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Local Government Energy Program
Energy Audit Final Report

Mullica Hilda Frame School
3410 Nesco Road, Hammonton, NJ

Project Number: LGEA44

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INTRODUCTION

On December 21 and 22, 2009 Steven Winter Associates, Inc. (SWA) performed an energy audit and assessment for the Mullica Board of Education buildings. The audit included a review of the:

- Mullica Elementary and Middle Public School
- Mullica Hilda Frame School

The buildings are located in Elwood and Hammonton New Jersey. A separate energy audit report is issued for each of the referenced buildings.

This report addresses the Mullica Hilda Frame School located at 3410 Nesco Road, Hammonton, NJ. The current conditions and energy-related information were collected in order to analyze and facilitate the implementation of energy conservation measures for the building.

The single-story with basement Mullica Hilda Frame School was originally built in 1900 with several additions/renovations, the latest in 2004. The building consists of 4,224 square feet of conditioned space and houses two classrooms, bathrooms and office space. The school's current enrollment is 60 students with 6 teachers and staff, and school is in session from 8:30 am to 3:30 pm for 10 months of the year.

The goal of this Local Government Energy Audit (LGEA) is to provide sufficient information to the Mullica Board of Education to make decisions regarding the implementation of the most appropriate and most cost-effective energy conservation measures for the Hilda Frame School.

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. For projects awarded on or prior to December 31, 2009, 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 (BPUs) Office of Clean Energy has assigned TRC Energy Services to administer the Program.

EXECUTIVE SUMMARY

The energy audit performed by Steven Winter Associates (SWA) encompasses the Mullica Hilda Frame School located at 3410 Nesco Road, Hammonton, NJ. The school is a single-story building with basement and a floor area of 4,224 square feet. The original structure was built in 1900, with several additions and renovations, the latest in 2004.

Based on the field visits performed by the SWA staff on December 21 and 22, 2009 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.

From October 2008 to September 2009 the Mullica Hilda Frame School consumed 15,615 kWh or $2,574 worth of electricity at an approximate rate of $0.165/kWh and 1,826 gallons or $5,564 worth of fuel oil #2 at an approximate rate of $3.048 per gallon. The joint energy consumption for the building, including both electricity and fuel oil, was 307 MMBtu of energy that cost a total of $8,137.

SWA has entered energy information about the Mullica Hilda Frame School building in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. This school facility is less than 5,000 square feet and therefore is not eligible for an Energy Star rating and cannot be compared to a Site Utilization Index (EUI) National Average. The Site Energy Use Intensity is 73 kBtu/ft^2/yr. Implementing this report's recommendations can reduce energy use by approximately 8.6 kBtu/ft^2/yr.

As of April 2009, Mullica Board of Education district joined the Alliance for Competitive Energy Services (ACES) which solicits bids for electric generation services at a reduced price. As a result, the Hilda Frame School is charged for electric supply through a third party supplier, South Jersey Energy, with Atlantic City Electric charging only the transport rate for electric service.

Based on the assessment of the Mullica Hilda Frame School, SWA has separated the recommendations into three categories (see Section 4 for more details). These are summarized as follows:

Category I Recommendations: Capital Improvement Measures

- Select NEMA Premium motors when replacing motors at the end of their useful operating lives
- Install occupancy sensors in offices, bathrooms and closets; current payback is in excess of 20 years

Category II Recommendations: Operations and Maintenance

- Thoroughly and evenly insulate space above the ceiling tiles
- Maintain roofs - SWA recommends regular maintenance to verify water is draining correctly
- Maintain downspouts - Repair/install missing downspouts as needed
- Replace damaged weather-stripping/air-sealing, especially to back exterior door
- Repair/seal wall cracks and penetrations
- Provide water efficient fixtures and controls
- Use Energy Star labeled appliances
- Use smart power electric strips

- Create an energy educational program

Category III Recommendations: Energy Conservation Measures - Upgrades with associated energy savings

At this time, SWA highly recommends a total of **1** Energy Conservation Measure (ECM) for the Mullica Hilda Frame School, as summarized in the following Table 1. The total investment cost for the ECM with incentives is **$159**. SWA estimates a first-year savings of **$83** with a simple payback of **1.9 years**. SWA also recommends **3** ECM's with a total first-year savings of **$4,896** as summarized in Table 2. There are also **2** recommended ECM's with a payback greater than 10 years, as shown in Table 3, with a total first-year savings of $627.

There are various incentive programs that the Mullica Board of Education could apply for that could also help lower the cost of installing the ECMs, such as the NJ SmartStart program through the New Jersey Office of Clean Energy. This incentive program 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 Atlantic City Electric that would allow the building to pay for the installation of the PV system through a loan issued by the utility.

The following tables summarize the proposed Energy conservation Measures (ECMs) and their economic relevance. In order to clearly present the overall energy opportunities for the building and ease the decision and choice of which ECM to implement, SWA calculated each ECM independently and did not incorporate slight / potential overlaps between some of the summarized ECMs (i.e. lighting change influence on heating / cooling).

Table 1 - Highly Recommended 0-5 Year Payback ECMs																				
ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	est. energy & operating 1st year cost 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, $	CO2 reduced, lbs/yr
1	3 new CFL fixtures to be installed with incentives	RS Means, lit search	159	none at this time	159	502	0.1	0	0.4	0	83	5	414	1.9	161	32	44	218	687

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	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	est. energy & operating 1st year cost 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, $	CO2 reduced, lbs/yr
2	Install 5 kW Solar Photovoltaic system	Similar Projects	35,000	5,000	30,000	5,900	5.0	0	4.8	0	4,514	25	77,438	6.6	158.1	6.3	13	88,235	10,564
3	Replace old refrigerator & ice box with one large 25 cu ft Energy Star Refrigerator with Ice Box	Energy Star purchasing and procurement site, similar projects	1,200	none at this time	1,200	1,433	0.9	0	1.2	0	236	12	2,837	5.1	136	11	17	1,126	1,963
1b	2 new pulse start metal halide fixtures to be installed with incentives	RS Means, lit search	1,418	50	1,368	125	0.0	0	0.1	125	146	15	2,185	9.4	60	4	7	65	172
	TOTALS		**37,618**		**32,568**	**7,458**	**5.9**	**0**	**6.1**	**125**	**4,896**		**82,460**	**6.7**	**-**	**-**	**-**	**-**	**12,699**

Table 3 - Recommended Payback > 10 years ECM's																		
ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
1c	52 new T8 fixtures to be installed with incentives	RS Means, lit search	11,197	780	10,417	2,201	0.5	0	1.8	200	563	15	8,448	18.5	-19	-1	-3	-4,877	3,016
1d	10 new LED exit sign fixtures to be installed with incentives	RS Means, lit search	2,033	200	1,833	385	0.1	0	0.3	0	64	15	954	28.8	-48	-3	-7	-1,208	528
	TOTALS		**13,230**		**12,250**	**2,587**	**0.5**	**0**	**2.1**	**200**	**627**		**9,402**	**20**	**-**	**-**	**-**	**-**	**3,544**

1. HISTORIC ENERGY CONSUMPTION

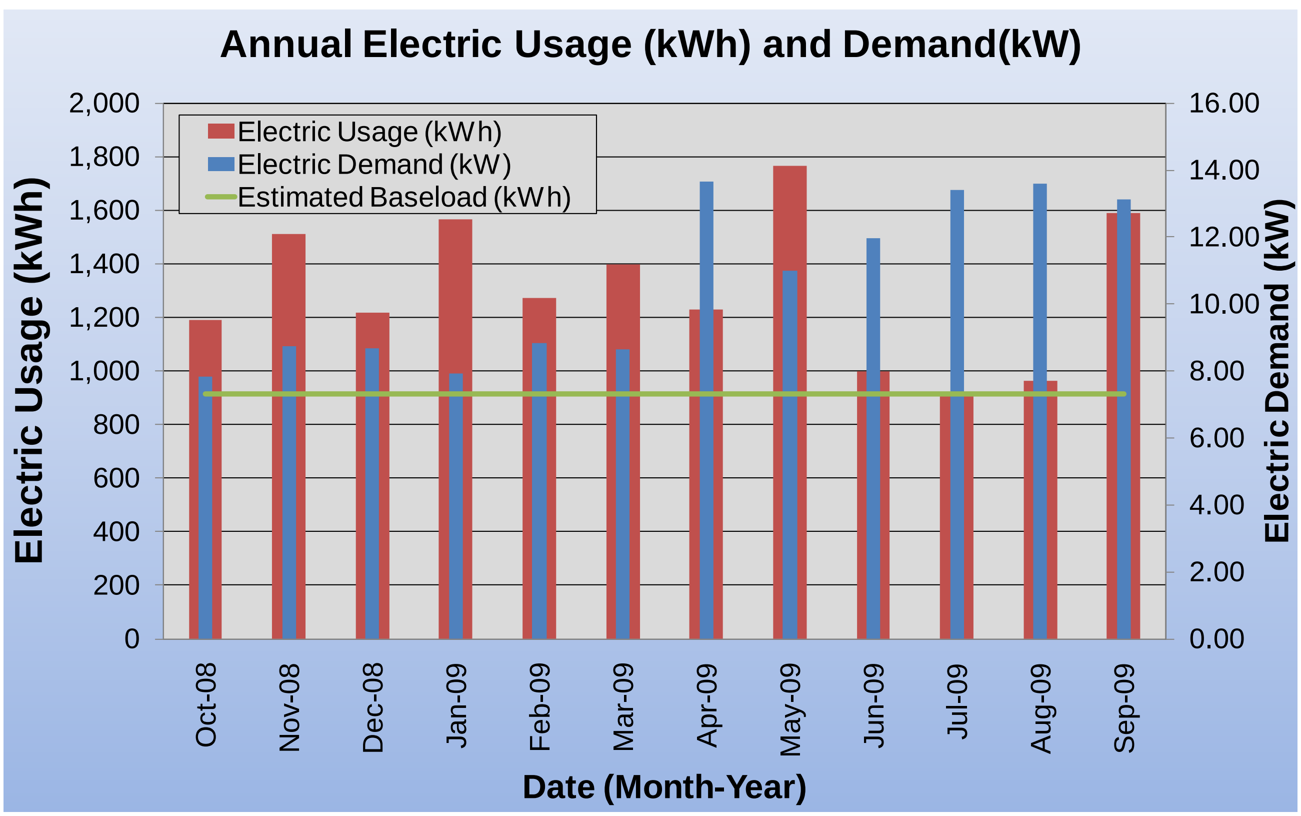
1.1. Energy usage and cost analysis

SWA analyzed utility bills from October 2008 through September 2009 that were received from the utility companies supplying the Mullica Hilda Frame School with electric and fuel oil.

