Comprehensive Energy Audit
ASHRAE Level 2 Report

New York Power Authority

in cooperation with

NYS Adirondack Park Agency

ES-ESN-0569

NYPA's Energy Efficiency Program

for

NYS Adirondack Park Agency

1133 State Route 86
Ray Brook NY 12977

BuildSmartNY

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I. Executive Summary

This report presents the results of the ASHRAE Level II energy audit conducted for the New York State Adirondack Park Agency building, as commissioned by the New York Power Authority (NYPA), and was performed by EME Group Consulting Engineers, LLC (EME). This audit has identified several opportunities for capital improvement that, if implemented, will reduce building energy use by an estimated 47.9%, and yield annual energy cost savings of $20,694 at current utility rates.

The NYS Adirondack Park Agency building is a single-floor office building located at 1133 State Route 86 in Ray Brook, New York. The building was opened in 1971, and contains approximately 23,700 square feet of government offices. The original building construction was that of a log cabin with chinking between the logs. In 2003, an additional portion of the building was constructed that featured sheetrock interior walls, various layers of insulation, and wood siding on the exterior to match the style of the original building. The 2003 addition consisted of two (2) new conference rooms, a garage/vehicle maintenance area, and additional office space.

The Adirondack Park Agency building utilizes two air handling units that condition a majority of the facility. The first of which, AHU-1, is used in conjunction with ACC-1 (air conditioning unit), and variable air volume control boxes (VAV) 1-7. AHU-1 is used only for summer cooling loads, the second air handling unit, AHU-2, is utilized year round. Both of these systems cannot be scheduled to shutoff during unoccupied periods due to the condition of the building management system (BMS).

The facility currently uses #2 fuel oil to fire one (1) boiler located in the boiler room. The hot water from the boiler is distributed through nine (9) hot water pumps that service the entire facility. Eight (8) of the hot water pumps service the old building and provide constant volume heating to eight (8) zones. The ninth hot water pump services the garage unit heaters equipped with three-way valves and the 2003 addition which includes the main lobby, two restrooms, two conference rooms and the records room, located in the basement area.

Domestic hot water (DHW) for the facility is provided by two (2) hot water heaters (HWH). One of the HWH's is a 41 gallon PurePro indirect water heater that uses hot water from the space heating boiler, whereas the other is an AO Smith 80 gallon hot water heater, which is scheduled to be replaced with a Rheem ELDS40 electric hot water heater. The indirect HWH is used during the heating season while the electric HWH is used the remainder of the year. The majority of

the mechanical systems are connected to a building management system (BMS) that was implemented in 2002.

Lighting systems were recently upgraded in 2008, interior lighting in the facility consists of primarily T8 fluorescent fixtures (electronically ballasted), and limited incandescent fixtures. Control for the interior lighting is comprised of a 32/68 mix of wall mounted occupancy sensor switches and manual wall switches. Exterior lighting is provided by metal halide and high pressure sodium fixtures, controlled by two photocells on the back of the facility.

The energy consumption at the Adirondack Park Agency has been analyzed through review of available utility bills from National Grid (electric) and MX Fuels & Propane (fuel oil #2). Total energy use at the Adirondack Park Agency for the year 2014 was 1,868 MMBtu at a cost of $48,358.

Over this time period, the annual energy use index (EUI) for the building was 78.8 kBtu/gsf. The US Department of Energy maintains an ongoing database, the Commercial Building Energy Consumption Survey (CBECS), which tabulates information on commercial buildings across the country, including EUIs for a wide range of building occupancies. This building has been compared to a "government office" type building due to its mixture of office, classroom, and large assembly areas, as well as its occupancy patterns. The expected CBECS EUI for the building is 92.9 kBtu/gsf. Based on this comparison, the Adirondack Park Agency building consumes 15.2% less total energy than the national average for similar buildings.

An analysis of electrical consumption for the year 2014 found that the Adirondack Park Agency building consumed 199,440 kWh. The CBECS database tabulates an electricity use index based on kWh consumption and gross square footage. The annual electrical consumption listed above yields an index of 8.4 kWh/gsf, which is 51.4% lower than the mean of 17.3 kWh/gsf found in the CBECS for this building type. The potential factors contributing to this lower average electrical consumption are discussed in more detail in the building narrative and ECM description sections, and include: a recent lighting upgrade, and the implementation of a building management system. Monthly peak electric demand is roughly 20kW higher during cooling season than heating season.

Annual #2 fuel oil delivery for the year 2014 was 8,540 gallons, or 1,187,060 kBtu, resulting in a fuel end-use index of 50.1 kBtu/gsf, which is 1064.8% higher than the CBECS expected value of 4.3 kBtu/gsf.

Based on the findings in this report, EME Group recommends six (6) specific energy conservation measures (ECMs). These measures, when modeled and evaluated as a total

package, are expected to reduce the total energy consumption at the Adirondack Park Agency by 46.8%, and yield savings of $20,247 at current utility rates.

ECM#	Description	Measure Status	Annual Savings				EUI Reduction (%)	Estimated Implementation Cost	Simple Payback (years)
			kWh	kW	MMBtu	Cost			
Proposed	Proposed Building	REC	134,161	10.6	436.3	$ 20,694	47.9%	$ 480,829	23.2

Table 1: Savings Summary of Proposed ECM Package

ECM#	Description	Measure Status	Annual Savings				EUI Reduction (%)	Estimated Implementation Cost	Simple Payback (years)
			kWh	kW	MMBtu	Cost			
Investigated	Proposed Building	INV	121,408	3.2	(4.1)	$ 9,364	22.0%	$ 429,862	45.9

Table 2: Savings Summary of Investigated but Not Recommended ECM Package

A summary of all individual measures can be found on the next page. A list of these individual measures, their implementation cost and resultant savings can be found on the following pages. Please note that the cost and savings listed for the Proposed Building will not precisely match the sum of the individual measures found in Table 2 on the next page. This is due to the fact that when all measures are analyzed as a package (as in Table 1) it includes the interactive effects that the measures have on each other, while these effects are absent when the measures are considered in isolation (as in Table 2). This methodology is discussed in further detail in the report section entitled "Energy Model Summary."

ECM #	FACILITY	MEASURE DESCRIPTION	TOTAL MEASURE COST[1]	TOTAL DIRECT CONSTRUCTION COSTS[2]	ANNUAL ELECTRIC SAVINGS (kWh)	ANNUAL DEMAND SAVINGS (kW)	ANNUAL FUEL SAVINGS (MMBtu)	ANNUAL OPERATION SAVINGS	ANNUAL ELECTRIC COST SAVINGS	ANNUAL FUEL COST SAVINGS	TOTAL ANNUAL SAVINGS	SIMPLE PAYBACK	MEASURE LIFE (years)	SAVINGS-TO-INVESTMENT RATIO (SIR)
1	APA	Interior Lighting Upgrade	$ 43,165	$ 28,695	17,319	4.6	(3)	$ 341	$ 1,392	$ (73)	$ 1,660	32.7	20	0.77
2	APA	LED Exterior Fixtures	$ 19,323	$ 12,683	27,213	5.6	-	$ 120	$ 2,170	$ -	$ 2,290	8.9	20	2.37
3	APA	BMS Upgrade and RCx	$209,364	$ 140,317	82,661	-	102	$ -	$ 6,414	$ 2,268	$ 8,682	24.1	25	1.04
4	APA	Hot Water Pump Upgrade	$ 24,716	$ 16,305	8,223	0.9	-	$ -	$ 648	$ -	$ 648	38.2	15	0.39
5	APA	Building Envelope Upgrades 1	$147,828	$ 98,988	(18)	(0.5)	185	$ -	$ (7)	$ 4,118	$ 4,111	36.0	40	1.11
6	APA	Building Envelope Upgrades 2	$ 35,220	$ 23,359	(2,353)	-	153	$ -	$ (183)	$ 3,399	$ 3,216	11.0	40	3.65
7	APA	Vending Controls	$ 1,213	$ 520	1,116	-	-	-	$ 87	$ -	$ 87	14.0	20	1.43
TOTALS - Recommended Measures			$480,829	$ 320,867	134,161	10.6	436.3	$ 461	$ 10,521	$ 9,711	$ 20,694	23.2		

Notes:

1. Total measure cost includes direct construction costs (Material & Labor), Contingency, NYPA Fees, Bonding, and account for Interest During Construction.
2. Material & Labor Costs only.
3. Total cost and energy savings for these measures, when considered as a package, differs from the total of the individual measures due to interactive effects. Please see Page 40 for additional details.

Table 3: Recommended ECM Energy Savings and Cost Breakdown

ECM #	FACILITY	MEASURE DESCRIPTION	TOTAL MEASURE COST[1]	TOTAL DIRECT CONSTRUCTION COSTS[2]	ANNUAL ELECTRIC SAVINGS (kWh)	ANNUAL DEMAND SAVINGS (kW)	ANNUAL FUEL SAVINGS (MMBtu)	ANNUAL OPERATION SAVINGS	ANNUAL ELECTRIC COST SAVINGS	ANNUAL FUEL COST SAVINGS	TOTAL ANNUAL SAVINGS	SIMPLE PAYBACK	MEASURE LIFE (years)	SAVINGS-TO-INVESTMENT RATIO (SIR)
8	APA	Lighting Controls Upgrade	$ 25,351	$ 16,731	10,674	3.2	(4)	$ -	$ 861	$ (90)	$ 771	32.9	20	0.61
9	APA	Condensing Unit Upgrades	$ 37,477	$ 24,875	4,212	-	-	-	$ 327	$ -	$ 327	114.7	18	0.16
10	APA	Data Center Cooling	$ 21,994	$ 14,477	770	-	-	-	$ 60	$ -	$ 60	368.0	18	0.05
11	APA	PV System	$343,112	$ 230,144	105,227	-	-	-	$ 8,165	$ -	$ 8,165	42.0	20	0.48
12	APA	Appliance Upgrades	$ 1,928	$ 1,000	525	-	-	-	$ 41	$ -	$ 41	47.3	20	0.42
TOTALS - Investigated Measures			$429,862	$ 287,227	121,408	3.2	(4.1)	$ -	$ 9,454	$ (90)	$ 9,364	45.9		

Notes:

1. Total measure cost includes direct construction costs (Material & Labor), Contingency, NYPA Fees, Bonding, and account for Interest During Construction.
2. Material & Labor Costs only.
3. Total cost and energy savings for these measures, when considered as a package, differs from the total of the individual measures due to interactive effects. Please see Page 40 for additional details.

Table 4: Investigated but Not Recommended ECM Energy Savings and Cost Breakdown

ECM #	FACILITY	MEASURE DESCRIPTION	EUI Reduction (%)	CO_2 Reduction (kg)	NOx Reduction (kg)	SO_2 Reduction (kg)
1	APA	Interior Lighting Upgrade	3.0%	6,817	7	19
2	APA	LED Exterior Fixtures	5.0%	11,124	12	33
3	APA	BMS Upgrade and RCx	20.6%	41,907	43	158
4	APA	Hot Water Pump Upgrade	1.5%	3,361	4	10
5	APA	Building Envelope Upgrades 1	9.9%	14,731	13	106
6	APA	Building Envelope Upgrades 2	7.7%	11,204	10	85
7	APA	Vending Controls	0.2%	456	0	1
TOTALS - Recommended Measures			47.9%	89,601	90	412

Table 5: Recommended ECM EUI Percent Reduction & Emissions Savings

ECM #	FACILITY	MEASURE DESCRIPTION	EUI Reduction (%)	CO_2 Reduction (kg)	NOx Reduction (kg)	SO_2 Reduction (kg)
8	APA	Lighting Controls Upgrade	1.7%	4,040	4	11
9	APA	Condensing Unit Upgrades	0.8%	1,722	2	5
10	APA	Data Center Cooling	0.1%	315	0	1
11	APA	PV System	19.2%	43,013	46	127
12	APA	Appliance Upgrades	0.1%	215	0	1
TOTALS - Investigated Measures			22.0%	49,305	52	144

Table 6: Investigated but Not Recommended ECM EUI Percent Reduction & Emissions Savings

II. Energy Use Analysis

A. Electric Use

Electricity for the Adirondack Park Agency is provided by National Grid. EME reviewed electric utility data for the period between April 2013 and December 2014. These values were broken out into monthly totals and are shown in the tables below. For the purposes of energy use analysis in this report, only the energy consumption values from the year 2014 are considered because of the incomplete utility data from 2013.

2013 Electric Use and Costs							
Month	Electric						
	kW	kWh	kW Cost	kWh Cost	$/kW	$/kWh	Total $
Apr-13	37.6	15,680	$ 392	$ 992	$ 10.42	$ 0.063	$ 1,384
May-13	69.6	15,920	$ 729	$ 1,126	$ 10.47	$ 0.071	$ 1,855
Jun-13	65.6	17,200	$ 687	$ 1,224	$ 10.47	$ 0.071	$ 1,911
Jul-13	66.4	20,800	$ 695	$ 1,711	$ 10.47	$ 0.082	$ 2,407
Aug-13	64.0	19,120	$ 670	$ 1,348	$ 10.47	$ 0.070	$ 2,018
Sep-13	59.2	15,040	$ 620	$ 1,071	$ 10.47	$ 0.071	$ 1,691
Oct-13	50.4	14,240	$ 528	$ 864	$ 10.47	$ 0.061	$ 1,392
Nov-13	37.6	15,280	$ 389	$ 930	$ 10.35	$ 0.061	$ 1,319
Dec-13	40.0	16,960	$ 396	$ 1,439	$ 9.91	$ 0.085	$ 1,836
TOTAL (9 Month)		150,240	$ 5,106	$ 10,706	$ 10.39	$ 0.071	$ 15,811

Table 7: Adirondack Park Agency 2013 Electricity Consumption (April-December)

2014 Electric Use and Costs							
Month	Electric						
	kW	kWh	kW Cost	kWh Cost	$/kW	$/kWh	Total $
Jan-14	42.4	17,920	$ 419	$ 2,935	$ 9.88	$ 0.164	$ 3,354
Feb-14	40.8	16,320	$ 400	$ 2,423	$ 9.80	$ 0.148	$ 2,823
Mar-14	39.2	15,680	$ 400	$ 1,437	$ 10.22	$ 0.092	$ 1,838
Apr-14	35.2	15,760	$ 391	$ 944	$ 11.11	$ 0.060	$ 1,336
May-14	61.6	15,920	$ 694	$ 521	$ 11.27	$ 0.033	$ 1,215
Jun-14	62.4	17,440	$ 699	$ 1,432	$ 11.20	$ 0.082	$ 2,131
Jul-14	60.8	19,200	$ 626	$ 1,272	$ 10.29	$ 0.066	$ 1,898
Aug-14	60.0	16,480	$ 617	$ 1,147	$ 10.29	$ 0.070	$ 1,765
Sep-14	58.4	14,960	$ 601	$ 881	$ 10.29	$ 0.059	$ 1,482
Oct-14	36.8	14,640	$ 379	$ 716	$ 10.29	$ 0.049	$ 1,095
Nov-14	39.2	17,040	$ 403	$ 998	$ 10.29	$ 0.059	$ 1,401
Dec-14	36.8	18,080	$ 379	$ 908	$ 10.29	$ 0.050	$ 1,287
TOTAL		199,440	$ 6,008	$ 15,615	$ 10.44	$ 0.078	$ 21,624

Table 8: Adirondack Park Agency 2014 Electricity Consumption

The US Department of Energy maintains an EUI database explicitly for electricity consumption in addition to total site energy use. The 2007 ASHRAE Handbook for HVAC Applications presents

EUI data from this survey. For the purpose of this analysis, the Adirondack Park Agency building has been classified as a government office facility.

Building Name					Square Feet
Adirondack Park Agency					23,700
Electricity					
Consumption	Cost	Cost/gsf	APA EUI	CBECS EUI (Office)	Difference
kWh/yr	$/yr	$/gsf	kWh/gsf	kWh/gsf	%
199,440	21,624	0.91	8.42	17.3	51.4%

Table 9: Adirondack Park Agency 2014 Electricity EUI and CBECS Comparison

Applying CBECS data, the total annual expected electricity usage and electricity use index for the Adirondack Park Agency building is 410,010 kWh and 17.3 kWh/gsf, respectively. The actual electricity consumption for the year 2014 was 199,440 kWh, resulting in an electricity use index of 8.42 kWh/gsf. Based on this comparison, the facility is using 51.4% less electricity than expected.

As shown in the table above, electricity consumption at the facility for the year 2014 was 199,440 kWh at a cost of $21,624, or $0.91 per square foot. The peak demand for this period was 62.4 kW, which occurred during June. The two figures below show electrical usage and peak demand, respectively.

