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June 28, 2010

Local Government Energy Program
Energy Audit Report

Township of Livingston

Okner Athletic Field Concession Building
Okner Parkway
Livingston, NJ 07039

Project Number: LGEA50

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INTRODUCTION

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

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

This report addresses the Okner Athletic Field Concession Building located on Okner Parkway, 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 Okner Athletic Field Concession Building located on Okner Parkway was opened in 2004. It is a single story, pre-engineered structure with approximately 392 square feet of conditioned space. This building operates only periodically during the Winter, Spring and Summer season for select sporting events.

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 concession stands, 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 Okner Athletic Field Concession Building located on Okner Parkway was opened in 2004. It is a single story, pre-engineered structure with approximately 392 square feet of conditioned space. This building operates only periodically during the Winter, Spring and Summer season for select sporting events.

Based on the field visit performed by the SWA staff on January 27, 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 January 2009 through December 2009, the period of analysis for this audit, the building consumed 54,840 kWh or $18,007 worth of electricity at an approximate rate of $0.328/kWh. The energy consumption for the building, was 187 MMBTUs of energy.

SWA has entered energy information about the concession stand 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 of its small size which means that it is still ineligible for Energy Star. SWA encourages the Township of Livingston to continue entering utility data in *Energy Star Portfolio Manager* in order to track weather normalized source energy use over time.

The Site Energy Use Intensity is 477.0 kBtu/sq ft yr compared to the national average of a commercial building consuming 104.0 kBtu/sq ft yr. Implementing this report's recommended Energy Conservations Measures (ECMs) will reduce use by approximately 29.7 kBtu/ sq ft yr, which would decrease the building's energy use intensity to 447.3 kBtu/sq ft yr.

Recommendations

The Okner Athletic Field Concession Building is almost brand new and most HVAC equipment has has not exceeded their recommended useful life cycle. Additionally lighting is a mix of efficient and inefficient lighting. In Appendix C, SWA has included a mechanical inventory list of equipment for the Okner Athletic Field Concession Building. 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

- Apply epoxy to exposed concrete floor.
- If window air conditioners are used while the facility is in use, use units that have the Energy Star label.

Category II Recommendations: - Operations and Maintenance

- Replace incandescent lamp in Shed with compact fluorescent lamp.
- Maintain roofs
- Provide weather-stripping and air sealing
- Repair/seal wall cracks and penetrations

Category III Recommendations: Energy Conservation Measures

At this time, SWA recommends a total of **3** Energy Conservation Measures (ECMs) for The Okner Athletic Field Concession Building as summarized in the following Tables 1-3. The total investment cost for these ECMs with incentives is **$18,537**. SWA estimates a first year savings of **$2,418** with a simple payback of **7.7 years**.

The implementation of all the recommended ECMs would reduce the building electric usage by 3,412 kWh annually, or 6% of the building's current electric consumption. SWA estimates that implementing these ECMs will reduce the carbon footprint of The Okner Athletic Field Concession Building by **4,674 lbs of CO_2**, which is equivalent to removing approximately 1 car from the roads each year or avoiding the need of 18 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 $0.178/kWh, 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 JCP&L that would allow the building to pay for the installation of the PV system through a loan issued by JCP&L.

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

Table 1 - Highly Recommended 0-5 Year Payback ECMs																	
ECM #	ECM description	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
1.1	Replace (1) Incandescent Fixture With CFL	7	0	7	7	0.0	N/A	0.1	4	6	5	32	1.1	354	71	87	22	10

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 avings, $	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	Replace (4) Metal Halide Fixtures With PSMH Fixtures	1,755	100	1,655	631	0.1	N/A	5.5	95	302	15	4,533	5.5	174	12	16	1,901	864

Table 3 - 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
2	Install 2.5 kW PV rooftop system with incentives	19,375	2,500	16,875	2,774	3	0	24.1	0	2,110	25	22,747	8.0	141.5	5.7	10.5	13,294	3,800

