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April 30, 2010

Local Government Energy Program
Energy Audit Final Report

Readington Municipal Building
Whitehouse Station, NJ 08889

Project Number: LGEA53

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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 Readington municipal buildings. The audit, conducted on February 5, 2010 included a review of the:

- Municipal Building
- Department of Public Works Building

The buildings are located in Whitehouse Station, NJ. A separate energy audit report is issued for each of the referenced buildings.

This report addresses the Readington Municipal Building located at 509 Route 523, Whitehouse Station, NJ 08889. 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 Readington Municipal Building is a single story structure with a partial basement, originally built in 1968 with additions/renovations in 1988 and 2001. The building consists of 21,030 square feet of conditioned space. Besides the Township Administration offices, the building also houses the Board of Adjustment, the Board of Health, Code Enforcement, Emergency Management, the Environmental Commission, the Finance Department, Fire Prevention, the Housing Department, the Municipal Clerk, the Municipal Court, the Planning Board, Zoning, the Police Department, the Tax Assessor and the Tax Collector offices. The building is occupied by approximately 30-35 employees daily Monday through Friday from 8:00 am to 5:00 pm, and open to the public 8:30 am to 4:30 pm. Evening meetings occur every night, Monday through Thursday 6:00 pm to 10:00 pm. The Court meets 3 times per month 6:00 pm to 10:00 pm and could have in excess of 100 visitors. The Police Department operates 24 hrs per day without a dedicated night dispatch.

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

Launched in 2008, the LGEA Program provides subsidized energy audits for municipal and local government-owned facilities, including offices, courtrooms, town halls, police and fire stations, sanitation buildings, transportation structures, schools and community centers. The Program will subsidize 75% of the cost of the audit. If the net cost of the installed measures recommended by the audit, after applying eligible NJ SmartStart Buildings incentives, exceeds the remaining cost of the audit, then that additional 25% will also be paid by the program. The Board of Public Utilities (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 Municipal Building located at 509 Route 523, Whitehouse Station, NJ 08889. The Municipal Building is a single-story building with a partial basement, comprising of a total conditioned floor area of 21,030 square feet. The original structure was built in 1968 with additions/renovations in 1988 and 2001.

Based on the field visits performed by the SWA staff on February 5, 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, natural gas and electric usage.

From January 2009 through December 2009 the Municipal Building consumed 447,360 kWh or $74,558 worth of electricity at an approximate rate of $0.167/kWh and 24,892 therms or $23,451 worth of natural gas at an approximate rate of $0.942/therm. The joint energy consumption for the building, including both electricity and natural gas, was 4,016 MMBtu of energy that cost a total of $98,009.

SWA has entered energy information about the Municipal Building in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. Currently, a benchmark score could not be generated for the building since it is mixed-use and contains areas that operated at different hours. This building is comprised of non-eligible (Other) space type, and national comparisons are yet unavailable for rating. SWA encourages the Township of Readington to continue entering utility data in *Energy Star Portfolio Manager* in order to track weather normalized source energy use over time. EPA is continually working to expand the available space types.

The Site Energy Use Intensity is 181.0 kBtu/ft2yr compared to the national average of (Other) space type buildings consuming an average of 104.0 kBtu/ft^2yr. Implementing this report's recommendations will reduce use approximately 27.6 kBtu/ft2yr. Due to the nature of its calculation based upon a survey or existing buildings of varying usage, the national average for "Other" space types is very subjective and is not an absolute bellwether for gauging performance. Additionally, should the Township of Readington desire to reach this average, there are other large scale and financially less advantageous improvements that can be made, such as increasing envelope insulation. The Municipal Building annual natural gas costs are competitive and the electric costs are $7,454 higher when compared to the average estimated NJ commercial utility rates.

Based on the assessment of the Municipal Building, 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
- Upgrade/expand the Building Management System (BMS)
- Replace common area heating equipment in the older building sections
- Install hot air diffusers on the Code Enforcement corridor
- Apply continuous 2" XPS rigid foam boards to the interior or exterior at the next renovation
- Replace older windows with newer advanced insulated windows at the next renovation

Category II Recommendations: Operations and Maintenance

- Adjust chiller glycol-water solution and check pump suctions for obstructions
- Maintain roofs - SWA recommends regular maintenance to verify water is draining correctly
- Maintain downspouts and cap flashing - repair/install missing downspouts and cap flashing as needed
- Provide weather stripping/air sealing
- Repair/seal wall cracks and penetrations
- Expand/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 **5** Energy Conservation Measures (ECMs) for the Municipal Building as summarized in the following Table 1. The total investment cost for these ECMs with incentives is **$30,382**. SWA estimates a first year savings of **$7,733** with a simple payback of **3.9 years**. SWA also recommends **7** more ECMs with a total first year savings of **$48,630** as summarized in Table 2 and **1** more End of Life Cycle ECM with a total first year savings of **$549** as summarized in Table 3. SWA estimates that implementing these recommended ECMs will reduce the carbon footprint of the Municipal Building by **201,438 lbs of CO_2**, which is equivalent to removing approximately 17 cars from the roads each year or avoiding the need of 491 trees to absorb the annual CO_2 generated.

There are various incentives that the Township of Readington could apply for that could also help lower the cost of installing the ECMs, such as enroll in 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, has been rolled out recently and 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 (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, $	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	Install (1) beverage vending machine energy miser - Sally Port	www.usatech.com and established costs	279	0	279	1,456	0.4	0	0.2	0	243	12	2,918	1.1	946	79	87	2,047	2,607
2.1	Replace (3) incandescent with CFLs	RS Means, Lit Search	105	None at this time	105	62	0.0	0	0.0	18	28	5	139	3.8	33	7	10	21	111
3	Retro-commissioning	Similar projects	26,288	none at this time	26,288	16,502	4.0	2,250	13.4	1,820	6,695	12	80,340	3.9	206	17	23	38,339	54,345
4	Install automatic vent damper on Raypack boiler vent duct	Published Case Studies	750	0	750	0	0.0	205	1.0	0	193	15	2,892	3.9	286	19	25	1,471	2,256
5	Replace (1) old Code Enforcement condenser - 5 Ton - est EER is 9.0 with new condenser - EER is 13.5 (or SEER 16)	Energy Star purchasing and procurement site, similar projects	3,420	460	2,960	2,239	0.5	0	0.4	200	574	15	8,608	5.2	191	13	18	3,675	4,009
	Totals		**30,842**	**460**	**30,382**	**20,259**	**4.9**	**2,454**	**15.0**	**2,038**	**7,733**	**-**	**94,897**	**3.9**	**212**	**-**	**23**	**45,554**	**63,327**

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, $	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
6	replace (1) electric DHW heater with an Energy Star natural gas condensing type model	Energy Star purchasing and procurement site, similar projects	2,150	50	2,100	2,402	0.6	-78	0.0	18	345	12	4,141	6.1	97	8	12	1,254	3,440
7	Install 50 kW PV with Incentives	Similar Projects	375,000	50,000	325,000	59,020	50.0	0	9.6	0	45,256	25	777,409	7.2	1	0	12	251,377	105,675
2.2	Install (14) occupancy sensors in offices and meeting room	RS Means, Lit Search	3,080	280	2,800	2,308	0.6	0	0.4	0	385	12	4,625	7.3	65	5	9	960	4,132
2.3	Replace (8) exterior Metal Halide fixtures with pulse start MH type	RS Means, Lit Search	5,200	200	5,000	2,768	0.7	0	0.4	160	622	15	9,334	8.0	87	6	9	2,250	4,956
8	Replace (2) 3/4 HP standard 75.5% eff fan motors on old Court room exhaust fans with NEMA premium motors and install new fans	MotorMaster+ International, similar projects	2,390	90	2,300	1,508	0.4	0	0.2	0	252	15	3,778	9.1	64	4	7	643	2,700
9	Replace (1) old Server room wall AC - EER 8.5 with unit - EER 11	Energy Star purchasing and procurement site, similar projects	780	65	715	324	0.1	0	0.1	18	72	15	1,074	10.0	50	3	6	124	580
2.4	Replace (95) T12 fixtures throughout the bldg with new T8 fixtures	RS Means, Lit Search	20,425	2,375	18,050	7,441	1.8	0	1.2	455	1,698	15	25,465	10.6	41	3	5	1,867	13,323
	Totals		**409,025**	**53,060**	**355,965**	**75,771**	**54.0**	**-78**	**11.9**	**650**	**48,630**	**-**	**825,826**	**7.3**	**132**	**-**	**11**	**258,475**	**134,808**

Note: ECM#6: -78 represents additional natural gas usage when traded off against saving more expansive electric usage.

Table 3 - Recommended End of Life Cycle 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, $	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
10	Replace (2) old AHUs with condensing furnaces - 93% eff and new evaporator coils, remove duct brittle inside insulation and apply duct insulation on outside	Energy Star purchasing and procurement site, similar projects	46,425	800	45,625	1,189	0.3	106	0.7	250	549	15	8,234	83.1	-82	-5	-16	-37,951	3,303
	Totals		**46,425**	**800**	**45,625**	**1,189**	**0.3**	**106**	**0.7**	**250**	**549**	**-**	**8,234**	**83.1**	**-82**	**-**	**-16**	**-37,951**	**3,303**

1. HISTORIC ENERGY CONSUMPTION

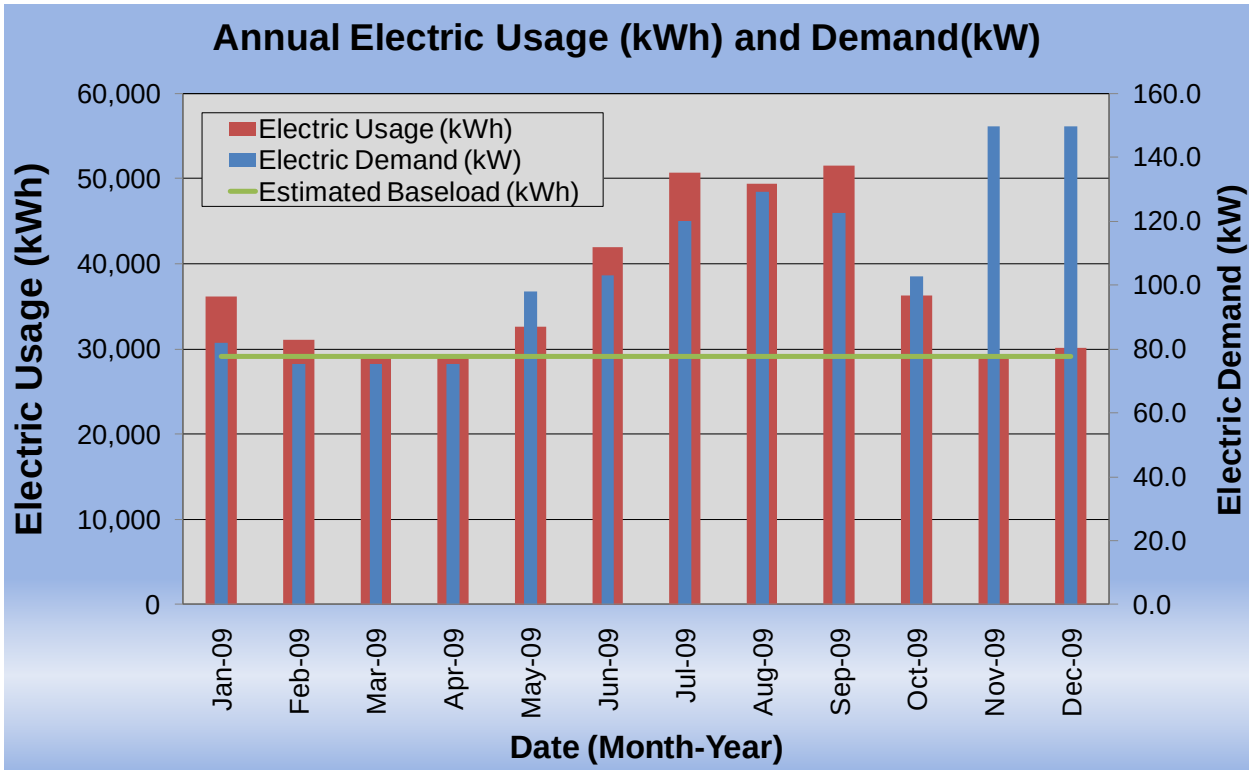
1.1. Energy Usage and Cost Analysis

SWA analyzed utility bills from February 2008 through January 2010 that were received from the utility companies supplying the Readington Municipal Building with electric and natural gas.

Electricity - The Readington Municipal Building is currently served by one electric meter. The Municipal Building currently buys electricity from JCP&L at **an average rate of $0.167/kWh** based on 12 months of utility estimates from January 2009 through December 2009. The Municipal Building purchased **approximately 447,360 kWh or $74,558 worth of electricity** in the previous year. The average monthly demand was 107 kW, peaking at 150 kW during the analyzed period.

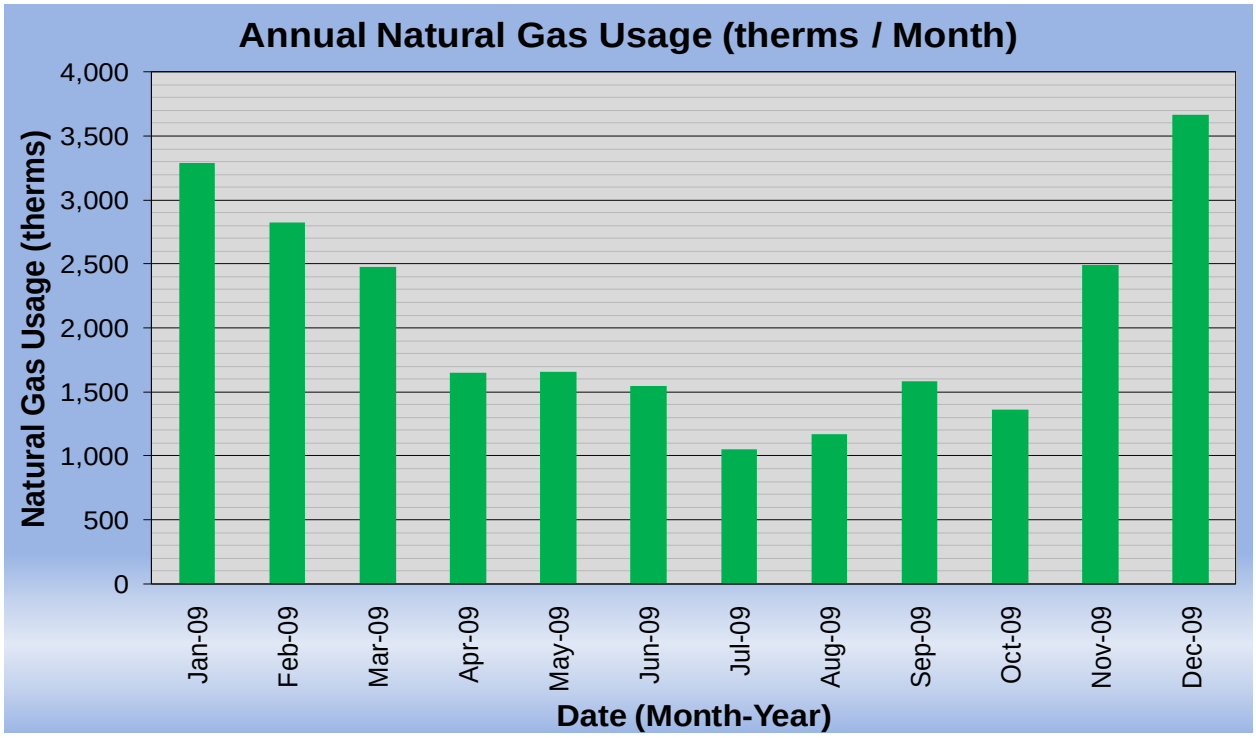
Natural gas - The Readington Municipal Building is currently served by one meter for natural gas. The Readington Municipal Building currently buys natural gas from PSE&G at **an average aggregated rate of $0.942/therm** based on 12 months of utility bills for January 2009 through December 2009. The Readington Municipal Building purchased **approximately 24,892 therms or $23,451 worth of natural gas** in the previous year at a very competitive rate.

The following chart shows electricity consumption for the Municipal Building based on electric bills for the 12 month period of January 2009 through December 2009. It is assumed that the Air Handling Unit (AHU) blowers are operating at all times to circulate the conditioned air.

