PSMH fixture and $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: *Replace Old Refrigerator with an Energy Star Model*

Description:

On the day of the site visit, SWA observed that there were two old refrigerators a 2.7 cu. ft. model and 17 cu. ft. model in the first floor mechanical room and second floor classroom which were not Energy Star rated (using approximately 254 and 773 kWh/yr each). 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 four refrigerators at The Monmouth Court Community Center building, the Welbilt and Kenmore models fall under this criteria and should be replaced. SWA recommends the replacement of the existing Kenmore refrigerator in the first floor mechanical room with a 17 cu. ft. top freezer refrigerator ENERGY STAR®, or equivalent and the Welbilt refrigerator with a 2.7 cf. ft. ENERGY STAR® model 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: $574 (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, l lbs/yr
2.1	Replace (1) compact refrigerator with an 2.7 cu ft model in kind	99	0	99	95	0.0	0	0.0	0	12	12	121	8.0	23	2	7	24	130
2.2	Replace one (1) garage refrigerator with an 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	**574**	**0**	**574**	**520**	**0.1**	**0**	**0.1**	**0**	**67**	**-**	**664**	**8.5**	**-**	**-**	**-**	**99**	**712**

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

ECM#3: *Install 44.1 kW PV system*

Description:

Currently the Monmouth Court Community 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 of Livingston further review installing a 44.1kW PV system 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 Monmouth Court Community 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.

There are many possible locations for a 44.1 kW PV installation on the building roofs. A commercial crystalline 230 watt panel has 17.5 square feet of surface area (13.1 watts per square foot). A 44.1 kW system needs approximately 210.0 panels which would take up 3,675 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: $341,775 (Includes $136,710 in labor cost)
Source of cost estimate: Similar Projects

Economics:

ECM #	ECM description	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand r 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	Install 44.1 kW PV rooftop system with incentives	341,775	44,100	297,675	38,905	44	0	12.8	0	29,414	25	165,346	10.1	70	3	6	89,678	53,300

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 $44,100.

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 1,000kWh (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. An annual SREC amount of $22,800 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#4: Replace Domestic Water Heater

Description:

There is one (1) gas-fired 75 gallon domestic water heater that serves the toilet rooms that are utilized for the entire year. This unit typically achieves approximately 70% efficiency in natural gas usage considering its current age. This equipment is approaching the end of its expected service life and should be replaced. The Monmouth Court Community Center can realize energy savings by installing a direct vent high efficiency water heater. This type of heater can achieve up to 95% efficiency. This measure cannot be justified by energy savings alone, but should be considered as an end-of-life energy savings opportunity.

Installation cost:

Estimated installed cost: $2,700 (Includes $678 in labor cost)
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 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
4.1	replace domestic water heater with 95% efficient unit	2,700	150	2,550	0	0.0	173	1.7	0	232	15	3,485	11.0	37	2	4	224	2,024
4.2	incremental cost to replace domestic water heater with 95% efficient unit	650	150	500	0	0.0	173	1.7	0	232	15	3,485	2.2	597	40	46	2,274	2,024

Assumptions: SWA calculated the savings for this measure using nameplate data taken the days of the field visits, equipment efficiencies listed above and using the billing analysis.

Rebates/financial incentives:

NJ Clean Energy – Gas-fired water heaters >50 gallons ($2.00 per MBH but no less than $50 per heater) Maximum incentive amount is $150.

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

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#3.