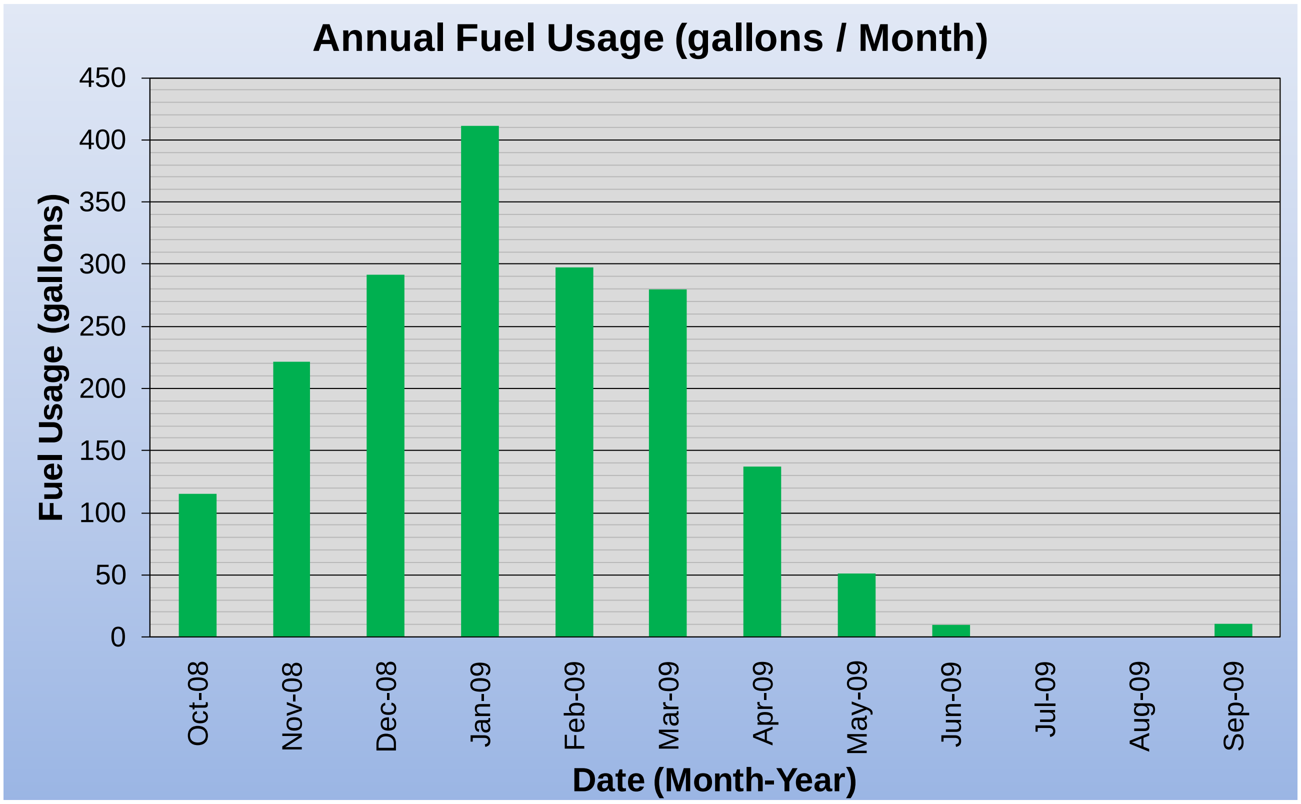
Electricity - The Mullica Hilda Frame School is currently served by one electric meter. The Mullica Hilda Frame School currently buys electricity from Atlantic City Electric at **an average rate of $0.165 /kWh** based on 12 months of utility bills from October 2008 to September 2009. The Mullica Hilda Frame School purchased **approximately 15,615 kWh or $2,574 worth of electricity** in the previous year. The average monthly demand was 10.0 kW.

Fuel oil - The Mullica Hilda Frame School is currently served by one fuel oil tank which is recharged once or twice annually. The Mullica Hilda Frame School currently buys fuel oil from Pedroni Fuel at **an average aggregated rate of $3.048/gallon** based on 12 months of utility bills from October 2008 to September 2009. The Mullica Hilda Frame School purchased **approximately 1,826 gallons or $5,564 worth of fuel oil** in the previous year.

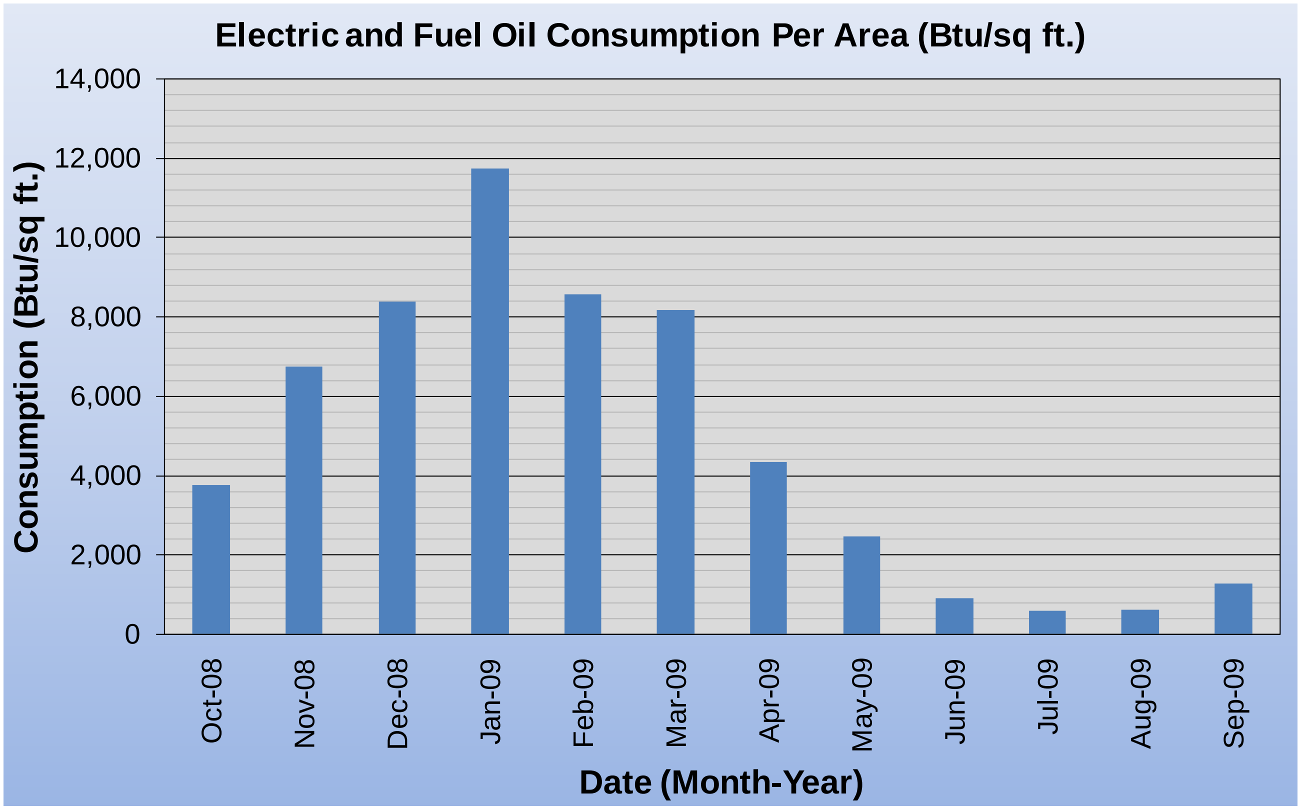
The following chart shows electricity use for the Mullica Hilda Frame School based on utility bills for the 12 month period of October 2008 to September 2009.



The following chart shows the fuel oil consumption for the Mullica Hilda Frame School based on fuel oil bills for the 12 month period of October 2008 to September 2009.

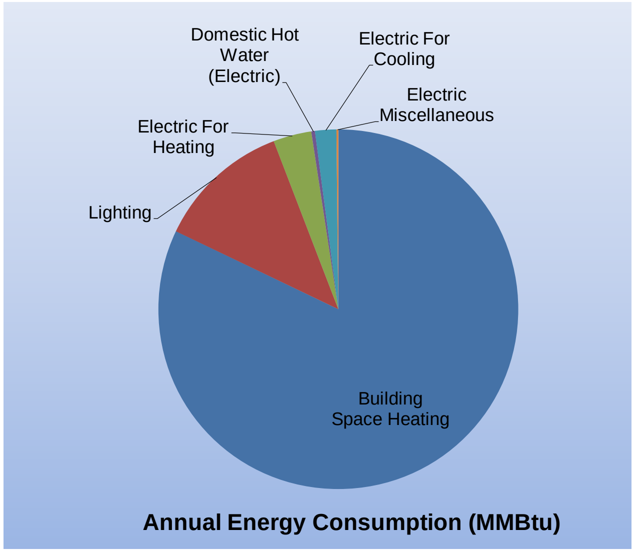


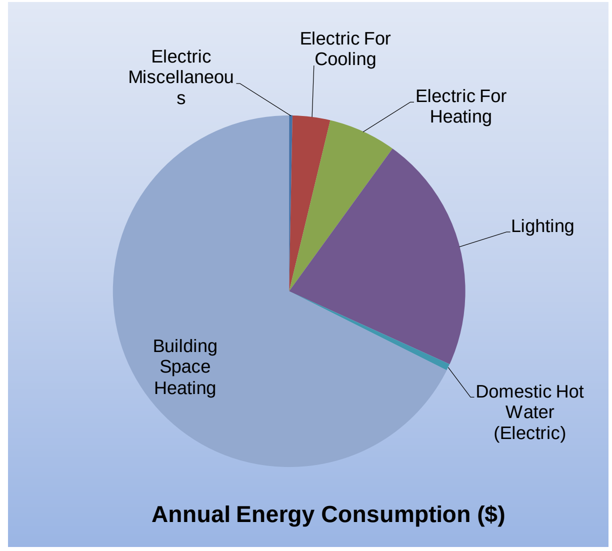
The following chart shows combined fuel oil and electric consumption in Btu/sq ft for the Mullica Hilda Frame School based on utility bills for the 12 month period of October 2008 to September 2009.