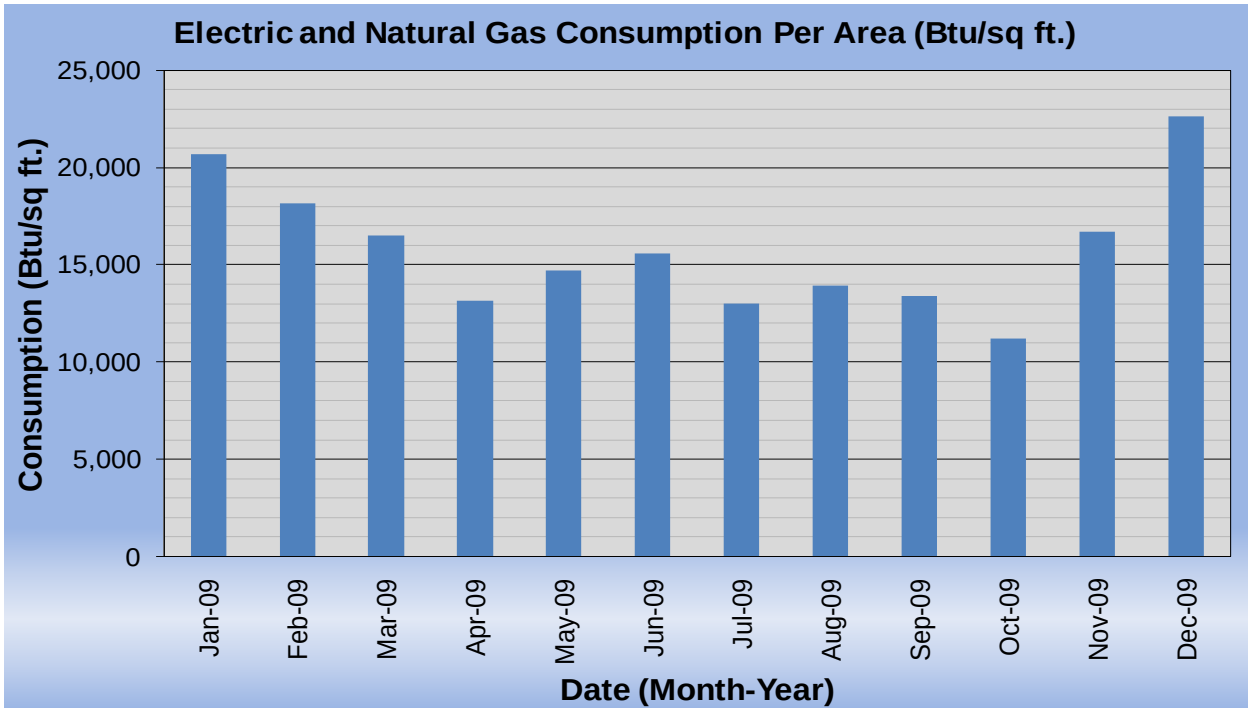


The following chart shows the natural gas consumption for the Municipal Building based on natural gas bills for the 12 month period of January 2009 through December 2009. Natural gas

is used during the summer to make hot water for reheat coils and allow comfort adjustment besides a small usage for heating the building's domestic hot water.

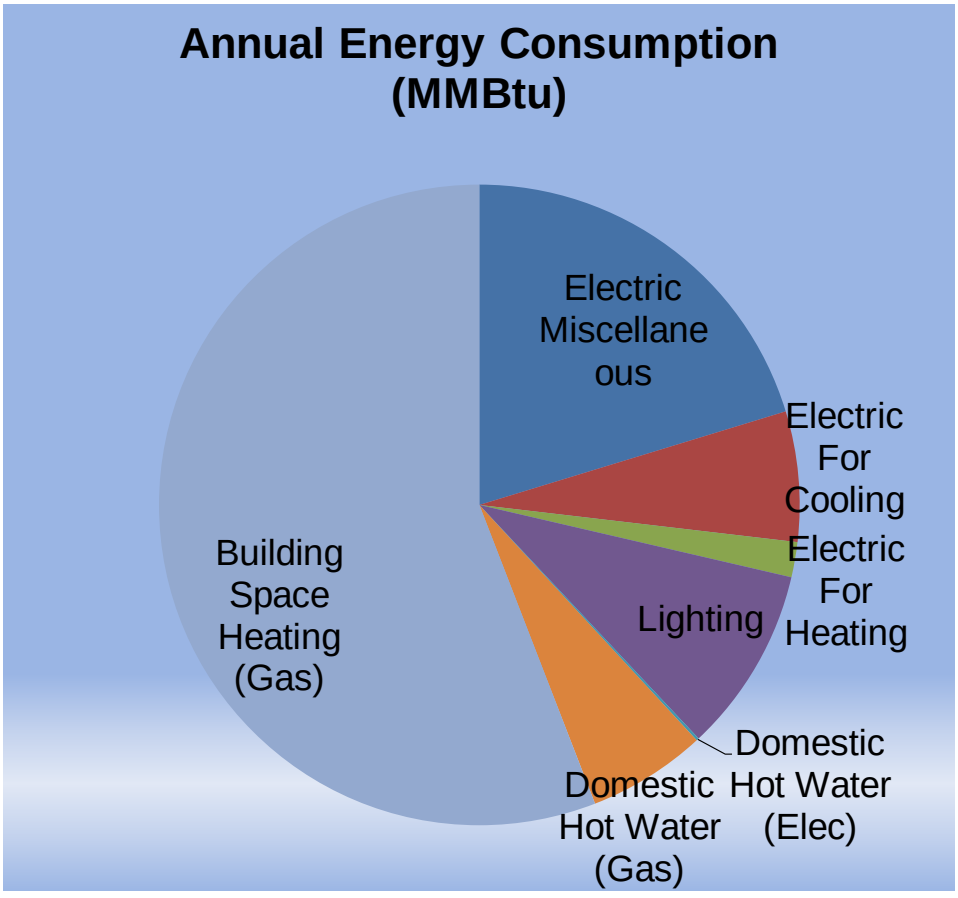


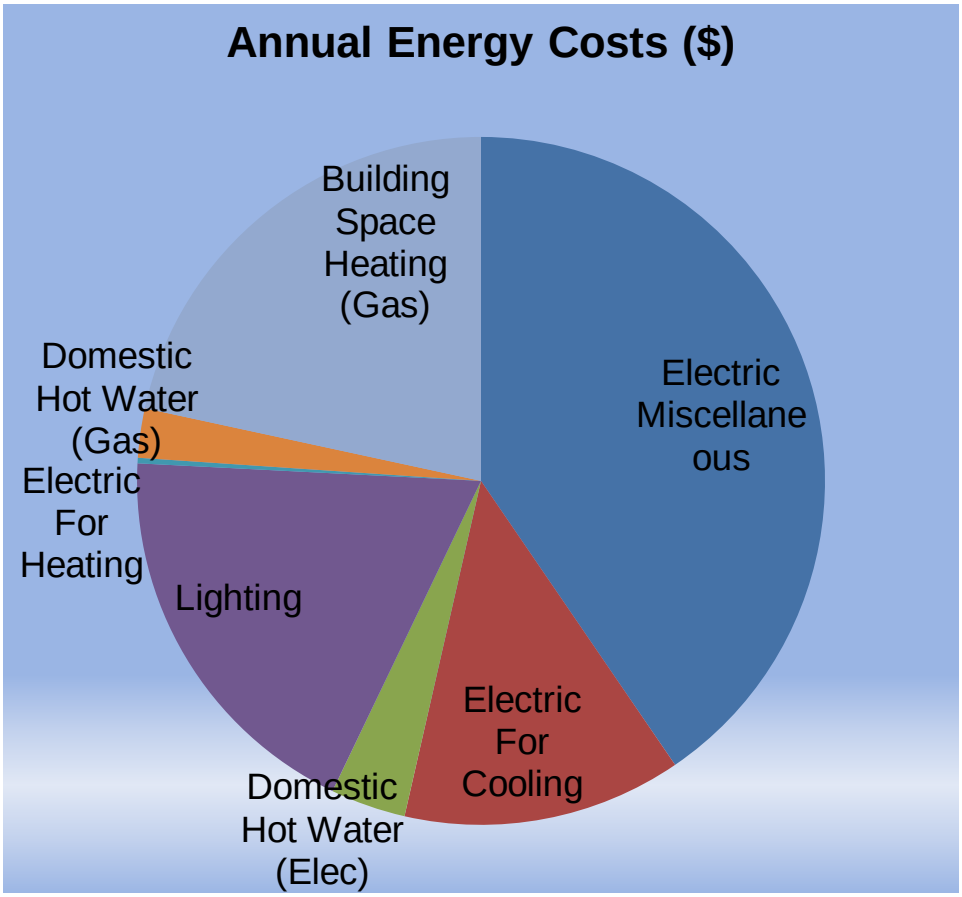
The following chart shows combined natural gas and electric consumption in Btu/sq ft for the Municipal Building based on estimates and utility bills for the 12 month period of January 2009 through December 2009.



The following table and pie charts show energy use for the Municipal Building based on utility bills for the 12 month period of January 2009 through December 2009. Note electrical cost at $49/MMBtu of energy is more than 5 times as expensive to use as natural gas at $9/MMBtu. Air Handling Unit (AHU) blower usage is included in the electric miscellaneous usage below.

2009 Annual Energy Consumption/Costs					
	MMBtu	**% MMBtu**	**$**	**% $**	**$/MMBtu**
Electric Miscellaneous	827	21%	$40,398	41%	49
Electric For Cooling	263	7%	$12,853	13%	49
Electric For Heating	71	2%	$3,467	4%	49
Lighting	360	9%	$17,587	18%	49
Domestic Hot Water (Elec)	5	0%	$254	0%	49
Domestic Hot Water (Gas)	240	6%	$2,258	2%	9
Building Space Heating (Gas)	2,250	56%	$21,194	22%	9
Totals	4,016	100%	$98,009	100%	24
Total Electric Usage	1,527	38%	$74,558	76%	49
Total Gas Usage	2,489	62%	$23,451	24%	9
Totals	4,016	100%	$98,009	100%	24





1.2. Utility Rate

The Municipal Building currently purchases electricity from JCP&L at a general service market rate for electricity use (kWh) with a separate (kW) demand charge. The Municipal Building currently pays an average rate of approximately $0.167/kWh based on the 12 months estimates of January 2009 through December 2009.

The Municipal Building currently purchases natural gas from the PSE&G at a competitive general service market rate for natural gas (therms). PSE&G also acts as the transport company. There is one gas meter that provides natural gas service to the Municipal Building currently. The average aggregated rate (supply and transport) for the meter is approximately $0.942/therm based on 12 months of utility bills for January 2009 through December 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 Municipal Building in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. Currently, a benchmark score could not be generated for the building since it is mixed-use and contains areas that operated at different hours. This building is comprised of non-eligible (Other) space type, and national comparisons are yet unavailable for rating. SWA encourages the

Township of Readington to continue entering utility data in *Energy Star Portfolio Manager* in order to track weather normalized source energy use over time. EPA is continually working to expand the available space types.

The Site Energy Use Intensity is 181.0 kBtu/ft2yr compared to the national average of (Other) space type buildings consuming an average of 104.0 kBtu/ft^2yr. Implementing this report's highly recommended Energy Conservations Measures (ECMs) will reduce use by approximately 15.0 kBtu/sq ft yr, with an additional 11.9 kBtu/sq ft yr from the recommended ECMs, and 0.7 kBtu/sq ft yr from the End of Life Cycle recommended ECM. Implementing this report's recommendations will reduce use approximately 27.6 kBtu/ft2yr. Due to the nature of its calculation based upon a survey or existing buildings of varying usage, the national average for "Other" space types is very subjective and is not an absolute bellwether for gauging performance. Additionally, should the Township of Readington desire to reach this average, there are other large scale and financially less advantageous improvements that can be made, such as increasing envelope insulation.

Per the LGEA program requirements, SWA has assisted the Township of Readington to create an *Energy Star Portfolio Manager* account and share the Municipal Building 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 Township of Readington (user name of "readingtontwp" with a password of "readingtontwp") and TRC Energy Services (user name of TRC-LGEA).

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Readington Township - Municipal Building

Building ID: 2062382
For 12-month Period Ending: December 31, 2009[1]
Date SEP becomes ineligible: N/A
Date SEP Generated: March 12, 2010

Facility
Readington Township - Municipal Building
509 Route 523
Whitehouse Station, NJ 08889

Facility Owner
N/A

Primary Contact for this Facility
N/A

Year Built: 1968
Gross Floor Area (ft²): 21,030

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

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	1,526,392
Natural Gas (kBtu)[4]	2,286,035
Total Energy (kBtu)	3,812,427

Energy Intensity[5]

Site (kBtu/ft²/yr)	181
Source (kBtu/ft²/yr)	356

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	354

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	67%
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 Readington Municipal Building is a single story structure with a partial basement, originally built in 1968 with additions/renovations in 1988 and 2001. The building consists of 21,030 square feet of conditioned space. Besides the Township Administration offices, the building also houses the Board of Adjustment, the Board of Health, Code Enforcement, Emergency Management, the Environmental Commission, the Finance Department, Fire Prevention, the Housing Department, the Municipal Clerk, the Municipal Court, the Planning Board, Zoning, the Police Department, the Tax Assessor and the Tax Collector offices.

Front Façade

Court House Façade (typ.)

Code Enforcement Façade (typ.)

Police Department (rear façade)

2.2. Building Occupancy Profiles

The building is occupied by approximately 30-35 employees daily Monday through Friday from 8:00 am to 5:00 pm, and open to the public 8:30 am to 4:30 pm. Evening meetings occur every night, Monday through Thursday 6:00 pm to 10:00 pm. The Court meets 3 times per month 6:00 pm to 10:00 pm and could have in excess of 100 visitors. The Police Department operates 24 hrs per day without a dedicated night dispatch.

2.3. Building Envelope

Due to favorable weather conditions (min. 20 deg F delta-T in/outside & no/low wind) 25 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 and thermal analysis, as far as accessibility and weather conditions allowed at the time of the field audit.

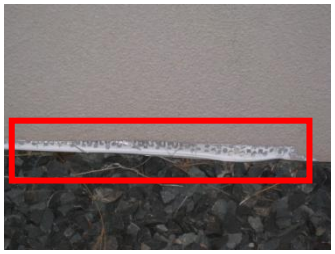
2.3.1. Exterior Walls

The exterior wall envelope is mostly constructed of brick veneer and some vinyl clapboard siding accents over a steel frame with 4 inches of fiberglass batt cavity insulation. This type of insulation type is greatly compromised by thermal bridging through the steel studs. Other areas are constructed of EIFS (Exterior Insulation Finishing System) over a steel frame with 2 inches of EPS (expanded polystyrene, white) insulation. The interior is mostly painted gypsum wallboard.

Note: Wall insulation levels could be partially verified in the field using IR camera and are based on partial construction plans.

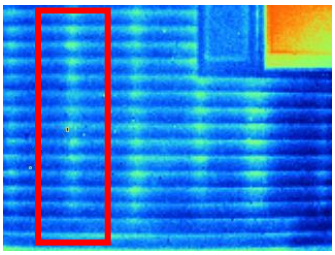
During the field audit exterior and interior wall surfaces were inspected. They were found/reported to be in overall good condition with some signs of uncontrolled moisture, air-leakage and/or other energy-compromising issues detected on all facades.

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



Damaged exterior wall finishes

Cracked/aged caulk



Thermal bridging through metal studs (typical example at Code Enforcement wing)

In light of the exterior wall conditions mentioned above SWA has the following recommendation which may be described, quantified and categorized further in the *Executive Summary*:

1. Inspect and replace cracked/ineffective caulk.

2. Inspect and replace cracked/damaged EIFS.

3. SWA suggests that at the next major renovation applying continuous 2" XPS rigid foam boards to the interior or exterior pending on the renovation and covering with a preferred finish to create a more robust thermal insulation layer.

2.3.2. Roof

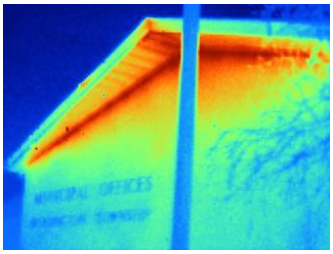
The building's roof is predominantly a medium-pitch gable type over a wood structure with a asphalt shingle finish. It was replaced approximately 9 years ago, in 2001. R-30 fiberglass batt of assumed attic/ceiling roof insulation were recorded. Limited parts of the building are also covered by a flat, no parapet type over a wood structure with an EPDM finish and 2 inches of XPS (extruded polystyrene, blue or pink) foam board roof of assumed insulation. This roof was also replaced approximately 9 years ago, in 2001.

Note: Roof insulation levels could not be verified in the field and are based on available construction plans.

During the field audit, roofs, related flashing, gutters and downspouts were inspected. They were found/reported to be in overall good condition with some signs of uncontrolled moisture, air-leakage and/or other energy-compromising issues mostly detected on sloped roof areas.

The following specific roof problem spots and areas were identified with IR images to further visualize some of the roof issues mentioned:

ineffective ceiling roof insulation



ineffective attic insulation found

In light of the exterior wall conditions mentioned above SWA has the following recommendation which may be described, quantified and categorized further in the *Executive Summary*:

1. Maintain roofs, gutters and downspouts - SWA recommends regular maintenance to verify water is draining correctly.

2. Add insulation to ineffectively and under-insulated roof/ceiling sections. SWA recommends properly maintaining exterior roof insulation in an effort to minimize energy loss.

2.3.3. Base

The building's base is composed partially of a below-grade basement with a slab under new addition and crawl-space under wood joist type under Code Enforcement area floor with a perimeter foundation and a slab edge/perimeter insulation. Slab/perimeter insulation levels could not be verified in the field and are based on partial construction plans.

The building's base and its perimeter were inspected. Judging from signs of uncontrolled moisture or water presence and other energy compromising issues, overall the base was found/reported to be in acceptable condition with no signs or reports of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

2.3.4. Windows

The building contains several different types of windows.

1. A number of fixed curtain wall/storefront type windows with a non-insulated aluminum frames, clear double glazing and no interior or exterior shading devices. The windows are located mainly on the new addition in the front of the building and are original (installed in 2001 and have never been replaced).
2. There are a few casement type windows with a vinyl frame, clear double glazing and interior blinds. The windows are located on the Police Department addition in the front of the building and are original (installed in 2001 and have never been replaced).
3. Most of the back windows are double-hung type windows with a vinyl frame, clear double glazing and interior blinds. The windows are located in the rear of the building on the Code Enforcement addition and are original (installed in 1988 and have never been replaced).
4. There are also casement type windows with a vinyl frame, clear double glazing and interior blinds. The windows are located on either side of the building in the old section of the building and are reported to have been replaced in approximately 2003.
5. A few slider type windows with a vinyl frames, clear double glazing and interior blinds are located on the rear of the building on the old courthouse and are reported to have been replaced in approximately 2003.

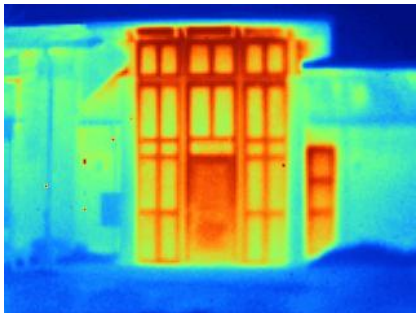
Windows, shading devices, sills, related flashing and caulking were inspected from the exterior and interior as far as accessibility allowed. Based on signs of moisture, air-leakage and other energy compromising issues, overall the windows were found and/or reported to be in acceptable/age appropriate condition. Windows are mainly double glazed, with an aluminum frame. The non-insulated aluminum frame conducts heat out of the building causing energy losses.