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

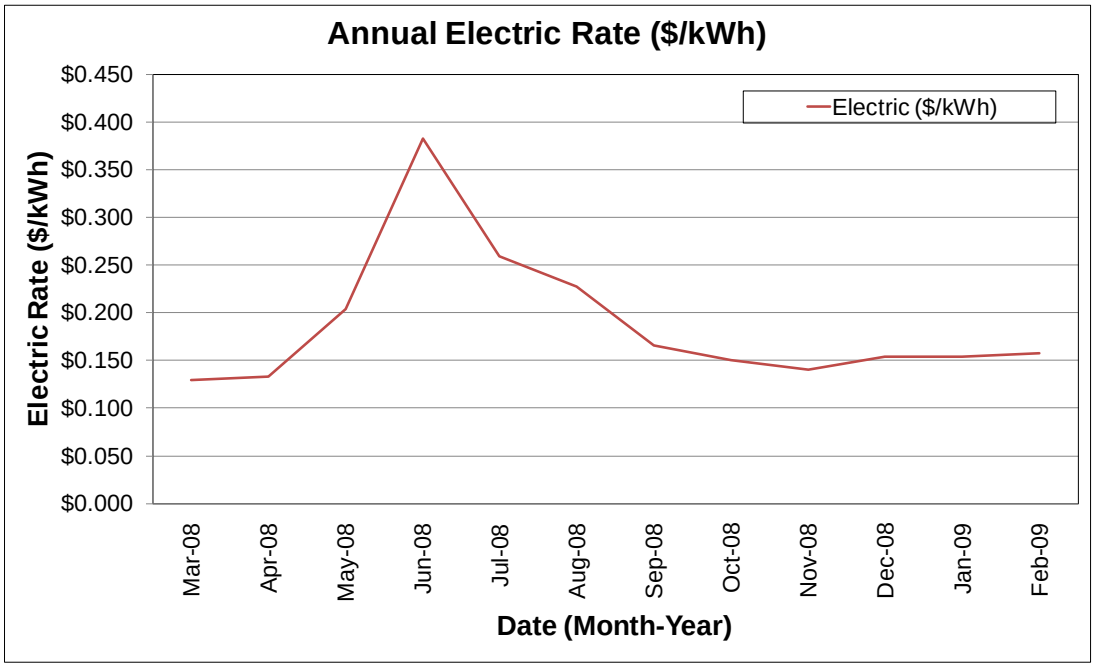
Geothermal is not applicable for this building because it would not be cost effective considering the size of the existing HVAC systems.

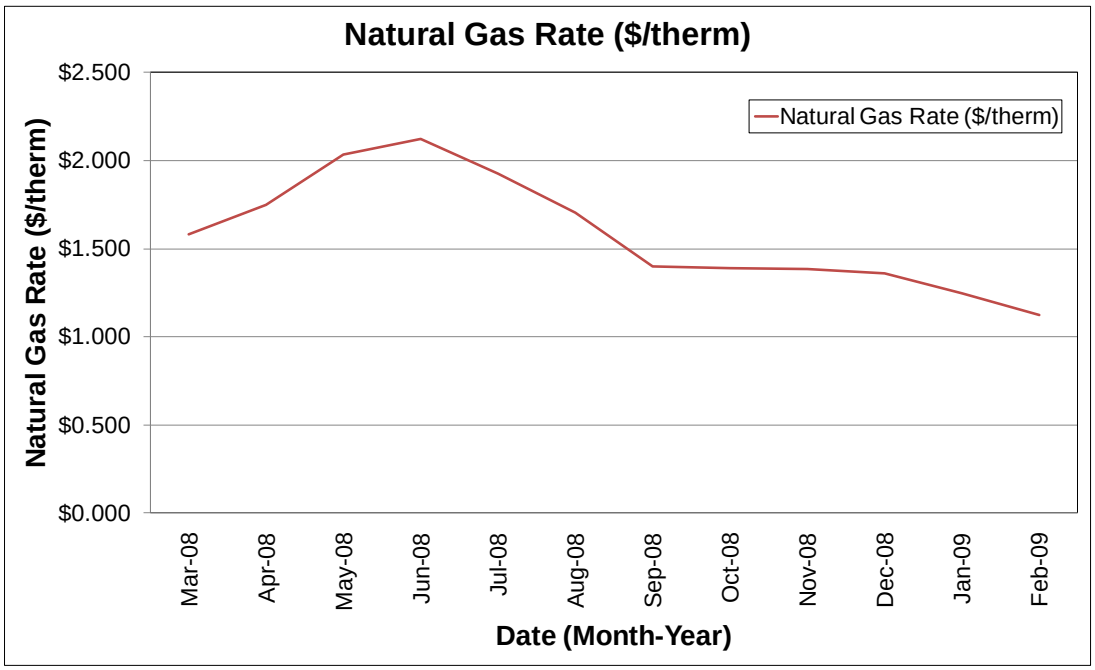
6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