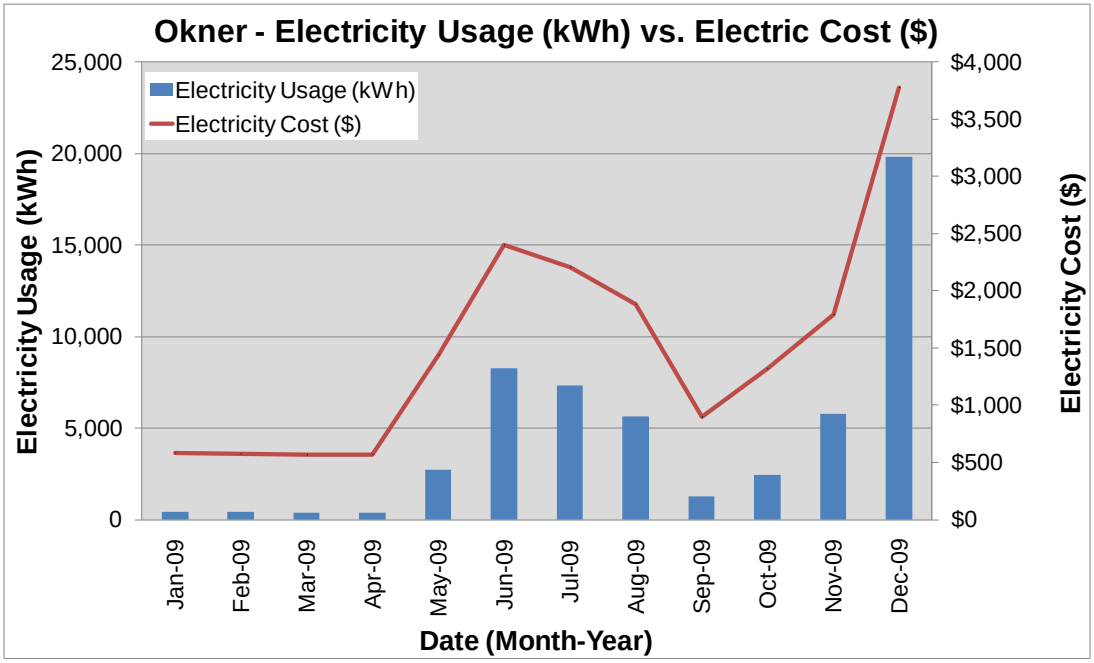
1. HISTORIC ENERGY CONSUMPTION

1.1. Energy usage, load profiles and cost analysis

SWA analyzed utility bills for the library for the 24 months between March 2007 to December 2009 with an analysis period between **January 2009 through December 2009**.

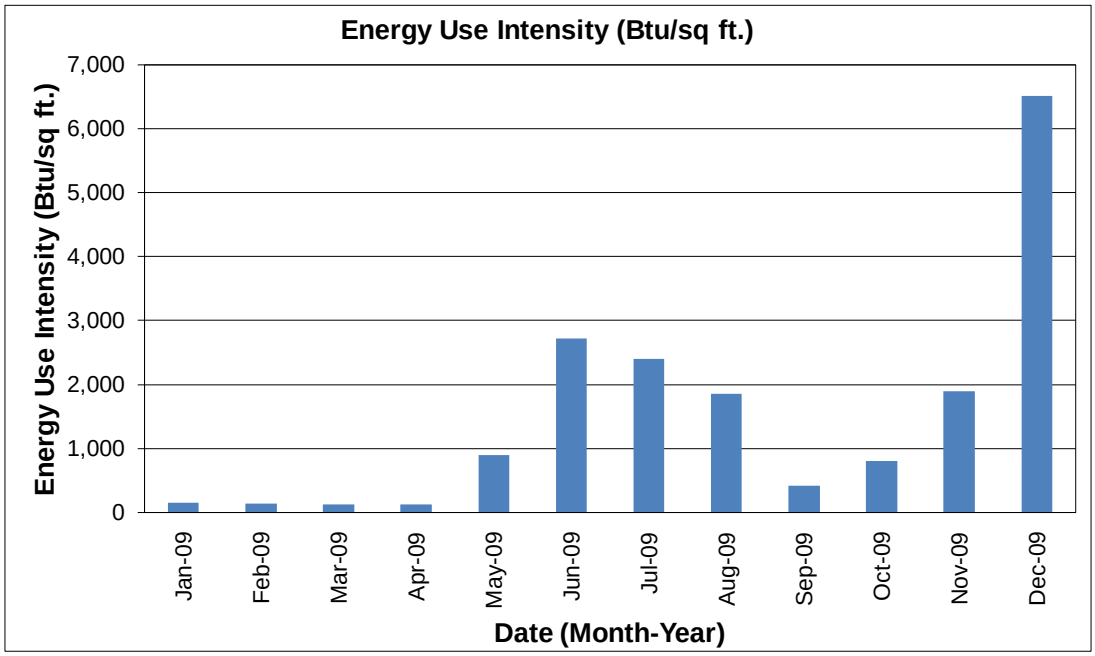
Electricity - The Okner Athletic Field Concession Building buys electricity from JCP&L at **an average rate of $0.328/kWh** based on 12 months of utility bills from **January 2009 through December 2009**. The building purchased **approximately 54,840 kWh or $18,807 worth of electricity** during the analysis period and is currently charged for demand (kW) which has been factored into each monthly bill. SWA estimates that approximately 95% of the building electric use and demand are a result of the nearby stadium lights that were not included as part of the audit. The building had an average monthly demand of **151.8 kW** and an annual peak demand of **163.9 kW**.