The following specific window problem spots and areas were identified:



typical window types


The following IR image further visualizes some of the window issues mentioned above (red indicates heat conducted through frames):



Store front type windows with aluminum frames with no thermal break

In light of the exterior wall conditions mentioned above SWA has the following recommendation which may be described, quantified and categorized further in the *Executive Summary*:

1. The perimeter of all window frames should be regularly inspected and any missing or deteriorated caulked areas should be re-caulked to provide an unbroken seal around the window frames.

2. SWA suggests that at the next major renovation replacement of older windows with newer advanced insulated windows with low-E, argon filled double (or triple) glazed type with

thermally broken frames, made of wood, vinyl or fiber glass frame which are less conductive than aluminum.

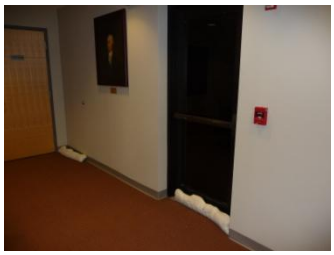
2.3.5. Exterior Doors

The building contains several different types of exterior doors.

1. Units with glass and aluminum/steel frame type exterior doors. They are located in the front of the building and are original (installed 2001 and have never been replaced).
2. Other doors are solid metal type exterior doors. They are located throughout the building and are original/have never been replaced.

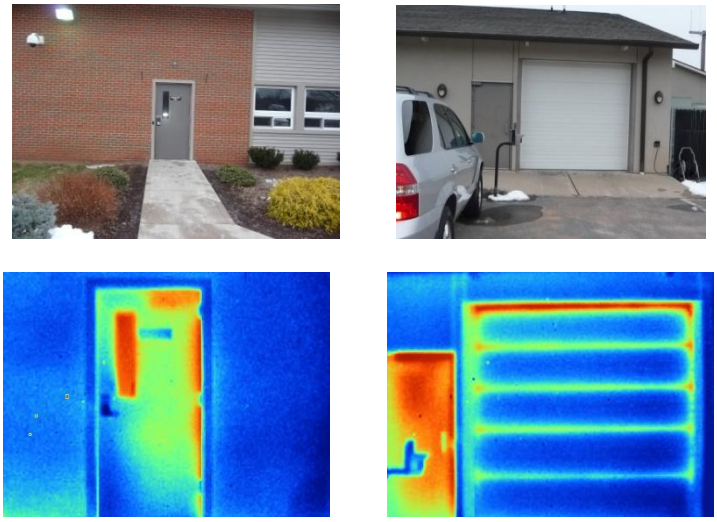
All exterior doors, thresholds, related flashing, caulking and weather-stripping were inspected. Based on signs of moisture, air-leakage and other energy compromising issues, overall the doors were found/reported to be in poor condition with numerous signs of uncontrolled moisture, air-leakage and/ or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

The following specific door problem spots and areas were identified:



Missing/worn weather stripping

The following IR images further visualize some of the door issues mentioned above:



Air-leakage around doors due to worn weather stripping

In light of the exterior wall conditions mentioned above SWA has the following recommendation which may be described, quantified and categorized further in the *Executive Summary*:

1. Install/replace/maintain weather stripping around all exterior doors and roof hatches. Doors and vestibules should be observed annually for deficient weather-stripping and replaced as needed.

2.3.6. Building Air-Tightness

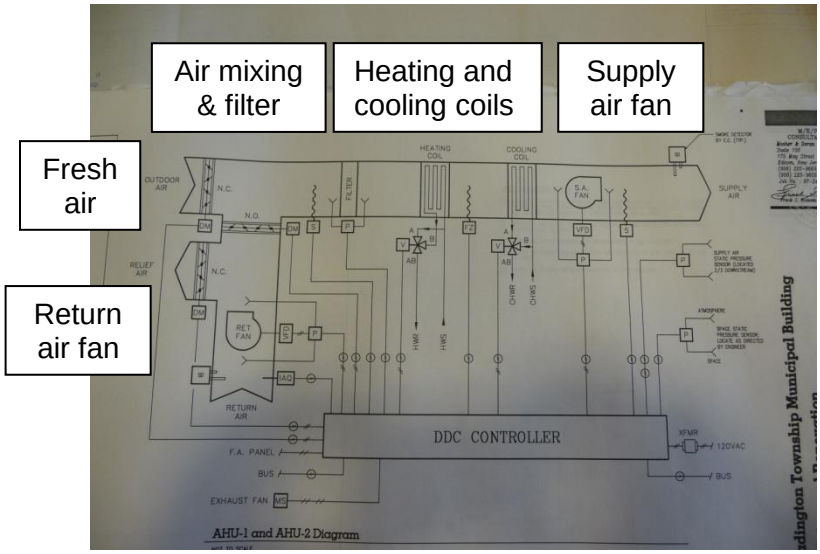
Overall the field auditors found the building to be reasonably air-tight, considering the building's use and occupancy, as described in more detail earlier in this chapter.

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

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

2.4. HVAC Systems

The Readington Municipal Building is heated/cooled by four main separate systems associated with the original and three building additions/renovations. The old Courtroom section (now offices, storage and meeting rooms) is heated/cooled by two attic Air Handling Units (AHUs) associated with a hot water boiler and outside condenser. The Middle office section is heated/cooled by individual through the wall units, each with DX cooling coils and heating hot water supplied by a central boiler. The Code Enforcement (trailer) section is heated/cooled by a condensing furnace located in the crawl space and an outside condenser. The latest 2001 New Addition - Lobby, Courtroom and Police Department are heated/cooled by two (2)-attic AHUs associated with a hot water boiler and outside chiller.



Typical New Addition schematic AHU setup and controls

2.4.1 Heating

The old Courtroom section (now offices, storage and meeting rooms) is heated by two attic York AHUs installed in 1968 and operating beyond their expected useful lives. Most likely the coils are partly fouled and the fans are operating at low efficiency. Hot air from the AHUs is delivered via ceiling diffusers to various spaces the system serves. The heating coils are supplied with hot water by a Utica 100,000 Btu/hr input, 83,000 Btu/hr output - 83% estimated efficient natural gas fired boiler, which has 70% left of its estimated useful life. Programmable area thermostats control comfort level in the different spaces. SWA recommends that the AHUs be replaced in kind with high efficiency models and that any brittle acoustic insulation inside the ducts be removed (so that served areas do not become dusty with breakaway pieces) and duct re-insulated well on the exterior.

Old Courtroom area DHW; Middles section Utica boiler; Utica boiler for old Courtroom AHUs

The Middle office section is heated by 12 individual Comitale National Inc. through the wall units (which have 50% left of their estimated useful lives), each with heating coils supplied with hot water by a Utica 175,000 Btu/hr input, 143,000 Btu/hr output - 82% estimated efficient natural gas fired boiler, which has 70% left of its estimated useful life. The control on each of the units is manual, by knobs and buttons without good accuracy or consistent setback. During winter, plywood boards are installed on the outside opening to prevent freezing outside air from entering the building and freezing the water coils. SWA recommends that interior wall mounted programmable thermostats be installed and tied-in to several units for improved comfort level control.

Comitale National Inc. through the wall unit

Comitale National Inc. unit manual controls

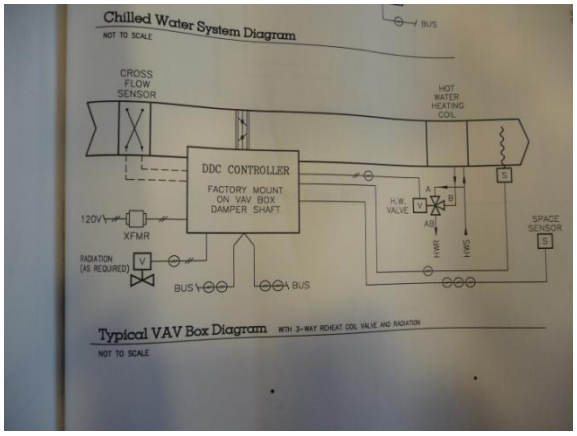
The Code Enforcement (trailer) section is heated by a Lennox 66,000 Btu/hr input, 62,000 Btu/hr output - 94% estimated efficient natural gas fired condensing type furnace, which has 90% left of its estimated useful life. Hot air from the furnace is delivered via floor diffusers to various spaces the system serves. Programmable area thermostats control comfort level in the different spaces. The Code Enforcement corridor is unheated/or cooled. SWA recommends that additional floor diffusers be installed on the corridor for an even heating of the space the furnace serves.

Code Enforcement condensing furnace in crawl space installed on the horizontal

The new 2001 Lobby, Courtroom and Police Department addition is heated by two attic Trane AHUs which have 40% left of their estimated useful lives. AHU-1 serves the conference room 102, Court room 101, vestibule 100A, bathrooms and the lunch room via 6 Variable Air Volume (VAVs) ceiling mounted air distribution units. AHU-2 serves the Police Department via 11 VAV ceiling mounted air distribution units. Hot air from the AHUs is delivered via ceiling diffusers to various spaces the systems serve. The heating coils are supplied with hot water by a Raypack 961,700 Btu/hr input, 788,600 Btu/hr output - 82% estimated efficient natural gas fired boiler, which has 60% left of its estimated useful life.

Programmable area thermostats control comfort level in the different spaces +/- 3 degrees (except for the Court room and the Lobby). The main control is by an Andover Building Management System (BMS) ATC/DDC - DMS 240, which has 40% left of its estimated useful life. VAV systems are designed to supply only the volume of conditioned air to a space that is needed to satisfy the load. Fan energy is saved when the volume of air handled by the fan is reduced. Air volume control is accomplished by installing modulating dampers, or in some cases, an air valve, in the supply duct to each zone. As the room temperature demand becomes satisfied, the thermostat signals the damper to move the supply air zone valve toward the closed position. When zone valves are throttled, the static pressure in the supply-duct changes. A static pressure sensor located in the supply duct senses the static pressure change and either increases or decreases the airflow from the source, using variable speed control or dampers on the main air supply fan. A key component in the VAV system is the air valve. It is commonly installed inside an insulated sheet metal box suspended in a ceiling plenum. The air valve has a damper that regulates the air flow in response to the room's thermostat. A multi-port pressure sensing ring provides both accurate airflow sensing and control in response to duct static pressure. Outside the heat provided by the AHUs, there isn’t any wall perimeter heating. The air handler units are programmed for occupied/unoccupied mode of operation through the BMS. During the occupied mode of operation, the supply air fan runs continuously. Minimum outdoor air is

provided through the outdoor air louver. There are Police Department complains that the temperature control is operating poorly. During the summer, the boiler hot water is reset at 90-118 deg F for the VAV reheat coils, while during the winter, the boiler hot water temp is ~190 deg F. Hot water temperature is adjusted by the outside temperature. SWA recommends retro-commissioning per ECM#3 In order to check that the system is operating as designed ten years ago.



Typical VAV Box schematic

New Addition Raypack boiler

New Addition hot water circulating pumps

Other smaller heating systems are found throughout the building. The Police Department Sally Port is heated by a Trane 92% estimated efficient natural gas fired condensing type furnace, which has 40% left of its estimated useful life. Hot air from the furnace is delivered via ceiling diffusers to the Sally Port garage. A programmable thermostat controls comfort level in the Sally Port. There are three (3) Sterling ceiling radiators with manual hot water control valves in the two front vestibules and Police Department administration office, which have 40% left of their estimated useful lives. The old Courtroom section corridors are heated by original Nesbitt hot water radiant heaters which are operating beyond their expected useful lives and should be replaced in kind. The payroll office in the Middle Section, which

used to be the old front entrance to the building is heated/cooled by a small split Sanyo heat pump system, which has 70% left of its estimated useful life.

2.4.2 Cooling

The old Courtroom section is cooled via two attic York AHUs described in the above section 2.4.1 Heating. Cold air from the AHUs is delivered via ceiling diffusers to various spaces the system serves. The cooling evaporator coils are cooled with R22 refrigerant supplied by an outside Lennox 7.5 Ton air cooled condenser which has 90% left of its estimated useful life.

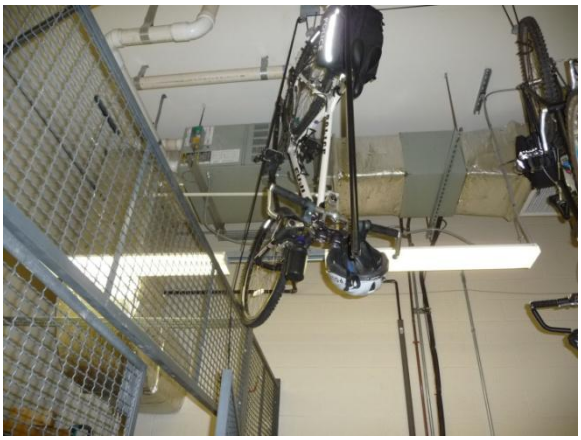
The Middle office section is cooled by 12 individual Comitale National Inc. through the wall units, each with DX cooling coils. During summer, plywood boards are removed from the outside opening and fresh air is mixed with recycled air, cooled and delivered to space surrounding each unit.

The Code Enforcement (trailer) section is cooled via a Lennox evaporator coil located in the furnace discharge duct with R22 refrigerant supplied by an outside Lennox 5 Ton air cooled condenser, which is operating beyond its estimated useful life. SWA recommends that the condenser be replaced with an Energy Star high efficiency unit.

The new 2001 Lobby, Courtroom and Police Department addition is cooled via two attic Trane AHUs described in the above section 2.4.1 Heating. Cold air from the AHUs is delivered via VAVs (with re-heat hot water coils for tempering the cold air as needed) and ceiling diffusers to various spaces the system serves. The AHU cooling evaporator coils are cooled with chilled water glycol solution supplied by an outside 60 Ton Trane air cooled chiller which has 40% left of its estimated useful life. On the day of the audit the chiller circulating pump was running all the time since the glycol-water solution has not yet been tested and Maintenance did not want to risk catastrophic freezing. SWA recommends that the glycol concentration be tested simply by using a specialized density kit and adjustments be made as needed in order to shut pump down when cooling is not required. Also, it was reported that chiller circulating pump motors are frequently replaced. SWA believes that this may be due to cavitation (poor pump suction piping arrangement) which could be heard when standing next to the chiller.

Chiller and water-glycol solution circulator pumps

Other smaller cooling systems are found throughout the building. The Police Department Sally Port is cooled via a Trane evaporator coil located in the furnace discharge duct with R22 refrigerant supplied by an outside Trane air cooled condenser, which has 40% left of its estimated useful life. The payroll office in the Middle Section, which used to be the old front entrance to the building is cooled by a small split Sanyo heat pump system, which has 70% left of its estimated useful life. Server room #112 is cooled by a through the wall GE AC unit which is operating beyond its expected useful life. SWA recommends that it is replaced with an Energy Star high efficiency unit.



Police Department Sally Port evaporator coil and furnace (back of bicycles)

2.4.3 Ventilation

The Municipal building ventilation I provided by the several York and Trane AHUs, Lennox and Trane furnaces, one GE AC through the wall unit, 12 Comitale National Inc. through the wall units, various AHU associated fans, Penn and Trane (1968 units are operating beyond their expected lives) bathroom exhaust fans.

2.4.4 Domestic Hot Water

The domestic hot water (DHW) for the old Courtroom bathrooms and utility sink is provided by a RehemGlas electric heater with 20 gal storage and 2,000 Watt upper/2,000 Watt lower electric coils with 10% estimated useful operating life left. SWA recommends that this unit is replaced with a high efficiency inline condensing type gas fired heater when it has reached the end of its operating life. DHW is provided to the rest of the building by an AO Smith natural gas fired heater with 100 gal storage and 75,000 Btu/hr capacity. This heater is 95% efficient and has 70% estimated useful operating life left.

Left: Old Courtroom electric DHW; Right: New Addition natural gas fired DHW

2.5 Electrical Systems

2.5.1 Lighting

Interior Lighting - The interior lighting of the Municipal Building consists of a mix of T12 fixtures with magnetic ballasts, T8 fixtures with electronic ballasts, compact fluorescent lights (CFLs) and a few incandescent bulbs. Based on measurements of lighting levels for each space, there are not any vastly over-illuminated areas. SWA recommends replacing T12 with T8 fixtures and incandescent bulbs with CFLs. CFL bulbs produce the same lumen output with less wattage than incandescent bulbs and last up to five times longer. All replacements should meet local code requirements, such as shielding for safety hazards. SWA also recommends installing occupancy sensors in areas that are occupied only part of the day and the payback on savings is 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 mean to control lighting operation. See the 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 efficient LED type.

Exterior Lighting - The exterior lighting surveyed during the building audit was found to be a mix of Metal Halide (MH) lamp fixtures, High Pressure Sodium (HPS) lamp fixtures and Compact Fluorescent Lights (CFLs). Exterior lighting is controlled by automatic timers. SWA recommends replacing MH fixtures of high wattage with pulse-start MH lamps which 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 light timers.

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. For example, Energy Star refrigerators use as little as 315 kWh/yr. When compared to the average electrical consumption of older equipment, Energy Star equipment results in a large savings. Building management should select Energy Star label appliances and equipment when replacing: refrigerators, printers, computers, copy machines, etc. More information can be found in the "Products" section of the Energy Star website at: http://www.energystar.gov. Also, energy vending miser devices are now available for conserving energy usage by Beverage and Snacks 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. See section 4, Energy Conservation Measures for details on replacing refrigerators and installing energy misers on vending machines.

Computers left on inside 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 building's 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 Readington Municipal building is a single-story building (with a small partial basement used for storage) without elevators.