The following table and chart pies show energy use for the Mullica Hilda Frame School based on utility bills for the 12 month period of October 2008 to September 2009. Note electrical cost at $48/MMBtu of energy is more than 2 times as expensive to use fuel oil at $22/MMBtu.

2009 Annual Energy Consumption / Costs					
	MMBtu	**% MMBtu**	**$**	**% $**	**$/MMBtu**
Electric Miscellaneous	0.50	0.2%	24	0.3%	48
Electric For Cooling	6	2%	274	3%	48
Electric For Heating	10	3%	494	6%	48
Lighting	36	12%	1,733	22%	48
Domestic Hot Water (Electric)	1	0.3%	48	1%	48
Building Space Heating (Oil)	245	80%	5,369	66%	22
Totals	307	100%	8,137	100%	27
Total Electric Usage	53	17%	2,574	32%	48
Total Fuel Usage	254	83%	5,564	68%	22
Totals	307	100%	8,137	100%	-





1.2. Utility rate

The Mullica Hilda Frame School currently purchases electricity from Atlantic City Electric at a general service market rate, with South Jersey Energy as a separate supplier for electricity use (kWh) with a separate (kW) demand charge. The Mullica Hilda Frame School currently pays an average rate of approximately $0.165/kWh based on the 12 months of utility bills of October 2008 to September 2009.

The Mullica Hilda Frame School currently purchases its fuel oil supply from the Pedroni Fuel at a general service market rate for fuel oil gallons. There is one fuel oil tank that serves the heating equipment for the Mullica Hilda Frame School. The average delivered rate for fuel is approximately $3.048/gallon based on 12 months of utility bills for October 2008 to September 2009.

Some of the minor unusual utility fluctuations that showed up for a couple of months on the utility bills may be due to adjustments between estimated and actual meter readings.

1.3. Energy benchmarking

SWA has entered energy information about the Mullica Hilda Frame School building in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. This school facility is less than 5,000 square feet and therefore is not eligible for an Energy Star rating and can not be compared to a Site Utilization Index (EUI) National Average. The Site Energy Use Intensity for the school is 73 kBtu/ft^2/yr. Implementing the highly recommended measures could account for at least 0.4 kBtu/ft^2/yr reduction in energy usage, with an additional 8.2 kBtu/ft^2/yr for recommended ECM's.

Per the LGEA program requirements, SWA has assisted the Mullica Board of Education to create an *Energy Star Portfolio Manager* account and share the Mullica Hilda Frame School facilities information to allow future data to be added and tracked using the benchmarking tool. SWA has shared this Portfolio Manager site information with the Mullica Board of Education (user name of "mullicatownship" with a password of "mullica3868") and TRC Energy Services (user name of TRC-LGEA).

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Mullica Township - Hilda Frame School

Building ID: 1973868
For 12-month Period Ending: September 30, 2009[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: February 12, 2010

Facility
Mullica Township - Hilda Frame School
3410 Nesco Road
Hammonton, NJ 08037

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 1900
Gross Floor Area (ft²): 2,496

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

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	54,951
Fuel Oil (No. 2) (kBtu)	253,193
Natural Gas - (kBtu)[4]	0
Total Energy (kBtu)	308,144

Energy Intensity[5]	
Site (kBtu/ft²/yr)	123
Source (kBtu/ft²/yr)	176

Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	27

Electric Distribution Utility
Pepco - Atlantic City Electric Co

National Average Comparison	
National Average Site EUI	
National Average Source EUI	
% Difference from National Average Source EUI	
Building Type	K-12 School

Stamp of Certifying Professional

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

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

Certifying Professional
N/A

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

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

EPA Form 5900-16

2. FACILITY AND SYSTEMS DESCRIPTION

2.1. Building Characteristics

The Mullica Hilda Frame School is a single-story building with a basement. The original wood structure was built in 1900 with several additions/renovations, the last in 2004. The school consists of 4,224 square feet of conditioned space. The building houses two classrooms, bathrooms, an office and storage rooms on the first floor and a multipurpose room, storage rooms and a boiler room in the basement.

2.2. Building occupancy profiles

The Mullica Hilda Frame School is occupied approximately 35 hours, 5 days/week, from 8:30 am to 3:30 pm by six teachers/staff and sixty students. Lunch is brought in daily from off-site.

2.3. Building envelope

2.3.1. Exterior Walls

The Mullica Hilda Frame School building is an old wood frame building with a peaked roof and a center roof cupola, which serves as attic ventilation as well as decoration. The inside building walls are plaster-based with the outside covered in recent years with wood clapboards. Exterior wall insulation levels could not be visually verified, however there was minimal to no insulation apparent in the outer walls detected in a couple of exposed places. The basement has concrete walls that appear to stay dry except for outside water running down the back staircase when it is wet outside.

Clapboard wood siding upgraded in 2005

2.3.2. Roof

The existing main roof is a pitched roof with new, dark brown asphalt shingles installed in 2005. Underneath the roof shingles is a layer of treated plywood and a vapor barrier above the existing roof framing. The missing gutter is allowing water run-off to wear out the soffits, evident by the pealing paint. The cupola is also in need of refurbishing. There have been reports that squirrels have been entering the attic space, perhaps via rotted soffit wood members or the cupola. The back staircase roof may need to be replaced in the near future, since the asphalt shingles are showing signs of age such as curling at corners and moss growth in a few areas.

Soffits in need of gutters

Cupola in need of refurbishing

Old metal ceiling above the drop ceiling

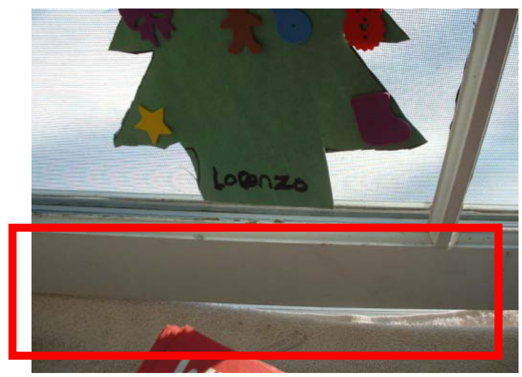
The attic insulation is minimal and original to the building. Whatever insulation is still left in the attic is located above the metal ceiling which is above and supporting the drop ceiling. SWA recommends blowing in low density cellulose insulation to approximately 1 ft high, as well as repairing/closing up attic penetrations and wrapping wire meshes on ventilation panels to prevent access to birds and rodents. Insulation should be consistent and tight throughout the attic. Installation of building gutters is highly recommended.

2.3.3. Base

The building's base is a 4" concrete slab with a perimeter footing. During the field survey there did not appear to be water seepage through the slab or basement; therefore there does not appear to be issues with moisture infiltration or thermal losses. The slab edge or perimeter insulation could not be verified. At times, there is water entering the basement via the back staircase and bottom of the basement back door.

2.3.4. Windows

Most of the original building windows have been replaced in 2005 with wood framed, operable double-hung, double-pane low-e windows. The one lingering issue with the new windows is the latch adjustment from summer to winter conditions. At the time of the field audit, the new windows did not close all the way and towels were being used to make the bottom seal.



Window latching issues have caused occupants to use towels to seal bottom of windows

The couple of single-pane, thermally inefficient windows in the basement are not well sealed to the walls and allow conditioned air to escape to the outside. As a best practice, SWA recommends that all windows be inspected at least once a year. Any gaps, cracks, or damage to weather-stripping or caulking should be repaired or replaced, as needed, to minimize energy loss around those openings. Building staff should also verify that windows open and close properly, and repair them as needed.

Basement window in need of perimeter sealing and caulking

2.3.5. Exterior doors

The Mullica Hilda Frame School building has one front exterior aluminum door and one back exterior aluminum door, both with vision panels. The exterior doors were inspected and found to be in acceptable condition. All doors are in need of new weather-stripping. Therefore, all exterior doors of the building should be weather-stripped in order to decrease the amount of conditioned air that is lost around each door. The basement outside door is in very poor condition, and the cost to refurbish it will be more than installing a replacement. SWA also recommends checking the weather-stripping of each door on a regular basis and replacing any broken seals. Tight seals around doors will help ensure the building to be is kept continuously insulated.

Front door in need of stripping (left), Back basement door deteriorating (center), Water on basement stairs (right)

2.3.6. Building air tightness

Based on a visual inspection, the Mullica Hilda Frame School building could benefit from tightly sealed windows and doors, plumbing and wire penetrations. Any water damage due to condensing un-insulated pipes, condensate lines dripping, plumbing leaks, or roof leaks should be repaired immediately, and ceiling tiles should be replaced. Ceiling tiles act as an air barrier containing expensive conditioned air from leaking into ceiling or wall cavities.