The following chart shows electricity use versus cost for the Okner Athletic Field Concession Building based on utility bills for the 12 month period of January 2009 to December 2009.



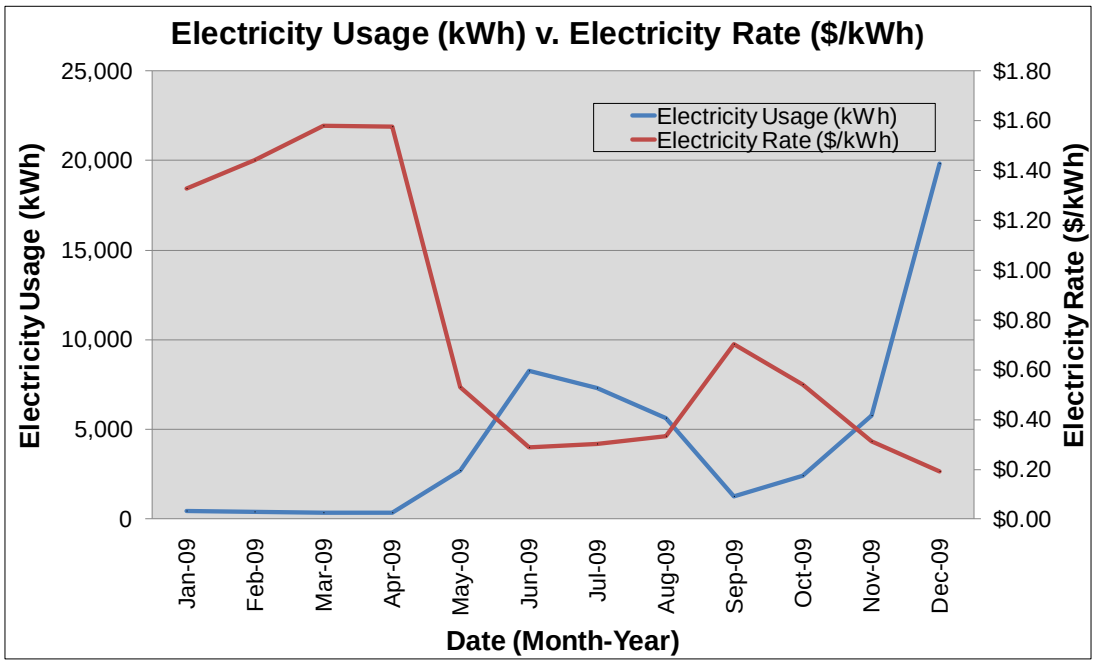
Electricity use follows a trend that is expected for this building with usage peaking during the winter due to increased usage from seasonal sporting events. The cost of electricity fluctuates as expected with usage peaking in the summer during the time of highest usage. Although the usage is high for a concession stand it is important to remember that this meter also includes athletic field lighting.

The following chart shows electric consumption in Btu/sq ft for the Okner Athletic Field Concession Building based on utility bills for the 12 month period of January 2009 to December 2009.



1.2. Utility Rate Analysis

The Okner Athletic Field Concession Building currently purchases electricity from JCP&L at a general service market rate for electricity use (kWh) including a separate (kW) demand charge that is factored into each monthly bill. The Okner Athletic Field Concession Building currently pays an average rate of approximately $0.328/kWh based on the 12 months of utility bills of January 2009 to December 2009. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year. Based on these observations this appears to be the appropriate rate for the building.



1.3. Energy benchmarking

SWA has entered energy information about the concession stand 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 of its small size which means that it is still ineligible for Energy Star. SWA encourages the Township of Livingston to continue entering utility data in *Energy Star Portfolio Manager* in order to track weather normalized source energy use over time.