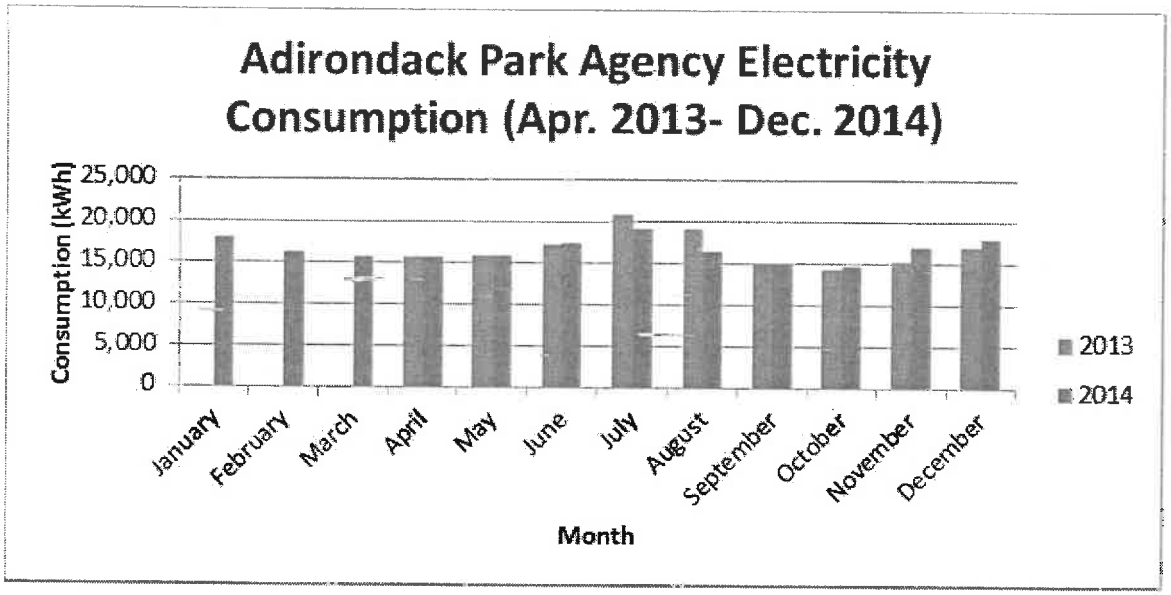

Figure 1: Adirondack Park Agency Electricity Consumption (April 2013-December 2014)

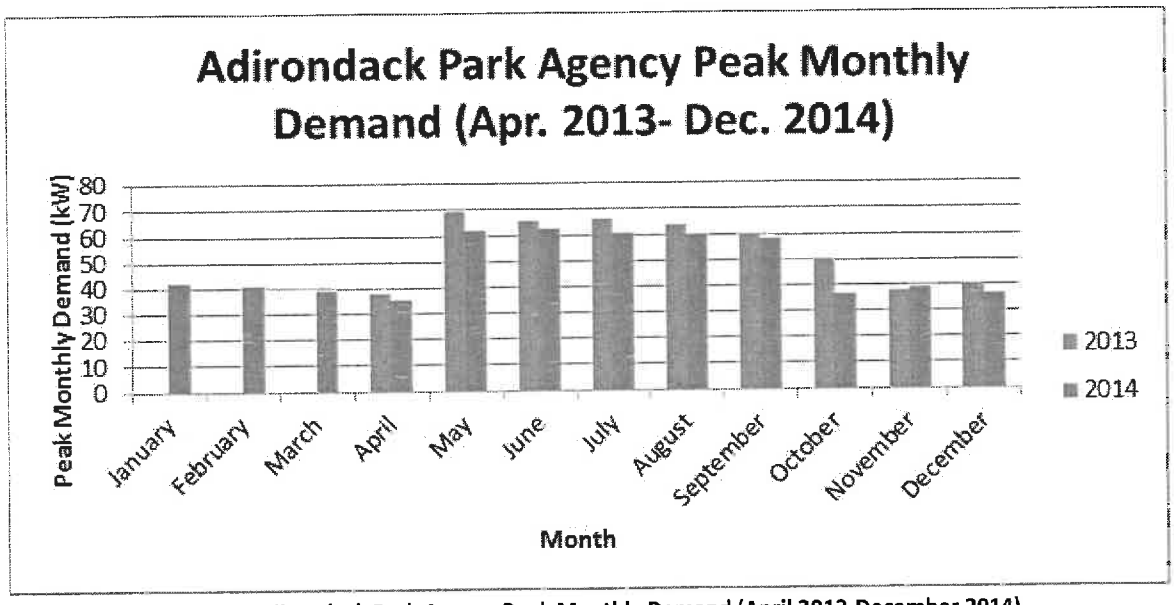

Figure 2: Adirondack Park Agency Peak Monthly Demand (April 2013-December 2014)

B. Fuel Oil Use

Fuel oil delivery for the Adirondack Park Agency is provided by MX Fuels & Propane. EME reviewed fuel oil delivery data for the period between April 2013 and December 2014. The values were broken out into monthly totals and are shown in the table below.

2013 Energy Use and Costs			
Month	Fuel Delivery (#2 Oil)		
	Gallons	$	$/gallon
April	1,910	$ 6,236	$3.265
May			
June			
July			
August			
September			
October	1,732	$ 5,547	$3.202
November	1,201	$ 3,811	$3.173
December	1,200	$ 3,917	$3.265
TOTAL (9 Month)	**6,043**	**$19,512**	**$3.226**

Table 10: Adirondack Park Agency 2013 #2 Fuel Oil Delivery (April-December)

2014 Energy Use and Costs			
Month	Fuel Delivery (#2 Oil)		
	Gallons	$	$/gallon
January	1,941	$ 6,518	$3.357
February	1,300	$ 4,685	$3.604
March	1,550	$ 5,284	$3.409
April	1,200	$ 3,905	$3.255
May			
June			
July			
August			
September			
October	1,050	$ 2,935	$2.796
November			
December	1,499	$ 3,408	$2.273
TOTAL	**8,540**	**26,734**	**$3.116**

Table 11: Adirondack Park Agency 2014 #2 Fuel Oil Delivery

Fuel oil delivery during the year 2014 was 8,540 gallons at a cost of $26,734 or $1.13 per square foot. The US Department of Energy maintains an EUI database for electrical consumption in addition to total site energy use. The 2007 ASHRAE Handbook for HVAC Applications presents EUI data from this survey. For the purpose of this analysis, the Adirondack Park Agency building has been classified as a government office facility.

Building Name				Square Feet	
Adirondack Park Agency				23,700	
Fuel Oil					
Consumption	Cost	Cost/gsf	APA EUI	CBECS EUI (Office)	Difference
gal/yr	$/yr	$/gsf	kBtu/gsf	kBtu/gsf	%
8,540	26,734	1.13	50.4	33.9	-48.8%

Table 12: Adirondack Park Agency 2014 Fuel Oil EUI and CBECS Comparison

Applying CBECS data, the total annual expected fuel oil usage and fuel oil use index for the Adirondack Park Agency building is 803,430 kBtu and 33.9 kBtu/gsf, respectively. In terms of gallons of #2 fuel oil, the CBECS expected annual consumption is 5,739 gallons. The actual fuel oil consumption for the year 2014 was 8,540 gallons of #2 fuel oil, which equates to 1,187,060 kBtu, resulting in a fuel oil use index of 50.4 kBtu/gsf. Based on this comparison, the facility is using 48.8% more fuel oil than expected. As shown in the table above, fuel oil deliveries at the facility during the year 2014 were 8,540 gallons at a cost of $26,734, or $1.13 per square foot.

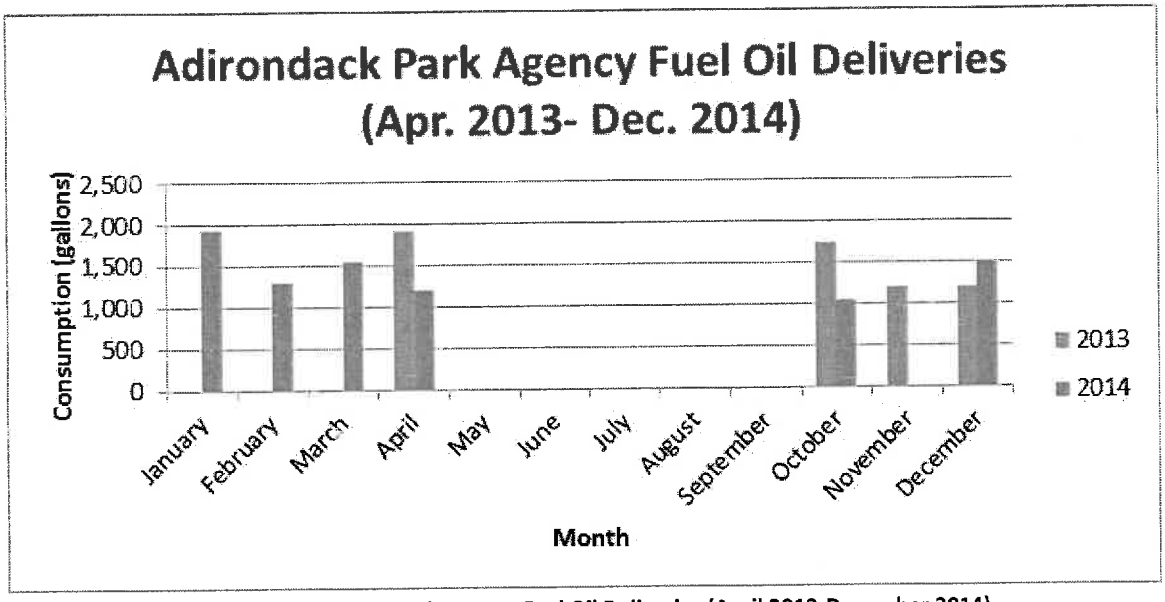

Figure 3: Adirondack Park Agency Fuel Oil Deliveries (April 2013-December 2014)

C. Water Use

EME reviewed water use utility data for the period between April 2013 and December 2014. These values were broken out into monthly totals and are shown in the tables below.

2013 Energy Use and Costs			
Month	Water		
	Gallons	$	$/gallon
April	7,467	$ 38.22	$0.005
May	7,533	$ 38.60	$0.005
June	7,533	$ 38.60	$0.005
July	7,533	$ 38.60	$0.005
August	8,567	$ 44.56	$0.005
September	8,567	$ 44.56	$0.005
October	8,567	$ 44.56	$0.005
November	7,667	$ 39.37	$0.005
December	7,667	$ 39.37	$0.005
TOTAL (9 Month)	**71,100**	**$366.45**	**$0.005**

Table 13: Adirondack Park Agency 2013 Water Consumption (April-December)

2014 Energy Use and Costs			
Month	Water		
	Gallons	$	$/gallon
January	7,667	$ 39.37	$0.005
February	7,533	$ 38.60	$0.005
March	7,533	$ 38.60	$0.005
April	7,533	$ 38.60	$0.005
May	9,067	$ 47.44	$0.005
June	9,067	$ 47.44	$0.005
July	9,067	$ 47.44	$0.005
August	8,000	$ 41.29	$0.005
September	8,000	$ 41.29	$0.005
October	8,000	$ 41.29	$0.005
November	7,100	$ 36.11	$0.005
December	7,100	$ 36.11	$0.005
TOTAL	**95,667**	**494**	**$0.005**

Table 14: Adirondack Park Agency 2014 Water Consumption

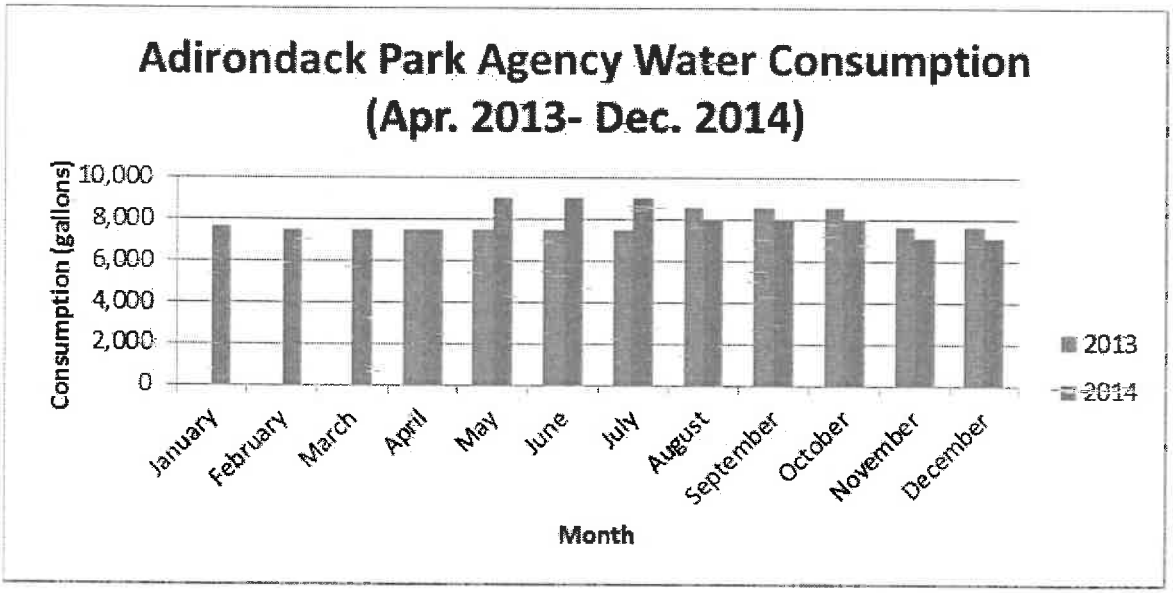

Figure 4: Adirondack Park Agency Water Consumption (April 2013-December 2014)

D. Energy Use Summary

The following figures illustrate the annual distribution of energy consumption at the site and at the source, in kBtu, for the Adirondack Park Agency building. Fuel oil consumption accounts for approximately 64% of all site energy consumption at the facility, whereas electric consumption accounts for approximately 36%. By contrast, 64% of the source energy end use is electric, and 36% of the use is fuel oil.

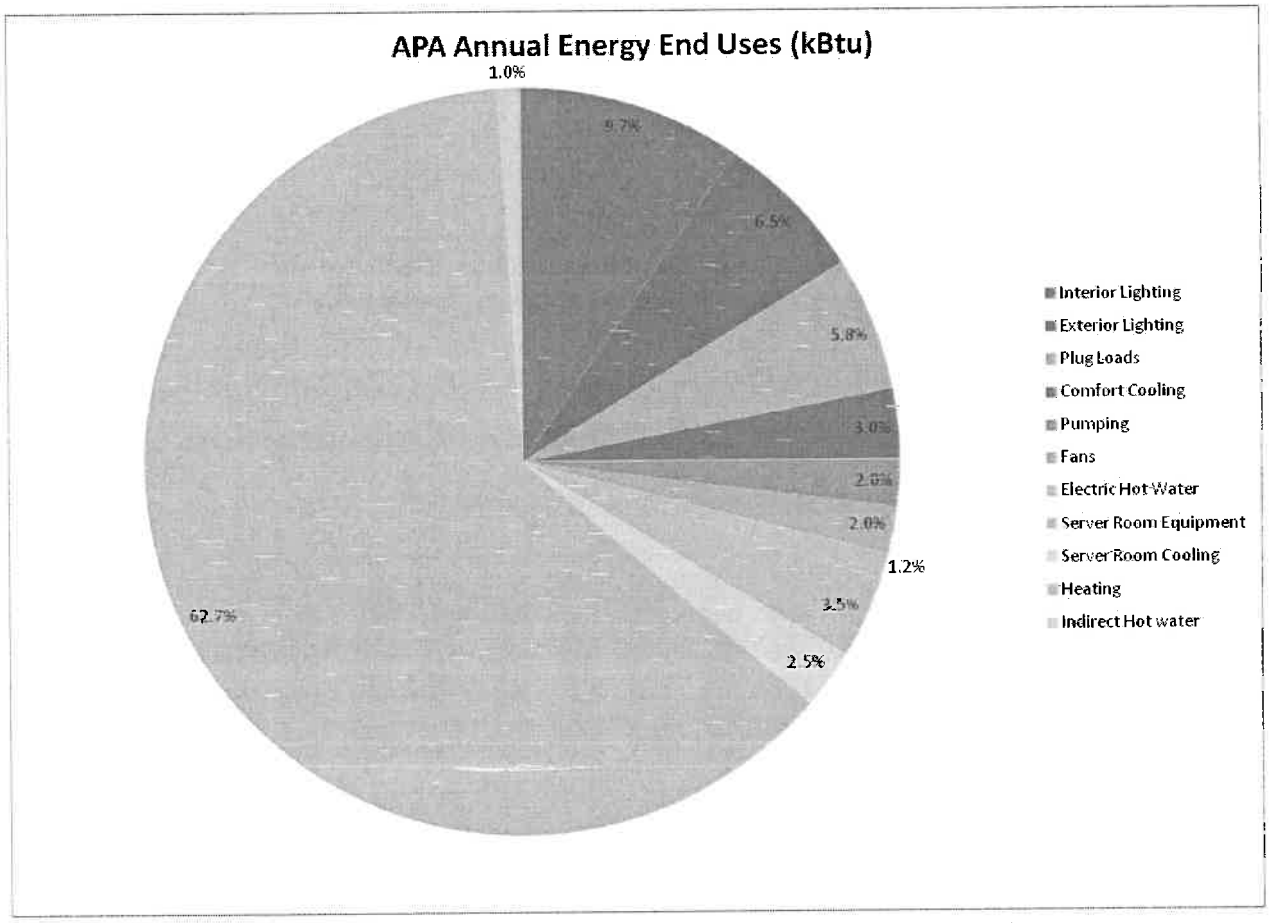

Figure 5: Adirondack Park Agency Annual Energy End Use Distribution (kBtu)

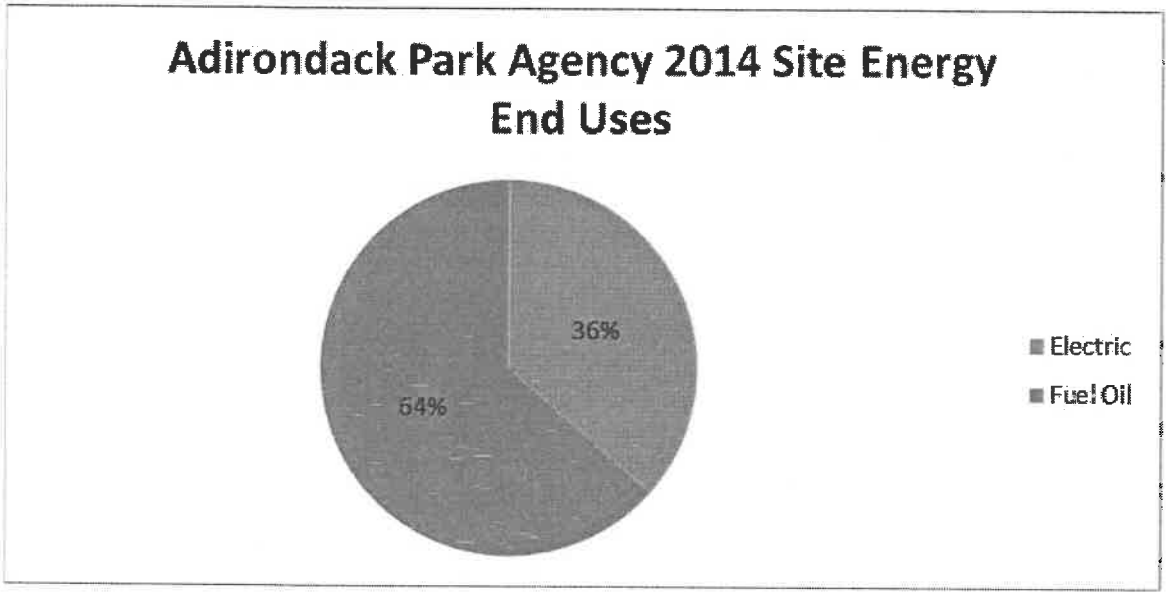

Figure 6: Adirondack Park Agency Site Energy End Use Distribution (2014)

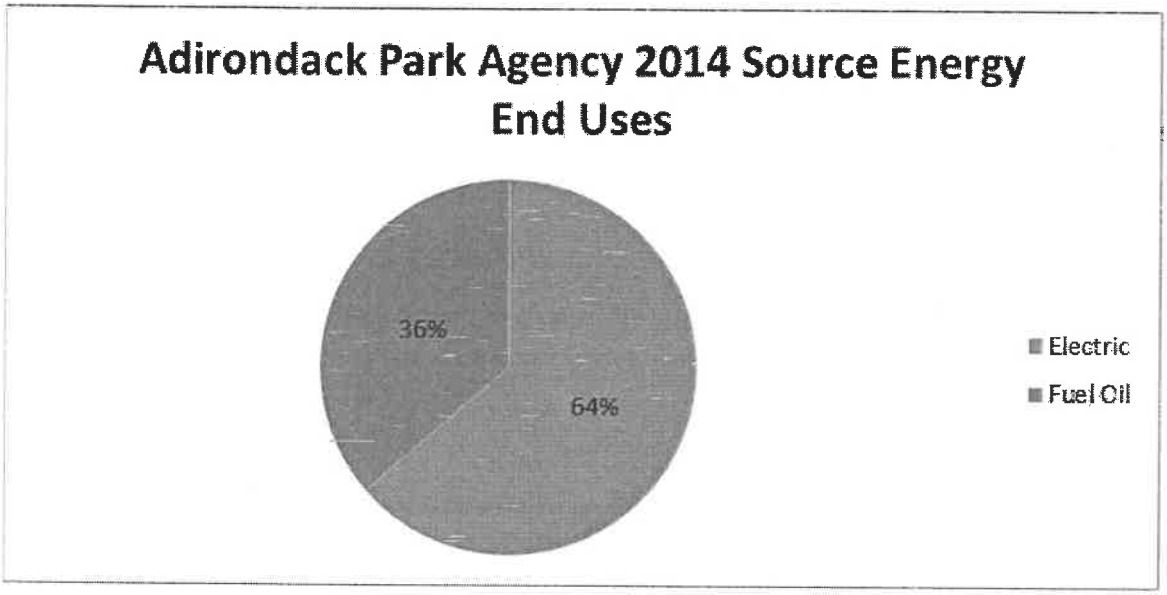

Figure 7: Adirondack Park Agency Source Energy End Use Distribution (2014)

EME Group compared the total building energy use for the facility to data for the most applicable space type in the CBECS survey shown in the following table.