6.1. Energy Purchasing

The Monmouth Court Community Center receives electricity purchased via one incoming meter directly for the Monmouth Court Community 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 66% over the 12 month period between March 2008 and February 2009. Natural gas is also purchased via one incoming meter directly from PSE&G as well. Natural gas bill analysis shows fluctuations of up to 47% 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 $1.550/therm for natural gas. The electricity rate for the fire department is $0.17/kWh, which means there is a potential cost savings of $775. The natural gas rate is $1.343/kWh, which competitive. 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 Monmouth Court Community 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 Monmouth Court Community 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 Monmouth Court Community 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	Mechanical Rm	Screw-in	N	Inc	3	1	100	S	2	180	0	300	108	CFL	Screw-in	CFL	N	S	3	1	35	2	180	0	105	38	70	0	70
2	1	Mechanical Rm	Screw-in	N	Inc	1	1	100	S	2	180	0	100	36	CFL	Screw-in	CFL	N	S	1	1	35	2	180	0	35	13	23	0	23
3	1	Vestibule	Screw-in	N	Inc	1	1	100	S	10	180	0	100	180	CFL	Screw-in	CFL	N	S	1	1	35	10	180	0	35	63	117	0	117
4	1	Vestibule	Screw-in	N	Inc	1	1	100	S	10	180	0	100	180	CFL	Screw-in	CFL	N	S	1	1	35	10	180	0	35	63	117	0	117
5	1	Classroom	Parabolic	M	4'T12	6	2	40	S	10	180	15	570	1,026	T8	Parabolic	4'T8	E	OS	6	2	32	8	180	6	420	567	270	189	459
6	1	Hallway	Parabolic	M	4'T12	3	2	40	S	10	180	15	285	513	T8	Parabolic	4'T8	E	S	3	2	32	10	180	6	210	378	135	0	135
7	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
8	1	Meeting Rm	2'U-shape	E	4'T8	12	2	32	S	10	180	6	840	1,512	C	2'U-Shape	4'T8	E	OS	12	2	32	8	180	6	840	1134	0	378	378
9	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
10	1	Vestibule	2'U-shape	E	4'T8	3	2	32	S	10	180	6	210	378	N/A	2'U-Shape	4'T8	E	S	3	2	32	10	180	6	210	378	0	0	0
11	1	Bathroom Men	2'U-shape	E	4'T8	1	2	32	S	4	180	6	70	50	N/A	2'U-Shape	4'T8	E	S	1	2	32	4	180	6	70	50	0	0	0
12	1	Bathroom Women	2'U-shape	E	4'T8	1	2	32	S	4	180	6	70	50	N/A	2'U-Shape	4'T8	E	S	1	2	32	4	180	6	70	50	0	0	0
13	1	Meeting Rm	HID	N	Hal	10	1	90	S	10	180	23	1,130	2,034	CFL	Screw-in	CFL	N	OS	10	1	30	8	180	0	300	405	1484	135	1629
14	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
15	1	Bathroom Women	Parabolic	E	4'T8	2	4	32	S	4	180	13	282	203	N/A	Parabolic	4'T8	E	S	2	4	32	4	180	13	282	203	0	0	0
16	1	Hallway	Exit Sign	N	FL.	1	4	15	N	24	365	8	68	596	LEDex	Exit Sign	LED	N	N	1	1	5	24	365	1	6	53	543	0	543
17	1	Bathroom Men	Recessed	E	4'T8	2	4	32	S	4	180	13	282	203	N/A	Recessed	4'T8	E	S	2	4	32	4	180	13	282	203	0	0	0
18	1	Bathroom Men	Recessed	E	4'T8	2	4	32	S	4	180	13	282	203	N/A	Recessed	4'T8	E	S	2	4	32	4	180	13	282	203	0	0	0
19	1	Storage Rm	Parabolic	M	4'T12	2	2	40	S	2	180	15	190	68	T8	Parabolic	4'T8	E	S	2	2	32	2	180	6	140	50	18	0	18