The Site Energy Use Intensity is 477.0 kBtu/sq ft yr compared to the national average of a Concession stand consuming 104.0 kBtu/sq ft yr. Implementing this report's recommended Energy Conservations Measures (ECMs) will reduce use by approximately 29.7 kBtu/ sq ft yr, which would decrease the building's energy use intensity to 447.3 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 - Okner Athletic Field

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 - Okner Athletic Field

Building ID: 2025754
For 12-month Period Ending: December 31, 2009[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: March 22, 2010

Facility
Township of Livingston - Okner Athletic Field
Okner Parkway
Livingston, NJ 07039

Facility Owner
Township of Livingston
357 South Livingston Avenue
Livingston, NJ 07039

Primary Contact for this Facility
Richard Calbi
357 South Livingston Avenue
Livingston, NJ 07039

Year Built: 2004
Gross Floor Area (ft²): 392

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

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	187,114
Natural Gas - (kBtu)[4]	0
Total Energy (kBtu)	187,114

Energy Intensity[5]	
Site (kBtu/ft²/yr)	477
Source (kBtu/ft²/yr)	1594

Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	28

Electric Distribution Utility
FirstEnergy - Jersey Central Power & Lt Co

National Average Comparison	
National Average Site EUI	104
National Average Source EUI	213
% Difference from National Average Source EUI	649%
Building Type	Other

Stamp of Certifying Professional

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

Certifying Professional
N/A

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

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

EPA Form 5900-16

2. FACILITY AND SYSTEMS DESCRIPTION

2.1. Building Characteristics

The Okner Concession Stand is a single story, pre-engineered structures, and slab-on-grade. The exterior facing of the walls is rough faced concrete block. The roof is standing seam metal panel. The Concession Stand is 392 gross square feet.

Orientation:	East Elevation –	Faces athletic field
	West Elevation –	Opposite side (Toilet Room entrance)
	North Elevation --	Right side (if at concession window)
	South Elevation –	Left side (if at concession window)

2.2. Building Occupancy Profiles

These buildings operate only periodically during the Spring and Summer season for selected sporting events. The facilities are essentially unoccupied outside of these seasons.

2.3. Building Envelope

Due to favorable weather conditions (min. 18 deg. F delta-T in/ outside & no/ low wind) 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 walls of both buildings are constructed of rough faced concrete block. The buildings are insulated with fiberglass batt insulation with PVC clad wall panels as the inside wall surface. There were no significant issues with the exterior walls.

2.3.2. Roof

The roofs of both buildings are constructed of standing seam metal panels with fiberglass batt insulation and PVC clad ceiling panels as the inside ceiling surface. There are four skylights in the roof of the Concession Building. The attic space is adequately vented with gable vents.

2.3.3. Base

The building's base is composed of a slab-on-grade floor with no detectable slab edge/perimeter insulation. Exposed concrete slabs should be epoxy coated to prevent deterioration.

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 observed 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 windows of the Concession Stand are triangular shaped mounted high on the east and west wall along the roof slope. These windows provide privacy for the Men's & Women's Rooms, allowing a diffused daylight into the space. There are no significant issues with the windows. The skylights in the Concession Stand are double glazed. There are no significant issues with the skylights.

2.3.5. Exterior doors

The personnel doors are insulated metal panel doors, metal frame and weather-stripping. The roll-up doors are not available as insulated doors. There are no significant issues with the doors on either building.

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.

The building being only three years old does not have any significant air tightness issues. The building meets the current energy and construction codes for the State of NJ.

2.4. HVAC Systems

2.4.1. General

The Okner Concession Stand and Storage building are essentially unconditioned buildings with sporadic use during the Spring and Summer months. The athletic field lights that are connected to the same meter are operated year round.

2.4.2. Heating

There is no heating in either of the buildings. The wet piping is drained prior to the winter months and the domestic water heater is removed and stored offsite.

2.4.3. Cooling

The building does not contain any mechanical cooling systems.

2.4.4. Ventilation

The only ventilation appears to be the toilet exhaust systems located in the attic space. This exhaust fan is operated by a switch located on the bathroom wall. Access to the attic space was not available during our survey.

2.4.5. Domestic Hot Water

The domestic water heater had been removed from the building at the time of our survey.

Platform Where Domestic Water Heater Is Located During Operational Hours

2.5. Electrical systems

2.5.1. Lighting

Interior Lighting – The concession building serving area and storage area contain three (3) 2'x4' fluorescent fixtures and one (1) 2'x4' fluorescent fixtures respectively. These fixtures contain T8 lamps and electronic ballasts. Each toilet room contained a light fixture that utilizes a compact fluorescent lamp. The storage building contains one (1) 60W incandescent fixture.