2.5.4 Others electrical systems

Besides a few small transformers in satisfactory condition and a 130 kW emergency generator (which has 50% left of its estimated useful life), there are not currently any other significant energy impacting electrical systems installed at the Municipal building.

Generac 130 kW Diesel driven generator

3. EQUIPMENT LIST

Inventory

Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Heating	1 boiler - 961.7 MBH input, 788.6 MBH output - 82% est eff.	Mech rm back of Police Dept	Raypack H2-0962N, Serial #: 0011177024	Natural Gas/Electric	Police Dept, Court Area, Lobby	2001	60%
Heating	2 hot water pumps, motors 82.5% eff	Mech rm back of Police Dept	Pumps with Baldor motors VJMM3558T, 2HP, 1725rpm	Electric	Police Dept, Court Area, Lobby	2001, 2009	40% and 90%
Cooling	1 chiller - capable of 60 Tons of refrigeration (est Full Load EER (Btu/Watt-hr) is 12.7 and Half Load EER is 8.9)	Back of Police Dept	Trane Intellipak CGAFC60EADA1000D000J00000TOWOD; Serial #: C00H24467	Electric	Police Dept, Court Area, Lobby	2001	40%
Cooling	2 chilled water-glycol mix circulating pumps, motors 85.5% eff	Mech rm back of Police Dept	Pumps with Baldor motors VJMM3615T, 5HP, 1725rpm	Electric	Police Dept, Court Area, Lobby	2008, 2009	90%
Heating/ Cooling	AHU-1 with 1 supply and 1 exhaust fans - est avg CFM/Watt of 8.0	In attic above new break room opposite Courtroom	Trane MCCA017 CLCH-IM-15B	Electric	Conf rm 102, court rm 101, vest 100A, baths, lunch rm	2001	40%
Heating/ Cooling	AHU-2 with 1 supply and 1 exhaust fans - est avg CFM/Watt of 9.5	In attic above corridor/Evidence RM	Trane MCCA017 CLCH-IM-15B	Electric	Police Department	2001	40%
Heating/ Cooling	RF-1 Return Fan for AHU-1, 3HP - est std motor eff of 83.5%	in attic by AHU-1	Trane CB1D20	Electric	conf rm 102, court rm 101, vest 100A, baths, lunch rm	2001	40%
Heating/ Cooling	RF-2 Return Fan for AHU-2, 2HP - est std motor eff of 82.5%	In attic by AHU-2	Trane CB1D20	Electric	Police Dept	2001	40%
Heating/ Cooling	6 VAVs (#1-#6) connected to AHU-1	Above various rooms where heat is controlled	Trane VCWE172H - SVN01A-EN	Electric	Conf rm 102, court rm 101, vest 100A, baths, lunch rm	2001	40%
Heating/ Cooling	11 VAVs (#7-#17) connected to AHU-2	Above various rooms where heat is controlled	Trane VCWE172H - SVN01A-EN; Serial #s: 653472, 653433,647815,627311,647762,653326,651433,651500,653228,653413,652112	Electric	Police Dept	2001	40%

continued on the next page

Note: The remaining useful life of a system (in %) is an estimate based on the system's manufacturing date and existing conditions derived from visual inspections

Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
continued from the previous page							
Heating/ Cooling	AHU for Police Sally Port, condensing gas furnace, 92% AFUE	Ceiling hung in Sally Port	Trane XE90, TDX060C936C2, Serial #: R193PCE7G	Natural Gas/Electric - blower	Sally Port	2001	40%
Cooling	Sally Port Condenser - est SEER is 10.0	Outside back Police Dept, next to chiller	Trane XE120, TTP030DTD0A0, Serial #: R3636MY2F	Electric	Sally Port	2001	40%
Heating	Ceiling hot water radiators (controlled with manual valves); 2 units 8ft long in Muni vestibule, 2 units 6ft long in Police vestibule, 2ft x 8ft unit in Police admin office	Ceiling mounted in two front vestibules & one Police admin office	Sterling (nameplates not found)	Electric	Two front vestibules & one Police admin office	2001	40%
Heating/ Cooling	2 AHUs for old Court rm area - est avg fan CFM/Watt of 8.5	Attic space off corridor above bathrooms and vault	York DHB-T090AC, Serial #: NAJM010236	Electric	Old Court rm area	1968	0%
Cooling	Condenser - 7.5 Ton - est EER is 10.5	Outside back bldg middle section	Lennox HS29-090-34, Serial #: 5607F16938	Electric	old Court rm area	2008	90%
Heating/ Cooling	12 wall units for cooling/heating (hot water coils)	Middle sect, individual rms by external wall	Comitale National Inc. with DX coils and hot water coils, PC-PH Series	Electric	Middle Sect. Rms	2003	50%
Heating	Radiant coils wall mounted on corridors and several rooms	Corridors and several rooms	Nesbitt (nameplates not on equip)	NA	Corridors and several rooms	1968	0%
Cooling	Small wall AC	RM 112 Server Rm	GE (nameplate inside the wall penetration	Electric	RM 112 Server Rm	1995	0%
Heating/ Cooling	1 furnace - 94% est eff, 66,000 Btu/hr input, 62,000 Btu/hr output; evaporator 3-1/2 Tons (R22)	Code Enforcement trailer crawl space	Lennox Elite furnace G51MP-35B-070-07, Serial #: 5909K22225; evaporator coil CH16-41-1FF, Serial #: 5487F06543	Natural Gas/Electric - blower	Code Enforcement trailer section	2008	90%
Cooling	Condenser (R22) - 5 Ton - est EER is 9.0	On side of Code Enforcement trailer bldg	Lennox HS16-461U-4P, Serial #: 5187D12291	Electric	Code Enforcement trailer section	1987	0%
Domestic Hot Water	1 A O Smith with 100 gal storage, 75,000 Btu/hr - est 80% thermal eff	Mech rm back of Police Dept	A O Smith BT100230, Serial #: MB00-0915111-230	Natural Gas	Municipal Bldg except old Court rm baths	2001	30%
Domestic Hot Water	1 electric RhemGlas with 20 gal storage, 2,000 W upper and 2,000 W lower coils, Energy Star rating $421/yr (on a scale $414-$443/yr)	Old mech rm	RhemGlas 68V-20S, Serial #: R068D05938	Electric	Old Court rm restrooms and janitor's sink	1998	10%
continued on the next page							

Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
continued from the previous page							
Heating	1 boiler - 100 MBH input, 83 MBH output - 83% est eff. - supplies hot water to old Court Rm AHU; with 1/25HP, 3,250 rpm, Taco cartridge circulator 007-FI	Old mech rm	Utica MGB100HD, Serial # F220677	Natural Gas	Old Court Rm area	2002	70%
Heating	2 boiler - 175 MBH input, 143 MBH output - 82% est eff. - supplies hot water to middle sect. wall units; with 3/4HP B&G circulator	Old mech rm	Utica MGB175HD, Serial # JZ 32737	Natural Gas	Middle Sect. Rms	2002	70%
Cooling	Sanyo KHS0971/CH0971 Mini Split AC Inverter unit, 9,000 Btu/hr, 16.0 EER; heat pump	Condenser in front of bldg by bench; evaporator - payroll office	Sanyo CH0971; Serial #: 0069362	Electric	Old bldg entrance way, finance payroll office now	2006	70%
Ventilation	EF-1 exhaust fan - est avg fan CFM/Watt of 5.7	Attic	Penn 5X115BC	Electric	Bathrooms - New additions	2001	40%
Ventilation	EF-2 exhaust fan - est avg fan CFM/Watt of 5.2	Attic	Penn 5X115BC	Electric	Bathrooms - New additions	2001	40%
Ventilation	EF-3 exhaust fan - est avg fan CFM/Watt of 13.5	Attic	Penn P10VA	Electric	Police lab - New additions	2001	40%
Ventilation	2 exhaust fans, 3/4 HP each, std est motor eff 75.5%	Attic, above old Court bathrooms	Trane U6FY-F6, Serial #: Ki42990	Electric	Old Court Rm Bathrooms	1968	0%
Generator	1 SD0130-G367 generator - 130 kW	Back of the Muni Bldg in a fenced area	Generac 20A01968-S, Serial #:2056858	Diesel/Electric	Municipal Bldg	2000	50%
Controls	BMS mostly for the 2001 addition	Mech rm back of Police Dept	Andover BMS system ATC/DDC - DMS 240	Electro-nic	Municipal Bldg, mainly 2001 addn	2001	40%
Well Pump	1 SP4" submersible well pump outside of bldg	In well outside the bldg	Goulds 10SB05422 pump with 1/2HP motor	Electric	Municipal Bldg	2001	50%
Lighting	See details - Appendix A	See details - Appendix A	See details - Appendix A	Electric	Municipal Bldg	Varies	On the average 30%

4. ENERGY CONSERVATION MEASURES

Based on the assessment of the Readington Municipal 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

- Install premium motors when replacements are required - Select NEMA Premium motors when replacing motors that have reached the end of their useful operating lives, such as those associated with the old Court room AHUs.

- Upgrade and Expand Building Management System (BMS) - SWA recommends retro-commissioning per ECM#3 In order to check that the heating/cooling systems are operating as designed ten years ago, properly maintained and effects reproducible. Currently, older building sections are controlled by individual stand alone manual and programmable thermostats. An overall digital BMS will result in energy savings via improved temperature control and coordination for the building. SWA recommends this upgrade with the next major building renovation.

- Replace common area heating equipment in the older building sections - such as finned tube radiation, outer wall baseboard and cabinet unit hot water heaters. This equipment is in fair condition, but age and wear have reduced the heat transfer capacity. This equipment should be replaced with more modern Energy Star rated equipment suited for the intended use. These changes cannot be justified based on energy savings alone. However, replacement is strongly recommended along with programmable thermostats and upgrades to other portions of the heating system. This is a replacement in kind recommendation offers negligible energy savings.

- Install hot air diffusers on the Code Enforcement corridor for a more even space temperature.

- At the next major renovation apply continuous 2" XPS rigid foam boards to the interior or exterior pending on the renovation and covering with a preferred finish to create a more robust thermal insulation layer in areas such as the Code Enforcement section.

- At the next major renovation replace older windows with newer advanced insulated windows with low-E, argon filled double (or triple) glazed type with thermally broken frames, made of wood, vinyl or fiber glass frame which are less conductive than aluminum.

Category II Recommendations: Operations and Maintenance

- Adjust chiller glycol-water solution and check pump suctions for obstructions. On the day of the audit the chiller circulating pump was running all the time since the glycol-water solution has not yet been tested and Maintenance did not want to risk catastrophic freezing. SWA recommends that the glycol concentration be tested simply by using a specialized density kit and adjustments be made as needed in order to shut pump down when cooling is not required. Also, it was reported that chiller circulating pump motors are frequently replaced. SWA believes that this may be due to cavitation (poor pump suction piping arrangement) which could be heard when standing next to the chiller.

- Maintain roofs - SWA recommends regular maintenance to verify water is draining correctly. Add insulation to ineffectively and under-insulated roof/ceiling sections. SWA recommends properly maintaining exterior roof insulation in an effort to minimize energy loss.

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

- Provide weather stripping/air sealing - Doors and vestibules should be observed annually for deficient weather-stripping and replaced as needed. The perimeter of all window frames should also be regularly inspected and any missing or deteriorated caulking should be re-caulked to provide an unbroken seal around the window frames. 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 - SWA recommends as part of the maintenance program to install proper flashing, seal wall cracks and penetrations wherever necessary in order to keep insulation dry and effective. Inspect and replace cracked/damaged EIFS. The perimeter of all window frames should be regularly inspected and any missing or deteriorated caulked areas should be re-caulked to provide an unbroken seal around the window frames.

- Expand/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. The Township of Redaington already made great strides in installing some of these fixtures in the Municipal Building. Maintenance 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 both energy and money 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 for the Maintenance staff - that teaches how to minimize their energy use. The US Department of Energy offers free information for hosting energy efficiency educational programs and plans, for more information please visit: http://www1.eere.energy.gov/education/ .

Category III Recommendations: Energy Conservation Measures - Summary Table

ECM#	Description of Highly Recommended 0-5 Year Payback ECMs
1	Install beverage vending machine miser
2.1	Install CFLs in place of incandescent lamps
3	Retro-commissioning heating and cooling mechanical equipment
4	Install boiler flue gas vent damper
5	Upgrade air conditioning split unit condenser
	Description of Recommended 5-10 Year Payback ECMs
6	Replace electric DHW heater with Energy Star natural gas fired unit
7	Install 50 kW Photo-Voltaic system
2.2 & 2.3	Install occupancy sensors and pulse Metal Halide fixtures
8	Replace old Court room exhaust fans with high efficiency units
9	Upgrade Server room wall unit air conditioner
2.4	Install T8 in place of T12 fixtures
	Description of Recommended End of Life Cycle ECMs
10	Replace old AHUs with condensing type furnaces

ECM#1: *Install Vending Miser*

Description:

The Municipal Building has one beverage vending machines located in the Sally Port. The Police Department is considering returning it to the vendor. In the meantime, SWA recommends this ECM. Energy vending miser devices are now available for conserving energy with these vending machines and coolers. There isn't a need to purchase new machines to reduce operating costs and greenhouse gas emissions. When equipped with the vending miser devices, refrigerated beverage vending machines use less energy and are comparable in daily energy performance to new ENERGY STAR qualified machines. Vending miser devices incorporate innovative energy-saving technology into small plug-and-play devices that installs in minutes, either on the wall or on the vending machine. Vending miser devices use a Passive Infrared Sensor (PIR) to: Power down the machine when the surrounding area is vacant; Monitor the room's temperature; Automatically repower the cooling system at one- to three-hour intervals, independent of sales; Ensure the product stays cold.

Snack vending miser devices can be used on snack vending machines to achieve maximum energy savings that result in reduced operating costs and decreased greenhouse gas emissions with existing machines. Snack vending miser devices also use a Passive Infrared Sensor (PIR) to determine if there is anyone within 25 feet of the machine. It waits for 15 minutes of vacancy, then powers down the machine. If a customer approaches the machine while powered down, the snacks vending miser will sense the presence and immediately power up.

Installation cost:

Estimated installed cost: $279 (includes $100 of labor)
Source of cost estimate: www.usatech.com *and established costs*

Economics:

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 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	Install (1) beverage vending machine energy miser - Sally Port	www.usatech.com and established costs	279	0	279	1,456	0.4	0	0.2	0	243	12	2,918	1.1	946	79	87	2,047	2,607

Assumptions: SWA assumes energy savings based modeling calculator found at www.usatech.com or http://www.usatech.com/energy_management/energy_calculator.php

Rebates/financial incentives:

This measure does not qualify for a rebate or other financial incentive at this time.

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#2: *Building Lighting Upgrades*

Description:

On the days of the site visits, SWA completed a lighting inventory of the Municipal Building (see Appendix A). The interior lighting of the Municipal Building consists of a mix of T12 fixtures with magnetic ballasts, T8 fixtures with electronic ballasts, compact fluorescent lights (CFLs) and a few incandescent bulbs. SWA recommends replacing the incandescent bulbs with CFLs. CFL bulbs produce the same lumen output with less wattage than incandescent bulbs and last up to five times longer. All replacements should meet local code requirements, such as shielding for safety hazards. SWA also recommends installing occupancy sensors in areas that are occupied only part of the day and the payback on savings is 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 mean to control lighting operation. The exterior lighting surveyed during the building audit was found to be a mix of Metal Halide (MH) lamp fixtures, High Pressure Sodium (HPS) lamp fixtures and Compact Fluorescent Lights (CFLs). Exterior lighting is controlled by automatic timers. SWA recommends replacing the higher wattage MH fixtures with pulse-start MH lamps which 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. 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. See the attached lighting schedule in Appendix A for a complete inventory of lighting throughout the building and estimated power consumption. The labor in all these installations was evaluated using prevailing electrical contractor wages. The Township of Readington may decide to perform this work with in-house resources from its Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor.

Installation cost:

Estimated installed cost: $25,955 (includes $17,999 of labor)
Source of cost estimate: RS *Means; Published and established costs*

Economics:

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 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
2.1	Replace (3) incandescent with CFLs	RS Means, Lit Search	105	None at this time	105	62	0.0	0	0.0	18	28	5	139	3.8	33	7	10	21	111
2.2	Install (14) occupancy sensors in offices and meeting room	RS Means, Lit Search	3,080	280	2,800	2,308	0.6	0	0.4	0	385	12	4,625	7.3	65	5	9	960	4,132
2.3	Replace (8) exterior Metal Halide fixtures with pulse start MH type	RS Means, Lit Search	5,200	200	5,000	2,768	0.7	0	0.4	160	622	15	9,334	8.0	87	6	9	2,250	4,956
2.4	Replace (95) T12 fixtures throughout the bldg with new T8 fixtures	RS Means, Lit Search	20,425	2,375	18,050	7,441	1.8	0	1.2	455	1,698	15	25,465	10.6	41	3	5	1,867	13,323
	Totals		**28,810**	**2,855**	**25,955**	**12,579**	**3.0**	**0**	2.0	**633**	**2,733**	**-**	**39,563**	**9.5**	**52**	**-**	**-**	**-**	**22,523**

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

Rebates/financial incentives:

- *NJ Clean Energy - Wall Mounted occupancy sensors ($20 per control) - Maximum incentive amount is $280.*
- *NJ Clean Energy - Metal Halide with pulse start ($25 per fixture) - Maximum incentive amount is $200.*
- *NJ Clean Energy - T8 lamps with electronic ballast in existing facilities ($10-30 per fixture, depending on quantity and lamps) Maximum incentive amount is $2,375.*

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#3: *Retro-Commissioning*

Description:

Retro-commissioning is a process that seeks to improve how building equipment and systems function together. Depending on the age of the building, retro-commissioning can often resolve problems that occurred during design or construction and/or address problems that have developed throughout the building's life. Owners often undertake retro-commissioning to optimize building systems, reduce operating costs, and address comfort complaints from building occupants.