In addition to the above mentioned recommendations, SWA suggests air sealing, caulking and/or insulating around all plumbing, electrical, HVAC and structural envelope penetrations. This should include bottom and top plates, recessed light fixtures, electrical boxes and windows.

The air tightness of buildings helps to maximize other implemented energy measures and investments and minimizes long-term maintenance and repair cost.

2.4. HVAC Systems

The Mullica Hilda Frame School heating is provided by steam radiators below windows in each of the two classrooms. Cooling is provided by unit ventilators also installed under windows in each classroom.

2.4.1. Heating

Steam heating is provided by a Weil McLain steam boiler with 400,000 Btu/hr capacity. The boiler serves steam radiators at the perimeter of the building. There are hot water heating coils installed within the unit ventilators, but the hot water system was never installed. The steam radiators adequately provide heat to the space and therefore it is not recommended to install a hot water system to serve the unit ventilators. The boiler burns fuel oil supplied by a 1,000 gallon storage tank located outside.

The steam boiler has 70% remaining useful life and appears in good condition.

Weil McLain steam boiler in basement mechanical room

2.4.2. Cooling

The Mullica Hilda Frame School is cooled by a split DX system consisting of an evaporator section within wall-mounted Unit Ventilators and separate condensing unit outside. There is one 3 Ton unit ventilator per classroom.

Outdoor air enters from the intake of the unit ventilator and a supply fan draws the air past the evaporator coil, which cools the air. This cool air then continues into the occupied space. The refrigerant waste heat is expelled to the atmosphere through separate Trane condensers located outside each classroom. The Trane condensers have 80% remaining estimated useful life and are in good condition. The unit ventilators also have 80% remaining estimated useful life and appear to be in good condition. SWA recommends removing all items from the supply diffuser of the unit ventilator to ensure proper distribution of air, as seen in the photo below.

Typical classroom unit ventilator, providing outside air ventilation and cooling

2.4.3. Ventilation

There are three exhaust fans serving to purge air from the system to maintain ventilation requirements. Two exhaust fans serve the bathrooms, and one serves occupied spaces.

2.4.4. Domestic Hot Water

The domestic hot water (DHW) for the Mullica Hilda Frame School is provided by two small storage-type electric units. One is a Space Saver 19 Gallon, 1500 W heater which serves the front bathroom sink, and the second is a 30 gallon electric heater that serves the classroom bathroom sinks. Both units appear to be in satisfactory condition.

2.5. Electrical systems

2.5.1. Lighting

Interior Lighting - The Mullica Hilda Frame School lighting currently consists of mainly T12 fluorescent fixtures with magnetic ballasts. Based on measurements of lighting levels for each space, there are not any vastly over-illuminated areas. SWA recommends installing occupancy sensors in closets and areas with sporadic occupancy such as the basement, when payback on savings are justified. 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 means to control lighting operation. SWA also recommends replacing incandescent lamps with compact fluorescent lights which use a third or less of the wattage for comparable lumen output, and replacing T12 magnetic fixtures with higher efficiency T8 lamps and electronic ballasts. See attached lighting schedule in Appendix A for a complete inventory of lighting throughout the building and estimated power consumption.

Exit Lights - Exit signs were found to be incandescent type and should be replaced with high efficiency LED type exit signs with at least half the wattage.

Exterior Lighting - The exterior lighting surveyed during the building audit was found to be a halogen lights and High Pressure Sodium lights. SWA recommends replacing halogen lights with CFLs which have lower wattage for the same output, as well as replacing HPS lamps with pulse-start metal halide lamps. Pulse-start metal halide (PSMH) lamps offer the advantages of standard HPS lights, but minimize the disadvantages. They produce higher light output both initially and over time, operate more efficiently, produce whiter light, and turn on and re-strike faster. Due to these characteristics, energy savings can be realized via one-to-one substitution of lower-wattage systems, or by taking advantage of higher light output and reducing the number of fixtures required in the space. Exterior lighting is controlled by an automatic timer.

2.5.2. Appliances and process

Appliances, such as refrigerators, that are over 10 years of age should be replaced with newer, efficient models with the Energy Star label. 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. Also, energy vending miser devices are now available for conserving energy usage by drink and snack vending machines. When equipped with the vending miser devices, vending machines use less energy and are comparable in daily energy performance to new ENERGY STAR qualified machines. SWA recommends replacing the existing refrigerator and ice box with a new Energy Star rated refrigerator; see Section 4, Energy Conservation Measures.

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, DVDs, stereos, computers, and kitchen appliances often have internal memories or clocks which consume approximately 3-5 watts of electricity when turned off. SWA recommends all computers and all appliances, (other than refrigerators and freezers), be plugged into power strips and turned off each evening just as the lights are turned off. The Mullica Hilda Frame School computers are generally NOT 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 Mullica Hilda Frame School is a one-story building with no elevator.

2.5.4. Others electrical systems

There are not currently any other significant energy impacting electrical systems installed at the Mullica Hilda Frame School.

3. EQUIPMENT LIST

Inventory

Building System	Description	Location	Manufacturer / Model #	Fuel	Space Served	Date Installed	Estimated Remaining Useful Life %
Cooling	Two (2) Unit ventilators, one per classroom - 3 Tons each, installed with heating coils but not used- never worked properly	Under back windows in each classroom	Carrier	Electric	All Areas	2005	80%
Cooling	Two (2) Condensers, 1/4 HP Fan RLA-20.5, LRA -115, Only one visible during time of audit, 9.8 EER	Outside	Trane 38CK042340, 2503E13845	Electric	All Areas	2005	80%
Domestic Hot Water	Domestic hot Water Heater, 30 gallon, 90% Eff.	BASEMENT STORAGE	E52-38L-045DB, 9645120491	Electric	Front Bathroom	2005	80%
Domestic Hot Water	Domestic Hot Water Heater 1500 W, 19 Gal, 91% Eff.	Basement Mech Rm	Space Saver SS19LSEB1, S0508507947	Electric	Back Bathrooms	2005	80%
Heating	Four (4) Steam Radiators, Approx 4' each	Under windows, classrooms	missing nameplates	Steam	All Areas	1900	0%
Heating	Weil McLain steam boiler, 400,000 BTH OUT, STEAM 1250 SQFT, 80% thermal eff.	BASEMENT	WEIL MCLAIN 478 Series #1 Burner: Beckett R7184B, 1/3 HP 3450 RPM	Oil	All Areas	2001	70%
Ventilation	Three (3) Exhaust fans, two horizontal; one rooftop	Outside Back wall / Roof	missing nameplates	Electric	All Areas	2001	70%
Lighting	See Appendix A	All Areas	N/A	Electric	All Areas	N/A	N/A

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 Mullica Hilda Frame School, 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

- Select NEMA Premium motors when replacing motors at the end of their useful operating lives.

- Install occupancy sensors in offices, bathrooms and closets during the next renovation; current payback is excess of 20 years

Category II Recommendations: Operations and Maintenance

- Thoroughly and evenly insulate space above the ceiling tiles, and plug all ceiling penetration. SWA recommends blowing in low-density cellulose insulation above the metal ceiling (which is above the drop ceiling) to approximately 1 ft high

- Maintain roofs - SWA recommends regular maintenance to verify water is draining correctly.

- Maintain downspouts - Repair/install missing downspouts as needed to prevent water/moisture infiltration and insulation damage.

- Replace weather-stripping/air-sealing - SWA observed that exterior door weather-stripping in places was deteriorated, and water was entering the basement through the back exterior door. Doors and vestibules should be observed annually for deficient weather-stripping and replaced as needed. The perimeter of all window frames should also be inspected regularly, and any missing or deteriorated caulking should be re-caulked to provide an unbroken seal around the window frames. Any other accessible gaps or penetrations in the thermal envelope penetrations should also be sealed with caulk or spray foam.

- Repair/seal wall cracks and penetrations - As part of the maintenance program, on a routine basis, SWA recommends properly re-caulking the flashing, and ensuring that the aluminum façade is securely in place in order to keep insulation dry and effective.

- Provide water-efficient fixtures and controls - Adding controlled on/off timers on all lavatory faucets is a cost-effective way to reduce domestic hot water demand and save water. Building staff can also easily install faucet aerators and/or low-flow fixtures to reduce water consumption. There are many retrofit options, which can be installed now or incorporated as equipment is replaced. Routine maintenance practices that identify and quickly address water leaks are a low-cost way to save water and energy. Retrofitting with more efficient water-consumption fixtures/appliances will save energy through reduced energy consumption for water heating, while also decreasing water/sewer bills.

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

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

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

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Category III Recommendations: Energy Conservation Measures - Summary table

ECM#	Description of Highly Recommended 0-5 Year Payback ECMs
1a	Lighting Upgrades- Replace Incandescent bulbs with CFLs
	Description of Recommended 5-10 Year Payback ECMs
2	Install 5 kW Solar Photovoltaic System on Roof
3	Replace old refrigerator and ice box with New Energy Star Model
1b	Lighting Upgrades- Replace exterior High Pressure Sodium fixtures with Pulse-start Metal Halide
	Description of Recommended > 10 Year Payback ECMs
1c	Lighting Upgrades-Replace T12 fixtures to T8
1d	Lighting Upgrades- Replace Inc Exit Signs with LED type

ECM#1a, 1b, 1c, 1d: Lighting Upgrades

Description:

On the days of the site visits, SWA completed a lighting inventory of the Mullica Hilda Frame School. There are several incandescent 40 Watt lights used in the building. SWA recommends replacing these lights with compact fluorescent lights with typically a third of the wattage for the same lumen output. SWA also recommends replacing the exterior high pressure sodium lamps with pulse-start metal halide lamps. Pulse-start metal halide (MH) lamps produce higher light output both initially and over time, operate more efficiently and turn on and re-strike faster. Due to these characteristics, energy savings can be realized via one-to-one substitution of lower-wattage systems. Most of the lighting in the school is magnetic ballast T12 lights. SWA recommends replacing these with electronic ballast T8 fixtures for energy savings in lamp wattage and ballast wattage and increased life. SWA also recommends replacing incandescent Exit Signs with LED type for a reduction in wattage. This is an effective measure because exit sign lights are active 24 hours a day, 365 days a year. The labor in all these installations was evaluated using prevailing electrical contractor wages.