Building Name		Sq. Ft.			
Adirondack Park Agency		23,700			
Total Energy					
Consumption	Cost	Cost / gsf	APA EUI	CBECS EUI (Office)	% Difference
kBtu/year	$	$	kBtu/gsf	kBtu/gsf	
1,867,578	$ 48,358	$ 2.04	78.8	92.9	15.2%

Table 15: Adirondack Park Agency 2014 Total Energy EUI and CBECS Comparison

The expected total building EUI for the facility, based on the building type, is 92.9 kBtu/gsf. The EUI based on the data available was 78.8 kBtu/gsf, which is 15.2% lower than expected.

The following table presents total building energy use in 2014 by utility for the Adirondack Park Agency building. As seen below, electricity consumption represents 36% of total site energy use, while fuel oil represents 64%.

Adirondack Park Agency Energy Use		
	kBtu	% of Total
Total Electricity Use	680,518	36%
Total Fossil Fuel Use	1,187,032	64%
Total Energy Use	1,867,550	-
Energy Use Index	78.8	-

Table 16: Adirondack Park Agency Total Energy Use by Utility (2014)

The following table and figure presents the total energy cost in 2014 by utility type for the facility. Electricity represents 45% of the total utility cost, while fuel oil represents 55%.

Adirondack Park Agency Energy Cost		
	Cost	% of Total
Total Electricity Cost	$ 21,624	45%
Total Fossil Fuel Use	$ 26,734	55%
Total Energy Cost	$ 48,358	-
Energy Cost / gsf	$ 2.04	-

Table 17: Adirondack Park Agency Total Energy Cost by Utility (2014)

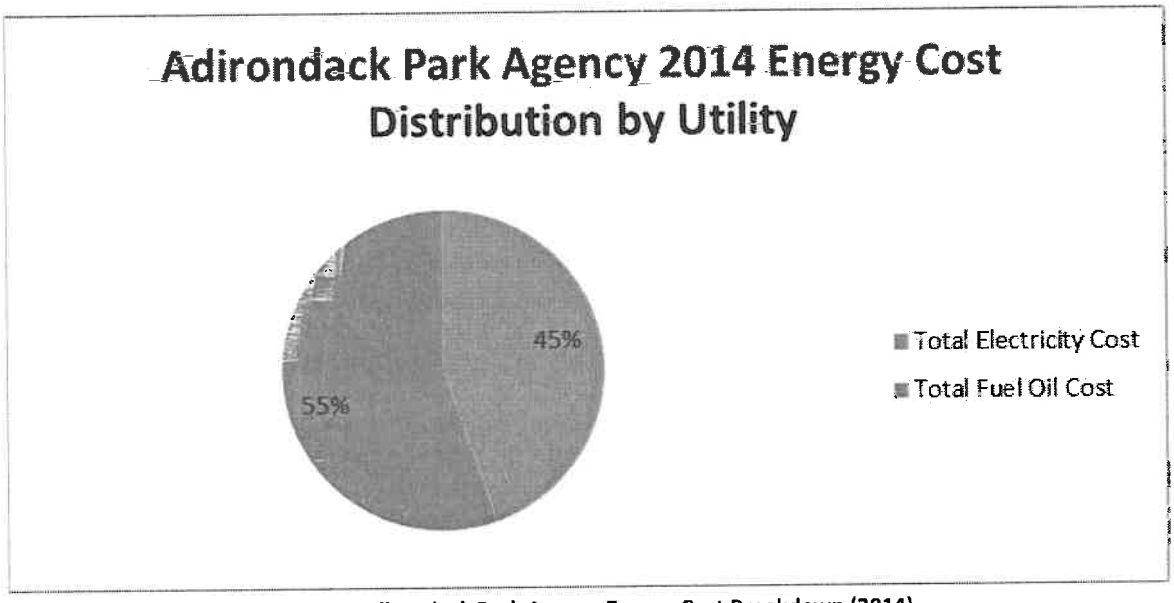

Figure 8: Adirondack Park Agency Energy Cost Breakdown (2014)

E. Conclusion

The utility analysis results vary from the expected results for the facility. Total energy consumption for the Adirondack Park Agency is 15.2% lower than expected. The table below shows a breakdown of the EUIs at the Adirondack Park Agency by utility and total, as well as the CBECS expected values and percent differences. The utility analysis showed that the facility consumed 51.4% less electricity than the CBECS expected value, 1064.8% more fuel oil than the CBECS expected value, and 15.2% less total energy than the CBECS expected value. Although evaluating the facility energy consumption against CBECS data is not a straight comparison, the results do serve as an indicator of how the facility is performing.

Building Name		Sq. Ft.	
Adirondack Park Agency			23,700
	Electric	Fuel	Total
	kWh/gsf	kBtu/gsf	kBtu/gsf
APA EUI	8.4	50.1	78.8
CBECS EUI (Office)	17.3	4.3	92.9
% Difference	51.4%	-1064.8%	15.2%

Table 18: Adirondack Park Agency 2014 EUI Summary and CBECS Comparison

III. Existing Conditions Description

A. Overview

The NYS Adirondack Park Agency building is located at 1133 State Route 86 in Ray Brook, New York. The building was opened in 1971 and contains approximately 23,700 square feet of government office space, conference rooms, and a garage area. In 2003, an addition to the original building was constructed that included conference rooms, a garage area, and additional office space.

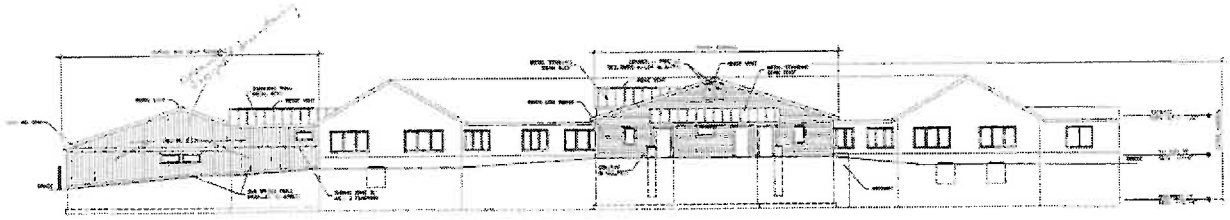

Figure 9: APA Building South Exposure

Building occupancy during the week begins at 6am and ends around 7pm, Monday through Friday. During the summer months, a significant portion of the building's occupants are out in the field, whereas during the winter months, the building is fully occupied. Two times per month, large meetings of 50-100 people are held in the conference rooms in the building addition.

B. Envelope

The building has one (1) above grade floor that consists of offices, as well as a garage, storage space, and a cellar that contains primary mechanical equipment. The original building was built as a log cabin, with chinking used between adjacent logs to provide insulation and fill air gaps. The building addition is steel and wood-framed with sheetrock interior walls, and exterior walls that consist of log siding backed by an air infiltration barrier over the sheathing, and R-19 batt insulation depending on the location. New windows were installed during the building addition construction in 2003 and consist of a mix of double-paned operable and non-operable glazing units with wood frames. The roof consists of a preformed metal roof panel and plywood sheathing. It was observed in the attic space that there is no insulation behind the plywood roof sheathing and no ridge vents in the original building roof. Attic ventilation/moisture control is provided by gable vents and ridge vents in the roof of the addition.

The existing glazing system is a mix of old and new that coincides with the old log cabin and the new building addition construction. In the newer portions of the building, glazing is relatively new and in good condition. Many of the newer windows feature low emissivity glass that facilitates thermal retention within those spaces. The seals at the majority of the windows are in good or fair condition, with a few instances of poor or no insulation between the frames and building opening. Occupants of the facility stated that infiltration negatively affected their thermal comfort, for example, that within the same zone there are significant temperature differences.

Analysis of the roof insulation was completed by observing the attic space at the facility. The roof construction consists of a preformed metal roof backed by plywood sheathing. The roof joists of the original building were approximately 7¾" deep and the roof joists of the building addition were approximately 9¼" deep. Conversations with facility representatives and analysis of facility drawings revealed that the floor of the attic was covered 6" deep in R-19 insulation. Through observation of the attic however, it was discovered that the insulation thickness was variable throughout the space, with some areas 6" or greater in thickness and other areas less than 6" thick or insufficiently covered. Additionally, the attic space contained a small section of exposed uninsulated ducting as a result of the deterioration of the sticky tape holding the insulation in place.

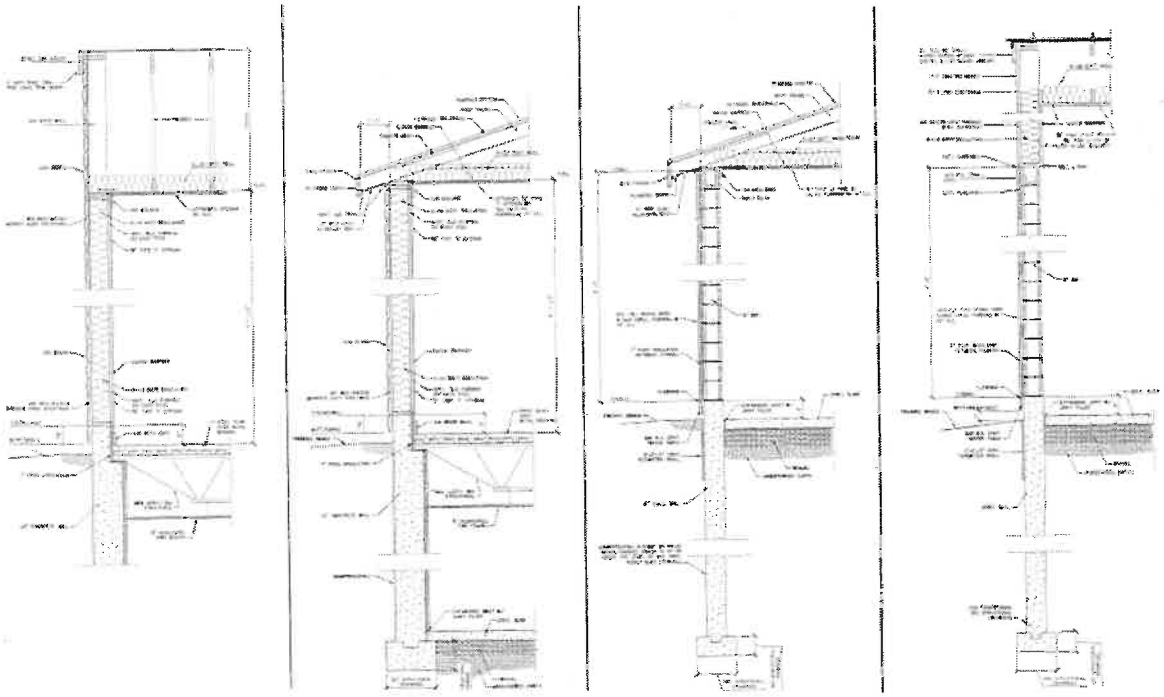

Figure 10: APA Sample Envelope Wall Sections

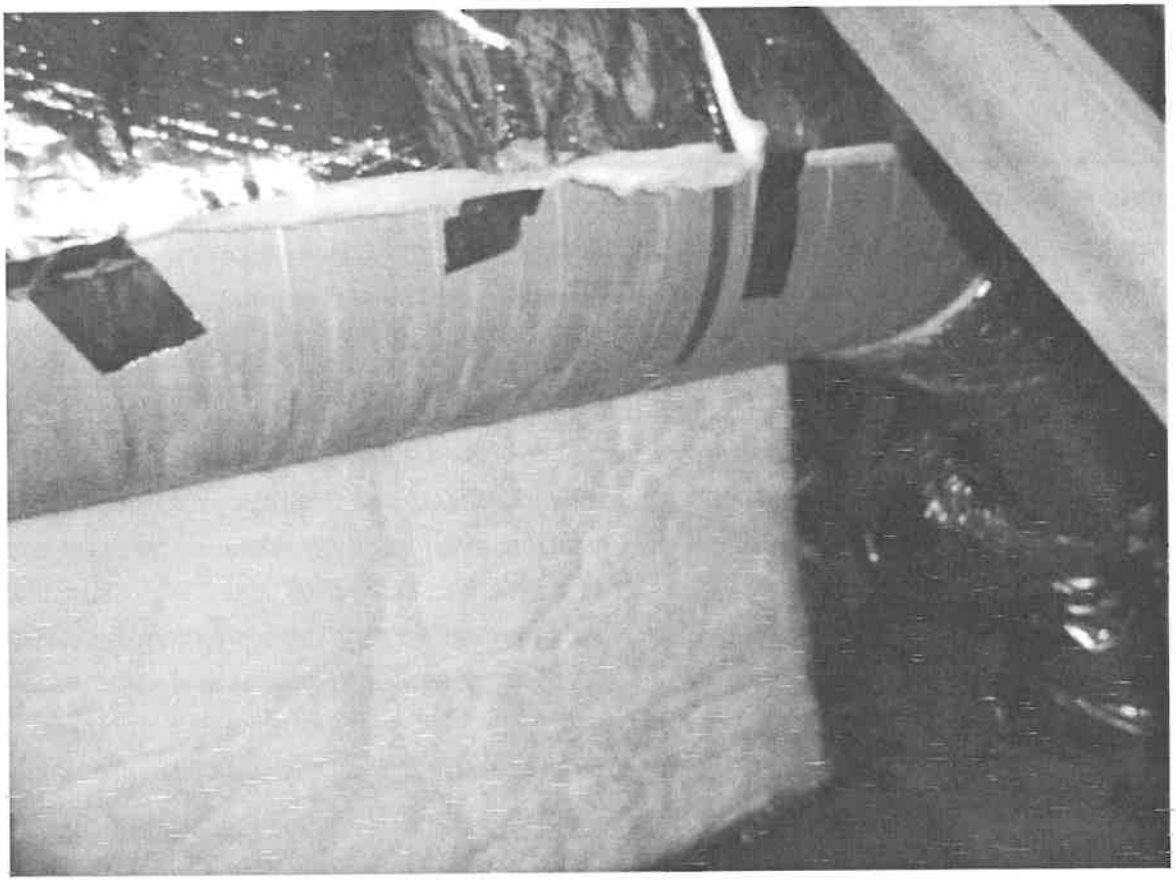

Figure 11: Attic Space Uninsulated Ducting Section

C. Heating

Heating for the building is provided by one (1) Weil-McLain 88 Series #2 oil fired boiler located in the boiler room. This boiler provides hot water for nine (9) hot water pumps, of which eight (8) serve the old building and one (1) serves the building addition. The hot water pumps that service the building operate at constant volume. The boiler also provides hot water to the cabinet and unit heaters throughout the facility. In the fall of 2015, the Adirondack Park Agency plans on replacing the existing oil boiler with two (2) propane fired gas condensing boilers. A Biomass Project is expected to begin in the fall of 2016. Once the biomass system is operational the facility plans on using the two (2) new 500MBH propane gas condensing boilers during the shoulder months, and the biomass boiler will be utilized during the coldest months of the year. The biomass boiler will serve three (3) buildings within close proximity including the Adirondack Park Agency, the Department of Environmental Conservation, and the New York State Police building. The boiler and hot water pumps were found to be in good condition during the building survey.