Since the systems at the Municipal Building have undergone some renovations in recent years, and the building continues to have concerns with thermal comfort control (while using a lot of natural gas for reheat during the summer), SWA recommends undertaking retro-commissioning to optimize system operation as a follow-up to completion of the upgrades. The retro-commissioning process should include a review of existing operational parameters for both newer and older installed equipment. During retro-commissioning, the individual loop temperatures and (setback) schedules should also be reviewed to identify opportunities for optimizing system performance, besides air balancing and VAV boxes' proper operation.

Installation cost:

Estimated installed cost: $26,288 (includes $22,334 of labor)
Source of cost estimate: Similar projects

Economics (without incentives):

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 cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
3	Retro-commissioning	Similar projects	26,288	none at this time	26,288	16,502	4.0	2,250	13.4	1,820	6,695	12	80,340	3.9	206	17	23	38,339	54,345

Assumptions: Since the utility bills have some accounting fluctuations, it is difficult to determine the amount of energy used for heating and cooling the Municipal Building. Based on experience with similar buildings, SWA estimated the heating and cooling energy consumption. Typical savings for retro-commissioning range from 5-20%, as a percentage of the total space conditioning

consumption. SWA assumed 10% savings. Estimated costs for retro-commissioning range from $0.50-$2.00 per square foot. SWA assumed $1.25 per square foot of a total square footage of 21,030. SWA also assumed on the average 1 hr/wk operational savings when systems are operating per design vs. the need to make more frequent adjustments.

Rebates/financial incentives:

There aren't any current incentives for this measure at this time.

Options for funding ECM:

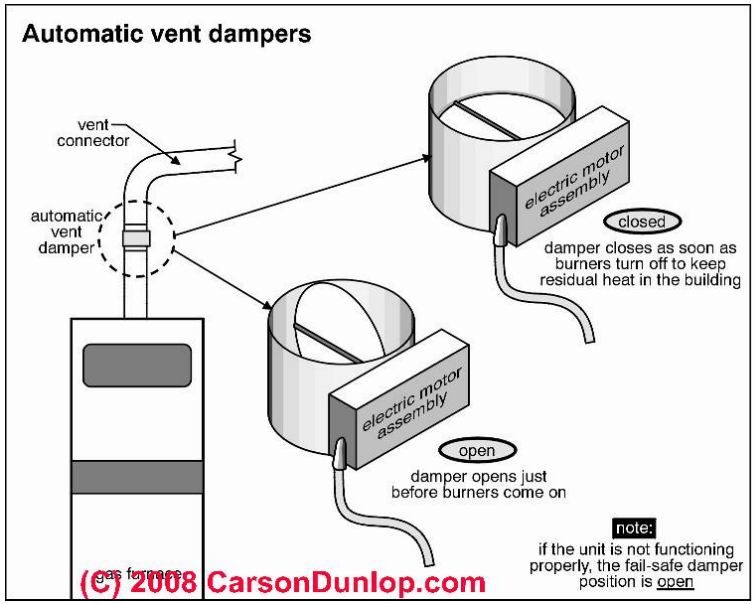
This project may benefit from enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.

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

ECM #4: *Install Boiler Vent Damper*

Description:

The new mechanical room contains Raypack boiler Model# H2-0962N, with 788,600 Btu/hr output capacity. This hot water boiler is provided with a vent hood but without a vent damper. When a boiler is not firing, the vent damper should be closed. Due to stack effect, air is drawn into the flue from the outside and without a damper, cold air enters the building through the flue, thereby cooling the heating equipment. An automatic or gravity flue damper is a device which closes the heating flue when the boiler is not firing so that cold air does not enter the building through the chimney. Studies have shown that installing a flue damper can increase boiler efficiency by 3% to 8% depending on boiler usage. When the heating system has turned off at the end of an "on" cycle of burning fuel, the automatic flue damper electric motor turns a baffle inside of the flue vent connector pipe to a position "across" the pipe so that the airflow inside the pipe is blocked or stopped as shown in the image below.



SWA recommends installing an automatic vent damper on the Raypack boiler vent duct to fully optimize the heating system.

Installation cost:

Estimated installed cost: $750 (including $263 total labor cost)
Source of cost estimate: Similar projects

Economics (without incentives):

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 cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
4	Install automatic vent damper on Raypack boiler vent duct	Published Case Studies	750	0	750	0	0.0	205	1.0	0	193	15	2,892	3.9	286	19	25	1,471	2,256

Assumptions: Typical savings for installing vent dampers range from 3-8%, as a percentage of the energy consumption for the boilers. To be conservative SWA assumed 3% efficiency improvement on the boiler 2,340 hours of operation.

Rebates / financial incentives: *There are currently no incentives for this measure at this time.*

Options for funding ECM:

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

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

ECM#5: *Air Conditioning Split Unit Condenser Upgrade*

Description:

Currently, the Code Enforcement office space is air conditioned by a 5 ton split unit with a Lennox outdoor condenser, 1987 vintage and operating beyond its expected service life of 15 years. This condenser unit is an older model of low efficiency and SWA recommends that it should be replaced with an updated 5 ton condenser 16 Seer R410A (after checking thoroughly compatibility with the associated Lennox condensing furnace and evaporative coil) or equivalent. The replacement should be Energy Star rated. The condenser installation should include but not limited to: 16 SEER rated compressor or higher, line-set, unit pad, digital thermostat, mechanical and electrical inspections, disposal of existing equipment and a minimum of one year labor warranty and five year equipment warranty.

Installation cost:

Estimated installed cost: $2,960 (includes $759 in labor)
Source of cost estimate: Similar projects

Economics:

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	gallons fuel oil, 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
5	Replace (1) old Code Enforcement condenser - 5 Ton - est EER is 9.0 with new condenser - EER is 13.5 (or SEER 16)	Energy Star purchasing and procurement site, similar projects	3,420	460	2,960	2,239	0.5	0	0.4	200	574	15	8,608	5.2	191	13	18	3,675	4,009

Assumptions: SWA assumed electrical loads calculated using modeling and by conducting the billing analysis. In order to estimate savings for this measure, SWA assumed in the model an energy reduction based on the difference in efficiencies of existing vs. the proposed equipment. SWA also assumed that the existing unit requires additional annual repairs vs. a new condenser.

Rebates/financial incentives:

- *NJ Clean Energy – Unitary HVAC / Split System, <5.4 tons ($92 per ton) - Maximum incentive amount is $460.*

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#6: *Replace Electric DHW Heater with Energy Star Natural Gas Fired Unit*

Description:

There is one (1) electric floor-mounted domestic water heater located in the old mechanical room that produces the domestic hot water for the entire year for the old Court room restrooms and janitor sink. The water heater utilizes a 20 gallon storage tank and. was installed in 1998 and is in fair condition. Based on the age and expected service life of 10-15 years, the Township of Readington may wish to replace this heater with a more efficient heater and tank as part of a capital improvement plan.

Installation cost:

Estimated installed cost: $2,100 (including $558 total labor cost)
Source of cost estimate: Similar projects

Economics (with incentives):

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 cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
6	replace (1) electric DHW heater with an Energy Star natural gas condensing type model	Energy Star purchasing and procurement site, similar projects	2,150	50	2,100	2,402	0.6	-78	0.0	18	345	12	4,141	6.1	97	8	12	1,254	3,440

Assumptions: SWA calculated the savings for this measure using nameplate data taken and using the billing analysis. SWA estimated that the annual electric usage for the domestic water heating system approximately 2,402 kWh. The new high efficiency gas fired water heater would operate with an efficiency of approximately 95%.

Rebates/financial incentives:

NJ Clean Energy - Gas Water Heaters <50 Gal ($50 per water heater) - Maximum incentive amount is $50.

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#7: *Install 50 kW PV system*

Description:

Currently, the Municipal 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. SWA presents below the economics, and recommends at this time that Township of Readington further review installing a 50 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 Mt. Olive Municipal building is not eligible for a 30% federal tax credit, available only to residential buildings. Instead, the Township of Readington 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 SRECs at $600 / MWh or best market offer.

There are many possible locations for a 50 kW PV installation on the building roofs and away from shade. A commercial multi-crystalline 230 Watts panel (37.0 volts, 8.24 amps) has 17.5 square feet of surface area (13. 1 Watts per square foot). A 50 kW system needs approximately 217 panels, which would take up 3,804 square feet. The installation of a renewable Solar Photovoltaic power generating system could also serve as a good educational tool and exhibit for the community.

Installation cost:

Estimated installed cost: $325,000 (including $130,000 total labor cost)
Source of cost estimate: Similar projects

Economics (with incentives):

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 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
7	Install 50 kW PV with Incentives	Similar Projects	375,000	50,000	325,000	59,020	50.0	0	9.6	0	45,256	25	777,409	7.2	1	0	12	251,377	105,675

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 50 kW or less. Incentive amount for this application is $50,000 for the Readington Municipal building.

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

NJ Clean Energy - Solar Renewable Energy Certificate Program. Each time a solar electric system generates 1,000kWh (1MWh) of electricity, a SREC is issued which can then be sold or traded separately from the power. The buildings must also become net-metered in order to earn SRECs as well as sell power back to the electric grid. A total of $35,400 / year has been incorporated in the above costs for the Township of Readington, 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#8: *Replace Old Court Room Exhaust Fans with High Efficiency Units*

Description:

Two (2) of the old Court room building exhaust fans are operating beyond their expected useful lives however in fair condition and should be considered for replacement. SWA recommends their replacement with exhaust fans driven by NEMA Premium efficiency motors.

Installation cost:

Estimated installed cost: $2,300 (includes $575 in labor)
Source of cost estimate: Similar projects

Economics (with incentives):

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 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
8	Replace (2) 3/4 HP standard 75.5% eff fan motors on old Court room exhaust fans with NEMA premium motors and install new fans	MotorMaster+ International, similar projects	2,390	90	2,300	1,508	0.4	0	0.2	0	252	15	3,778	9.1	64	4	7	643	2,700

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 - Premium three-phase motors ($45-$700 per motor) - Maximum incentive amount is $90.

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#9: *Wall Unit Air Conditioner Upgrade*

Description:

Currently, the Server room #112 is air conditioned by a through the wall GE AC unit, 1995 vintage and operating at the end of its expected service life of 15 years. This AC unit is an older model of low efficiency and SWA recommends that it should be replaced with an updated AC 11 EER or equivalent. The replacement should be Energy Star rated. The AC installation should include but not limited to: 11 EER rated compressor or higher, digital thermostat, mechanical and electrical inspections, disposal of existing equipment and a minimum of one year labor warranty and five year equipment warranty.

Installation cost:

Estimated installed cost: $715 (includes $175 in labor)
Source of cost estimate: Similar projects

Economics:

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	gallons fuel oil, 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
9	Replace (1) old Server room wall AC - EER 8.5 with unit - EER 11	Energy Star purchasing and procurement site, similar projects	780	65	715	324	0.1	0	0.1	18	72	15	1,074	10.0	50	3	6	124	580

Assumptions: SWA assumed electrical loads calculated using modeling and by conducting the billing analysis. In order to estimate savings for this measure, SWA assumed in the model an energy reduction based on the difference in efficiencies of existing vs. the proposed equipment. SWA also assumed that the existing unit requires additional annual repairs vs. a new AC.

Rebates/financial incentives:

- *NJ Clean Energy - Packaged Terminalt System, >9,000 to 12,000 BTUH ($65 per ton) - Maximum incentive amount is $65.*

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#10: *Replace Old AHUs with Condensing Type Furnaces*

Description:

The (2) old Court room AHUs are original to the 1968 building construction and operating beyond their estimated useful lives. Their coils are of an older design and may be partly fouled. The blower motors are standard rather than NEMA premium efficiency. The ductwork appears to be acoustically insulated on the inside and there is concern that aged insulation starts to become brittle and be carried away with the airflow into the conditioned spaces creating a dusty unhealthy atmosphere. SWA recommends continuation of AHU routine maintenance, such as belt changes (a couple heard squeaking during the field audit), lubrication, air filter changes and customary inspections until the next major capital HVAC investment. At that time SWA recommends that the AHUs are replaced/upgraded with Energy Star condensing furnace of 93% Annual Fuel Utilization Efficiency (AFUE) rating. The heat capacity of each furnace should match the capacity of the AHU it is replacing. The brittle insulation inside the ducts should be removed and the ducts thoroughly vacuumed out. Then, new insulation and jacketing should be applied to the outside of all the ducts. This re-insulation work is labor intensive and expensive. New evaporator coils are to be added to the furnace discharge ducts for cooling the re-circulating air with R22 refrigerant.

SWA recommends replacement with two-stage furnaces, which is like having two furnaces in one. On the coldest days, the furnace operates in the high-stage mode at 100% capacity. But on most days, the furnace comfortably conserves energy by operating in the low-stage mode at just 70% capacity. The two-stage gas valve runs quietly on the low stage 90% of the time, producing just 25% of the normal high-fire sound, while significantly reducing energy consumption. A central furnace control orchestrates the various functions of the furnace with digital accuracy. Functions like the blower and inducer motor are monitored for proper operation, increasing safety and reliability. SWA also recommends features like the corrosion-resistant, aluminized steel tubular heat exchanger with stainless-steel recuperative coil which will provide many years of trouble-free service. Plus, a furnace heavy-gauge, reinforced and insulated steel cabinet. The high-efficiency combustion process allows venting with 2 - 4 inch PVC without the need for a traditional chimney flue. And because it can be direct-vented to the outside, fresh air can be used for combustion. The fuel stingy auto-ignition system eliminates the old-fashioned standing pilot for greater ignition dependability without the wasted energy.

Installation cost:

Estimated installed cost: $45,625 (includes $28,338 of labor)
Source of cost estimate: Manufacturer's data and similar projects

Economics:

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 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
10a	Replace (2) old Court room AHUs in kind, remove duct brittle inside insulation and apply duct insulation on outside	Similar projects	41,625	0	41,625	1	0.0	0	0.0	250	250	15	3,753	166.4	-91	-6	-21	-37,482	2
10b	Incremental difference to replace (3) old Court room AHUs with condensing furnaces - 93% eff and new evaporator coils	Similar projects	4,800	800	4,000	1,188	0.3	106	0.7	0	299	15	4,481	13.4	12	1	1	-470	3,295
10 (a+ b)	Replace (2) old AHUs with condensing furnaces - 93% eff and new evaporator coils, remove duct brittle inside insulation and apply duct insulation on outside	Energy Star purchasing and procurement site, similar projects	46,425	800	45,625	1,189	0.3	106	0.7	250	549	15	8,233	83.1	-82	-5	-16	-37,952	3,297

Assumptions: SWA assumed electrical / gas loads calculated using modeling and by conducting the billing analysis. In order to estimate savings for this measure, SWA assumed in the model an energy reduction based on the difference in efficiencies of existing vs. the proposed equipment. SWA also assumed that the existing unit requires additional annual repairs vs. a new.

Rebates/financial incentives:

- *NJ Clean Energy - Gas Furnace, 92% or greater AFUE, electronic commutated motor ($400 per furnace) - Maximum incentive amount is $800.*

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:

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

Description:

Pleases see the above recommended ECM#7.

5.4. Solar Thermal Collectors

Description:

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

Description:

CHP is not applicable for this building because of several existing cooling systems and insufficient domestic hot water use.

5.6. Geothermal

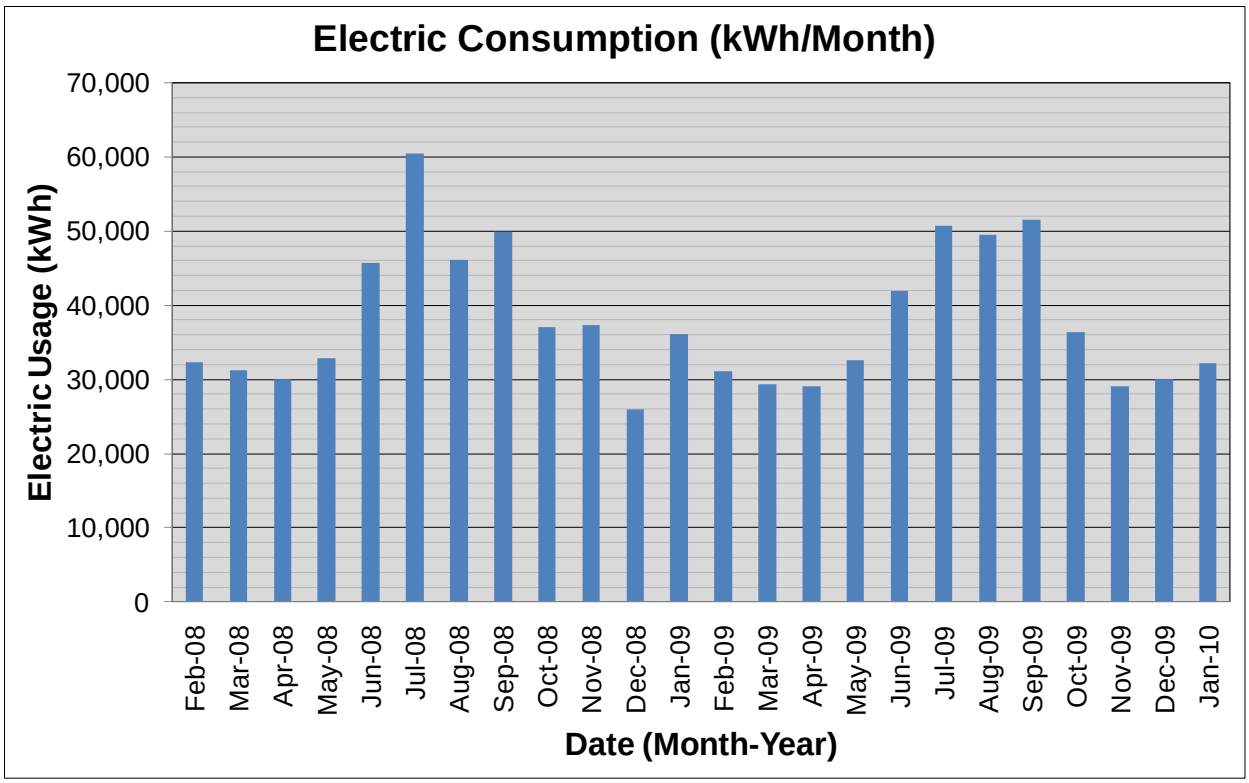
Description:

Geothermal would not be cost effective because it would require replacement of the existing HVAC system, of which major components still have as a whole a number of useful operating years.