Installation cost:

Estimated installed cost: $13,776, including $4,000 total labor cost
Source of cost estimate: Similar projects

Economics (with incentives):

ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
52 New T8 fixtures to be installed with incentives	RS Means, lit search	11,197	780	10,417	2,201	0.5	N/A	1.8	200	563	15	8,448	18.5	-19%	-1%	-3	-3,790	3,016
3 New CFL fixtures to be installed with incentives	RS Means, lit search	159	none at this time	159	502	0.1	N/A	0.4	0	84	5	420	1.9	165%	33%	45	224	687
10 New LED exit sign fixtures to be installed with incentives	RS Means, lit search	2,033	200	1,833	385	0.1	N/A	0.3	0	64	15	954	28.8	-48%	-3%	-7	-1,085	528
2 New pulse start metal halide fixtures to be installed with incentives	RS Means, lit search	1,418	50	1,368	125	0.0	N/A	0.1	125	146	15	2,185	9.4	60%	4%	7	346	172
TOTALS		**14,806**		**13,776**	**3,214**	**1**	**0**	**2.6**	**325**	**857**		**12,008**	**16.1**	**-**	**-**	**-**	**-**	**4,403**

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 4 hrs/yr to replace aging burnt out lamps vs. newly installed.

Rebates/financial incentives:

- *NJ Clean Energy – HPS with pulse start ($25 per fixture) – total $50, Exit Sign Inc with Exit Sign LED - $20/fixture - $200 total, T12 to T8 -1 &2 lamp- $25/fixture, 3&4 lamp - $30/fixture - $780 total*

Options for funding the Lighting 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#2: ***Install 5 kW PV system***

Description:

Currently, the Mullica Hilda Frame School 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 being used demand charges go up to offset the utility's cost to provide enough electricity at that given time. Photovoltaic systems not only offset the amount of electricity use by a building, but also reduce the building's electrical demand, resulting in a higher cost savings as well. SWA presents below the economics, and recommends at this time that Mullica Board of Education further review installing a 5 kW 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 Mullica Hilda Frame School is not eligible for a 30% federal tax credit. Instead, the Mullica Board of Education 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. Atlantic City Electric provides the ability to buy SRECs at $600/MWh or best market offer.

The size of the system was determined using the amount of roof surface area as a limiting factor, as well as the facilities annual base load. A PV system could be installed on a portion of the sloped roof that faces South or West. A commercial multi-crystalline 123 watt panel (17.2 volts, 7.16 amps) has 10.7 square feet of surface area (11.51 watts per square foot). A 5 kW system needs approximately 40 panels which would take up 435 square feet. The installation of a renewable Solar Photovoltaic power generating system could serve as a good educational tool and exhibit for the community as well.

Installation cost:

Estimated installed cost: $35,000 (labor included at $3/Watt, totaling $15,000)
Source of cost estimate: Similar projects

Economics (with incentives):

ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
Install 5 kW Solar Photovoltaic system	Similar Projects	$35,000	$5,000	$30,000	5,900	5.0	0	4.8	$0	4,514	25	77,438	6.6	158.1	6.3	13.01	88,235	10,564

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 (123 Watts, Model ND-123UJF). 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 50 kW or less. Incentive amount for this application is $5,000 for the Mullica Hilda Frame School.

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 of $3,600 / year, based on $600/SREC, has been incorporated in the above costs for the Community Center 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 #3: *Replace Old Refrigerators with Energy Star Models*

Description:

On the day of the site visit, SWA observed that there is one old refrigerator and one old ice box in the basement kitchen area, both of which are beyond their useful life and not Energy Star rated (using approximately 559 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. SWA recommends the replacement of the existing refrigerator and ice box with a 22 cu. ft. bottom freezer ENERGY STAR® refrigerator operating at 447 kWh/yr, or equivalent. Besides saving energy, the replacement will also keep the kitchen and other areas 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: $1200 (includes $150 labor)
Source of cost estimate: *Manufacturer and Store established costs*

Economics:

ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	est. energy & operating 1st year cost 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, $	CO2 reduced, lbs/yr
Replace old refrigerator & ice box with one large 22 cu ft Energy Star Refrigerator with Ice Box	Energy Star purchasing and procurement site, similar projects	1,200	none at this time	1,200	1,433	0.9	0	1.2	0	236	12	2,837	5.1	136	11	17	1,126	1,963

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 the Lighting 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 MEASURES

5.1. Existing systems

There aren't currently any existing renewable energy systems.

5.2. Wind

Description:

Wind power generation is not cost-effective for this building and would not be recommended due to insufficient wind conditions in this area of New Jersey.

5.3. Solar Photovoltaic

Please see the above-recommended ECM#2.

5.4. Solar Thermal Collectors

Description:

Solar thermal collectors are not recommended due to the insufficient and inconsistent use of domestic hot water throughout the building to justify the expenditure.

5.5. Combined Heat and Power

Description:

CHP is not applicable for a building with such low electric and heating loads. Also since the building is not occupied for several months during the year, the investment could not be fully utilized.

5.6. Geothermal

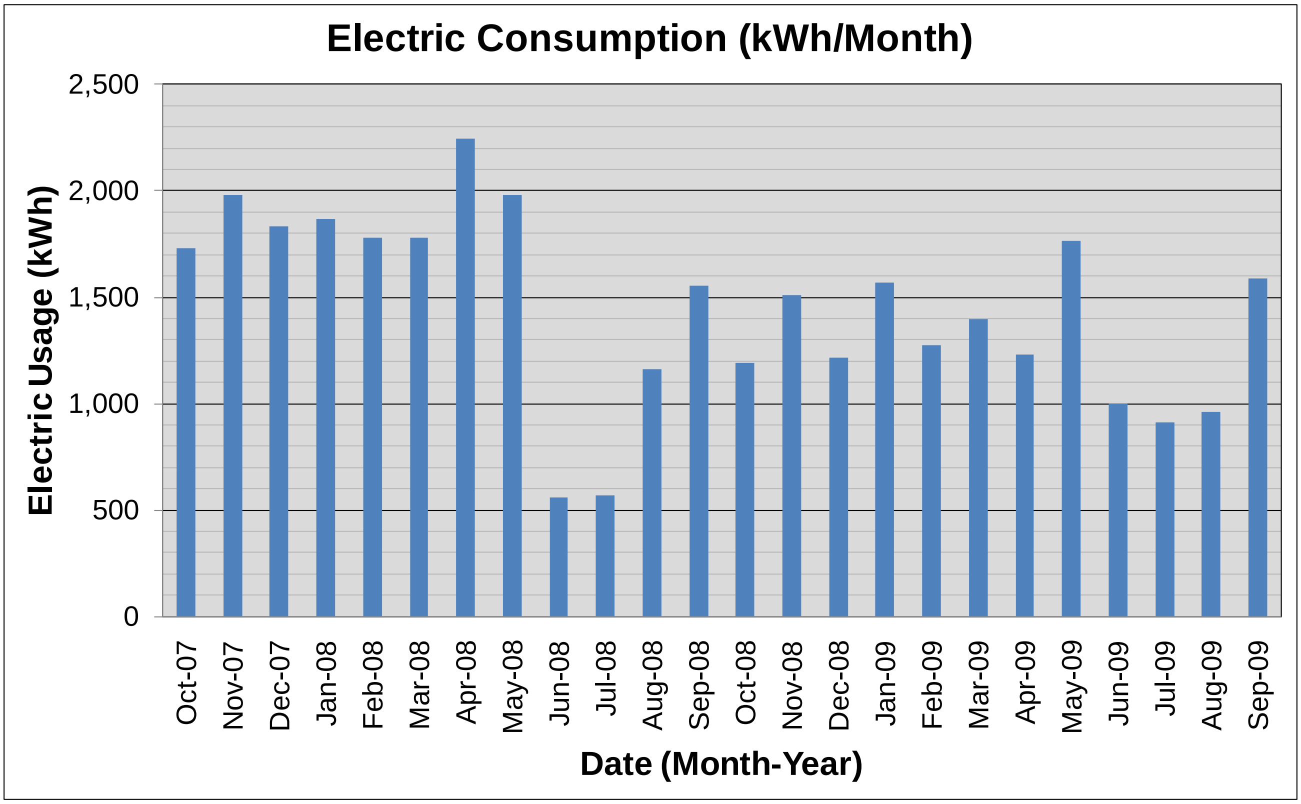
Description:

Geothermal is not applicable for this building because it would not be cost effective, since it would require replacement of the existing HVAC system, of which major components still have a number of useful operating years.