20	1	Office	Parabolic	M	4'T12	2	2	40	S	10	180	15	190	342	T8	Parabolic	4'T8	E	S	2	2	32	10	180	6	140	252	90	0	90
21	1	Gymnasium	Exit Sign	N	LED	3	1	5	N	24	365	1	18	158	N/A	Exit Sign	LED	N	N	3	1	5	24	365	1	18	158	0	0	0
22	1	Gymnasium	Parabolic	M	2'T12	1	1	20	S	10	180	8	28	50	T8	Parabolic	2'T8	E	S	1	1	17	10	180	2	19	34	16	0	16
23	1	Gymnasium	Recessed	N	Inc	16	1	100	S	10	180	0	1,600	2,880	N/A	Recessed	CFL	N	S	16	1	100	10	180	0	1600	2880	0	0	0
24	2	Office	Parabolic	M	4'T12	4	4	40	S	9	180	24	736	1,192	T8	Parabolic	4'T8	E	S	4	4	32	9	180	13	564	914	279	0	279
25	2	Office	Screw-in	N	Inc	1	1	60	S	9	180	0	60	97	CFL	Screw-in	CFL	N	S	1	1	20	9	180	0	20	32	65	0	65
26	2	Bathroom	Screw-in	N	Inc	1	1	60	S	4	180	0	60	43	CFL	Screw-in	CFL	N	S	1	1	20	4	180	0	20	14	29	0	29
27	2	Janitor's Closet	Screw-in	N	Inc	1	1	100	S	2	180	0	100	36	CFL	Screw-in	CFL	N	S	1	1	35	2	180	0	35	13	23	0	23
28	2	Meeting Rm	Parabolic	E	4'T8	6	4	32	S	9	180	13	846	1,371	C	Parabolic	4'T8	E	OS	6	4	32	7	180	13	846	1028	0	343	343
29	2	Office	Parabolic	E	4'T8	2	4	32	S	9	180	13	282	457	N/A	Parabolic	4'T8	E	S	2	4	32	9	180	13	282	457	0	0	0
30	2	Classroom	Parabolic	E	4'T8	6	4	32	S	9	180	13	846	1,371	C	Parabolic	4'T8	E	OS	6	4	32	7	180	13	846	1028	0	343	343
31	2	Classroom	Parabolic	E	4'T8	6	4	32	S	9	180	13	846	1,371	C	Parabolic	4'T8	E	OS	6	4	32	7	180	13	846	1028	0	343	343
32	2	Staircase	Screw-in	E	CFL	3	1	19	S	9	180	0	57	92	N/A	Screw-in	CFL	E	S	3	1	19	9	180	0	57	92	0	0	0
33	2	Staircase	Screw-in	E	CFL	3	1	19	S	9	180	0	57	92	N/A	Screw-in	CFL	E	S	3	1	19	9	180	0	57	92	0	0	0
34	2	Fitness	Parabolic	E	4'T8	1	4	32	S	9	180	13	141	228	N/A	Parabolic	4'T8	E	S	1	4	32	9	180	13	141	228	0	0	0
35	2	Bathroom	Screw-in	N	Inc	1	1	100	N	4	180	0	100	72	CFL	Screw-in	CFL	N	N	1	1	35	4	180	0	35	25	47	0	47
36	2	Hallway	Parabolic	M	4'T12	3	2	40	S	9	180	15	285	462	T8	Parabolic	4'T8	E	S	3	2	32	9	180	6	210	340	122	0	122
37	2	Office	Parabolic	M	4'T12	5	4	40	S	9	180	24	920	1,490	T8	Parabolic	4'T8	E	OS	5	4	32	7	180	13	705	857	348	286	634
38	2	Office	Parabolic	M	4'T12	2	4	40	S	9	180	24	368	596	T8	Parabolic	4'T8	E	S	2	4	32	9	180	13	282	457	139	0	139
39	2	Storage Rm	Parabolic	M	4'T12	1	2	40	S	2	180	15	95	34	T8	Parabolic	4'T8	E	S	1	2	32	2	180	6	70	25	9	0	9
40	2	Classroom	Parabolic	M	4'T12	6	4	40	S	9	180	24	1,104	1,788	T8	Parabolic	4'T8	E	OS	6	4	32	7	180	13	846	1028	418	343	761
41	2	Classroom	Parabolic	M	4'T12	6	4	40	S	9	180	24	1,104	1,788	T8	Parabolic	4'T8	E	OS	6	4	32	7	180	13	846	1028	418	343	761
42	2	Storage Rm	Parabolic	M	4'T12	1	4	40	S	2	180	24	184	66	T8	Parabolic	4'T8	E	S	1	4	32	2	180	13	141	51	15	0	15
43	Ext	Exterior	Exterior	N	MH	5	1	150	PC	12	365	38	940	4,117	PSMH	Exterior	PSMH	N	PC	5	1	100	12	365	22	610	2672	1445	0	1445
44	Ext	Exterior	Exterior	N	Inc	4	1	100	PC	12	365	0	400	1,752	CFL	Exterior	CFL	N	PC	4	1	35	12	365	0	140	613	1139	0	1139
Totals:						135	97	1,867				405	14,924	23,577						135	94	1,228			249	11,966	16,070	4,806	2,701	7,507