Photo – Light Fixture With Compact Fluorescent Lamp in Toilet Room

Exit Lights – There are no exit lights in the facility.

Exterior Lighting – There are three (3) metal halide fixtures on the front of the concession building and one beside each toilet room door. These fixtures are fairly new and in excellent condition.

Photo – Exterior Metal Halide Fixtures

Sports Field Lighting – There are twelve (12) pole mounted lighting fixture arrangements. Each pole has between five (5) and eighteen (18) 1500W metal halide fixtures, adding up to a total of one hundred and sixteen (116) 1500W metal halide light fixtures for the sports field area. The field lighting is relatively new and controlled by a Musco Lighting Control System that is mounted to the exterior of the concession building.

Photo – Musco Lighting Controller for Sports Field Lighting

2.5.2. Appliances

SWA performed a basic survey of appliances installed at the Okner Athletic Field Concession Building and there were no appliances present at the time of our survey. SWA auditors were informed that appliances such as refrigerators, microwaves, etc. are removed seasonally and were not present to be observed at the building.

2.5.3. Elevators

The Okner Athletic Field Concession Building 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 concession stand.

3. EQUIPMENT LIST - Inventory

There was one bathroom exhaust fan installed at the building at the time of the audit.

4. ENERGY CONSERVATION MEASURES

Based on the assessment of the Okner Concession 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

- Apply epoxy to exposed concrete floor. The estimated cost for this upgrade is $5,500.
- If window air conditioners are used while the facility is in use, install units that have the Energy Star label.

Category II Recommendations: - Operations and Maintenance

- Replace incandescent lamp in Shed with compact fluorescent lamp.
- Maintain roofs – SWA recommends regular maintenance to verify that the rainwater is draining correctly.
- Provide weather-stripping and air sealing – Doors should be observed annually for deficient weather-stripping and replaced as needed. Perimeter of all window frames should also be regularly inspected and any missing or deteriorated caulking should be re-caulked to provide an unbroken seal around the window frames. Any other accessible gaps or penetrations in the thermal envelope penetrations should be sealed with caulk or spray foam.
- Repair/seal wall cracks and penetrations – SWA recommends as part of the maintenance program to install weep holes, install proper flashing, correct masonry efflorescence and seal wall cracks and penetrations wherever necessary in order to keep insulation dry and effective.

Category III Recommendations: Energy Conservation Measures

ECM#	Description of Highly Recommended 0-5 Year Payback ECMs
1.1	**Replace (1) Incandescent Fixture With CFL**
	Description of Recommended 5-10 Year Payback ECMs
1.2	**Replace (4) Metal Halide Fixtures With PSMH Fixtures**
	Description of Renewable ECMs
2	***Install 2.5 kW PV system***

ECM#1: *Building Lighting Upgrades*

Description:

On the days of the site visits, SWA completed a lighting inventory of the Okner Athletic Field Concession Building (see Appendix A). The Okner Athletic Field Concession Building currently consists of mostly efficient lighting with T8 fluorescent fixtures with electronic ballasts, and an inefficient incandescent fixtures. Based on measurements of lighting levels for each space, there are not any vastly over-illuminated areas. SWA recommends replacing the following inefficient fixtures with more energy efficient types: incandescents should be replaced with compact fluorescent. 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 metal halide fixtures. Exterior lighting is controlled by photocells. SWA recommends replacing the Metal Halide lamps with pulse start Metal Halide lamps. Pulse-start metal halide (MH) lamps offer the advantages of standard (probe-start) MH lamps, but minimize the disadvantages. They produce higher light output both initially and over time, operate more efficiently, produce whiter light, and turn on and re-strike faster. SWA is not recommending at this time any upgrades to the exterior timers. The labor in all these installations was evaluated using prevailing electrical contractor wages. The Township of Livingston may decide to perform this work with in-house resources on a scheduled, longer timeline than otherwise performed by a contractor.