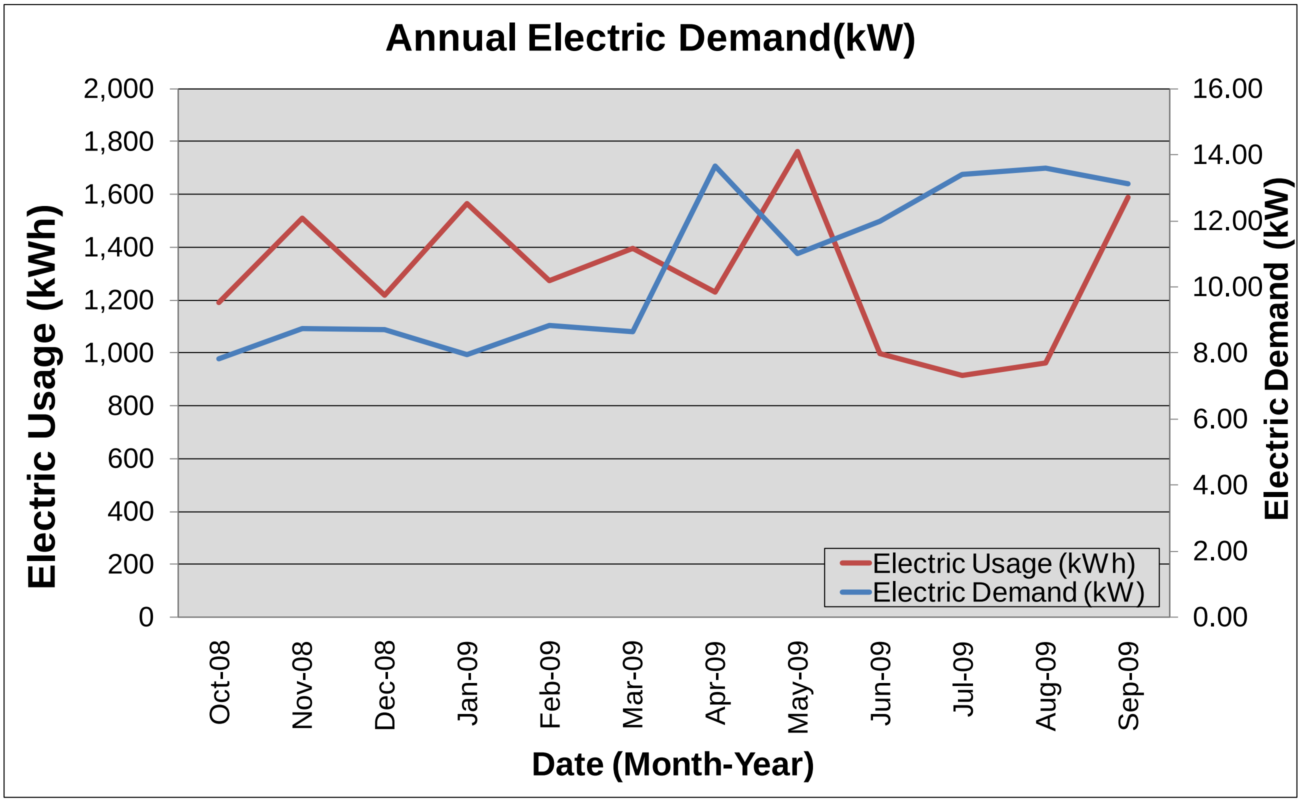
6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

6.1. Load profiles

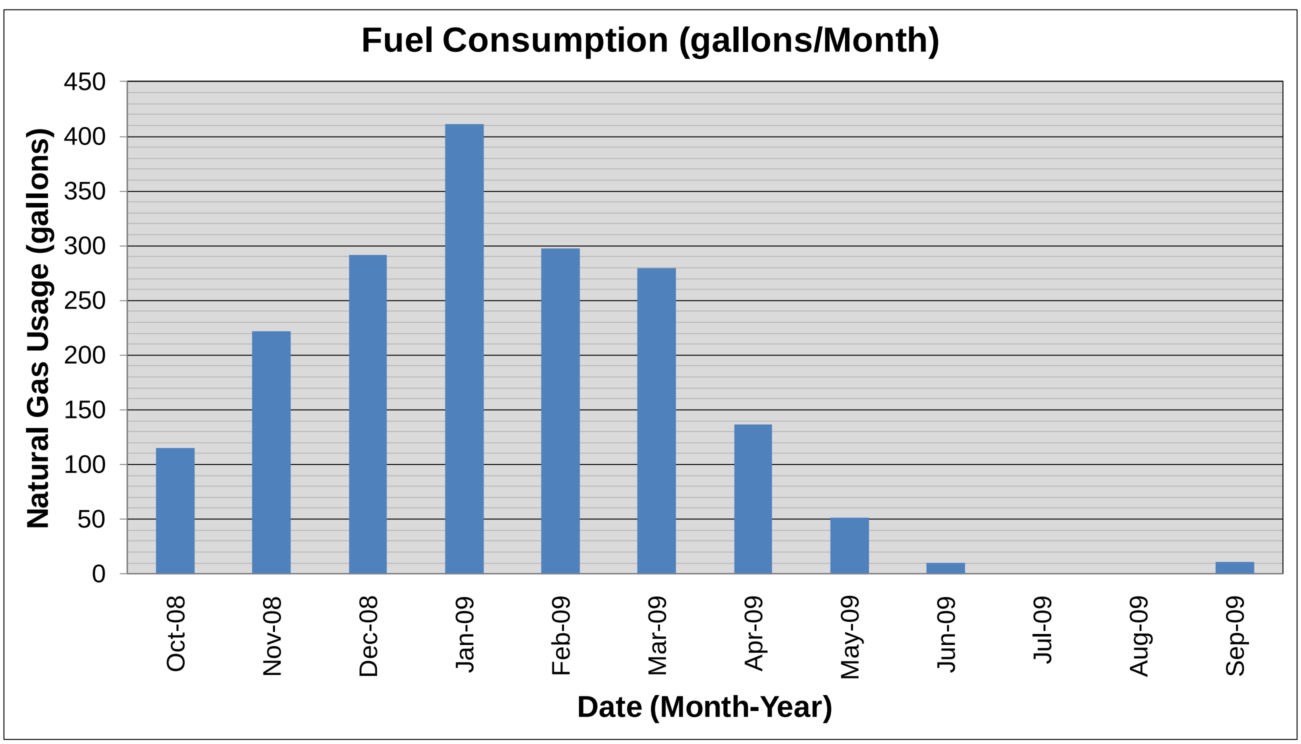
The following are charts that show the annual electric and fuel oil load profiles for the Mullica Hilda Frame School.



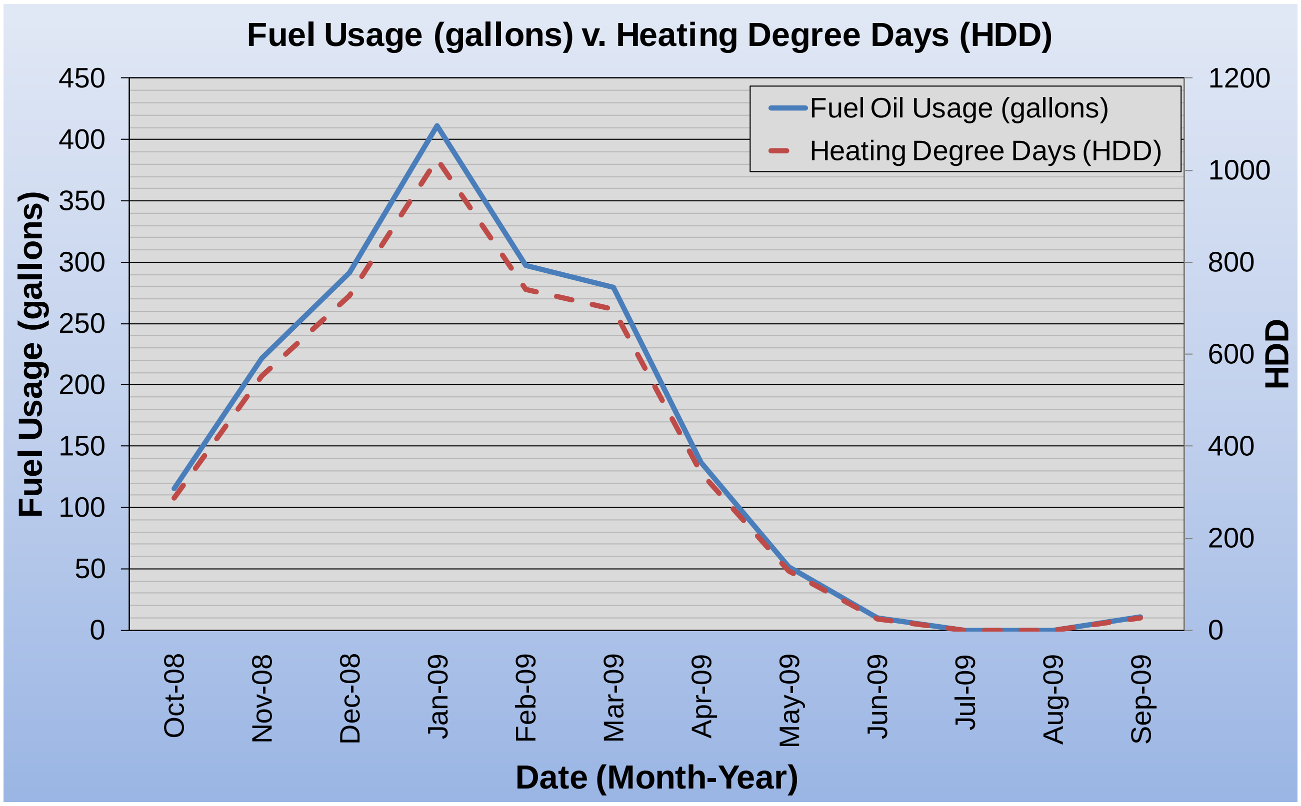
Some minor unusual electric fluctuations shown may be due to adjustments between estimated and actual meter readings. Also, note on the following chart how the electrical Demand follows electric consumption.



The following is a chart of the fuel oil annual load profile for the building, peaking in the coldest months of the year.