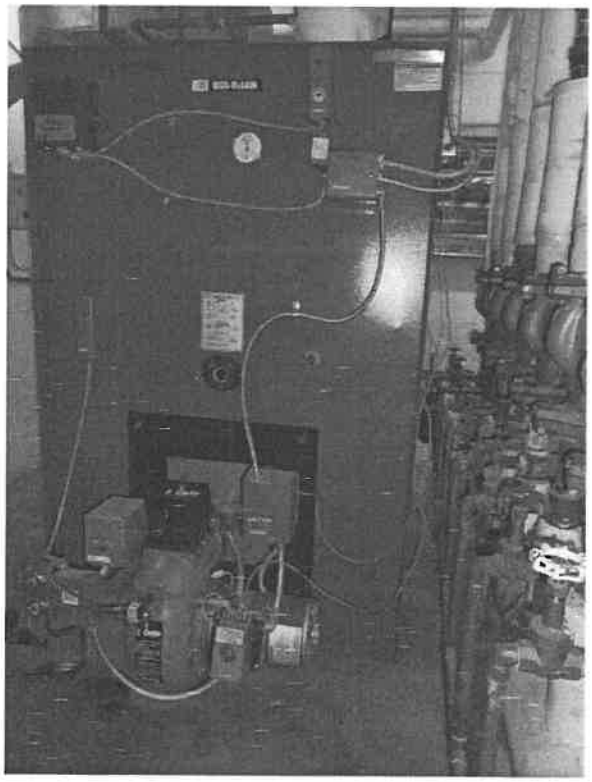

Figure 12: APA Existing Weil-McLain 688 Boiler

D. Distribution System

The Adirondack Park Agency building utilizes two air handling units to control the heating and cooling loads. The first of which, AHU-1, is used in conjunction with ACC-1 (air conditioning condensing unit), and variable air volume control boxes (VAV) 1-7. AHU-1 is used only for summer cooling loads, and the supply fan runs continuously. By contrast, the second air handling unit, AHU-2, with ACC-2, and variable air volume control boxes (VAV) 8-10 is utilized year round and also runs continuously.

E. Domestic Hot Water

Domestic hot water (DHW) for the facility is provided by one (1) PurePro indirect hot water heater installed in the boiler room. A second hot water heater in the boiler room, an AO Smith DRE-80 electric hot water heater, does not work and is to be replaced by a Rheem ELDS40 electric hot water heater. The indirect hot water heater is used during the winter months when the boiler is operational, the electric hot water heater is used the remainder of the year.

F. Pumping Systems

The hot water from the boiler is distributed through nine (9) constant volume hot water pumps. Eight (8) of the hot water pumps service the perimeter heating in the original building as well as the basement under the conference room. The ninth hot water pump services the garage and conference room VAVs.

PUMP SCHEDULE														
TAG	SERVICE	LOCATION	GPM	TOTAL HEAD (FT)	ELECTRIC CHARACTERISTICS					MOTOR CONTROLLER				REMARKS
					HP	RPM	VOLT	PHASE	CYCLE	TYPE	SIZE	POLES	ACCESSORIES	
HWP-1 THRU 7	EXISTING	BOILER ROOM	12.5	20.5	1/4	1750	120	1	60	A-1	0	1	ON-OFF SWITCH	HORIZONTAL IN-LINE
HWP-8	ADDITION BASEMENT	BOILER ROOM	12.5	20.5	1/4	1750	120	1	60	A-1	0	1	ON-OFF SWITCH	HORIZONTAL IN-LINE
HWP-9	GARAGE & CONFERENCE	BOILER ROOM	36	50	1 1/2	1750	120	1	60	A-1	0	1	ON-OFF SWITCH	HORIZONTAL IN-LINE

Table 19: APA Hot Water Pump Schedule

G. Cooling

Cooling for the building is provided by two (2) split direct expansion (DX) air-cooled condensing units located outside of the facility. The first unit (ACC-2) is a Trane Odyssey condensing unit, which is rated for 10 tons of cooling and is located near the south side of the building. The second unit (ACC-1) is a Trane condensing unit, which is rated for 25 tons of cooling and is located at the north end of the facility. When not in economizer mode, the compressors of the ACC's will cycle on and off to satisfy the cooling requirements of their corresponding AHU. The two (2) air condensing units appeared to be well maintained; no signs of rust, corrosion or fluid leakage were observed.

The facility has a small server room that is conditioned year round by a split direct expansion air cooled system. The Carrier system consists of a 30 MBH (2.5 tons) condensing unit and 1,000 CFM air handling unit.

H. Ventilation

The AHU's, heating and ventilation units, and exhaust fans were found to be in generally fair condition. The exhaust fans that serve the bathrooms in the original building are ventilated into the attic space, whereas the exhaust fans that serve the garage and elevator mechanical room ventilate directly to the exterior. If the attic insulation and ventilation are corrected, then the current scenario of ventilating the bathrooms in the original building into the attic space must be corrected by ducting the exhaust directly to the exterior of the building.

EXHAUST FAN SCHEDULE										
TAG	TYPE	CFM	TOTAL S.P.	RPM	ELECTRIC MOTOR				AREA SERVED	REMARKS
					HP	VOLT	PH	CYCLE		
EF-1	INLINE CABINET	200	0.3	1050	1/10	120	1	60	ADDITION BATHROOMS	WITH FACTORY MOUNTED SPEED CONTROLLER, DISCONNECT SWITCH AND LOOSE WALL CAP
EF-2	CEILING CABINET WITH GRILLE	250	0.3	1550	1/6	120	1	60	ELEV. MECH. RM.	WITH FACTORY MOUNTED SPEED CONTROLLER, DISCONNECT SWITCH AND LOOSE WALL CAP
EF-3	DIRECT DRIVE SQUARE INLINE	1400	0.3	1550	1/2	120	1	60	GARAGE	FACTORY MOUNTED DISCONNECT SWITCH WITH LOOSE SPEED CONTROLLER, LOOSE BACKDRAFT DAMPER AND RUBBER IN SHEAR VIBRATION ISOLATORS

Table 20: APA Exhaust Fan Schedule

I. Lighting

Interior lighting in the facility consists of primarily T8 fluorescent fixtures (electronically ballasted), and a small number of incandescent fixtures. Control for the interior lighting is comprised of a 32/68 mix of wall mounted occupancy sensor switches and manual wall switches. Exterior lighting is provided by metal halide and high pressure sodium fixtures, controlled by two photocells located on the back of the building.

J. Elevators

There is only one (1) elevator at the Adirondack Park Agency Building, which is located in the main lobby. The Otis elevator is operated using a 15 HP hydraulic pump motor, which is located in the elevator mechanical room in the basement of the facility.

IV. Recommended Energy Conservation Measures

ECM #1: Interior Lighting Upgrade

Existing Conditions

The primary technologies that are used throughout the interior of the facility are T8 fluorescent fixtures (88%) and incandescent fixtures (12%). Discussions with representatives of the facility revealed that there was an energy audit conducted at the facility in October 2006 through NYSERDA's Energy Audit Program, which resulted in the installation of T8 fluorescent lamps.

Recommendation

Based on the average 3-5 year lifespan of T8 fluorescent lamps, and the economic viability of converting to LED lamps, this measure proposes replacing the T8 fluorescent lamps with T8 LED retrofit kits. The recommendation is a 1:1 replacement of the existing T8 fluorescent lamps and ballasts with T8 LED retrofit kits that include an external driver. Advances in LED lighting technology have resulted in interior fixtures that not only yield reduced energy consumption and maintenance costs (due to the increased lifespan of the LED elements), but also improve general visibility which leads to a more comfortable and productive work place. Upgrading the interior lighting to higher efficiency fixtures has an associated fuel savings penalty because the reduction in fixture wattage corresponds to a reduction in energy output. Reduction in lighting energy output results in less thermal energy transferred to the space by the lights. This results in energy savings during the cooling season because the cooling equipment has less heat to remove from the space. Conversely, during the heating season, there is an energy penalty because the heating equipment has to compensate for the reduced thermal energy output of the more efficient lighting.

Constructability Issues: Moving office furniture and or equipment in order to access light fixtures.

Potentially Hazardous Materials: Fluorescent and HID lamps contain mercury and must be managed as hazardous waste in accordance with New York State Hazardous Waste Regulations or the Universal Waste Rule. Ballasts manufactured before 1979 contain PCB's, which the EPA regulates under the Toxic Substances and Control Act. Ballasts manufactured after 1979 do not contain PCB's, although they may contain lead solders, which are regulated by the Reduction of Hazardous Substances (RoHS) directive.

Applicable Codes: Illuminating Engineer Society (IES) Footcandle Recommendations.

Permits Required: No permit is required

Estimated Installed Cost:	$ 43,165
Estimated Disposal Cost:	$ 489
Estimated Annual Electric Savings:	17,319 kWh
Estimated Demand Reduction:	4.6 kW
Estimated Fuel Savings:	-3.3 MMBtu
Estimated Annual Cost Savings:	$ 1,660
Simple Payback:	32.7 years

ECM #2: LED Exterior Fixtures

Existing Conditions

The exterior lighting at the facility is comprised of nine (9) wall mounted fixtures, five (5) walkway fixtures, and four (4) poles with a total of six (6) fixtures serving the parking lot . The wall mounted fixtures are a mix of 70W high pressure sodium and 90W metal halide lamps. The walkway fixtures contain 70W metal halide lamps, and the parking lot poles contain 1000W metal halide lamps. Two (2) photocells on the back of the facility provide control for the exterior fixtures.

Recommendation

This measure recommends the installation of new 20W LED area light equivalents to replace the existing 70W high pressure sodium and 90W metal halide fixtures. Also recommended is the installation of new 240W LED area light equivalents to replace the existing 1000W metal halide parking lot fixtures. The above recommendations propose changing out only the fixture head on pole mounted fixtures, and replacing the wall mounted and walkway fixtures 1:1. Advances in LED lighting technology have resulted in exterior fixtures that not only yield reduced energy consumption and maintenance costs (due to the increased life span of the LED elements), but also improve general visibility, and produce less light pollution than existing technologies.

Constructability Issues: Moving parked vehicles in order to access the pole mounted parking lot fixtures.

Potentially Hazardous Materials: Fluorescent and HID lamps contain mercury and must be managed as hazardous waste in accordance with New York State Hazardous Waste Regulations or the Universal Waste Rule. Ballasts manufactured before 1979 contain PCB's, which the EPA regulates under the Toxic Substances and Control Act. Ballasts manufactured after 1979 do not contain PCB's, although they may contain lead solders, which are regulated by the Reduction of Hazardous Substances (RoHS) directive.

Applicable Codes: Illuminating Engineer Society (IES) Footcandle Recommendations.

Permits Required: There are no permits required.

Estimated Installed Cost:	$ 19,323
Estimated Annual Electric Savings:	27,213 kWh
Estimated Demand Reduction:	5.6 kW
Estimated Annual Cost Savings:	$ 2,290
Simple Payback:	8.9 years

ECM #3: BMS Upgrade and Retro-Commissioning

Existing Conditions

The building controls consists of a Johnson Metasys system that controls the boiler, hot water heating pumps, VAVs, cabinet and unit heaters, and the air handling units. The control sequences include but are not limited to heating hot water temperature reset based on outdoor air temperature, outdoor air economizer and cooling supply air temperature reset based on zone temperature averages. The facility staff indicated the existing sequences do not provide unoccupied temperature set back and the VAV boxes never modulate, the systems do not shutdown during unoccupied periods. Testing Adjusting and Balancing (TAB) reports of the systems were never provided to the facility staff.

Recommendation

The BMS should be upgraded with a new front end (computer and controls software), equipment controllers and VAV controls. The new system and HVAC systems should be

commissioned/retro-commissioned to ensure the systems are operating as intended and the controls provide all the functionality required to keep the system operating at peak efficiency. Retro-commissioning is a process that investigates how and why a building's systems are operated and maintained as they are, and then identifies ways to improve overall building performance. Since operational parameters in equipment settings naturally change over time, RCx is an effective efficiency strategy that saves energy while improving building performance. RCx relies on building and equipment documentation, along with functional testing and covers a range of technical depth. Retro-commissioning measures have been shown to save between 5% and 15% on building energy use and typically have short payback periods. The new BMS will enable scheduling of the system, optimal start/stop, and dry bulb economizer control functions.

Constructability Issues: There are no constructability issues.

Potentially Hazardous Materials: There are no potentially hazardous materials.

Applicable Codes: There are no applicable codes.

Permits Required: There are no permits required.

Estimated Installed Cost:	$ 209,364
Estimated Annual Electric Savings:	82,661 kWh
Estimated Fuel Savings:	102 MMBtu
Estimated Annual Cost Savings:	$ 8,682
Simple Payback:	24.1 years

ECM #4: Hot Water Pump Upgrade

Existing Conditions

The building has nine (9) hot water pumps (HWP) that distribute heat to eleven (11) zones throughout the facility. HWP-9 is a 1.5 HP Taco 1619 series hot water pump that distributes hot water to the 14 zones of the 2003 building addition. HWP-1 through HWP-8 are 1/3 HP each and operate at constant volume to provide heating hot water to the original sections of the building.

Recommendation

This measure involves replacing the existing pumps and installing a single pump with variable speed drive. The proposed system requires that two way control valves be installed on the perimeter heating loops and all three way valves be replaced with two way valves.

The existing boiler is being replaced with a propane gas fired condensing type and the pumping system is to be converted to a primary/secondary configuration. It is recommended that the new design consider using variable speed drives on the primary pumps if suitable for the design and minimum flow through the boilers is maintained during part load conditions.

Constructability Issues: There are no constructability issues.

Potentially Hazardous Materials: There are no potentially hazardous materials.

Applicable Codes: There are no applicable codes.

Permits Required: There are no permits required.

Estimated Installed Cost:	$ 24,716
Estimated Annual Electric Savings:	8,223 kWh
Estimated Demand Reduction:	0.9 kW
Estimated Annual Cost Savings:	$ 648
Simple Payback:	38.2 years

ECM #5: Building Envelope Upgrades 1

Existing Conditions

The facility is comprised primarily of double-pane windows with crank operation, with varying degrees of insulation and sealing conditions. The entrance and exit doors at the facility are primarily made of steel, and there is a mix of doors that feature window panes. Weather stripping on several of the doors throughout the facility, including the garage doors, is degraded or in poor condition. The exterior doors themselves are poorly insulated and in need of replacement in order to reduce the rate of infiltration at the facility. Chinking between the logs in the original portion of the facility is degraded in some areas, and several of the logs themselves have cracks. The windows in the cellar of the original building are a source of air infiltration, and the facility staff indicated the space between the window frames and building

opening are not insulated or air sealed. Insulation in the attic space is comprised of R-19 insulation batts that cover the floor non-uniformly.

Recommendation

This measure proposes installing additional insulation, air sealing, and weather stripping and replacement of the steel exterior doors. The proposed insulation includes installing exterior sheathing, vapor wrap, 2 inches of insulated exterior sheathing and wood siding to match the existing exterior siding. Spray foam is recommended to insulate the underside of the original building roof and should include the 2003 front addition roof. The upgrade consists of installing rafter vents, ridge vents, closing off the gable vents and installing 5-1/2 inches of spray foam insulation. Rafter vents and ridge vents are necessary in the roof assembly to provide sufficient ventilation such that moisture buildup is prevented on the underside of the roof sheathing. The damaged weather stripping on the window frames is to be replaced. Six (6) steel exterior doors are to be replaced with new doors that have better insulation and low emissivity glazing where applicable. Upgrades to the building envelope to increase thermal retention and eliminate air leaks would reduce the heating and cooling loads at the facility as well as alleviate comfort issues associated with thermal disparities within the building.

There is a small cooling energy penalty associated with this measure. During the cooling season when the outdoor air temperature is below the interior temperature the increased insulation will retain more of the internal heat gains from the lighting, equipment and occupants resulting in slighting higher mechanical cooling energy use.

Constructability Issues: The historical status of the facility should be verified with the state historic preservation office (SHPO) to see if covering the exterior of the log building is feasible.

Potentially Hazardous Materials: Many buildings contain asbestos that is used for thermal insulation, however during the site visit there was no asbestos observed or discussed.

Applicable Codes: NYS ECC Wall and Roof Insulation Codes

Permits Required: Permits are required

Estimated Installed Cost:	$ 147,828
Estimated Annual Electric Savings:	-18 kWh
Estimated Demand Reduction:	-0.5 kW
Estimated Fuel Savings:	185 MMBtu

Estimated Annual Cost Savings: $ 4,111

Simple Payback: 36.0 years

ECM #6: Building Envelope Upgrades 2

Existing Conditions

The below grade walls of the original building are not insulated resulting in the basement being cool year round.

Recommendation

This measure proposes installing insulation in the cellar. The proposed upgrade includes installing a 2x4 framed wall along the interior of the exterior basement concrete masonry unit (CMU) walls of the original building with two inches of spray foam insulation and gypsum wall board (GWB) finish.

There is a small cooling energy penalty associated with this measure. During the cooling season when the below grade ground temperature is below the interior temperature the increased insulation will retain more of the internal heat gains from the lighting, equipment and occupants resulting in slighting higher mechanical cooling energy use.

Constructability Issues: Perimeter office equipment will have to be moved, and perimeter outlets will have to be removed and reinstalled, and baseboard heaters will have to be removed and reinstalled.

Potentially Hazardous Materials: Many buildings contain asbestos that is used for thermal insulation, however during the site visit there was no asbestos observed or discussed.

Applicable Codes: NYS ECC Wall Insulation Codes

Permits Required: Permits are required

Estimated Installed Cost: $ 35,220

Estimated Annual Electric Savings: -2,353 kWh

Estimated Demand Reduction: 0.0 kW

Estimated Fuel Savings: 153 MMBtu

Estimated Annual Cost Savings: $ 3,216

Simple Payback: 11.0 years

ECM #7: Vending Machine Controls

Existing Conditions

There are two (2) vending machines at the facility, of which one is a snack machine and the other is a cold beverage machine. Both run continuously.

Recommendation

This measure investigates the installation of a control system for the vending machines on site. The control system uses occupancy sensors to reduce the hours of operation of the lighting equipment within the vending machines. Additionally, the occupancy based controls reduce the load on the refrigerated vending machine while the facility is unoccupied.

Constructability Issues: There are no constructability issues.

Potentially Hazardous Materials: There are no potentially hazardous materials.

Applicable Codes: There are no applicable codes.

Permits Required: There are no permits required.

Estimated Installed Cost: $ 1,213

Estimated Annual Electric Savings: 1,116 kWh

Estimated Annual Cost Savings: $ 87

Simple Payback: 14.0 years

V. Energy Conservation Measures Investigated but Not Recommended

ECM #8: Interior Lighting Control Upgrades

Existing Conditions

The existing controls for the interior fluorescent T8 lighting is comprised of a 32/68 mix of wall mounted occupancy sensor switches and manual wall switches.

ECM Investigated

This measure investigates installing wall mounted occupancy sensors in the spaces in which lighting is currently operated manually. Each space would be surveyed to identify a location near the door to mount this sensor such that it has an optimal view of the entire space. The occupancy sensor operates by use of an infrared and/or ultrasonic sensor that monitors the room for movement. When the occupant enters the room, the sensors will detect motion and activate the connected lights. The sensor continuously monitors the room for movement. If no movement is detected for a preset amount of time, the lights in the office will deactivate. Occupancy sensors work well in office settings because they provide a fail-safe to deactivate the lights if the user forgets to when leaving the office. The cost estimate for this measure accounts for the removal of the existing manual controls and installation of new passive infrared (PIR) wall-mounted occupancy sensors. This measure was not recommended because the Savings-to-Investment Ratio (SIR) was calculated to be 0.61, which is significantly less than the 1.0 SIR threshold for recommended measures.