Installation cost:

Estimated installed cost: $8,246 (this includes $2,612 in labor cost)
Source of cost estimate: RS *Means; Published and established costs*

Economics:

ECM #	ECM description	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
1.1	Replace (1) Incandescent Fixture With CFL	7	0	7	7	0.0	N/A	0.1	4	6	5	32	1.1	354%	71%	87	22	10
1.2	Replace (4) Metal Halide Fixtures With PSMH Fixtures	1,755	100	1,655	631	0.1	N/A	5.5	95	302	15	4,533	5.5	174%	12%	16	1,901	864
	Totals	**1,762**	**100**	**1,662**	**638**	**0**	**0**	**6**	**99**	**309**	**-**	**4,564**	**5.4**	**-**	**-**	**-**	**1,923**	**874**

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 - $25 per PSMH fixture

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#1: *Install 2.5 kW PV system*

Description:

Currently the Okner Concession Building does not use any renewable energy systems. Renewable energy systems such as photovoltaic panels, can be mounted on the building roofs, and can offset a portion of the purchased electricity for the building. Power stations generally have two separate electrical charges: usage and demand. Usage is the amount of electricity in kilowatt-hours that a building uses from month to month. Demand is the amount of electrical power that a building uses at any given instance in a month period. During the summer periods, when electric demand at a power station is high due to the amount of air conditioners, lights, equipment, etc… being used within the region, demand charges go up to offset the utility's cost to provide enough electricity at that given time. Photovoltaic systems not only offset the amount of electricity use by a building, but also reduce the building's electrical demand, resulting in a higher cost savings as well. It is recommended at this time that the Township further review installing a 2.5 kW PV system at Okner Concession Building 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 Okner Concession Building 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. JCP&L provides the ability to buy SREC's at $600/MWh or best market offer.

The rear flat roof and/or a portion of the peaked roof are possible locations for a 2.5 kW PV installation on the building roof. A commercial crystalline 230 watt panel has 17.5 square feet of surface area (13.1 watts per square foot). A 2.5 kW system needs approximately 11.0 panels which would take up 190 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: $19,375 (This includes $7,750 in labor)
Source of cost estimate: Similar Projects

ECM #	ECM description	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
2	install 2.5 kW PV rooftop system with incentives	19,375	2,500	16,875	2,774	3	N/A	24.1	0	2,110	25	22,747	8.0	141.5	5.7	10.5	13,294	3,800

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 $2,500 for the proposed option.

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

NJ Clean Energy - Solar Renewable Energy Certificate Program. Each time a solar electric system generates 1000kWh (1MWh) of electricity, a SREC is issued which can then be sold or traded separately from the power. The buildings must also become net-metered in order to earn SRECs as well as sell power back to the electric grid. A total annual SREC credit of $1,200 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

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 # 2

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

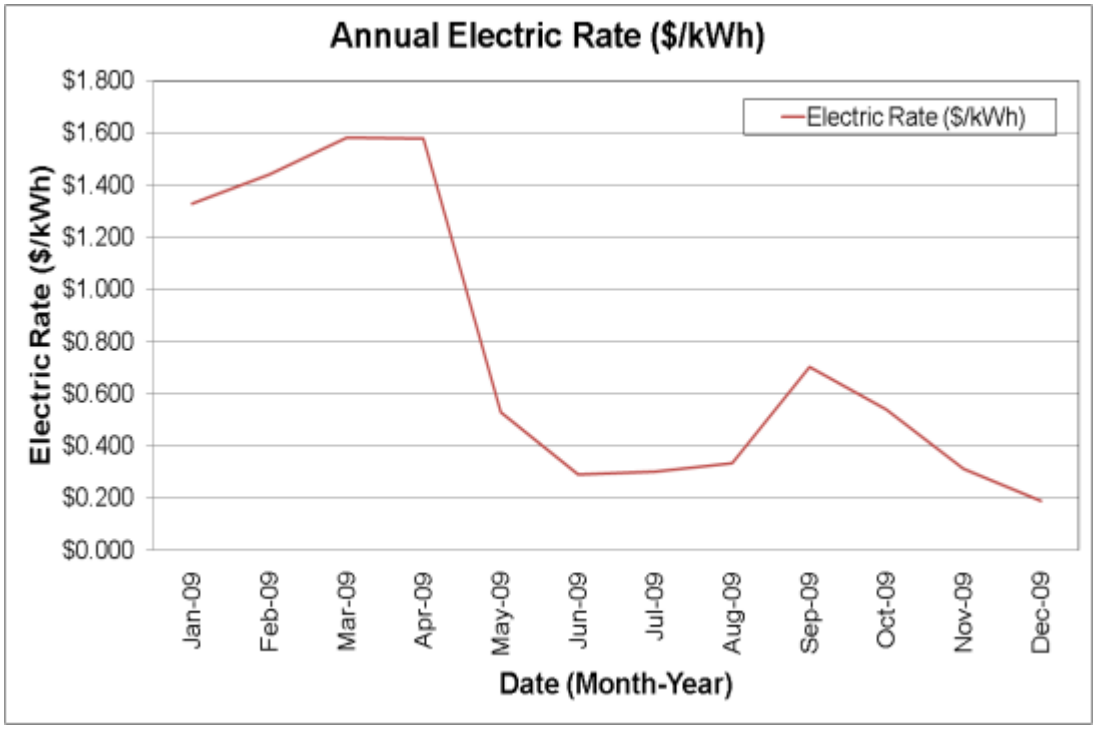
6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