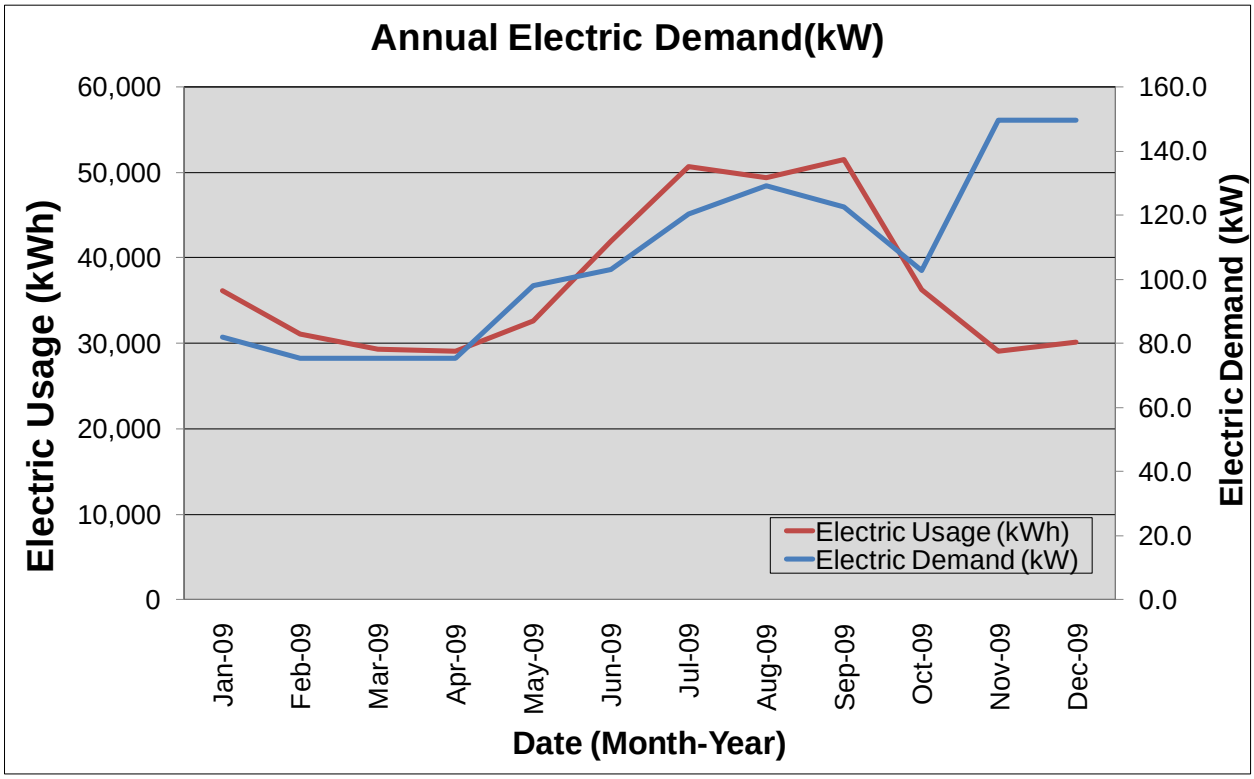
6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

6.1. Load Profiles

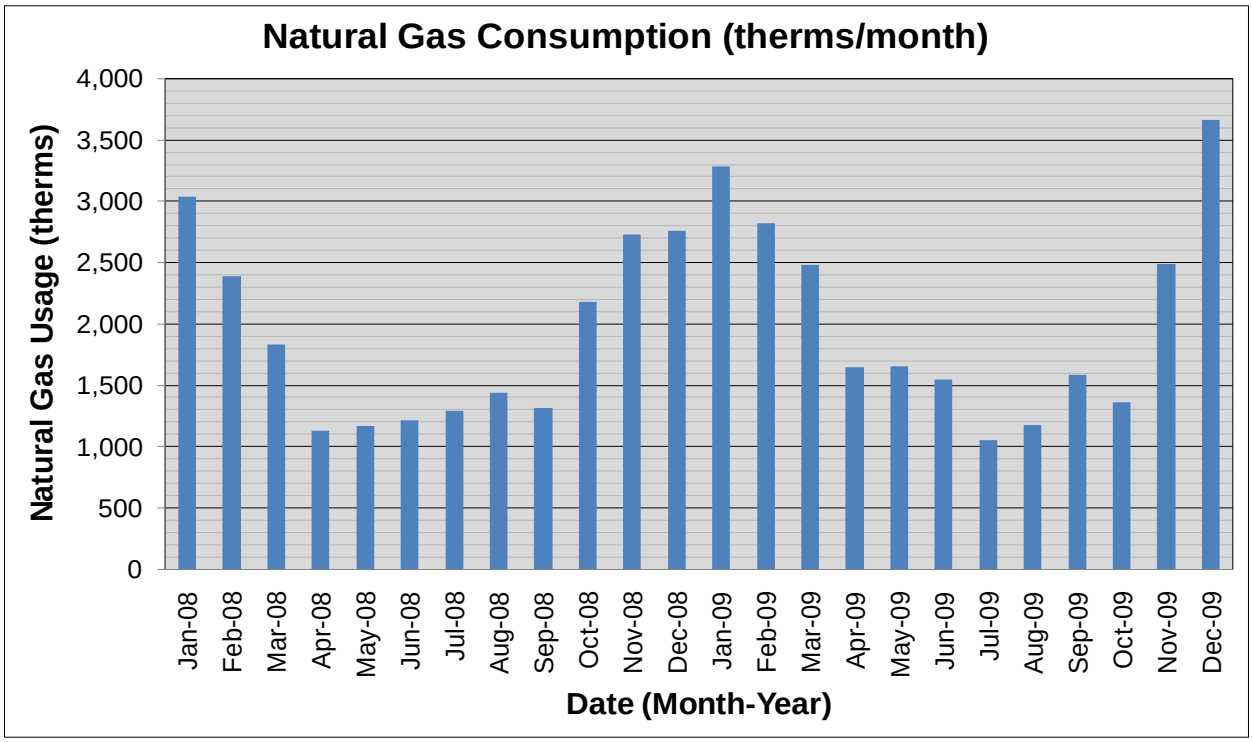
The following are charts that show the annual electric and natural gas load profiles for the Readington Municipal Building. For annual electric and natural gas usage please also see Section 1. Historic Energy Consumption.

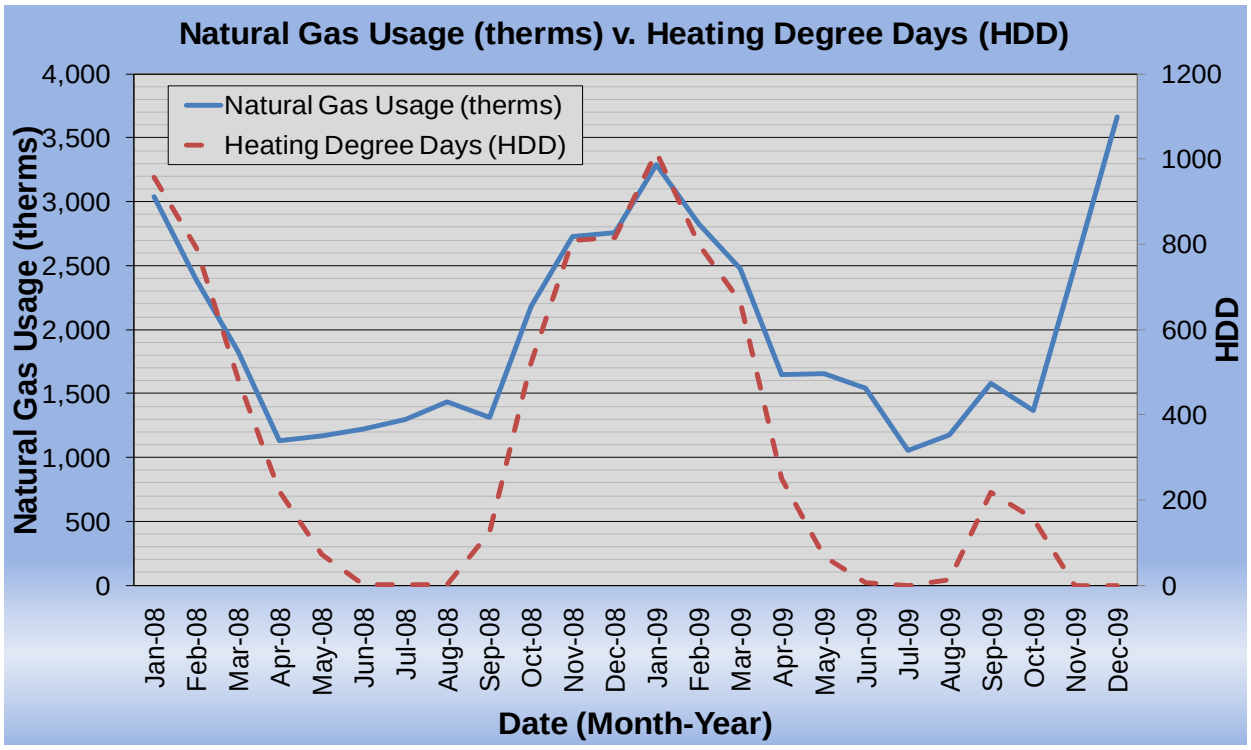


Some minor unusual electric fluctuations shown may be due to adjustments between estimated and actual meter readings. Also, note on the following chart how the electrical Demand peaks (except for a few unusual fluctuation anomalies) follow the electrical consumption peaks.



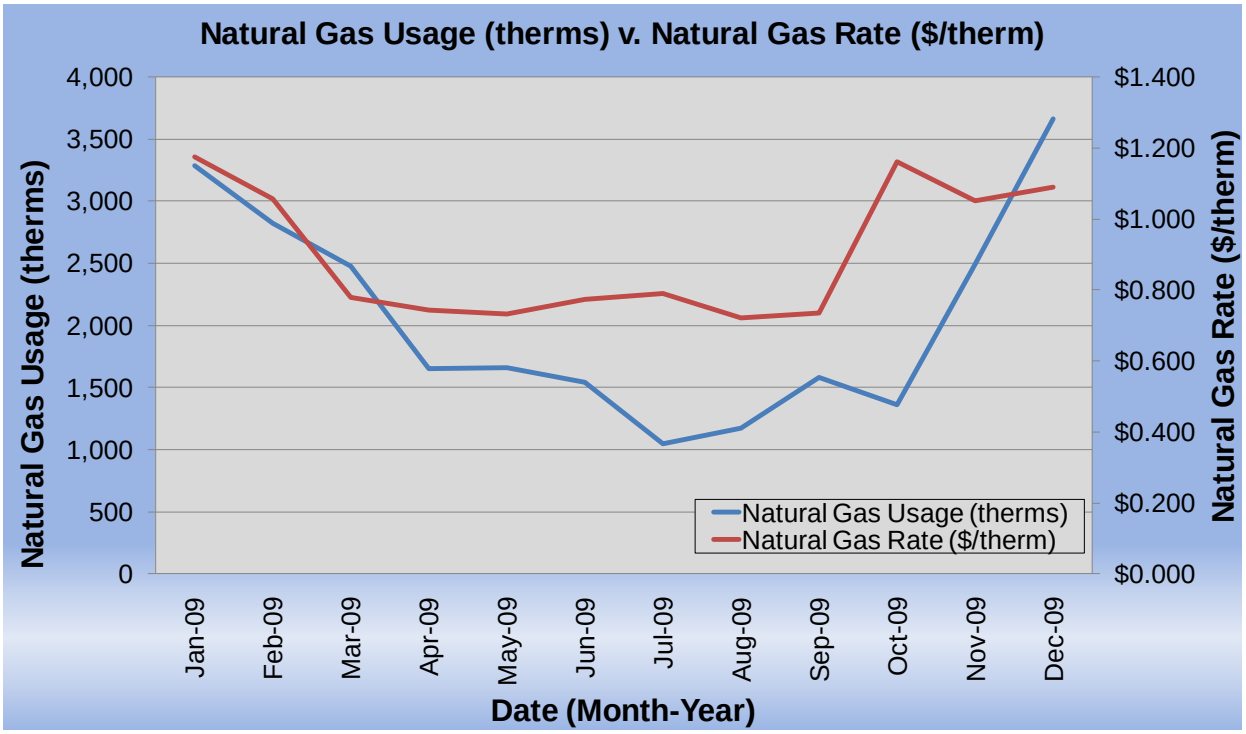
The following is a chart of the natural gas load profile for the building, peaking in the coldest months of the year and a chart showing natural gas consumption following the “heating degree days” curve. Some utility bills have more than one month estimated and combined. Note the use of reheat natural gas used during the summer to adjust the air conditioned temperatures. Retro-commissioning may be able to substantially reduce this usage



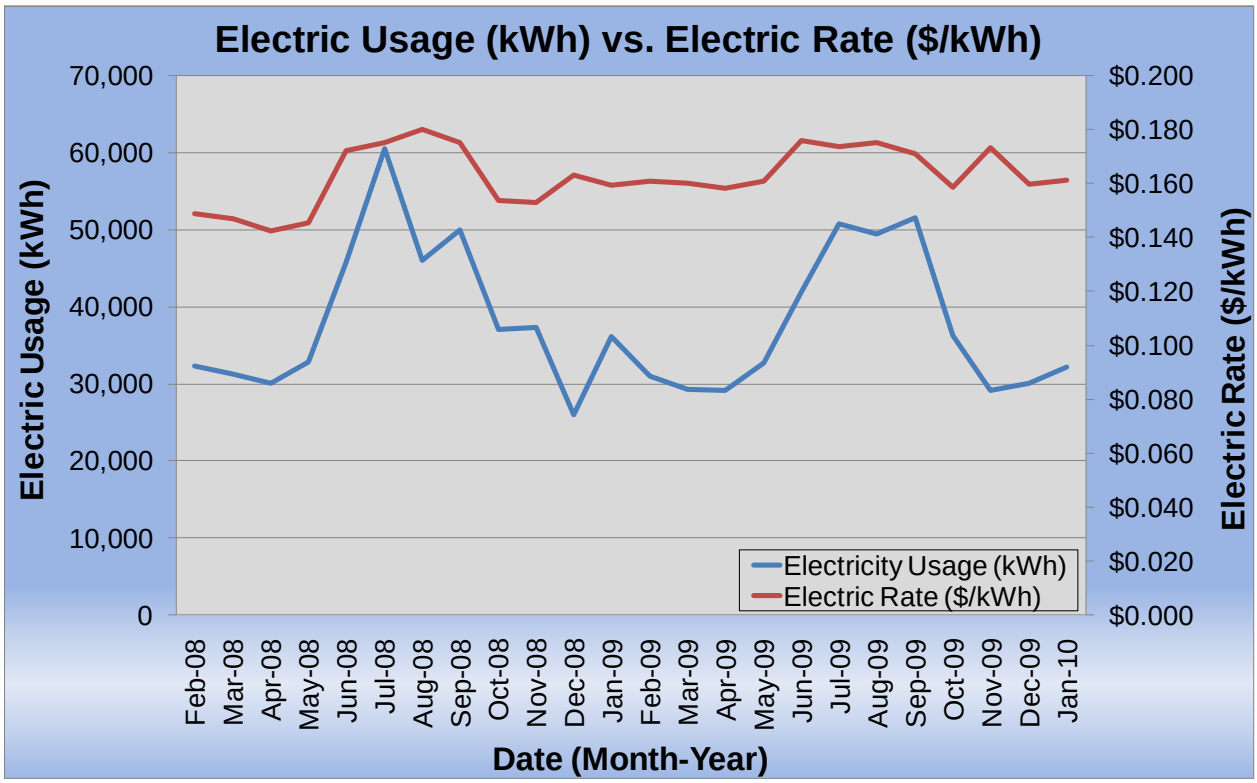


6.2. Tariff Analysis

Currently, natural gas is provided to the Municipal Building via one gas meter with the PSE&G acting as the supply and also the transport company. Gas is provided by the PSE&G at a general and very competitive service rate. The suppliers' general service rate for natural gas charges a market-rate price based on use and the Municipal Building billing does not breakdown demand costs for all periods. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year. Typically, the natural gas prices increase during the heating months when natural gas is used by the boiler and the furnace units. Some high gas price per therm fluctuations in the summer may be due to high energy costs that recently occurred and low use caps for the non-heating months. Thus the building pays for fixed costs such as meter reading charges during the summer months. Some of the cap payments are excluded from the following chart.



The Municipal Building is direct-metered and currently purchases electricity from the JCP&L at a general service rate. The general service rate for electric charges is market-rate based on use and the Municipal Building does not track a breakdown of demand costs. Demand prices are generally reflected in the utility bills and can be verified by observing the price fluctuations throughout the year. Typically, the electricity prices increase during the cooling months when electricity is used by the air conditioning systems.