Estimated Installed Cost:	$25,351
Estimated Annual Electric Savings:	10,674 kWh
Estimated Demand Reduction:	3.2 kW
Estimated Annual Fuel Savings:	-4 MMBtu
Estimated Annual Cost Savings:	$771
Simple Payback:	32.9 years

ECM #9: Condensing Unit Upgrades

Existing Conditions

The facility utilizes two (2) two-stage scroll compressor air-cooled condensing units to provide cooling to the building. The first of which, ACC-1, corresponds to AHU-1 and VAV's 1-7 and provides 25 tons of cooling during the summer months only. The second air cooled condensing unit, ACC-2, corresponds to AHU-2 and VAV's 8-11 and provides 10 tons of cooling year round.

The data center at the facility is cooled with a portable air conditioning unit, with the exhaust heat expelled to a separate part of the building. The data center contains both air supply and return ventilation that is provided by AHU-2. There is a local thermostat in the data center.

ECM Investigated

This measure investigates upgrading the air cooled condensing units with higher efficiency units. Another benefit to upgrading the condensing units is that both ACC-1 and ACC-2 currently operate using R-22 refrigerant, which the U.S. is currently phasing out in accordance with the Montreal Protocol. The investigated condensing units both operate using environmentally friendly R-410A refrigerant. This measure was not recommended because the Savings-to-Investment Ratio (SIR) was calculated to be 0.16, which is significantly less than the 1.0 SIR threshold for recommended measures.

Estimated Installed Cost:	$37,477
Estimated Annual Electric Savings:	4,212 kWh
Estimated Demand Reduction:	2.5 kW
Estimated Annual Cost Savings:	$ 327
Simple Payback:	114.7 years

ECM #10: Data Center Cooling

Existing Conditions

The server room equipment has a total IT demand load of 5.9 kW that constantly expels heat into the room. The cooling load is dependent on the use of the servers and varies throughout the day. The equipment is cooled by a 2.5 ton split direct expansion air conditioning unit that operates year round.

ECM Investigated

This measure investigates installing a dry cooler and blower coil to cool the server room during the winter months. The investigated system consists of a dry cooler located outside the building with piping connecting the dry cooler to the blower coil. A 45% glycol solution will be circulated between the dry cooler and blower coil by a small inline pump. Once the outdoor air temperature drops below 40 °F the existing DX system will shut down and the dry cooler would operate. Using outdoor air to cool the server room during the winter months was also

considered but not investigated due to the proximity to an above grade exterior wall and concerns of server reliability as the outdoor air relative humidity is not in the equipment's operating range. This measure was not recommended because the Savings-to-Investment Ratio (SIR) was calculated to be 0.05, which is significantly less than the 1.0 SIR threshold for recommended measures.

Estimated Installed Cost:	$21,994
Estimated Annual Electric Savings:	770 kWh
Estimated Annual Cost Savings:	$ 60
Simple Payback:	368.0 years

ECM #11: Photovoltaic System

Existing Conditions

There is no existing photovoltaic system at the site.

ECM Investigated

This measure investigates the installation of a photovoltaic system at the site. A PV Watts simulation recommended a PV system size of 89.9 kW to cover a large area of the facility's roof. PV Watts generated estimated annual kWh savings based on the location of the facility and annual solar radiation. This measure was not recommended because the Savings-to-Investment Ratio (SIR) was calculated to be 0.48, which is significantly less than the 1.0 SIR threshold for recommended measures.

Estimated Installed Cost:	$343,112
Estimated Annual Electric Savings:	105,227 kWh
Estimated Demand Reduction:	0 kW
Estimated Annual Cost Savings:	$ 8,165
Simple Payback:	42.0 years

ECM #12: Appliance Upgrades

Existing Conditions

On site observations revealed that the majority of the appliances on site are energy efficient. Among the appliances observed were microwaves, coffee makers, refrigerators, toasters, etc. Several small, single-office-use-only box refrigerators were found throughout the facility, as well as larger refrigerators located in the break rooms.

ECM Investigated

This measure investigates removing the small box refrigerators throughout the facility and making the large refrigerators in the break rooms the primary means of cold food storage. Small box refrigerators are typically less efficient than full sized refrigerators. Additionally, a full refrigerator retains cold more efficiently than an empty one. The differences in energy efficiency between small and large refrigerators, and the increased energy efficiency associated with keeping a large refrigerator stocked with food, both contribute to the recommendation that the cold food storage throughout the facility be consolidated to the large refrigerators on site.

Estimated Installed Cost:	$1,928
Estimated Annual Electric Savings:	525 kWh
Estimated Demand Reduction:	0 kW
Estimated Annual Cost Savings:	$ 41
Simple Payback:	47.3 years

ECM #13: Water Conservation

Existing Conditions

There are several sinks, toilets, and showers throughout the facility that were observed to have low flow operation. Typical urinals at the site were observed to operate at 0.5 gallons per flush, and typical sinks at the site were observed to operate at 0.5 gallons per minute. Additionally, the water closet contained a fixture that operated at 1.1 gallons per flush.

ECM Investigated

Based on the existing low flow water technology observed at the site, there are no water conservation measures identified

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ECM #14: Piping / Ducting Insulation

Existing Conditions

The existing piping and ducting insulation at the facility was overall in good condition. A small section of the ducting in the attic space was uninsulated because the sticky tape holding the insulation in place has deteriorated over time.

ECM Investigated

This measure investigates that the insulation hanging from the ducting be reattached and vapor proofed.

ECM #15: Computer Power Management

Existing Conditions

Discussions with facility representatives revealed that the computers throughout the facility are shut down over night, and the monitors enter sleep mode after a specified time duration.

ECM Investigated

The existing conditions of the computer power management are energy efficient and thus there is not an opportunity for significant energy savings by upgrading or modifying the computer power management system or schedule.

VI. Description of Equipment

System	Sub-System	Description	Age of Equipment (years)	Service Life Estimates* (years)	Physical Condition
Building Envelope	Windows	Crank Operated double pane windows	Varies	Windows: 20** Window Film: 10**	Fair
	Exterior Doors	Lobby entrance door: Steel with Glazing Other exterior doors: Hollow Metal Doors	Varies	Exterior Weather Stripping: 5-8****	Fair
	Roof	Built Up Roofing	10	Roof: 15-30****	Fair
	Façade	Log, Log siding	Original, 2003	Opaque Shell Insulation: 30**	Fair
HVAC	Boiler Room	Plant Components Number of Boilers: 1 Boiler Type: Hot water oil fired boiler Plant Component Technical Data Boiler Gross Output (MBH): 1.358 Primary Fuel: Fuel Oil #2	Varies	Boiler Plant Boiler: 25 Burner: 21 Electric Motor: 18 Motor Starter: 17 Base Mounted Pump: 20 Inline Pump: 15	Fair

System	Sub-System	Description	Age of Equipment (years)	Service Life Estimates* (years)	Physical Condition
HVAC	Control Sequences	The boiler provides hot water to the constant volume hot water pumps, cabinet and unit heaters, reheat coils and perimeter heating Boiler OA High Setpoint: 60°F Boiler OA Low Setpoint: 0°F Boiler Supply Low Temperature: 140°F Boiler Supply Low Temperature: 170°F HWP-1 through HWP-8: Operates when the zone thermostat calls for heat HWP-9: Operates when the boiler is ON during the heating season Cabinet and Unit Heaters: Operate and change 3-way valve from bypass to full coil whenever the zone thermostat calls for heat.	Varies	<u>Controls</u> Pneumatic: 20 Electronic: 15 <u>Perimeter Heating System</u> Hydronic Baseboard: 50 Cast Iron Radiators: 50+	Fair
	BMS / BAS	Johnson Metasys System Majority of systems are connected to BMS	N/A	N/A	N/A
	Air-side Distribution Systems (<5,000 CFM)	ACC-1 ACC-2	Varies	Fan: 25 Ductwork: 30 Damper: 20 Low Leakage Damper: 9*** Diffusers, Grilles & Registers: 27 Electric Motor: 15** Motor Starter: 17 Duct Insulation & Sealants:18**	Fair
	Air-side Distribution Systems (>5,000 CFM)	None	N/A		N/A

System	Sub-System	Description	Age of Equipment (years)	Service Life Estimates* (years)	Physical Condition
HVAC	Hydronic/Steam Distribution Systems	Hot water fin tube radiators, unit heaters, reheat coils	Varies	Hot water radiator: 25	Fair
	Pipe Insulation	Fiberglass insulation was observed.	Varies	Insulation: 20	Fair
Domestic Hot Water System (DHW)		PurePro Indirect Hot Water Heater (heating season) Rheem ELDS40 (remainder of year) Number of Circulation Pumps: 1 Circulation pump size (hp): 1/4	New	Furnace: 18 Shell and Tube Heat Exchanger: 24 Pipe Mounted Pump: 10 Aquastat (Electronic Controls): 15 Coils: 20	Fair
Electrical & Lighting Systems	Fixtures	Mix of T8, CFL and incandescent fixtures	Varies	Ballasts: 12*** Fixtures (Fluorescent/HID): 20** Fixtures (CFLs): 9,000 hours or 5 years** Fixtures (LED): 50,000+ hours	Fair
	Sensors	Occupancy / photocell	Varies	Occupancy sensors: 20**	Fair

System	Sub-System	Description	Age of Equipment (years)	Service Life Estimates* (years)	Physical Condition
Plug Loads	Appliances	(2) Portable Air Conditioners (5) Refrigerators (3) Microwave Ovens (2) Coffee Makers (1) Hot Water Pot (1) Toaster Oven (8) Personal Space Heaters	N/A	N/A	N/A
	Computers	(66) Desktop Computers (121) Computer Monitors (1) Laptop (13) Copy Machines (1) Fax Machine (1) Desktop Printer (3) Flatscreen Televisions	N/A	N/A	N/A
Conveyance System	Elevators	1 passenger elevator, hydraulic	N/A	Elevator Cab: 20**** Elevator Controller: 20****	Fair

Service life estimates can vary greatly and is dependent on climate type, installation, quality of material and usage.

* Unless otherwise indicated, all service life estimates are from 2011 ASHRAE Handbook – HVAC Applications

**Service life estimates are from the Washington State Department of Enterprise Services – Energy Conservation Measure/Equipment Median Service Life (years)

*** Service life estimates are from the International Association of Certified Home Inspectors (http://www.nachi.org/life-expectancy.htm)

****NYC Department of Consumer Affairs – 2011 Architectural Manual Expected Useful Life Table.

VII. Energy Model Summary

A. Overview

EME Group completed an evaluation of potential energy conservation measures for the Adirondack Park Agency Building located in Ray Brook, NY. Analysis was performed to determine the energy and cost savings associated with the implementation of these measures when compared to the existing building.

B. Baseline Model

The model of the existing building that served as a baseline for the evaluation of the potential energy conservation measures was prepared utilizing existing building information (e.g. as-built drawings, equipment schedules, etc.), walkthrough surveys of the mechanical rooms, walkthrough surveys of all occupied building spaces to quantify lighting and controls, building management system data, and available utility bills from the last two calendar years. The output of this existing building energy model was tuned to match the 2014 utility bills provided in consumption, demand (where applicable), and cost.

C. Proposed Model

The model of the proposed building incorporates all the potential ECMs and is created by beginning with the baseline model, and changing those inputs associated with each particular ECM. This produces a whole building model that accounts both for the impact of the individual ECMs, as well as their impact on each other (interactive effects). The savings associated with each individual ECM is then determined by defining parametric runs in which all inputs associated with that measure are reset to their baseline values, while the rest of the model remains unchanged.

D. Parameter Comparison

A side-by-side listing of the key building characteristics that were varied between the baseline and proposed model are included below for reference.

ECM #1 – Interior Lighting Upgrade

Parameter	Baseline Building	Proposed Building
Lighting Type	Fluorescent T8	T8 LED
Additional Comments:	This measure modeled the replacement of existing fluorescent T8 fixtures with more energy efficiency LED T8 fixtures. Demand and consumption reductions based on NYPA Energy Savings Handbook.	

ECM #2 – LED Exterior Fixtures

Parameter	Baseline Building	Proposed Building
Lighting Type	High Intensity Discharge	LED
Additional Comments:	This measure modeled the replacement of HID exterior fixtures with more energy efficient LED exterior fixtures. Demand and consumption reductions based on NYPA Energy Savings Handbook.	

ECM #3 – BMS Upgrade and Retro-Commissioning

Parameter	Baseline Building	Proposed Building
BMS Operation	Not Operating as Intended	Operating as Intended
Additional Comments:	This measure modeled the energy savings as a result of installing a new BMS and tuning it to enable scheduling of the system, optimal start/stop, and dry bulb economizer control functions. Electric and fuel consumption reductions are based on bin hour models for the site.	

ECM #4 – Hot Water Pump Upgrades

Parameter	Baseline Building	Proposed Building
Pump Operation	Constant volume	VFD
Additional Comments:	This measure modeled the reconfiguration of the existing piping system to a primary/secondary pumping system. This measure also modeled the effects of using a Variable Forward Drive (VFD) in order to reduce energy consumption. Demand and consumption reductions based on NYPA Energy Savings Handbook.	

ECM #5 – Building Envelope Upgrades

Parameter	Baseline Building	Proposed Building
Infiltration	Leaky Infiltration	Tight Infiltration
Additional Comments:	This measure modeled the installation of new exterior doors, weather stripping and spray foam insulation to reduce the heat loss and infiltration rates. Electric and fuel consumption reductions are based on bin hour models for the site.	

ECM #6 – Vending Controls

Parameter	Baseline Building	Proposed Building
Control Type	No Control	Refrigeration & Lighting Control
Additional Comments:	This measure modeled the installation of new occupancy based lighting controls as well as auto-on refrigeration controls for the vending machines. Energy consumption reduction is a result of decreasing the hours of operation of the lighting and refrigeration	

	equipment within the vending machines.

VIII. Energy Calculations

A. Interior & Exterior Lighting Upgrades

Adirondack Park Agency Existing Interior Lighting Inventory						Adirondack Park Agency Proposed Interior Lighting Inventory					
Type	Code	# Fixtures	# Lamps / Fixture	Fixture Wattage	Total Wattage	Type	Code	# Fixtures	# Lamps / Fixture	Fixture Wattage	Total Wattage
4' T8	1F32	56	1	31	1,736	T8 LED	1LEDT8	56	1	19	1,064
4' T8	2F32	156	2	59	9,204	T8 LED	2LEDT8	156	2	38	5,928
4' T8	3F32	24	3	89	2,136	T8 LED	3LEDT8	24	3	58	1,392
4' T8	4F32	12	4	112	1,344	T8 LED	4LEDT8	12	4	76	912
INC	I/18	1	1	18	18	N/A	I/18	1	1	18	18
INC	I/40	1	1	40	40	N/A	I/40	1	1	40	40
INC	I/52	2	1	52	104	N/A	I/52	2	1	52	104
INC	I/60	10	1	60	600	N/A	I/60	10	1	60	600
INC	I/2/60	4	2	120	480	N/A	I/2/60	4	2	120	480
INC	I/100	3	1	100	300	N/A	I/100	3	1	100	300
Total		**269**			**15,962**	**Total**		**269**			**10,838**

Table 21: Interior Lighting Inventory, Existing and Proposed

Adirondack Park Agency Existing Exterior Lighting Inventory						Adirondack Park Agency Proposed Exterior Lighting Inventory					
Type	Code	# Fixtures	# Lamps / Fixture	Fixture Wattage	Total Wattage	Type	Code	# Fixtures	# Lamps / Fixture	Fixture Wattage	Total Wattage
CFL	CF23	1	4	92	92	CFL	CF23	1	4	92	92
HPS	HPS/70	3	1	95	285	LED	LED20	3	1	20	60
MH	MH/100	10	1	128	1,280	LED	LED20	10	1	20	200
MH	MH/1000	6	1	1080	6,480	LED	LED240	6	1	240	1,440
Total		**20**			**8,137**	**Total**		**20**			**1,792**

Table 22: Exterior Lighting Inventory, Existing and Proposed

Energy Calculations																		
Existing				Proposed				Information Given			Calculations							
Code	$FixWatts_{existing}$	$FixNum_{existing}$	$LLoad_{existing}$	Code	$FixWatts_{new}$	$FixNum_{new}$	$LLoad_{new}$	AOH	PCF	$Rate_{energy}$	Annual kWh Savings	ΔkW_s	ΔkWh	$\Delta MMBTU$	Totalized Monthly kW Reduction	kW Reduction
1F32	31	56	1.74	1LEDT8	19	56	1.06	3380	0.9	0.077596587	2271	0.13	227.14	-0.43	7.3	0.6
2F32	59	156	9.20	2LEDT8	38	156	5.93	3380	0.9	0.077596587	11073	0.66	1107.29	-2.10	35.4	2.9
3F32	89	24	2.14	3LEDT8	58	24	1.39	3380	0.9	0.077596587	2515	0.15	251.47	-0.48	8.0	0.7
4F32	112	12	1.34	4LEDT8	76	12	0.91	3380	0.9	0.077596587	1460	0.09	146.02	-0.28	4.7	0.4
I/18	18	1	0.02	I/18	18	1	0.02	338	0.9	0.077596587	0				0.0	0.0
I/40	40	1	0.04	I/40	40	1	0.04	338	0.9	0.077596587	0				0.0	0.0
I/52	52	2	0.10	I/52	52	2	0.10	338	0.9	0.077596587	0				0.0	0.0
I/60	60	10	0.60	I/60	60	10	0.60	338	0.9	0.077596587	0				0.0	0.0
I/2/60	120	4	0.48	I/2/60	120	4	0.48	338	0.9	0.077596587	0				0.0	0.0
I/100	100	3	0.30	I/100	100	3	0.30	338	0.9	0.077596587	0				0.0	0.0
	Total	269	15.96			269	10.84				17319			-3.3	55.3	4.6