6.1. Energy Purchasing

The Okner Athletic Field Concession Building receives electricity purchased via one incoming meter directly for the Okner Athletic Field Concession Building from JCP&L 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 90% over the 12 month period between January 2009 and December 2009.

Currently, New Jersey commercial buildings of similar type pay $0.150/kWh for electricity. The electricity rate for the concession builidng is $0.328/kWh, which means there is a large potential cost savings if a lower flat rate can be negotiated. This will involve 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 Okner Athletic Field Concession Building. 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 Okner Athletic Field Concession Building 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 Okner Athletic Field Concession Building

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 Wattage	Total Watts	Energy Use kWh/year	Fixture Savings ($/unit)	Control Savings ($/unit)	Total Savings ($/unit)
1	1	Okner Kitchen	Surface	E	4'T8	3	3	32	S	2	180	-4	276	99	T8	Surface	4'T8	E	OS	3	3	32	2	180	-4	276	99	0	33	33
2	1	Okner Storage	Surface	E	4'T8	2	2	32	S	2	180	0	128	46	T8	Surface	4'T8	E	OS	2	2	32	2	180	-4	120	43	3	0	3
3	1	Okner Toilet Rooms	Screw In	N/A	CFL	2	1	20	S	2	180	0	40	14	CFL	Screw In	4'T8	N/A	OS	2	1	20	2	180	0	40	14	0	5	5
4	1	Okner Shed	Screw In	N/A	Inc	1	1	60	S	1	180	0	60	11	CFL	Screw In	CFL	N/A	OS	1	1	20	1	180	0	20	4	7	1	8
5	1	Okner Exterior	Screw In	N/A	MH	4	1	70	PC	12	365	0	280	1,226	MH	Screw In	MH	N/A	PC	4	1	70	12	365	0	280	1226	0	0	0
6	1	Soccer 1, 2 / Baseball	Pole	CWA	MH	1	5	1500	LCP	3	75	625	8,125	1,828	MH	Pole	MH	CWA	LCP	1	5	1500	3	75	625	8125	1828	0	0	0
7	1	Soccer 1, 2 / Baseball	Pole	CWA	MH	1	5	1500	LCP	3	75	625	8,125	1,828	MH	Pole	MH	CWA	LCP	1	5	1500	3	75	625	8125	1828	0	0	0
8	1	Soccer 3 / Softball	Pole	CWA	MH	1	5	1500	LCP	3	62	625	8,125	1,511	MH	Pole	MH	CWA	LCP	1	5	1500	3	62	625	8125	1511	0	0	0
9	1	Soccer 3 / Softball	Pole	CWA	MH	1	5	1500	LCP	3	62	625	8,125	1,511	MH	Pole	MH	CWA	LCP	1	5	1500	3	62	625	8125	1511	0	0	0
10	1	Soccer 1, 2 / Baseball	Pole	CWA	MH	1	14	1500	LCP	3	75	1750	22,750	5,119	MH	Pole	MH	CWA	LCP	1	14	1500	3	75	1750	22750	5119	0	0	0
11	1	Soccer 1, 2 / Baseball	Pole	CWA	MH	1	18	1500	LCP	3	75	2250	29,250	6,581	MH	Pole	MH	CWA	LCP	1	18	1500	3	75	2250	29250	6581	0	0	0
12	1	Soccer 3 / Softball	Pole	CWA	MH	1	10	1500	LCP	3	62	1250	16,250	3,023	MH	Pole	MH	CWA	LCP	1	10	1500	3	62	1250	16250	3023	0	0	0
13	1	Soccer 3 / Softball	Pole	CWA	MH	1	10	1500	LCP	3	62	1250	16,250	3,023	MH	Pole	MH	CWA	LCP	1	10	1500	3	62	1250	16250	3023	0	0	0
14	1	Soccer 3 / Softball	Pole	CWA	MH	1	3	1500	LCP	3	62	375	4,875	907	MH	Pole	MH	CWA	LCP	1	3	1500	3	62	375	4875	907	0	0	0
15	1	Soccer 1, 2 / Baseball	Pole	CWA	MH	1	10	1500	LCP	3	75	1250	16,250	3,656	MH	Pole	MH	CWA	LCP	1	10	1500	3	75	1250	16250	3656	0	0	0
16	1	Soccer 1, 2 / Baseball	Pole	CWA	MH	1	13	1500	LCP	3	75	1625	21,125	4,753	MH	Pole	MH	CWA	LCP	1	13	1500	3	75	1625	21125	4753	0	0	0
17	1	Soccer 1, 2 / Baseball	Pole	CWA	MH	1	9	1500	LCP	3	75	1125	14,625	3,291	MH	Pole	MH	CWA	LCP	1	9	1500	3	75	1125	14625	3291	0	0	0
18	1	Soccer 1, 2 / Baseball	Pole	CWA	MH	1	9	1500	LCP	3	75	1125	14,625	3,291	MH	Pole	MH	CWA	LCP	1	9	1500	3	75	1125	14625	3291	0	0	0
Totals:						26	124	19714				14498	189234	41718.2						26	124	19874			14482	189288	41708.1	10.08	38	48
Rows Highlighted 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 JCPL Service Territory	Telephone & Web Site
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com
BOC Energy Services, Inc. 575 Mountain Avenue Murray Hill, NJ 07974	(800) 247-2644 www.boc.com
Commerce Energy, Inc. 4400 Route 9 South, Suite 100 Freehold, NJ 07728	(800) 556-8457 www.commerceenergy.com
Constellation NewEnergy, Inc. 900A Lake Street, Suite 2 Ramsey, NJ 07446	(888) 635-0827 www.newenergy.com
Direct Energy Services, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com
FirstEnergy Solutions 300 Madison Avenue Morristown, NJ 07926	(800) 977-0500 www.fes.com
Glacial Energy of New Jersey, Inc. 207 LaRoche Avenue Harrington Park, NJ 07640	(877) 569-2841 www.glacialenergy.com
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
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