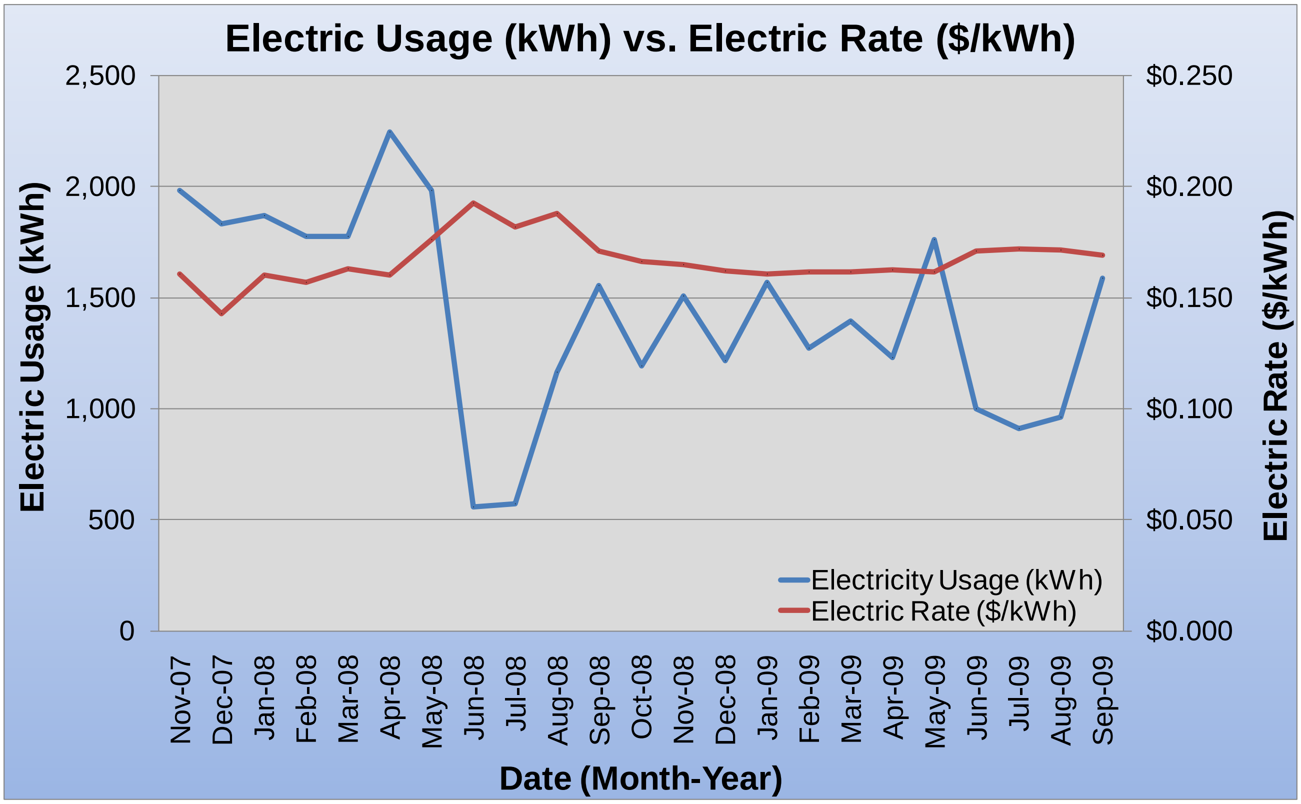
Below is a chart showing how the fuel oil consumption follows the "heating degree days" curve. Some utility bills have more than one month estimated and combined.



6.2. Tariff analysis

Currently, fuel oil is provided to the Mullica Hilda Frame School building via one 1,000 gallon fuel oil tank with Pedroni Fuel acting at a general service rate including supply and delivery. The tank is filled one or two times per year and charged a bulk fee, so there is no price fluctuation. The 2009 rate is an average of $3.048 per gallon.

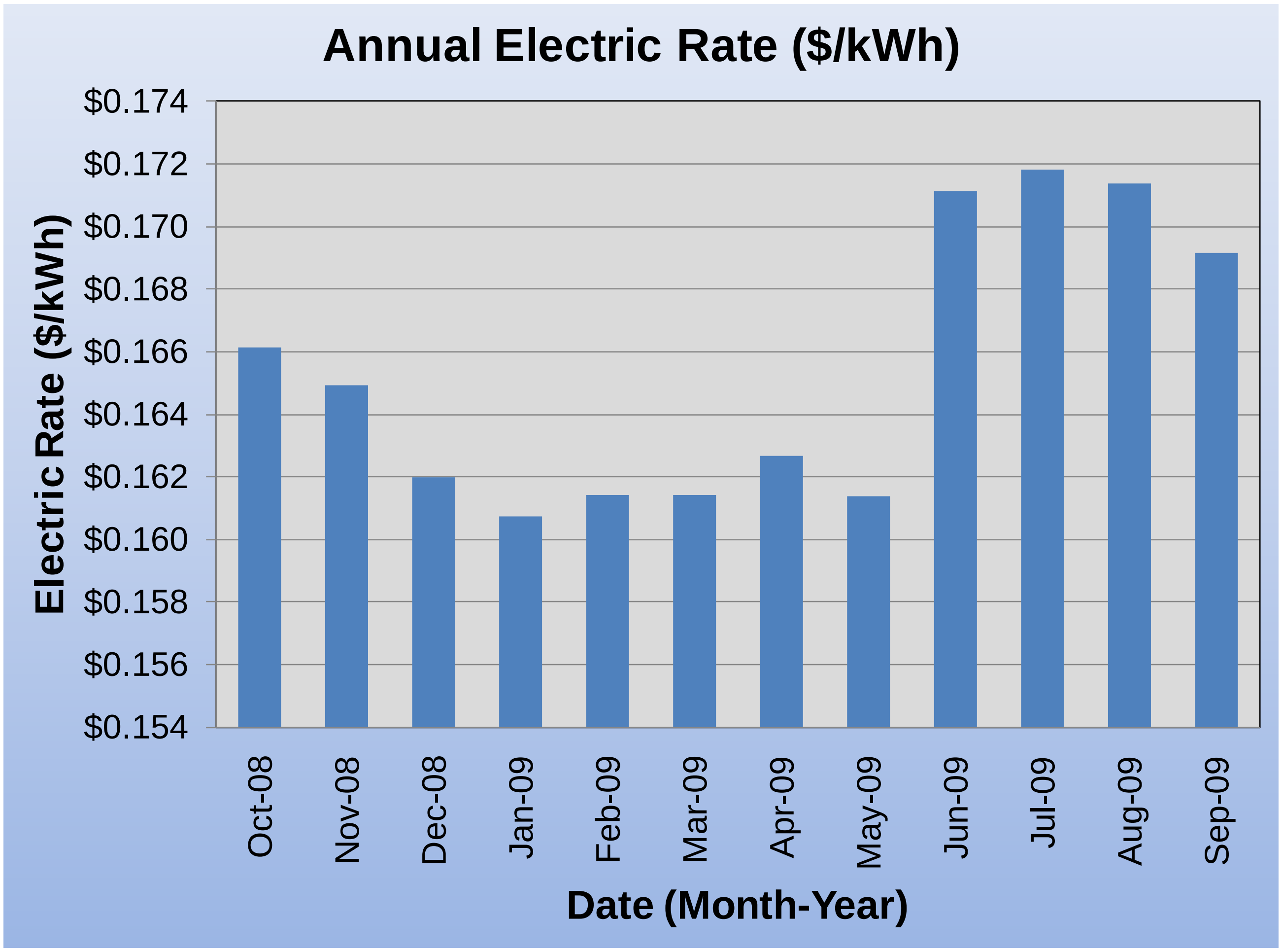
The Mullica Hilda Frame School is direct-metered and currently purchases electricity from Atlantic City Electric and is part of the Alliance for Competitive Energy Services (ACES), a cooperative pricing system that solicits bids for electric generation services and therefore pays at a much lower rate when compared to the average estimated NJ commercial utility rates. The Mullica Hilda Frame School billing does show a breakdown of demand costs. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year. Typically, the electric rate follows consumption with slight increases during the cooling months, due to higher electric demands by HVAC condensing units and air handlers.



6.3. Energy Procurement strategies

The Mullica Hilda Frame School receives fuel oil by Pedroni Fuel supply and transport services on an as-needed basis. As of April 2009, Mullica Board of Education district joined the Alliance for Competitive Energy Services (ACES) which solicits bids for electric generation services at a reduced price. As a result, the Hilda Frame School is charged for electric supply through a third party supplier, South Jersey Energy, with Atlantic City Electric charging only the transport rate for electric service. Appendix B contains a complete list of third party energy suppliers for the Mullica Township Board of Education service area. Also, the Mullica Hilda Frame School would not be eligible for enrollment in a Demand Response Program because the school electric maximum demand was less than 20 kW and the program requires the building to shed a minimum of 150 kW electric demand during peak demand periods.

The following charts show the Mullica Hilda Frame School monthly spending per kWh in 2009.



7. METHOD OF ANALYSIS

7.1. Assumptions and tools (See Appendix C for more details)

Energy modeling tool:	established/standard industry assumptions, 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