Energy Calculations																
Existing				Proposed				Information Given			Calculations					
Code	$FixWatts_{existing}$	$FixNum_{existing}$	$LLoad_{existing}$	Code	$FixWatts_{new}$	$FixNum_{new}$	Lloadnew	AOH	PCF	$Rate_{energy}$	Annual kWh Savings	ΔkW_s	ΔkWh	$\Delta MMBTU$	Annual kW Reduction	Monthly kW Reduction
CF23	92	1	0.09		92	1	0.09	4380	0.9	0.077596587	0				0.0	0.0
HPS/70	95	7	0.67		20	7	0.14	4380	0.9	0.077596587	2300				5.7	0.5
MH/100	128	6	0.77		20	6	0.12	4380	0.9	0.077596587	2838				7.0	0.6
MH/1000	1080	6	6.48		240	6	1.44	4380	0.9	0.077596587	22075				54.4	4.5
	Total	20	8.01			20	1.79				27213				67.1	5.6

Table 23: Interior & Exterior Lighting Efficiency Calculations

Install LED T8 Retrofit Kits

Qty	Assembly Number	Description	Unit	Mat.	Inst.	Total
56	Vendor Quote	1 LED T8 lamp, 19W total, 4100K, 1 non-dimmable driver, 2 non-shunted lamp holders	Ea.	$ 2,914.80	$ 1,232.00	$ 4,711.54
156	Vendor Quote	2 LED T8 lamps, 38W total, 4100K, 1 non-dimmable driver, 4 non-shunted lamp holders	Ea.	$ 12,061.92	$ 3,432.00	$ 17,603.99
24	Vendor Quote	3 LED T8 lamps, 58W total, 4100K, 1 non-dimmable driver, 6 non-shunted lamp holders	Ea.	$ 3,039.12	$ 552.00	$ 4,062.58
12	Vendor Quote	4 LED T8 lamps, 78W total, 4100K, 1 non-dimmable driver, 8 non-shunted lamp holders	Ea.	$ 1,760.04	$ 306.00	$ 2,317.24
						$ 28,695.34

Install LED Exterior Fixtures

Qty	Assembly Number	Description	Unit	Mat.	Inst.	Total
13	Vendor Quote	20W LED Wallpack, 5000K	Ea.	$ 2,548.00	$ 598.00	$ 3,620.72
6	Vendor Quote	240W LED Parking Lot Shoebox Fixture, 5000K	Ea.	$ 6,498.00	$ 1,368.00	$ 9,062.21
						$ 12,682.93

Table 24: Interior & Exterior Lighting Efficiency Material & Labor Costs

Existing O/M Calculations								Proposed O/M Calculations						O/M Savings
Existing Lamp Life (Hours)	Existing Lamp Cost Per Fixture	Existing Ballast Cost Per Fixture	Bi-Pin Cost Per Fixture	Existing Labor Cost Per Fixture	Measure Life (years)	# Lamp Replacements Per Measure Life	O/M Cost Per Measure Life	Proposed Lamp Life (Hours)	Proposed Lamp Cost Per Fixture	Proposed Labor Cost Per Fixture	Measure Life (years)	# Lamp Replacements Per Measure Life	O/M Cost Per Measure Life	
20000	2	12	2	22	20	3.38	$ 7,193	60000	52.05	22	20	1.13	$ 4,672	
20000	4	12	4	22	20	3.38	$ 22,146	60000	77.32	22	20	1.13	$ 17,456	
20000	6	12	6	23	20	3.38	$ 3,813	60000	126.63	23	20	1.13	$ 4,046	
20000	8	12	8	25.5	20	3.38	$ 2,170	60000	146.67	25.5	20	1.13	$ 2,328	
							$ 35,321						$ 28,502	$ 340.94

Existing O/M Calculations								Proposed O/M Calculations						O/M Savings
Existing Lamp Life (Hours)	Existing Lamp Cost Per Fixture	Existing Ballast Cost Per Fixture	Bi-Pin Cost Per Fixture	Existing Labor Cost Per Fixture	Measure Life (years)	# Lamp Replacements Per Measure Life	O/M Cost Per Measure Life	Proposed Lamp Life (Hours)	Proposed Cost Per Fixture	Proposed Labor Cost Per Fixture	Measure Life (years)	# Lamp Replacements Per Measure Life	O/M Cost Per Measure Life	
25000	20	30	0	46	20	3.50	$ 2,355	100000	196	46	20	0.88	$ 1,484	
15000	20	0	0	46	20	5.84	$ 2,313	100000	196	46	20	0.88	$ 1,272	
18000	25	0	0	228	20	4.87	$ 7,388	100000	1083	228	20	0.88	$ 6,891	
							$ 12,055						$ 9,647	$ 120.42

Table 25: Interior & Exterior Lighting Efficiency Operations & Maintenance Costs

Lighting Efficiency Calculations

Inputs

Code	Individual fixture code to identify lamp type, count, and wattage
FixWatts	Individual fixture wattages from existing facility inventory and proposed facility inventory
FixNum	Number of fixtures from existing facility inventory and proposed facility inventory
AOH	Annual Operation Hours : 6am-7pm M-F = 13 hours/day * 5 days/week * 52 weeks/year = 3380 hours/year
PCF	Participant Coincidence Factor. Source: NYPA Energy Savings Handbook Version 0 Table 4-4
$Rate_{energy}$	Derived from facility's electric utility data

Outputs

Lload (kW)	=	FixWatts	X	FixNum	/	1000 W/kW		
Annual kWh Savings	=	$LLoad_{existing}$	-	$LLoad_{new}$	X	AOH		
Annual mmBTU Savings	=	Annual kWh Savings	X	-0.003412142		mmBTU/kWh		
Annual kW Reduction	=	$LLoad_{existing}$	-	$LLoad_{new}$	X	PCF	X	12 months/year
Monthly kW Reduction	=	Annual kW Reduction	/	12 months/year				
Annual Cost Savings	=	Annual kWh Savings	X	Energy Rate				

Sample Calculation

Existing Code	=	1F32								
$FixWatts_{existing}$	=	31								
$FixNum_{existing}$	=	56								
$LLoad_{existing}$	=	31W / fixture	X	56 fixtures	/	1000 W/kW	=	1.736kW		
Proposed Code	=	1LEDT8								
$FixWatts_{new}$	=	19								
$FixNum_{new}$	=	56								
$LLoad_{new}$	=	19W / fixture	X	56 fixtures	/	1000 W/kW	=	1.064kW		
Annual kWh Savings	=	1.736kW	-	1.064kW	X	3380 hrs/yr	=	2271.4kWh		
Annual mmBTU Savings	=	2271.4kWh	X	-0.003412142		mmBTU/kWh	=	-7.75mmBTU		
Annual kW Reduction	=	1.736kW	-	1.064kW	X	0.9	X	12 months/year	=	7.25kW
Monthly kW Reduction	=	7.25kW	/	12 months/year	=	0.605kW				

Table 26: Lighting Efficiency Assumptions and Sample Calculation

The following calculations were derived from the NYS TechSmart manual and use the existing and proposed lighting data to calculate the interactive effects of lighting efficiency / controls on heating and cooling energy.

Inputs	*Description*	*Value*
$HVAC_{d,s}$	HVAC system interaction factor at utility summer peak hour	0.2
$HVAC_c$	HVAC system interaction factor for annual energy consumption	0.1
$HVAC_g$	HVAC system interaction factor for gas	-0.019
FLH	full-load operating hours	3380
$FixNum_{existing}$	existing quantity of fixtures	varies
$FixWatt_{existing}$	existing wattage of fixtures	varies
$FixNum_{proposed}$	proposed quantity of fixtures	varies
$FixWatt_{proposed}$	proposed wattage of fixtures	varies
CF	coincidence factor	1
Outputs	***Description***	***Value***
ΔkW_s	gross summer coincident demand savings	varies
ΔkWh	gross annual energy savings	varies
$\Delta therm$	gas impacts from heating interactions	varies
$\Delta MMBtu$	$\Delta therm$ X 0.1	varies

Table 27: Lighting Efficiency & Controls Interactive Effects Inputs

Sample Calculations

Outputs

ΔkW_s = [(FixWatt$_{existing}$ X FixNum$_{existing}$) - (FixWatt$_{proposed}$ X FixNum$_{proposed}$)] / 1000 X CF X HVAC$_{d,s}$

ΔkWh = [(FixWatt$_{existing}$ X FixNum$_{existing}$) - (FixWatt$_{proposed}$ X FixNum$_{proposed}$)] / 1000 X FLH X HVAC$_c$

$\Delta therm$ = ΔkWh X HVAC$_g$

Lighting Efficiency

ΔkW_s	=	[(31	X	56)	-	(19	X	56)]	/	1000	X	1	X	0.2	=	0.134
ΔkWh	=	[(31	X	56)	-	(19	X	56)]	/	1000	X	3380	X	0.1	=	227.136
$\Delta therm$	=	227.136	X	-0.019	=	-4.32										
$\Delta MMBtu$	=	-0.432														

Lighting Controls

ΔkW_s	=	[(31	X	21)	-	((21.7	X	21)]	/	1000	X	1	X	0.2	=	0.039
ΔkWh	=	[(31	X	21)	-	((21.7	X	21)]	/	1000	X	3380	X	0.1	=	132.023
$\Delta therm$	=	132.023	X	-0.019	=	-2.508										
$\Delta MMBtu$	=	-0.2508437														

Table 28: Interior Lighting Efficiency & Controls Interactive Effects Sample Calculations

B. BMS Upgrades and Retro-Commissioning

Assumptions			
Input	***Description***	***Value***	***Units***
$\eta_{cooling}$	Efficiency of the cooling equipment	12.1	EER
$\eta_{heating}$	Efficiency of the heating equipment	78	%
$Rate_{Infiltration}$	Average rate of infiltration	770	CFM
$Rate_{ventilation}$	Average rate of ventilation	723	CFM
OccNum	Average number of occupants	50	Occupants
OccHeatGain	Average heat output per person	450	BTU / hr / Occ
LLoad	Total load contributed by lighting	13.6	kW
PLoad	Total load contributed by plug loads	8.2	kW
SHG	Average solar heat gain through windows	42.7	BTU / hr
Cooling Shutdown Temperature		55	°F
$GroundTemp_{avg}$	Average below grade ground temperature	32	°F
Existing Occupied Cooling Setpoint	Enthalpy = 28.9 BTU / lb	73	°F
Existing Unoccupied Cooling Setpoint	Enthalpy = 28.9 BTU / lb	73	°F
Existing Occupied Heating Setpoint		72	°F
Existing Unoccupied Heating Setpoint		72	°F
Proposed Occupied Cooling Setpoint	Enthalpy = 28.9 BTU / lb	73	°F
Proposed Unoccupied Cooling Setpoint	Enthalpy = 28.9 BTU / lb	85	°F
Proposed Occupied Heating Setpoint		72	°F
Proposed Unoccupied Heating Setpoint		65	°F
R Value	Thermal resistance of building components	varies	(sqft)(°F)(hr) / BTU
U Factor	Inverse of R Value		BTU / (sqft)(°F)(hr)
UA	Product of U Factor and building component area		BTU / (°F)(hr)

Table 29: BMS Upgrades and Retro-Commissioning Inputs and Assumptions

Building Envelope Calculations				
Envelope	Area (sq. ft.)	R Value	U Factor	UA
Wall A	1,352	17.10	0.058	79
Wall B	5,606	19.65	0.051	285
Wall C	1,601	13.35	0.075	120
Wall D	5,650	9.09	0.110	622
Roof	14,695	37.00	0.027	397
Windows	1,423	2.22	0.450	640

Table 30: BMS Upgrades and Retro-Commissioning Inputs and Assumptions

Output

Envelope Load (MBH)	=	ΣUA $_{w/o\ Wall\ D}$	X	(Bin Temp (°F)	-	IF(Bin Temp (°F)	>	Cooling Shutdown Temp (°F)	THEN	Occupied Cooling Setpoint	ELSE	Occupied Heating Setpoint)]	/	1000	-	UA $_{Wall\ D}$	X	(Occupied Heating Setpoint	-	Unoccupied Heating Setpoint)	/	1000		
Occupant Load (MBH)	=	OccNum	X	OccHeatGain	/	1000																		
Lighting & Plug Load (MBH)	=	LLoad	+	PLoad	X	3.412																		
Infiltration Load (MBH)	=	IF(Bin Enthalpy	>	Cooling Setpoint Enthalpy	THEN	4.05	X	Rate $_{Infiltration}$	X	(Bin Enthalpy	-	Cooling Setpoint Enthalpy)	ELSE	1.08	X	Rate $_{Infiltration}$	X	(Bin Temp	-	Occupied Heating Setpoint)]	/	1000		
Ventilation Load (MBH)	=	IF(Bin Enthalpy	>	Cooling Setpoint Enthalpy	THEN	4.5	X	Rate $_{ventilation}$	X	(Bin Enthalpy	-	Cooling Setpoint Enthalpy)	ELSE	1.08	X	Rate $_{ventilation}$	X	(Bin Temp	-	Occupied Heating Setpoint)]	/	1000		
Solar Heat Gain (MBH)	=	SHG	X	0.55																				
Total Load (MBH)	=	Envelope Load	+	Occupant Load	+	Lighting & Plug Load	+	Infiltration Load	+	Ventilation Load	+	Solar Heat Gain												
Base Cooling Power (kW)	=	IF(Bin Temp	>	Cooling Shutdown Temp	THEN	(12	/	$\eta_{cooling}$)	X	(Total Load	/	12)	ELSE	0)										
Base Cooling Use (kWH	=	Base Cooling Power	X	Bin Hours																				
Base Heating (Therms)	=	IF(Total Load)	<	0	THEN	- Total Load	/	$\eta_{heating}$	/	100	ELSE	0)	X	Bin Hours										

Table 31: BMS Upgrades and Retro-Commissioning Output Calculations

Sample Calculation

Bin Temp = 93°

Bin Enthalpy = 37.2 BTU/lb

Bin Hours = 3 hours

Envelope Load (MBH)	=	1522	X	93	-	IF(93	>	, 55	THEN	73	ELSE	72)]	/	1000	-	622	X	(72	-	72)	/	1000	=	5.57
Occupant Load (MBH)	=	50	X	450	/	1000	=	22.5																
Lighting & Plug Load (MBH)	=	13.6	+	8.2	X	3.412	=	74.1																
Infiltration Load (MBH)	=	IF(37.2	>	28.9	THEN	4.05	X	770	X	(37.2	-	28.9)	ELSE	1.08	X	770	X	(93	-	72)	/	1000	=	25.88
Ventilation Load (MBH)	=	IF(37.2	>	28.9	THEN	4.5	X	723	X	(37.2	-	28.9)	ELSE	1.08	X	723	X	(93	-	72)	/	1000	=	27
Solar Heat Gain (MBH)	=	42.7	X	0.55	=	23.46																		
Total Load (MBH)	=	5.57	+	22.5	+	74.1	+	25.88	+	27	+	23.46	=	178.51										
Base Cooling Power (kW)	=	IF(93	>	55	THEN	12	/	12.1)	X	(178.51	/	12)	ELSE	0)	=	14.75								
Base Cooling Use (kWH	=	14.75	X	3	=	44.25																		
Base Heating (Therms)	=	IF(178.51	<	0	THEN	-178.51	/	0.78	/	100	ELSE	0)	X	3	=									

Table 32: BMS Upgrades and Retro-Commissioning Sample Calculation

Note: Temperature bin hour energy model was used to calculated electric and fuel savings for this measure.

BMS Upgrade and Retro-Commissioning

Qty	Assembly Number	Description	Unit	Mat.	Inst.	Total
11.000	230923102130	Control components/DDC system, subcontractor's quote incl. material & labor, status (alarms), digital inputs (average 50' run in 1/2" EMT), differential pressure, air	Ea.			6,600
24.000	230923102210	Control components/DDC system, status (alarms), digital output (average 50' run in 1/2" EMT), start/stop	Ea.			8,280
2.000	230923103214	Control components/DDC system, subcontractor's quote incl. material & labor, DDC controller (average 50' run in conduit), mechanical room, 16 point controller, incl. 120V/1 phase power supply	Ea.			6,600
4.000	230923103229	Control components/DDC system, subcontractor's quote incl. material & labor, DDC controller (average 50' run in conduit), mechanical room, 32 point controller, incl. 120V/1 phase power supply	Ea.			21,900
11.000	230923103266	Control components/DDC system, subcontractor's quote incl. material & labor, DDC controller (average 50' run in conduit), space, VAV terminal box, incl. space temperature sensor	Ea.			9,350
1.000	230923104100	Control components/DDC system, front end costs, computer (PC) with software program	Ea.			6,425
1.000	230923104200	Control components/DDC system, front end costs, color graphics software	Ea.			3,975
8.000	230923104300	Control components/DDC system, front end costs, color graphics slides	Ea.			3,960
221.000	230923104600	Control components/DDC system, front end costs, calibration labor	Point			26,741
221.000	230923104700	Control components/DDC system, front end costs, startup, checkout labor	Point			26,741
26.000	230923108100	Control components/DDC system, applications software, time program	Point			181
2.000	230923108140	Control components/DDC system, applications software, optimum start/stop	Point			84
1.000		Miscellaneous hardware, wiring, cutting and patching	L.S.			10,000
23,700.000		General Cx	SQ.FT			9,480
						140,317

Table 33: BMS Upgrades and Retro-Commissioning Material & Labor Costs

C. Hot Water Pump Upgrades

Input	Type	Units	Symbol	Source
Existing Motor Horsepower	Variable	HP	HP_{Exist}	Existing equipment nameplate information
Existing Motor Efficiency Rating	Variable	Ratio (dimensionless)	η_{Exist}	Existing equipment nameplate information
Energy Factor	Variable	kWh/HP-Year	EF_{kWh}	Table 2-35 through Table 2-42
Demand Factor	Variable	kW/HP	EF_{kW}	Table 2-43
Participant Coincidence Factor	Fixed	Ratio (0 to 1.0, dimensionless)	PCF	Table 4-4, or participant billing analysis or other engineering analysis.
Energy Rate	Variable	$/kWh	$Rate_{Energy}$	Utility tariff or participant electric bills, usually calculated as an annual average.