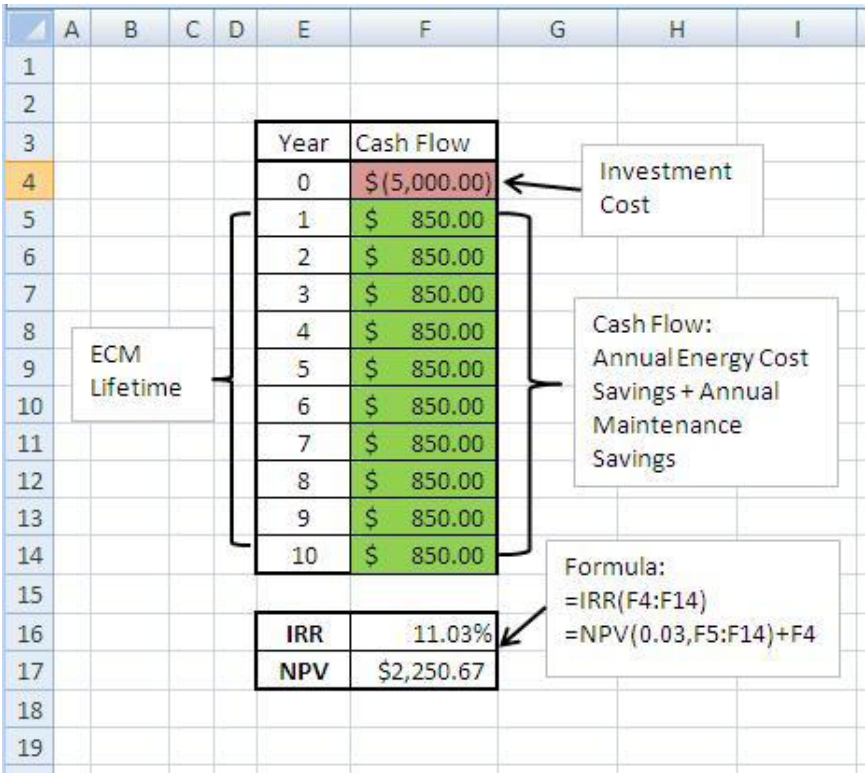
Net ECM Cost = Total ECM Cost – Incentive
LECS = AECS X ECM Lifetime
AOCS = LOCS / ECM Lifetime
LCS = LOCS+LECS

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