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)
3	1	BATHROOM (BATH BOY)	Recessed	M	4'T12	1	4	40	S	2	190	24	184	70	T8	Recessed	4'T8	E	S	1	4	32	2	190	13	141	54	16	0	16
4	1	BATHROOM (BATHGIRL)	Recessed	M	4'T12	1	4	40	S	2	190	24	184	70	T8	Recessed	4'T8	E	S	1	1	32	2	190	0	32	12	58	0	58
1	1	CLASSROOM (CLASS A)	Recessed	M	4'T12	12	4	40	S	6	190	24	2,208	2,517	T8	Recessed	4'T8	E	S	12	4	32	6	190	13	1692	1929	588	0	588
6	1	CLASSROOM (CLASS B)	Recessed	M	4'T12	12	4	40	S	6	190	24	2,208	2,517	T8	Recessed	4'T8	E	S	12	4	32	6	190	13	1692	1929	588	0	588
12	1	CLOSET (CLASS B)	Recessed	M	4'T12	1	2	40	S	2	190	15	95	36	T8	Recessed	4'T8	E	S	1	1	32	2	190	0	32	12	24	0	24
2	1	EXIT SIGN (CLASS A)	Exit Sign	N	Inc	2	1	10	N	24	365	0	20	175	LEDex	Exit Sign	LED	N	N	2	1	5	24	365	1	12	105	70	0	70
5	1	EXIT SIGN (Lobby)	Exit Sign	N	Inc	1	1	10	N	24	365	0	10	88	LEDex	Exit Sign	LED	N	N	1	1	5	24	365	0	5	44	44	0	44
7	1	EXIT SIGN (EXIT LOBBY)	Exit Sign	N	INC	1	1	10	N	24	365	0	10	88	LEDex	Exit Sign	LED	N	N	1	1	5	24	365	0	5	44	44	0	44
8	1	EXIT SIGN (CLASS B)	Exit Sign	N	INC	2	1	10	N	24	365	0	20	175	LEDex	Exit Sign	LED	N	N	2	1	5	24	365	1	12	105	70	0	70
11	1	EXIT SIGN (ENTRANCE LOBBY)	Exit Sign	N	INC	1	1	10	N	24	365	0	10	88	LEDex	Exit Sign	LED	N	S	1	1	5	24	365	1	6	53	35	0	35
18	B	EXIT SIGN (MAIN RM)	Exit Sign	N	INC	2	1	10	N	24	365	0	20	175	LEDex	Exit Sign	LED	N	N	2	1	5	24	365	0	10	88	88	0	88
20	B	EXIT SIGN (MECH RM)	Exit Sign	N	INC	1	1	10	N	24	365	0	10	88	LEDex	Exit Sign	LED	N	N	1	1	5	24	365	1	6	53	35	0	35
21	Ext	Exterior ()	Exterior	N	Hal	2	2	65	T	10	190	32	324	616	CFL	Exterior	CFL	N	T	2	2	20	10	190	0	80	152	464	0	464
22	Ext	Exterior ()	Exterior	N	HPS	2	1	75	T	10	190	19	188	357	PSMH	Exterior	PSMH	N	T	2	1	50	10	190	11	122	232	125	0	125
9	1	LOBBY (ENTRANCE LOBBY)	Recessed	M	4'T12	2	2	40	S	7	190	15	190	253	T8	Recessed	4'T8	E	S	2	2	32	7	190	6	140	186	67	0	67
16	B	LOBBY (MAIN RM)	Recessed	M	4'T12	10	4	40	S	7	190	24	1,840	2,447	T8	Recessed	4'T8	E	S	10	4	32	7	190	13	1410	1875	572	0	572
10	1	PANTRY (ENTRANCE LOBBY)	Recessed	M	4'T12	1	2	40	S	2	190	15	95	36	T8	Recessed	4'T8	E	S	1	2	32	2	190	6	70	27	10	0	10
13	B	STAIRWELL (ENTRANCE LOBBY)	Recessed	M	4'T12	2	2	40	S	5	190	15	190	181	T8	Recessed	4'T8	E	S	2	1	32	5	190	0	64	61	120	0	120
14	B	STAIRWELL (STAIR)	Screw-in	N	INC	1	1	60	S	5	190	0	60	57	CFL	Screw-in	CFL	N	S	1	1	20	5	190	0	20	19	38	0	38
15	B	STAIRWELL (STAIR)	Recessed	M	4'T12	1	2	40	S	5	190	15	95	90	T8	Recessed	4'T8	E	S	1	1	32	5	190	0	32	30	60	0	60
17	B	STORAGE (MAIN RM)	Recessed	M	4'T12	2	4	40	S	2	190	24	368	140	T8	Recessed	4'T8	E	S	2	4	32	2	190	13	282	107	33	0	33
19	B	(MECH RM)	Recessed	M	4'T12	7	2	40	S	2	190	15	665	253	T8	Recessed	4'T8	E	S	7	2	32	2	190	6	490	186	67	0	67
Totals:												**285**	**8,994**	**10,515**											**98**	**6,355**	**7,302**	**3,214**	**0**	**3,214**
Rows Highlighed Yellow Indicate an Energy Conservation Measure is recommended for that space																														

Proposed Lighting Summary Table			
Total Surface Area (SF)	4,224		
Average Power Cost ($/kWh)	0.1650		
Exterior Lighting	**Existing**	**Proposed**	**Savings**
Exterior Annual Consumption (kWh)	973	384	**589**
Exterior Power (watts)	512	202	**310**
Total Lighting	**Existing**	**Proposed**	**Savings**
Annual Consumption (kWh)	9,542	6,918	**3,214**
Lighting Power (watts)	8,482	6,153	**2,329**
Lighting Power Density (watts/SF)	2.01	1.46	**0.55**
Estimated Cost of Fixture Replacement ($)	14,806		
Estimated Cost of Controls Improvements ($)	0		
Total Consumption Cost Savings ($)	**857**		

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 (Installl 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)
Circiline	2'T8	DL (Daylight Sensor)		D (Delamping)
Exterior	3'T8	M (Microphonic Sensor)		C (Controls Only)
HID (High Intensity Discharge)	4'T8			
	6'T8			
	8'T8			
	2'T12			
	3'T12			
	4'T12			
	6'T12			
	8'T12			
	CFL (Compact Fluorescent Lightbulb)			
	MR16			
	Halogen			
	MV (Mercury Vapor)			
	MH (Metal Halide)			
	HPS (High Pressure Sodium			
	LPS (Low Pressure Sodium)			

Appendix B: Third Party Energy Suppliers (ESCOs)

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

Pedroni Fuel Service Territory	Telephone & Web Site
Cooperative Industries 412-420 Washington Avenue Belleville, NJ 07109	(800) 628-9427 www.cooperativenet.com
Direct Energy Services, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com
Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701	(800) 805-8586 www.gesc.com
UGI Energy Services, Inc. 704 East Main Street, Suite 1 Moorestown, NJ 08057	(856) 273-9995 www.ugienergyservices.com
Great Eastern Energy 116 Village Riva, Suite 200 Princeton, NJ 08540	(888) 651-4121 www.greateastern.com
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com
Intelligent Energy 2050 Center Avenue, Suite 500 Fort Lee, NJ 07024	(800) 724-1880 www.intelligentenergy.org
Metromedia Energy, Inc. 6 Industrial Way Eatontown, NJ 07724	(877) 750-7046 www.metromediaenergy.com
MxEnergy, Inc. 510 Thornall Street, Suite 270 Edison, NJ 08837	(800) 375-1277 www.mxenergy.com
NATGASCO (Mitchell Supreme) 532 Freeman Street Orange, NJ 07050	(800) 840-4427 www.natgasco.com
Pepco Energy Services, Inc. 112 Main Street Lebanon, NJ 08833	(800) 363-7499 www.pepco-services.com
PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 www.pplenergyplus.com
South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037	(800) 756-3749 www.southjerseyenergy.com
Woodruff Energy 73 Water Street Bridgeton, NJ 08302	(800) 557-1121 www.woodruffenergy.com

Atlantic City Electric 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
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
Integrys Energy Services, Inc. 99 Wood Ave, South, Suite 802 Iselin, NJ 08830	(877) 763-9977 www.integrysenergy.com
Liberty Power Delaware, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(866) 769-3799 www.libertypowercorp.com
Liberty Power Holdings, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(800) 363-7499 www.libertypowercorp.com
Pepco Energy Services, Inc. 112 Main St. Lebanon, NJ 08833	(800) 363-7499 www.pepco-services.com
PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 www.pplenergyplus.com
Sempra Energy Solutions 581 Main Street, 8th Floor Woodbridge, NJ 07095	(877) 273-6772 www.semprasolutions.com
South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037	(800) 756-3749 www.southjerseyenergy.com
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

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

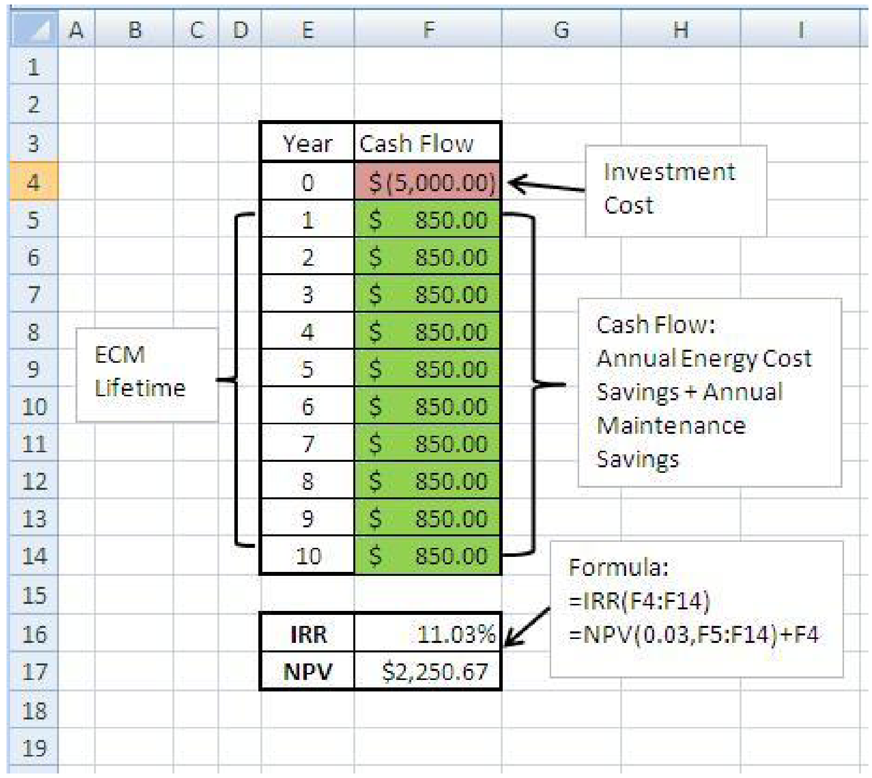
Note: The lifetime operating cost savings are all avoided operating, maintenance, and / or component replacement costs over the lifetime of the ECM. This can be the sum of any annual operating savings, recurring or bulk (i.e. one-time repairs) maintenance savings, or the savings that comes from avoiding 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