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	1T5	OS (Occupancy Sensor)	M (Magnetic)	T5 (Install new T5)
Parabolic	2T5	T (Timer)		CFL (Install new CFL)
Recessed	3T5	PC (Photocell)		LEDex (Install new LED Exit)
2'U-shape	4T5	D (Dimming)		LED (Install new LED)
Circline	2T8	DL (Daylight Sensor)		D (Delamping)
Exterior	3T8	M (Microphonic Sensor)		C (Controls Only)
	4T8			PSMH (Install new Pulse-Start Metal Halide)
	6T8			
	8T8			
	2T12			
	3T12			
	4T12			
	6T12			
	8T12			
	CFL (Compact Fluorescent Lightbulb)			
	Hal (Halogen)			
	MV (Mercury Vapor)			
	MH (Metal Halide)			
	HPS (High Pressure Sodium			
	FL (Fluorescent)			

Appendix B: 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 C: 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

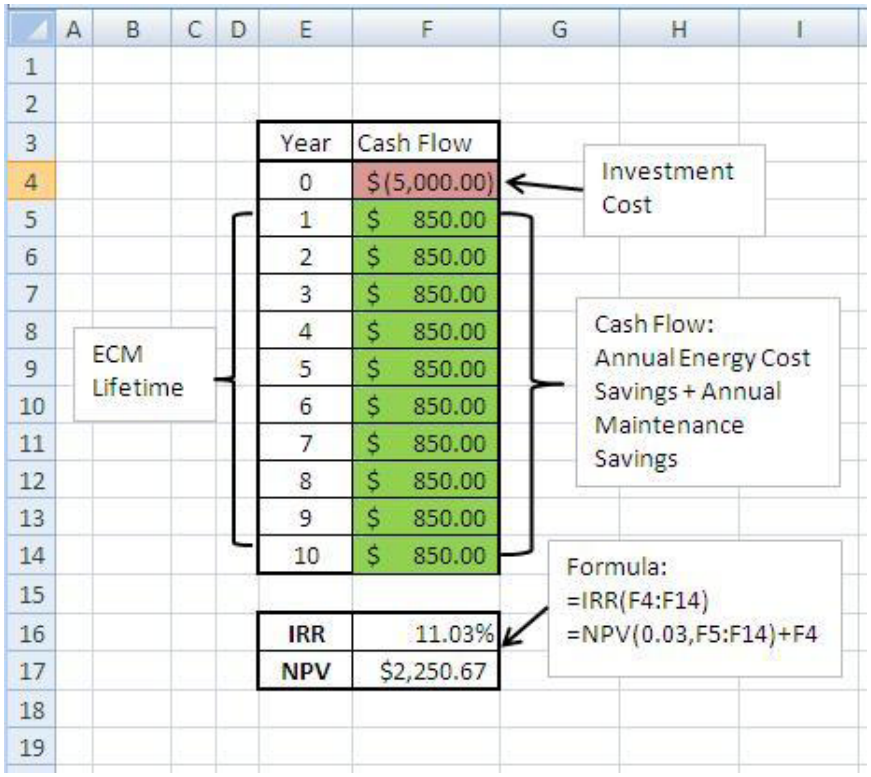
Net ECM Cost = Total ECM Cost – Incentive
LECS = AECS X ECM Lifetime
AOCS = LOCS / ECM Lifetime
LCS = LOCS+LECS

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