Table 34: Hot Water Pump Inputs and Assumptions (NYPA Energy Savings Handbook)

Output

Annual kWh Savings = $(HP_{exist} \times EF_{kWh}) + (HP_{new} \times EF_{kWh})$

Monthly Demand Reduction (kW) = $(HP_{exist} \times EF_{kW} \times PCF) + (Hp_{new} \times EF_{kW} \times PCF)$

Annual Cost Savings = Annual kWh Savings $\times Rate_{Energy}$

Sample Calculation

Annual kWh Savings = $(1.5 \times 981) + (1 \times 981) = 2452.5$

Monthly Demand Reduction (kW) = $(1.5 \times 0.498 \times .8) + (1 \times 0.498 \times .8) = 1$

Table 35: Hot Water Pump Outputs and Sample Calculation

Install New Hot Water Pump

Qty	Assembly Number	Description	Unit	Mat.	Inst.	Total
1	Vendor Quote	Pump, circulating, bronze, heated or chilled water application, in line, flanged joints, 1 H.P., 3" size	Ea.	$ 1,960.00	$ 219.00	$ 2,446.90
						$ 2,446.90

Table 36: Hot Water Pump Material & Labor Costs

D. Building Envelope Upgrades

Assumptions			
Input	***Description***	***Value***	***Units***
$\eta_{cooling}$	Efficiency of the cooling equipment	12.1	EER
$\eta_{heating}$	Efficiency of the heating equipment	78	%
$Rate_{infiltration}$	Average rate of infiltration	770	CFM
$Rate_{ventilation}$	Average rate of ventilation	723	CFM
OccNum	Average number of occupants	50	Occupants
OccHeatGain	Average heat output per person	450	BTU / hr / Occ
LLoad	Total load contributed by lighting	13.6	kW
PLoad	Total load contributed by plug loads	8.2	kW
SHG	Average solar heat gain through windows	42.7	BTU / hr
Cooling Shutdown Temperature		55	°F
$GroundTemp_{avg}$	Average below grade ground temperature	32	°F
Existing Occupied Cooling Setpoint	Enthalpy = 28.9 BTU / lb	73	°F
Existing Unoccupied Cooling Setpoint	Enthalpy = 28.9 BTU / lb	73	°F
Existing Occupied Heating Setpoint		72	°F
Existing Unoccupied Heating Setpoint		72	°F
Proposed Occupied Cooling Setpoint	Enthalpy = 28.9 BTU / lb	73	°F
Proposed Unoccupied Cooling Setpoint	Enthalpy = 28.9 BTU / lb	85	°F
Proposed Occupied Heating Setpoint		72	°F
Proposed Unoccupied Heating Setpoint		65	°F
R Value	Thermal resistance of building components	varies	(sqft)(°F)(hr) / BTU
U Factor	Inverse of R Value		BTU / (sqft)(°F)(hr)
UA	Product of U Factor and building component area		BTU / (°F)(hr)

Table 37: Building Envelope Upgrades Inputs and Assumptions

Existing					Proposed				
Building Envelope Calculations - Log					Building Envelope Calculations - Log				
Envelope	Area (sq. ft.)	R Value	U Factor	UA	Envelope	Area (sq. ft.)	R Value	U Factor	UA
Wall A	1352	5.10	0.20	265.1	Wall A	1352	17.10	0.06	79.1
Wall B	5606	19.65	0.05	285.3	Wall B	5606	19.65	0.05	285.3
Wall C	1601	13.35	0.07	119.9	Wall C	1601	13.35	0.07	119.9
Wall D	5650	4.81	0.21	1175.2	Wall D	5650	4.81	0.21	1175.2
Roof	14695	18.87	0.05	778.7	Roof	14695	18.87	0.05	778.7
Windows	1423	2.22	0.45	640.4	Windows	1423	2.22	0.45	640.4
Infiltration Rate		906CFM			Infiltration Rate		770CFM		

Existing					Proposed				
Building Envelope Calculations - Ceiling					Building Envelope Calculations - Ceiling				
Envelope	Area (sq. ft.)	R Value	U Factor	UA	Envelope	Area (sq. ft.)	R Value	U Factor	UA
Wall A	1352	17.10	0.06	79.1	Wall A	1352	17.10	0.06	79.1
Wall B	5606	19.65	0.05	285.3	Wall B	5606	19.65	0.05	285.3
Wall C	1601	13.35	0.07	119.9	Wall C	1601	13.35	0.07	119.9
Wall D	5650	4.81	0.21	1175.2	Wall D	5650	4.81	0.21	1175.2
Roof	14695	18.87	0.05	778.7	Roof	14695	37.00	0.03	397.2
Windows	1423	2.22	0.45	640.4	Windows	1423	2.22	0.45	640.4
Infiltration Rate		770CFM			Infiltration Rate		770CFM		

Existing					Proposed				
Building Envelope Calculations - Cellar					Building Envelope Calculations - Cellar				
Envelope	Area (sq. ft.)	R Value	U Factor	UA	Envelope	Area (sq. ft.)	R Value	U Factor	UA
Wall A	1352	17.10	0.06	79.1	Wall A	1352	17.10	0.06	79.1
Wall B	5606	19.65	0.05	285.3	Wall B	5606	19.65	0.05	285.3
Wall C	1601	13.35	0.07	119.9	Wall C	1601	13.35	0.07	119.9
Wall D	5650	4.81	0.21	1175.2	Wall D	5650	9.09	0.11	621.6
Roof	14695	37.00	0.03	397.2	Roof	14695	37.00	0.03	397.2
Windows	1423	2.22	0.45	640.4	Windows	1423	2.22	0.45	640.4
Infiltration Rate		770CFM			Infiltration Rate		770CFM		

Table 38: Building Envelope Existing and Proposed Inputs and Calculations

Output

Envelope Load (MBH)	=	$\Sigma UA_{w/o\ walls}$	X	(Bin Temp (°F)	-	IF(Bin Temp (°F)	>	Cooling Shutdown Temp (°F)	THEN	Occupied Cooling Setpoint	ELSE	Occupied Heating Setpoint)]	/	1000	-	UA_{walls}	X	(Occupied Heating Setpoint	-	Unoccupied Heating Setpoint)	/	1000		
Occupant Load (MBH)	=	OccNum	X	OccHeatGain	/	1000																		
Lighting & Plug Load (MBH)	=	LLoad	+	PLoad	X	3.412																		
Infiltration Load (MBH)	=	IF(Bin Enthalpy	>	Cooling Setpoint Enthalpy	THEN	4.05	X	$Rate_{infiltration}$	X	(Bin Enthalpy	-	Cooling Setpoint Enthalpy)	ELSE	1.08	X	$Rate_{infiltration}$	X	(Bin Temp	-	Occupied Heating Setpoint)]	/	1000		
Ventilation Load (MBH)	=	IF(Bin Enthalpy	>	Cooling Setpoint Enthalpy	THEN	4.5	X	$Rate_{ventilation}$	X	(Bin Enthalpy	-	Cooling Setpoint Enthalpy)	ELSE	1.08	X	$Rate_{ventilation}$	X	(Bin Temp	-	Occupied Heating Setpoint)]	/	1000		
Solar Heat Gain (MBH)	=	SHG	X	0.55																				
Total Load (MBH)	=	Envelope Load	+	Occupant Load	+	Lighting & Plug Load	+	Infiltration Load	+	Ventilation Load	+	Solar Heat Gain												
Base Cooling Power (kW)	=	IF(Bin Temp	>	Cooling Shutdown Temp	THEN	(12	/	$\eta_{cooling}$),	X	(Total Load	/	12)]	ELSE	0]										
Base Cooling Use (kWH	=	Base Cooling Power	X	Bin Hours																				
Base Heating (Therms)	=	IF(Total Load	<	0	THEN	- Total Load	/	$\eta_{heating}$	/	100	ELSE	0]	X	Bin Hours										

Table 39: Building Envelope Upgrades Output Calculations

Sample Calculation

Bin Temp = 93°

Bin Enthalpy = 37.2 BTU/lb

Bin Hours = 3 hours

Envelope Load (MBH)	=	2089	X	93	-	IF(93	>	55	THEN	73	ELSE	72)]	/	1000	-	1175	X	(72	-	72)	/	1000	=	-5.22
Occupant Load (MBH)	=	50	X	450	/	1000		22.5																
Lighting & Plug Load (MBH)	=	13.6	+	8.2	X	3.412		74.1																
Infiltration Load (MBH)	=	IF(37.2	>	28.9	THEN	4.05	X	906	X	(37.2	-	28.9)	ELSE	1.08	X	906	X	(93	-	72)	/	1000	=	30.46
Ventilation Load (MBH)	=	IF(37.2	>	28.9	THEN	4.5	X	723	X	(37.2	-	28.9)	ELSE	1.08	X	723	X	(93	-	72)	/	1000	=	27
Solar Heat Gain (MBH)	=	42.7	X	0.55	=	23.46																		
Total Load (MBH)	=	-5.22	+	22.5	+	74.1	+	30.46	+	27	+	23.46	=	172.3										
Base Cooling Power (kW)	=	IF(93	>	55	THEN	12	/	12.1)	X	(172.3	/	12)	ELSE	0]	=	14.24								
Base Cooling Use (kWH	=	14.24	X	3		42.72																		
Base Heating (Therms)	=	IF(172.3	<	0	THEN	-172.3	/	0.78	/	100	ELSE	0]	X	3	=	0								

Table 40: Building Envelope Upgrades Sample Calculation

Replace Exterior Doors

Qty	Assembly Number	Description	Unit	Mat.	Inst.	Total
6	80111101130	Door & window maintenance, install door	Ea.	$0.00	$324.00	$531.00
6	81116100520	Doors & frames, aluminum, entrance, wide stile, clear finish, 3'-0" x 7'-0" opening, incl. sta	Ea.	$6,450.00	$2,370.00	$11,400.00
1	81116109000	Doors & frames, minimum labor/equipment charge	Job	$0.00	$177.00	$292.00
6	80505100200	Door demolition, exterior door, single, 3' x 7' high, 1-3/4" thick, remove	Ea.	$0.00	$105.90	$174.00
1	80505109000	Door demolition, minimum labor/equipment charge	Job	$0.00	$88.50	$145.00
						$12,542.00

Insulate Cellar Walls

Qty	Assembly Number	Description	Unit	Mat.	Inst.	Total
2,350	C1010 124 1200	Wood partition, 5/8"fire rated gypsum board face, none base,2 x 4,@ 16" OC framing,same opposite face, 0 insul	S.F.	3,102.00	8,789.00	$ 11,891.00
2,350	07212 910 0310	Insulation, polyurethane foam, 2#/CF density, 1" thick, R6.5, sprayed	S.F.	1,363.00	681.50	$ 2,467.50
		Remove and reinstall existing base board heating	LS			$ 5,000.00
		Relocate Electrical on exterior walls	LS			$ 4,000.00
						$ 23,358.50

Insulate Log Walls

Qty	Assembly Number	Description	Unit	Mat.	Inst.	Total
1,352	07251 010 0480	Weather barriers, building paper, housewrap, exterior, spun bonded polypropylene, large roll	S.F.	$ 216.32	$ 135.20	$ 446.16
1,352	06161 310 0100	Insulating sheathing, polyisocyanurate, 2" thick, 2#/CF density, fastening excluded	S.F.	$ 1,216.80	$ 851.76	$ 2,744.56
1,352	06163 610 0507	Sheathing, plywood on walls, CDX, 3/8" thick, pneumatic nailed	S.F.	$ 770.64	$ 689.52	$ 1,973.92
800	07921 320 0055	Joint sealants, caulking and sealants, bulk acrylic latex, 1/4" x 1/4", in place	L.F.	$ 72.00	$ 1,032.00	$ 1,768.00
1,352	07462 310 5500	Wood siding, boards, white pine, rough sawn, stained, 1" x 8"	S.F.	$ 3,244.80	$ 1,662.96	$ 6,300.32
1	07462 310 9000	Wood siding, boards, minimum labor/equipment charge	Job	$ -	$ 204.00	$ 330.00
1		Trim out around windows and doors	LS	$ -	$ -	$ 3,000.00
						$ 16,562.96

Insulate Roof

Qty	Assembly Number	Description	Unit	Mat.	Inst.	Total
11,680.000	07212 910 0355	Insulation, polyurethane foam, 2#/CF density, 5-1/2" thick, R36, sprayed	S.F.	37,259.20	18,337.60	$ 67,160.00
230.000	07722 610 0100	Ridge vents, aluminum strips, mill finish	L.F.	669.30	489.90	$ 1,621.50
28.000	07722 610 0200	Ridge vents, aluminum strips, mill finish, connectors	Ea.	141.40	198.80	$ 513.80
6.000	07722 610 0300	Ridge vents, aluminum strips, mill finish, end caps	Ea.	12.90	42.60	$ 90.90
2.000	23372 310 2120	Ventilator, stationary, gravity, syphon, galvanized, 50 CFM, 4" neck diameter, includes base	Ea.	81.00	84.00	$ 222.00
10.000	23311 313 0110	Metal ductwork, fabricated rectangular, 100 to 500 lb., aluminum alloy 3003-H14, includes fittings, joints, supports and allow for a flexible connections field sketches, excludes as-built drawings and insulation	Lb.	18.80	163.00	$ 275.00
						$ 69,883.20

Table 41: Building Envelope Upgrades Material and Labor Costs

E. Vending Machine Controls

Input Variables	
Energy Costs ($0.000 per kWh)	0.078
Facility Occupied Hours per Week	65
Number of Cold Drink Vending Machines	1
Number of Non-cooled Snack Machines	1
Power Requirements of Cold Drink Machine (avg. Watts)	302
Power Requirements of Snack Machine (avg. Watts)	90
Cold Beverage Machine Controls Price	$360.00
Snack Machine Controls Price	$160.00

Table 42: Vending Machine Controls Inputs and Assumptions

Cold Beverage Machine Output			
Existing		Proposed	
Estimated Additional Auto-On Hours Per Week	0	Estimated Additional Auto-On Hours Per Week	17
Power-on Hours Per Week	133	Weekly Occupied Hours + Additional Auto-On Hours	82
Power-on Hours Per Year	6916	Power-on Hours Per Year	4273
kWh/year	2089	kWh/year	1290
Cost of Operation	$ 162	Cost of Operation	$ 100

Snack Machine Output			
Existing		Proposed	
Facility Occupied Hours per Week	65	Facility Occupied Hours per Week	65
Power-on Hours Per Week	133	Power-on Hours Per Week	65
Power-on Hours Per Year	6916	Power-on Hours Per Year	3380
kWh/year	622	kWh/year	304
Cost of Operation	$ 48	Cost of Operation	$ 24

Vending Machine Savings Summary	
Total Annual kWh Savings	1116
Annual Cost Savings	$ 87

Table 43: Vending Machine Controls Outputs and Calculations

Cold Beverage Machine Controls Calculations

Existing			
Power-on Hours Per Week	=	133	
Power-on Hours Per Year	= Power-on Hours Per Week	X	52 weeks/year
kWh/year	= Power-on Hours Per Year	X	302W
Cost of Operation	= kWh/year	X	$0.078/kWh
Proposed			
Additional Auto-on Hours Per Week	=	17.17	
Power-on Hours Per Week	= Facility Occupied Hours per Week	+	Additional Auto-on Hours Per Week
Power-on Hours Per Year	= Power-on Hours Per Week	X	52 weeks/year
kWh/year	= Power-on Hours Per Year	X	302W
Cost of Operation	= kWh/year	X	$0.078/kWh

Snack Machine Controls Calculations

Existing			
Power-on Hours Per Week	=	133	
Power-on Hours Per Year	= Power-on Hours Per Week	X	52 weeks/year
kWh/year	= Power-on Hours Per Year	X	90W
Cost of Operation	= kWh/year	X	$0.078/kWh
Proposed			
Power-on Hours Per Week	= Facility Occupied Hours per Week		
Power-on Hours Per Year	= Power-on Hours Per Week	X	52 weeks/year
kWh/year	= Power-on Hours Per Year	X	302W
Cost of Operation	= kWh/year	X	$0.078/kWh

Sample Calculation					
Additional Auto-on Hours Per Week	= 17.17				
Power-on Hours Per Week	= 65	+ 17.17		=	82
Power-on Hours Per Year	= 82	X 52		=	4273
kWh/year	= 4273	X 302		=	1290
Cost of Operation	= 1290	X $	0.078	=	$100

Table 44: Vending Machine Controls Sample Calculation

F. Lighting Controls Upgrade

Adirondack Park Agency Existing Interior Lighting Controls Inventory						Adirondack Park Agency Proposed Interior Lighting Controls Inventory				
Type	Code	# Fixtures w/ OCC	# Fixtures w/ MANUAL	Fixture Wattage	Total Wattage	Type	Code	# Fixtures w/ MANUAL	Fixture Wattage	Total Wattage
4'T8	1F32	35	21	31	651	OCC	Sensor	21	31	651
4'T8	2F32	40	116	59	6,844	OCC	Sensor	116	59	6,844
4'T8	3F32	0	24	89	2,136	OCC	Sensor	24	89	2,136
4'T8	4F32	4	8	112	896	OCC	Sensor	8	112	896
INC	I/18	0	1	18	18	OCC	Sensor	1	18	18
INC	I/40	0	1	40	40	OCC	Sensor	1	40	40
INC	I/52	0	2	52	104	OCC	Sensor	2	52	104
INC	I/60	2	8	60	480	OCC	Sensor	8	60	480
INC	I/2/60	0	4	120	480	OCC	Sensor	4	120	480
INC	I/100	0	3	100	300	OCC	Sensor	3	100	300
	Total	**81**	**188**		**11,949**		**Total**	**188**		**11,949**

Table 45: Interior Lighting Controls Inventory, Existing & Proposed

Energy Calculations															
Code	FixWatts	FixNum	AOH	ESF	DSF	$Rate_{energy}$	$LLoad_{existing}$	Annual kWh Savings	Annual mmBTU Savings	DkW_s	DkWh	Dtherm	DMMBTU	Totalized Monthly kW Reduction	kW Reduction
1F32	31	21	3380	0.3	0.3	0.078	0.65	660	-2.25	0.04	132.02	-2.51	-0.25	2.3	0.2
2F32	59	116	3380	0.3	0.3	0.078	6.84	6940	-23.68	0.41	1387.96	-26.37	-2.64	24.6	2.1
3F32	89	24	3380	0.3	0.3	0.078	2.14	2166	-7.39	0.13	433.18	-8.23	-0.82	7.7	0.6
4F32	112	8	3380	0.3	0.3	0.078	0.90	909	-3.10	0.05	181.71	-3.45	-0.35	3.2	0.3
I/18	18	0	338	0.3	0.3	0.078	0.00	0	0.00					0.0	0.0
I/40	40	0	338	0.3	0.3	0.078	0.00	0	0.00					0.0	0.0
I/52	52	0	338	0.3	0.3	0.078	0.00	0	0.00					0.0	0.0
I/60	60	0	338	0.3	0.3	0.078	0.00	0	0.00					0.0	0.0
I/2/60	120	0	338	0.3	0.3	0.078	0.00	0	0.00					0.0	0.0
I/100	100	0	338	0.3	0.3	0.078	0.00	0	0.00					0.0	0.0
	Total	**169**					10.53	**10674**	**-36**				**-4.1**	37.9	**3.2**