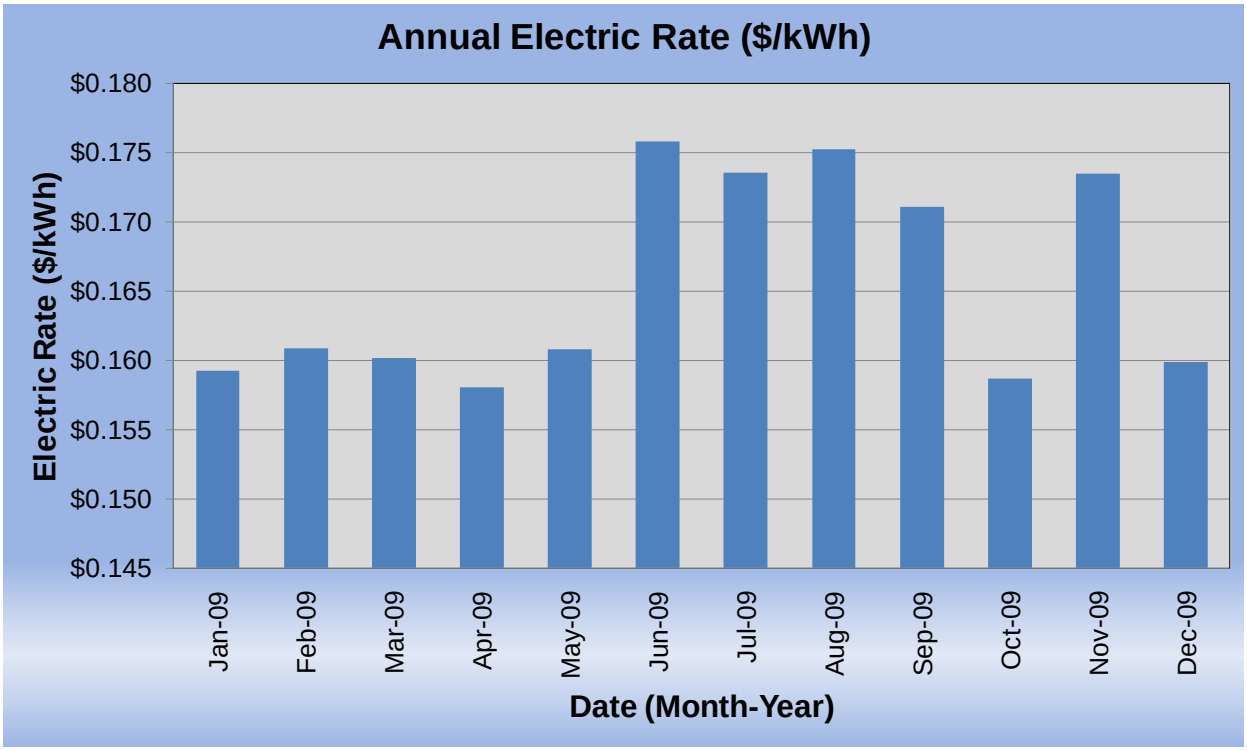


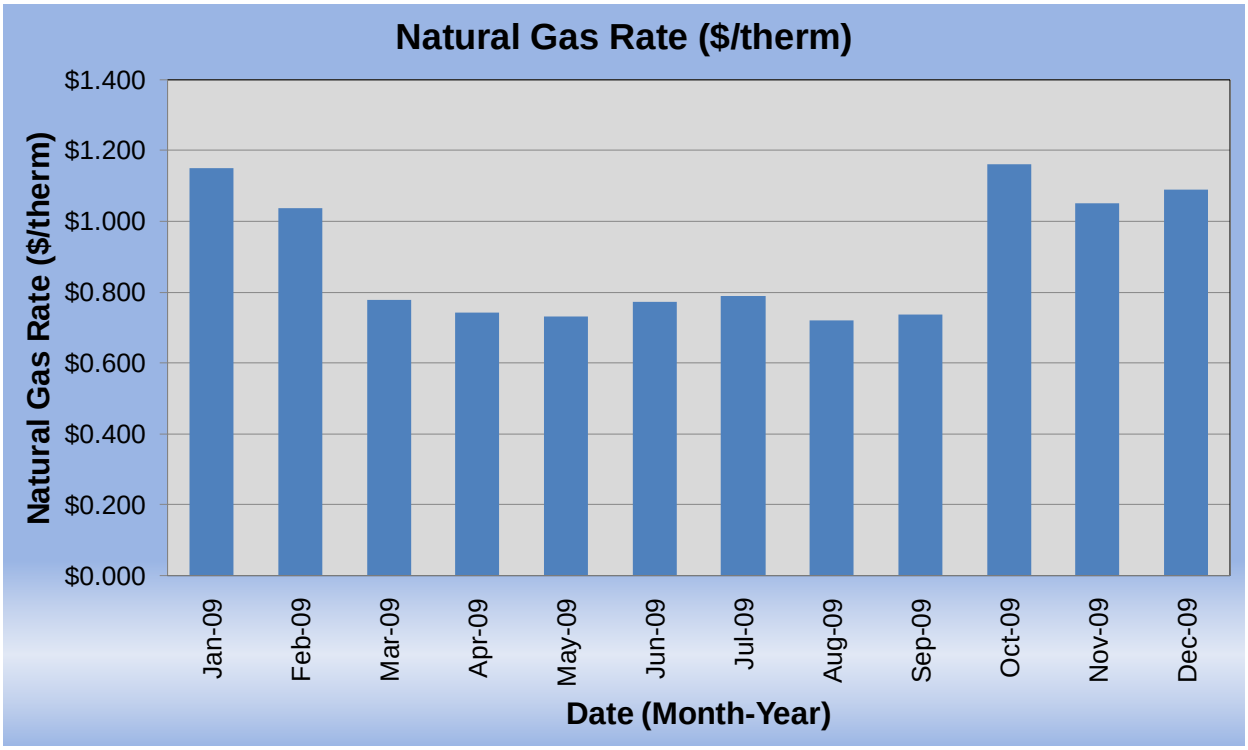
6.3. Energy Procurement strategies

The Municipal Building receives natural gas via one incoming meter. PSE&G supplies the gas and transports it. There is not an ESCO engaged in the process. 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. Electricity is also purchased via one incoming meter directly for the main Municipal Building from JCP&L without an ESCO. SWA analyzed the utility rate for natural gas and electricity supply over an extended period. Electric bill analysis shows fluctuations up to 10% over the most recent 12 month period. Natural gas bill analysis shows fluctuations up to 25% over the most recent 12 month period. Some of these fluctuations may have been caused by adjustments between estimated and actual meter readings, others may be due to unusual high and recent escalating energy costs.

The average estimated NJ commercial utility rates for electric and gas are $0.150/kWh and $1.550/therm respectively. The Municipal Building annual natural gas costs are competitive and the electric costs are $7,454 higher when compared to the average estimated NJ commercial utility rates. SWA recommends that the Township of Readington further explore opportunities of purchasing both natural gas and electricity from ESCOs in order to reduce rate fluctuation and ultimately reduce the annual cost of energy for the Municipal Building. Appendix B contains a complete list of third party energy suppliers for the Township of Readington service area. The Township of Readington 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. Also, the Municipal 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. The following chart show the Municipal Building monthly electric and natural gas spending per unit of energy in 2009.





7. METHOD OF ANALYSIS

7.1. Assumptions and tools

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 & established specialized equipment material & 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)
1	1	Court Room	Recessed	N	CFL	30	1	32	S	4	260	0	960	998	C	Recessed	CFL	N	OS	30	1	32	3	260	0	960	749	0	250	250
2	1	Court Room	Pin	N	CFL	32	1	24	S	4	260	0	768	799	C	Pin	CFL	N	OS	32	1	24	3	260	0	768	599	0	200	200
3	1	Court Room	Pin	N	CFL	10	1	18	S	4	260	0	180	187	N/A	Pin	CFL	N	S	10	1	18	4	260	0	180	187	0	0	0
4	1	Court Room	Exit Sign	N	LED	4	1	5	N	24	365	1	24	210	N/A	Exit Sign	LED	N	N	4	1	5	24	365	1	24	210	0	0	0
5	1	Chamber Conference Room	Recessed	N	CFL	21	1	32	S	9	260	0	672	1,572	C	Recessed	CFL	N	OS	21	1	32	7	260	0	672	1179	0	393	393
6	1	Chamber Conference Room	Exit Sign	N	LED	1	1	5	N	24	365	1	6	53	N/A	Exit Sign	LED	N	N	1	1	5	24	365	1	6	53	0	0	0
7	1	Chamber Conference Room	Recessed	N	CFL	4	1	13	S	9	260	0	52	122	C	Recessed	CFL	N	OS	4	1	13	7	260	0	52	91	0	30	30
8	1	Office	Recessed	M	4'T12	2	4	40	S	9	260	24	368	861	T8	Recessed	4'T8	E	S	2	4	32	9	260	13	282	660	201	0	201
9	1	Hallway	Recessed	M	4'T12	3	4	40	S	9	260	24	552	1,292	T8	Recessed	4'T8	E	S	3	4	32	9	260	13	423	990	302	0	302
10	1	Hallway	Exit Sign	N	LED	1	1	5	N	24	365	1	6	53	N/A	Exit Sign	LED	N	N	1	1	5	24	365	1	6	53	0	0	0
11	1	Office	Recessed	M	4'T12	3	4	40	S	9	260	24	552	1,292	T8	Recessed	4'T8	E	S	3	4	32	9	260	13	423	990	302	0	302
12	1	Office	Recessed	M	4'T12	2	4	40	S	9	260	24	368	861	T8	Recessed	4'T8	E	S	2	4	32	9	260	13	282	660	201	0	201
13	1	Office	Recessed	M	4'T12	2	4	40	S	9	260	24	368	861	T8	Recessed	4'T8	E	S	2	4	32	9	260	13	282	660	201	0	201
14	1	Office Area - Reception	Recessed	M	4'T12	6	4	40	S	9	260	24	1,104	2,583	T8	Recessed	4'T8	E	S	6	4	32	9	260	13	846	1980	604	0	604
15	1	Break Room	Recessed	M	4'T12	2	4	40	S	9	260	24	368	861	T8	Recessed	4'T8	E	S	2	4	32	9	260	13	282	660	201	0	201
16	1	File Room	Recessed	M	4'T12	4	4	40	S	9	260	24	736	1,722	T8	Recessed	4'T8	E	S	4	4	32	9	260	13	564	1320	402	0	402
17	1	Office	Recessed	M	4'T12	3	2	40	S	9	260	15	285	667	T8	Recessed	4'T8	E	S	3	2	32	9	260	6	210	491	176	0	176
18	1	Office (116)	Recessed	E	4'T8	4	3	32	S	9	260	10	424	992	N/A	Recessed	4'T8	E	S	4	3	32	9	260	10	424	992	0	0	0
19	1	Office (117)	Recessed	E	4'T8	2	3	32	S	9	260	10	212	496	N/A	Recessed	4'T8	E	S	2	3	32	9	260	10	212	496	0	0	0
20	1	Office (118)	Recessed	E	4'T8	2	3	32	S	9	260	10	212	496	N/A	Recessed	4'T8	E	S	2	3	32	9	260	10	212	496	0	0	0
21	1	Office (119)	Recessed	E	4'T8	3	3	32	S	9	260	10	318	744	N/A	Recessed	4'T8	E	S	3	3	32	9	260	10	318	744	0	0	0
22	1	Office (120)	Recessed	E	4'T8	3	3	32	S	9	260	10	318	744	N/A	Recessed	4'T8	E	S	3	3	32	9	260	10	318	744	0	0	0
23	1	File / Copy Room (121)	Recessed	E	4'T8	2	3	32	S	9	260	10	212	496	N/A	Recessed	4'T8	E	S	2	3	32	9	260	10	212	496	0	0	0
24	1	Office w/Storage Room (122)	Recessed	E	4'T8	3	3	32	S	9	260	10	318	744	N/A	Recessed	4'T8	E	S	3	3	32	9	260	10	318	744	0	0	0
25	1	Storage Room (122)	Recessed	E	4'T8	1	3	32	S	9	260	10	106	248	N/A	Recessed	4'T8	E	S	1	3	32	9	260	10	106	248	0	0	0
26	1	Hallway	Recessed	E	4'T8	6	3	32	S	9	260	10	636	1,488	N/A	Recessed	4'T8	E	S	6	3	32	9	260	10	636	1488	0	0	0
27	1	Hallway	Exit Sign	N	LED	3	1	5	N	24	365	1	18	158	N/A	Exit Sign	LED	N	N	3	1	5	24	365	1	18	158	0	0	0
28	1	Conf. Rm (114)	Recessed	E	4'T8	3	3	32	S	9	260	10	318	744	C	Recessed	4'T8	E	OS	3	3	32	7	260	10	318	558	0	186	186
29	1	Hallway	Parabolic	M	4'T12	11	2	40	S	9	260	15	1,045	2,445	T8	Parabolic	4'T8	E	S	11	2	32	9	260	6	770	1802	644	0	644
30	1	Hallway	Exit Sign	M	LED	4	1	5	S	24	365	1	24	210	N/A	Exit Sign	LED	M	S	4	1	5	24	365	1	24	210	0	0	0
31	1	Boiler Rm	Screw-in	N	Inc	2	1	60	S	2	260	0	120	62	CFL	Screw-in	CFL	N	S	2	1	20	2	260	0	40	21	42	0	42
32	1	Bathroom Men	2'U-shape	N	4'T12	2	2	40	S	9	260	15	190	445	T8	2'U-Shape	4'T8	E	S	2	2	32	9	260	6	140	328	117	0	117
33	1	Bathroom Men	Parabolic	M	2'T12	1	1	20	S	9	260	8	28	66	T8	Parabolic	2'T8	E	S	1	1	17	9	260	2	19	44	21	0	21
34	1	Bathroom Women	2'U-shape	M	4'T12	2	2	40	S	9	260	15	190	445	T8	2'U-Shape	4'T8	E	S	2	2	32	9	260	6	140	328	117	0	117
35	1	Bathroom Women	Parabolic	M	2'T12	1	1	20	S	9	260	8	28	66	T8	Parabolic	2'T8	E	S	1	1	17	9	260	2	19	44	21	0	21
36	1	Utility Rm	Screw-in	N	Inc	1	1	60	S	2	260	0	60	31	CFL	Screw-in	CFL	N	S	1	1	20	2	260	0	20	10	21	0	21
37	1	Office (112)	Parabolic	M	4'T12	3	3	40	S	9	260	20	420	983	T8	Parabolic	4'T8	E	S	3	3	32	9	260	10	318	744	239	0	239
38	1	Office (113)	Parabolic	M	4'T12	3	3	40	S	9	260	20	420	983	T8	Parabolic	4'T8	E	S	3	3	32	9	260	10	318	744	239	0	239

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)
39	1	Office (110)	Parabolic	M	4'T12	2	4	40	S	9	260	24	368	861	T8	Parabolic	4'T8	E	S	2	4	32	9	260	13	282	660	201	0	201
40	1	Office (110)	Parabolic	M	4'T12	3	3	40	S	9	260	20	420	983	T8	Parabolic	4'T8	E	S	3	3	32	9	260	10	318	744	239	0	239
41	1	Office (109)	Parabolic	M	4'T12	12	2	40	S	9	260	15	1,140	2,668	T8	Parabolic	4'T8	E	S	12	2	32	9	260	6	840	1966	702	0	702
44	1	Office (109)	Parabolic	E	4'T8	4	1	32	S	9	260	3	140	328	N/A	Parabolic	4'T8	E	S	4	1	32	9	260	3	140	328	0	0	0
45	1	Office (107)	Parabolic	M	4'T12	4	4	40	S	9	260	24	736	1,722	T8	Parabolic	4'T8	E	S	4	4	32	9	260	13	564	1320	402	0	402
46	1	Conf. room (106)	Parabolic	M	4'T12	4	3	40	S	9	260	20	560	1,310	T8	Parabolic	4'T8	E	S	4	3	32	9	260	10	424	992	318	0	318
47	1	File Room (105)	Parabolic	M	4'T12	4	3	40	S	9	260	20	560	1,310	T8	Parabolic	4'T8	E	S	4	3	32	9	260	10	424	992	318	0	318
48	1	Office (108)	Parabolic	M	4'T12	3	4	40	S	9	260	24	552	1,292	T8	Parabolic	4'T8	E	S	3	4	32	9	260	13	423	990	302	0	302
49	1	Office (108)	Parabolic	M	4'T12	4	3	40	S	9	260	20	560	1,310	T8	Parabolic	4'T8	E	S	4	3	32	9	260	10	424	992	318	0	318
50	1	Office (108)	Parabolic	M	4'T12	2	2	40	S	9	260	15	190	445	T8	Parabolic	4'T8	E	S	2	2	32	9	260	6	140	328	117	0	117
51	1	Office (104)	Parabolic	E	4'T8	4	4	32	S	9	260	13	564	1,320	N/A	Parabolic	4'T8	E	S	4	4	32	9	260	13	564	1320	0	0	0
52	1	Lobby	Recessed	N	CFL	15	1	32	S	9	260	0	480	1,123	N/A	Recessed	CFL	N	S	15	1	32	9	260	0	480	1123	0	0	0
53	1	Lobby	Pin	N	CFL	3	1	18	S	9	260	0	54	126	N/A	Pin	CFL	N	S	3	1	18	9	260	0	54	126	0	0	0
54	1	Lobby	Exit Sign	N	LED	2	1	5	N	24	365	1	12	105	N/A	Exit Sign	LED	N	N	2	1	5	24	365	1	12	105	0	0	0
55	1	Hallway to Breakroom	Exit Sign	N	LED	1	1	5	N	24	365	1	6	53	N/A	Exit Sign	LED	N	N	1	1	5	24	365	1	6	53	0	0	0
56	1	Hallway to Breakroom	Recessed	N	CFL	3	2	13	S	9	260	0	78	183	N/A	Recessed	CFL	N	S	3	2	13	9	260	0	78	183	0	0	0
57	1	Mail Room	Recessed	E	4'T8	1	2	32	S	9	260	6	70	164	N/A	Recessed	4'T8	E	S	1	2	32	9	260	6	70	164	0	0	0
58	1	Breakroom	Recessed	E	4'T8	4	3	32	S	9	260	10	424	992	C	Recessed	4'T8	E	OS	4	3	32	7	260	10	424	744	0	248	248
59	1	Hallway to Police Dept	Recessed	N	CFL	6	2	13	S	9	260	0	156	365	N/A	Recessed	CFL	N	S	6	2	13	9	260	0	156	365	0	0	0
60	1	Hallway to police Dept	Exit Sign	N	LED	2	1	5	N	24	365	1	12	105	N/A	Exit Sign	LED	N	N	2	1	5	24	365	1	12	105	0	0	0
61	1	File Room	Recessed	E	4'T8	1	3	32	S	9	260	10	106	248	N/A	Recessed	4'T8	E	S	1	3	32	9	260	10	106	248	0	0	0
62	1	Closet	Recessed	E	4'T8	1	2	32	S	9	260	6	70	164	N/A	Recessed	4'T8	E	S	1	2	32	9	260	6	70	164	0	0	0
63	1	Women's	Recessed	E	CFL	5	1	32	S	9	260	0	160	374	N/A	Recessed	CFL	E	S	5	1	32	9	260	0	160	374	0	0	0
64	1	Women's	Recessed	E	4'T8	2	1	32	S	9	260	3	70	164	N/A	Recessed	4'T8	E	S	2	1	32	9	260	3	70	164	0	0	0
65	1	Men's	Recessed	E	CFL	5	1	32	S	9	260	0	160	374	N/A	Recessed	CFL	E	S	5	1	32	9	260	0	160	374	0	0	0
66	1	Men's	Recessed	E	4'T8	2	1	32	S	9	260	3	70	164	N/A	Recessed	4'T8	E	S	2	1	32	9	260	3	70	164	0	0	0
67	1	JC	Recessed	E	4'T8	1	2	32	S	9	260	6	70	164	N/A	Recessed	4'T8	E	S	1	2	32	9	260	6	70	164	0	0	0
68	1	attorney conference	Recessed	E	4'T8	2	3	32	S	9	260	10	212	496	N/A	Recessed	4'T8	E	S	2	3	32	9	260	10	212	496	0	0	0
69	1	Stairs	Parabolic	E	4'T8	2	2	32	S	9	260	6	140	328	N/A	Parabolic	4'T8	E	S	2	2	32	9	260	6	140	328	0	0	0
70	B	0	Parabolic	E	4'T8	2	2	32	S	2	260	6	140	73	N/A	Parabolic	4'T8	E	S	2	2	32	2	260	6	140	73	0	0	0
73	1	Lobby	Recessed	N	CFL	6	2	13	S	9	260	0	156	365	N/A	Recessed	CFL	N	S	6	2	13	9	260	0	156	365	0	0	0
74	1	Vestibule	Recessed	N	CFL	2	2	13	S	9	260	0	52	122	N/A	Recessed	CFL	N	S	2	2	13	9	260	0	52	122	0	0	0
75	1	Hallway - Main	Recessed	M	4'T8	12	2	32	S	9	260	6	840	1,966	N/A	Recessed	4'T8	M	S	12	2	32	9	260	6	840	1966	0	0	0
76	1	Bathroom	Recessed	M	4'T8	1	2	32	S	9	260	6	70	164	N/A	Recessed	4'T8	M	S	1	2	32	9	260	6	70	164	0	0	0
77	1	???	Recessed	M	4'T8	4	2	32	S	9	260	6	280	655	N/A	Recessed	4'T8	M	S	4	2	32	9	260	6	280	655	0	0	0
78	1	Meeting Rm	Recessed	M	4'T8	4	3	32	S	9	260	10	424	992	C	Recessed	4'T8	M	OS	4	3	32	7	260	10	424	744	0	248	248
79	1	Office Area - Reception/Administration	Recessed	M	4'T8	6	3	32	S	9	260	10	636	1,488	N/A	Recessed	4'T8	M	S	6	3	32	9	260	10	636	1488	0	0	0
80	1	Office Area - Reception/Administration	Parabolic	M	4'T8	4	1	32	S	9	260	3	140	328	N/A	Parabolic	4'T8	M	S	4	1	32	9	260	3	140	328	0	0	0

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)
81	1	Office	Recessed	E	4'T8	2	3	32	S	9	260	10	212	496	N/A	Recessed	4'T8	E	S	2	3	32	9	260	10	212	496	0	0	0
82	1	Office	Recessed	E	4'T8	2	3	32	S	9	260	10	212	496	N/A	Recessed	4'T8	E	S	2	3	32	9	260	10	212	496	0	0	0
83	1	Office	Recessed	E	4'T8	2	3	32	S	9	260	10	212	496	N/A	Recessed	4'T8	E	S	2	3	32	9	260	10	212	496	0	0	0
84	1	Office	Recessed	E	4'T8	4	3	32	S	9	260	10	424	992	N/A	Recessed	4'T8	E	S	4	3	32	9	260	10	424	992	0	0	0
85	1	Storage Rm	Recessed	E	4'T8	2	3	32	S	9	260	10	212	496	N/A	Recessed	4'T8	E	S	2	3	32	9	260	10	212	496	0	0	0
86	1	Storage Rm	Recessed	E	4'T8	2	3	32	S	9	260	10	212	496	N/A	Recessed	4'T8	E	S	2	3	32	9	260	10	212	496	0	0	0
87	1	Interview2	Recessed	E	4'T8	1	3	32	S	9	260	10	106	248	N/A	Recessed	4'T8	E	S	1	3	32	9	260	10	106	248	0	0	0
88	1	Interview3	Recessed	E	4'T8	1	3	32	S	9	260	10	106	248	N/A	Recessed	4'T8	E	S	1	3	32	9	260	10	106	248	0	0	0
89	1	Interview1	Recessed	E	4'T8	2	3	32	S	9	260	10	212	496	N/A	Recessed	4'T8	E	S	2	3	32	9	260	10	212	496	0	0	0
90	1	Evidence	Recessed	E	4'T8	2	3	32	S	9	260	10	212	496	N/A	Recessed	4'T8	E	S	2	3	32	9	260	10	212	496	0	0	0
91	1	Clean Lab	Recessed	E	4'T8	1	3	32	S	9	260	10	106	248	N/A	Recessed	4'T8	E	S	1	3	32	9	260	10	106	248	0	0	0
92	1	Men's Locker Room - Toiletroom	Recessed	E	CFL	5	1	32	S	9	260	0	160	374	N/A	Recessed	CFL	E	S	5	1	32	9	260	0	160	374	0	0	0
93	1	Men's Locker Room - Shower	Recessed	E	CFL	1	2	18	S	9	260	0	36	84	N/A	Recessed	CFL	E	S	1	2	18	9	260	0	36	84	0	0	0
94	1	Men's Locker Room - Toiletroom Vanity	Recessed	E	4'T8	2	1	32	S	9	260	3	70	164	C	Recessed	4'T8	E	OS	2	1	32	7	260	3	70	123	0	41	41
95	1	Men's Locker Room	Recessed	E	4'T8	6	2	32	S	9	260	6	420	983	C	Recessed	4'T8	E	OS	6	2	32	7	260	6	420	737	0	246	246
96	1	Storage Rm	Recessed	E	4'T8	1	2	32	S	9	260	6	70	164	N/A	Recessed	4'T8	E	S	1	2	32	9	260	6	70	164	0	0	0
97	1	Women's Locker Room - Toiletroom	Recessed	E	CFL	3	1	32	S	9	260	0	96	225	C	Recessed	CFL	E	OS	3	1	32	7	260	0	96	168	0	56	56
98	1	Women's Locker Room - Shower	Recessed	E	CFL	1	2	18	S	9	260	0	36	84	C	Recessed	CFL	E	OS	1	2	18	7	260	0	36	63	0	21	21
99	1	Women's Locker Room - Toiletroom Van	Recessed	E	4'T8	1	1	32	S	9	260	3	35	82	C	Recessed	4'T8	E	OS	1	1	32	7	260	3	35	61	0	20	20
100	1	Women's Locker Room	Recessed	E	4'T8	1	2	32	S	9	260	6	70	164	C	Recessed	4'T8	E	OS	1	2	32	7	260	6	70	123	0	41	41
101	1	Storage Room ()	Recessed	E	4'T8	1	2	32	S	9	260	6	70	164	N/A	Recessed	4'T8	E	S	1	2	32	9	260	6	70	164	0	0	0
102	1	Armory	Recessed	M	4'T8	2	2	32	S	9	260	6	140	328	N/A	Recessed	4'T8	M	S	2	2	32	9	260	6	140	328	0	0	0
103	1	Jail - Cell	Recessed	E	4'T8	2	2	32	S	24	365	6	140	1,226	N/A	Recessed	4'T8	E	S	2	2	32	24	365	6	140	1226	0	0	0
104	1	Jail - Cell 2	Recessed	E	4'T8	2	2	32	S	24	365	6	140	1,226	N/A	Recessed	4'T8	E	S	2	2	32	24	365	6	140	1226	0	0	0
105	1	Jail - Toilet	Recessed	E	2'T8	2	1	17	S	24	365	2	38	333	N/A	Recessed	2'T8	E	S	2	1	17	24	365	2	38	333	0	0	0
106	1	Jail	Recessed	E	4'T8	6	2	32	S	24	365	6	420	3,679	N/A	Recessed	4'T8	E	S	6	2	32	24	365	6	420	3679	0	0	0
107	1	Truck Bay	Parabolic	M	4'T8	8	2	32	S	9	260	6	560	1,310	C	Parabolic	4'T8	M	OS	8	2	32	7	260	6	560	983	0	328	328
108	1	Police Department	Exit Sign	N	LED	7	1	5	S	24	365	1	42	368	N/A	Exit Sign	LED	N	S	7	1	5	24	365	1	42	368	0	0	0
71	1	Mechanical Room	Parabolic	E	4'T8	4	2	32	S	2	260	6	280	146	N/A	Parabolic	4'T8	E	S	4	2	32	2	260	6	280	146	0	0	0
72	1	Electrical Room	Parabolic	E	4'T8	2	2	32	S	2	260	6	140	73	N/A	Parabolic	4'T8	E	S	2	2	32	2	260	6	140	73	0	0	0
109	Ext	Exterior - post ()	Exterior	N	HPS	17	1	250	T	12	365	63	5,321	23,306	HPS	Exterior	HPS	N	T	17	1	250	12	365	63	5321	23306	0	0	0
110	Ext	Exterior -post ()	Exterior	N	MH	8	1	175	T	12	365	44	1,752	7,674	PSMH	Exterior	PSMH	N	T	8	1	115	12	365	25	1120	4906	2768	0	2768
111	Ext	Exterior - wall mounted ()	Exterior	N	CFL	6	1	32	T	12	365	0	192	841	N/A	Exterior	CFL	N	T	6	1	32	12	365	0	192	841	0	0	0
112	Ext	Exterior - wall mounted ()	Exterior	N	MH	3	1	50	T	12	365	13	189	828	N/A	Exterior	MH	N	T	3	1	50	12	365	13	189	828	0	0	0
113	Ext	Exterior - in ground (disconnected) ()	Exterior	N	MH	3	1	50	T	12	365	13	189	828	N/A	Exterior	MH	N	T	3	1	50	12	365	13	189	828	0	0	0
Totals:						**459**	**247**	**3,828**				**1,074**	**37,631**	**105,522**						**459**	**247**	**3,482**			**789**	**33,699**	**92,942**	**10,272**	**2,308**	**12,580**

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

Legend:

Fixture Type	Lamp Type	Control Type	Ballast Type	Retrofit Category
Exit Sign	LED	N (None)	N/A (None)	N/A (None)
Screw-in	Inc (Incandescent)	S (Switch)	E (Electronic)	T8 (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)			

Proposed Lighting Summary Table			
Total Surface Area (SF)	21,030		
Average Power Cost ($/kWh)	0.1670		
Exterior Lighting	**Existing**	**Proposed**	**Savings**
Exterior Annual Consumption (kWh)	33,476	30,708	**2,768**
Exterior Power (watts)	7,643	7,011	**632**
Internal Lighting	**Existing**	**Proposed**	**Savings**
Annual Consumption (kWh)	72,046	62,234	**12,580**
Lighting Power (watts)	29,988	26,688	**3,300**
Lighting Power Density (watts/SF)	1.43	1.27	**0.16**
Estimated Cost of Fixture Replacement ($)	**23,155**		
Estimated Cost of Controls Improvements ($)	**2,800**		
Total Consumption Cost Savings ($)	**25,955**		

Appendix B: Third Party Energy Suppliers (ESCOs)

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

JCP&L ELECTRICAL SERVICE TERRITORY Last Updated: 06/15/09		
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 Corp.** 300 Madison Avenue Morristown, NJ 07962 (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 (866) 769-3799 www.libertypowercorp.com	**Pepco Energy Services, Inc.** 112 Main St. Lebanon, NJ 08833 (800) ENERGY-9 (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 The Mac-Cali Building 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) 800-756-3749 www.south jerseyenergy.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		

PSE&G NATURAL GAS SERVICE TERRITORY Last Updated: 06/15/09		
Cooperative Industries 412-420 Washington Avenue Belleville, NJ 07109 800-6BUYGAS (6-289427) www.cooperativenet.com	**Direct Energy Services, LLP** 120 Wood Avenue, Suite 611 Iselin, NJ 08830 866-547-2722 www.directenergy.com	**Dominion Retail, Inc.** 395 Highway 170 - Suite 125 Lakewood, NJ 08701 866-275-4240 http://retail.dom.com
Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701 800-805-8586 www.gesc.com	**UGI Energy Services, Inc. d/b/a GASMARK** 704 East Main Street, Suite 1 Moorestown, NJ 080111 856-273-9995 www.ugienergyservices.com	**Great Eastern Energy** 116 Village Riva, Suite 200 Princeton, NJ 08540 888-651-4121 www.greateastern.com
Hess Energy, Inc. One Hess Plaza Woodbridge, NJ 07095 800-437-7872 www.hess.com	**Hudson Energy Services, LLC** 920 Route 17 South Ridgewood, NJ 07450 877- Hudson 9 www.hudsonenergyservices.com	**Intelligent Energy** 2050 Center Avenue, Suite 500 Fort Lee, NJ 07024 800-724-1880 www.intelligentenergy.org
Keil & Sons 1 Bergen Blvd. Fairview, NJ 07002 1-877-Systrum www.systrumenergy@aol.com	**Metromedia Energy, Inc.** 6 Industrial Way Eatontown, NJ 07724 877-750-7046 www.metromediaenergy.com	**Metro Energy Group, LLC** 14 Washington Place Hackensack, NJ 07601 888-111-Metro www.metroenergy.com
MxEnergy, Inc. 510 Thornall Street, Suite 270 Edison, NJ 088327 800-375-1277 www.mxenergy.com	**NATGASCO (Mitchell Supreme)** 1112 Freeman Street Orange, NJ 07050 800-840-4GAS 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 - Office 105 Cherry Hill, NJ 08002 800-281-2000 www.pplenergyplus.com	**Sempra Energy Solutions** The Mac-Cali Building 581 Main Street, 8th fl. Woodbridge, NJ 07095 877-273-6772 800-2 SEMPRA www.semprasolutions.com	**South Jersey Energy Company** One South Jersey Plaza, Route 54 Folsom, NJ 08037 800-756-3749 www.sjindustries.com/sje.htm
Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 011128 800-225-1560 www.spragueenergy.com	**Stuyvesant Energy LLC** 10 West Ivy Lane, Suite 4 Englewood, NJ 07631 800-646-64111 www.stuyfuel.com	**Woodruff Energy** 73 Water Street Bridgeton, NJ 08302 800-5111-1121 www.woodruffenergy.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

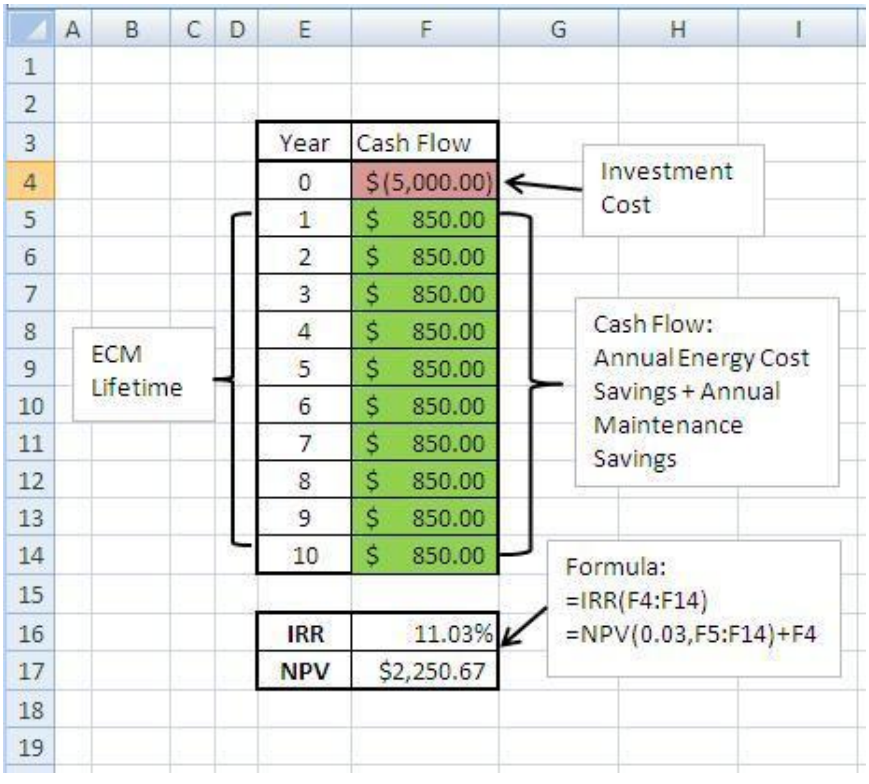
Net ECM Cost = Total ECM Cost – Incentive
LECS = AECS X ECM Lifetime
AOCS = LOCS/ECM Lifetime
LCS = LOCS+LECS

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.

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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