Table 46: Lighting Controls Upgrades Energy Calculations

Install Occupancy Sensors

Qty	Assembly Number	Description	Unit	Mat.	Inst.	Total
169	Vendor Quote	Automatic Wall Switch occupancy sensor	Ea.	$ 10,731.50	$ 3,211.00	$ 16,731.00

$ 16,731.00

Table 47: Lighting Controls Upgrades Material & Labor Costs

Lighting Controls Calculations

Inputs								
Code	Individual fixture code to identify lamp type, count, and wattage							
FixWatts	Individual fixture wattages from existing facility inventory and proposed facility inventory							
FixNum	Number of fixtures from existing facility inventory and proposed facility inventory							
AOH	Annual Operation Hours : 6am-7pm M-F = 13 hours/day * 5 days/week * 52 weeks/year = 3380 hours/year							
ESF	Energy Savings Factor = 0.3 Source: NYPA Energy Savings Handbook Version 0 Table 2-28							
DSF	Demand Savings Factor = 0.3 Source: NYPA Energy Savings Handbook Version 0 Table 2-28							
$Rate_{energy}$	Derived from facility's electric utility data							
Outputs								
Lload (kW)	=	FixWatts	X	FixNum	/	1000 W/kW		
Annual kWh Savings	=	LLoad	X	ESF	X	AOH		
Annual mmBTU Savings	=	Annual kWh Savings	X	-0.003412142		mmBTU/kWh		
Annual kW Reduction	=	LLoad	X	DSF	X	12 months/year		
Monthly kW Reduction	=	Annual kW Reduction	/	12 months/year				
Annual Cost Savings	=	Annual kWh Savings	X	Energy Rate				
Sample Calculation								
Existing Code	=	1F32						
FixWatts	=	31						
FixNum	=	21						
LLoad	=	31W / fixture	X	21 fixtures	/	1000 W/kW	=	0.651kW
Annual kWh Savings	=	0.651kW	X	0.3	X	3380	=	660kWh
Annual mmBTU Savings	=	660kWh	X	-0.003412142		mmBTU/kWh	=	-2.25mmBTU
Annual kW Reduction	=	0.651kW	X	0.3	X	12 months/year	=	2.34kW
Monthly kW Reduction	=	2.34kW	/	12 months/year			=	0.1953kW

Table 48: Lighting Controls Upgrades Assumptions and Sample Calculation

Lighting Controls Upgrades O/M Note

Operation and Maintenance costs associated with upgrading lighting controls were determined to be zero. This is because the reduction in lamp life as a result of increasing the switching frequency is equal to the estimated energy savings associated with

installing occupancy based lighting controls. For example, Sylvania's FO32/835/XP/XL/ECO3 has a rated lamp life of 52,000 hours at 12 hour switching intervals, compared to 36,000 hours at 3 hour switching intervals, resulting in a 30% reduction of lamp life. The estimated energy savings factor associated with installing occupancy based lighting controls is also 30%. In summary, the operation and maintenance costs that are saved by reducing the hours of operation of the lighting under consideration are negated by the reduced lamp life associated with switching frequency.

G. Condensing Unit Upgrades

APA Condensing Unit Upgrades				
	ACC-1		ACC-2	
	BASELINE	PROPOSED	BASELINE	PROPOSED
MFG	Trane	Trane	Trane	Trane
Model #	RAUCC25EBX03A0D	RAUJC25EBX03A0D	TTA150B300EA	TTA150E300
Cooling Capacity (tons)	25	25	12.5	12.5
ARI Net Cooling Capacity (MBH)	314	324.9	144	150
kW	28.3	26.9	14.7	13.63
EER	9.8	9.8	10.8	10.8
IEER	9.9	9.9	11	11
# Comp.	2	2	2	2
Refrigerant	R-22	R-410A	R-22	R-410A
EER	11.1	12.1	11	11.7
IPLV	15.2	15.1	13.7	15.9

Table 49: Condensing Unit Upgrades Existing & Proposed

Input	Units	Symbol
Total Annual Equivalent Full Load Hours for Cooling	Hours/Year	$EFLH_{Cooling}$
Cooling Capacity	kBTU/Hour	$kBTU_{Cooling}$
Annual Bin Hours at Bin Temperature	Hours/Year	ABH_n
Cooling Load at Corresponding Bin Temperature	%	$Load_n$, where n is the temperature bin
Seasonal Average Cooling Efficiency	BTU/Watt-hour	SEER, IEER or $IPLV_{Cooling}$
Cooling Efficiency at Peak Load	BTU/Watt-hour	$EER_{Cooling}$
Participant Coincidence Factor	Ratio (0 to 1.0, dimensionless)	PCF
Months of Motor Use	Months/Year	MMU
Energy Rate	$/kWh	$Rate_{Energy}$

Table 50: Condensing Unit Upgrades Inputs and Assumptions

$$Total\ Annual\ EFLH_{Heating} = 1{,}894 \text{ (New York Tech Manual 2010, Appendix G)}$$

$$Participant\ Energy\ Savings\ Cooling, EER\ \left(\frac{kWh}{Year}\right) = kBTUh_{Cooling} \times \left[\frac{1}{COP_{Existing\ Cooling}} - \frac{1}{COP_{New\ Cooling}}\right] \times \frac{EFLH_{Cooling}}{3.413\frac{BTU}{Watt-hour}}$$

$$Participant\ Energy\ Savings\ Cooling, IPLV\ \left(\frac{kWh}{Year}\right) = kBTUh_{Cooling} \times \left[\frac{1}{SEER,IEER\ or\ IPLV_{Existing\ Cooling}} - \frac{1}{SEER,IEER\ or\ IPLV_{New\ Cooling}}\right] \times EFLH_{Cooling}$$

$$Total\ Annual\ EFLH_{Heating} = 1{,}894.0$$

$$Participant\ Energy\ Savings\ Cooling, EER\ \left(\frac{kWh}{Year}\right) = 324.9 \times \left[\frac{1}{11.1} - \frac{1}{12.1}\right] \times \frac{1{,}894}{3.413} = 1{,}342.41$$

$$Participant\ Energy\ Savings\ Cooling, IPLV\ \left(\frac{kWh}{Year}\right) = 324.9 \times \left[\frac{1}{11.1} - \frac{1}{12.1}\right] \times 1{,}894 = 2{,}869.30$$

Table 51: Condensing Unit Upgrades Sample Calculations

Condensing Units

Qty	Assembly Number	Description	Unit	Mat.	Inst.	Total
1.000	Vendor Quote	Condensing unit, air cooled, compressor, 25 ton, includes standard controls	Ea.	14,000.00	3,975.00	17,975
1.000	Vendor Quote	Condensing unit, air cooled, compressor, 10 ton, includes standard controls	Ea.	5,100.00	1,800.00	6,900
						24,875

Table 52: Condensing Unit Upgrades Material & Labor Costs

H. Data Center Cooling Upgrades

Note: Data Center Cooling Upgrades energy savings were calculated using a Bin Model.

Existing System		
AHU Fan	0.5	HP
AHU Fan	0.60	kW
CU Preformance	13	EER
CU Capacity	30	MBH

Proposed System		
Dry Cooler		
# of Fans	HP/Ea	Total kW
2	0.33	0.69
Blower Coil		
# of Fans	HP/Ea	Total kW
1	0.50	0.60
Pump		
# of Pumps	HP/Ea	Total kW
1	0.33	0.34

Table 53: Data Center Cooling Upgrades Existing & Proposed

Server Room Equipment kW	=	5.91
Load MBH	=	Server Room Equipment kW x 0.8 x 3412 / 1000
Condensing Unit kW/ton	=	12 / CU Performance
Condensing Unit kW	=	Load MBH / 12 x Condensing Unit kW/ton
Crank Case Heater (kW)	=	IF(Bin Temp < 0 , 60 , IF (Bin Temp < 50 , 32 , 0))/1000
AHU Fan (kW)	=	0.6 kW
Cooling Total (kW)	=	Condensing Unit kW + Crank Case Heater (kW) + AHU Fan (kW)
Cooling kWh	=	Cooling Total (kW) x Occupied Hours
AHU	=	IF(Bin Temp > 40 , Cooling Total (kW) , 0)
Dry Cooler kW	=	IF(Bin Temp > 40 , 0 , Load MBH / (45153/5 x (45-C16)/1000) x Dry Cooler Total kW)
Blower kW	=	IF(Bin Temp > 40 , 0 , Blower Coil Total kW)
Pump kW	=	IF(Bin Temp > 40 , 0 , Pump Total kW)
Cooling Total (kW)	=	AHU + Dry Cooler kW + Blower kW + Pump kW

Table 54: Data Center Cooling Upgrades Inputs and Sample Calculations

I. Photovoltaic System

PV Watts Inputs and System Specifications	
Location and Station Identification	
Requested Location	1133 NYS Route 86
Weather Data Source	(TMY3) ADIRONDACK RGNL, NY 8.3 mi
Latitude	44.38° N
Longitude	74.2° W
PV System Specifications *(Commercial)*	
DC System Size	89.9 kW
Module Type	Standard
Array Type	Fixed (open rack)
Array Tilt	20°
Array Azimuth	180°
System Losses	14%
Inverter Efficiency	96%
DC to AC Size Ratio	1.1
Initial Economic Comparison	
Average Cost of Electricity Purchased from Utility	0.078 $/kWh
Initial Cost	2.56 $/Wdc
Cost of Electricity Generated by System	0.14 $/kWh
NYSERDA Incentive	0

Table 55: PV Watts Inputs and PV System Specifications

PV Watts Output			
Month	Solar Radiation (kWh / m2 / day)	AC Energy (kWh)	Energy Value ($)
January	2.60	6,279	487
February	3.29	7,234	561
March	3.40	8,030	623
April	6.14	13,524	1049
May	4.31	9,713	754
June	6.26	12,740	989
July	5.51	11,856	920
August	5.32	11,310	878
September	4.05	8,515	661
October	2.51	5,750	446
November	2.28	5,252	408
December	2.05	5,024	390
Annual	**3.98**	**105,227**	**$8,165**

Table 56: PV Watts Monthly Energy and Cost Savings Breakdown

PV System Cost		
$/Wdc	Wdc	Cost
$ 2.56	89900	$ 230,144

Table 57: Photovoltaic System Cost

J. Appliance Upgrades

BASELINE						PROPOSED					
MFG.	M/N	SIZE	Unit kWh/year	quantity	Total kWh/year	MFG.	M/N	SIZE	Unit kWh/year	quanti ty	Total kWh/year
GE	GMR06	SM	360	1	360	GE	GTH18EBTWW	LG	335	2	670
Avanti	28RC	SM	400	1	400	LG	LTCS24223S	LG	500	1	500
Sanyo		SM	265	1	265				**TOTAL**	**3**	**1170**
GE	GTH18EBTZRWW	LG	335	2	670						
			TOTAL	**5**	**1,695**						

Table 58: Appliance Upgrades Calculations

IX. Building Life Cycle Cost (BLCC) Output

A. Interior Lighting Upgrade

NIST BLCC 5.3-15: Comparative Analysis
Consistent with Federal Life Cycle Cost Methodology and Procedures, 10 CFR, Part 436, Subpart A
Base Case: Existing
Alternative: Interior Lighting Upgrade
General Information

File Name:	T:\-=EME Projects=-\NYPA Energy Program\Adirondack Park Agency\ADK FEMP BLCC.xml
Date of Study:	Mon Jan 11 15:43:26 EST 2016
Project Name:	Adirondack Park Agency
Project Location:	New York
Analysis Type:	FEMP Analysis, Energy Project
Analyst:	Taylor Bastow
Base Date:	October 1, 2015
Service Date:	April 1, 2016
Study Period:	40 years 0 months(October 1, 2015 through September 30, 2055)
Discount Rate:	3%
Discounting Convention:	End-of-Year

Comparison of Present-Value Costs
PV Life-Cycle Cost

	Base Case	Alternative	Savings from Alternative
Initial Investment Costs:			
Capital Requirements as of Base Date	$0	$43,165	-$43,165
Future Costs:			
Energy Consumption Costs	$1,490,198	$1,439,082	$51,116
Energy Demand Charges	$0	$0	$0
Energy Utility Rebates	$0	$0	$0

Water Costs	$0	$0	$0
Recurring and Non-Recurring OM&R Costs	$0	$0	$0
Capital Replacements	$0	$0	$0
Residual Value at End of Study Period	$0	$0	$0
Subtotal (for Future Cost Items)	$1,490,198	$1,439,082	$51,116
Total PV Life-Cycle Cost	$1,490,198	$1,482,247	$7,951

Net Savings from Alternative Compared with Base Case

PV of Non-Investment Savings $51,116

- Increased Total Investment $43,165

Net Savings $7,951

Savings-to-Investment-Ratio (SIR)

SIR = 1.18

Adjusted Internal Rate of Return

AIRR = 3.44%

Payback Period

Estimated Years to Payback (from beginning of Service Period)

Simple Payback occurs in year 21

Discounted Payback occurs in year 31

Energy Savings Summary

Energy Savings Summary (in stated units)

Energy	-----Average	Annual	Consumption-----	Life-Cycle
Type	Base Case	Alternative	Savings	Savings
Electricity	199,440.0 kWh	182,121.0 kWh	17,319.0 kWh	684,035.3 kWh
Distillate Fuel Oil (#1, #2)	8,539.8 Gal	8,563.5 Gal	-23.7 Gal	-934.9 Gal

Energy Savings Summary (in MBtu)

Energy	----Average	Annual	Consumption----	Life-Cycle
Type	Base Case	Alternative	Savings	Savings
Electricity	680.5 MBtu	621.4 MBtu	59.1 MBtu	2,334.0 MBtu
Distillate Fuel Oil (#1, #2)	1,296.1 MBtu	1,299.7 MBtu	-3.6 MBtu	-141.9 MBtu

Emissions Reduction Summary

Energy	----Average	Annual	Emissions----	Life-Cycle
Type	Base Case	Alternative	Reduction	Reduction
Electricity				
CO2	81,524.95 kg	74,445.47 kg	7,079.48 kg	279,612.62 kg
SO2	239.96 kg	219.12 kg	20.84 kg	823.00 kg
NOx	86.53 kg	79.02 kg	7.51 kg	296.78 kg
Distillate Fuel Oil (#1, #2)				
CO2	95,250.57 kg	95,514.58 kg	-264.01 kg	-10,427.35 kg
SO2	681.35 kg	683.24 kg	-1.89 kg	-74.59 kg
NOx	85.86 kg	86.10 kg	-0.24 kg	-9.40 kg
Total:				
CO2	176,775.52 kg	169,960.05 kg	6,815.47 kg	269,185.28 kg
SO2	921.31 kg	902.36 kg	18.95 kg	748.41 kg
NOx	172.39 kg	165.11 kg	7.28 kg	287.38 kg

B. LED Exterior Fixtures

NIST BLCC 5.3-15: Comparative Analysis
Consistent with Federal Life Cycle Cost Methodology and Procedures, 10 CFR, Part 436, Subpart A
Base Case: Existing
Alternative: LED Exterior Fixtures
General Information

File Name:	T:\-=EME Projects=-\NYPA Energy Program\Adirondack Park Agency\ADK FEMP BLCC.xml
Date of Study:	Mon Jan 11 15:43:37 EST 2016
Project Name:	Adirondack Park Agency
Project Location:	New York
Analysis Type:	FEMP Analysis, Energy Project
Analyst:	Taylor Bastow
Base Date:	October 1, 2015
Service Date:	April 1, 2016
Study Period:	40 years 0 months(October 1, 2015 through September 30, 2055)
Discount Rate:	3%
Discounting Convention:	End-of-Year

Comparison of Present-Value Costs
PV Life-Cycle Cost

	Base Case	Alternative	Savings from Alternative
Initial Investment Costs:			
Capital Requirements as of Base Date	$0	$19,323	-$19,323
Future Costs:			
Energy Consumption Costs	$1,490,198	$1,406,075	$84,123
Energy Demand Charges	$0	$0	$0
Energy Utility Rebates	$0	$0	$0
Water Costs	$0	$0	$0
Recurring and Non-Recurring OM&R Costs	$0	-$2,734	$2,734

Capital Replacements	$0	$0	$0
Residual Value at End of Study Period	$0	$0	$0
Subtotal (for Future Cost Items)	$1,490,198	$1,403,341	$86,857
Total PV Life-Cycle Cost	$1,490,198	$1,422,664	$67,534

Net Savings from Alternative Compared with Base Case

PV of Non-Investment Savings	$86,857
- Increased Total Investment	$19,323
Net Savings	$67,534

Savings-to-Investment Ratio (SIR)

SIR = 4.50

Adjusted Internal Rate of Return

AIRR = 6.94%

Payback Period

Estimated Years to Payback (from beginning of Service Period)

Simple Payback occurs in year 6

Discounted Payback occurs in year 7

Energy Savings Summary

Energy Savings Summary (in stated units)

Energy Type	Average Base Case	Annual Alternative	Consumption Savings	Life-Cycle Savings
Electricity	199,440.0 kWh	172,227.0 kWh	27,213.0 kWh	1,074,811.1 kWh
Distillate Fuel Oil (#1, #2)	8,539.8 Gal	8,539.8 Gal	0.0 Gal	0.0 Gal

Energy Savings Summary (in MBtu)

Energy Type	Average Base Case	Annual Alternative	Consumption Savings	Life-Cycle Savings

Electricity	680.5 MBtu	587.7 MBtu	92.9 MBtu	3,667.4 MBtu
Distillate Fuel Oil (#1, #2)	1,296.1 MBtu	1,296.1 MBtu	0.0 MBtu	0.0 MBtu

Emissions Reduction Summary

Energy	-----Average	Annual	Emissions-----	Life-Cycle
Type	Base Case	Alternative	Reduction	Reduction
Electricity				
CO2	81,524.95 kg	70,401.11 kg	11,123.84 kg	439,349.75 kg
SO2	239.96 kg	207.22 kg	32.74 kg	1,293.16 kg
NOx	86.53 kg	74.72 kg	11.81 kg	466.32 kg
Distillate Fuel Oil (#1, #2)				
CO2	95,250.57 kg	95,250.57 kg	0.00 kg	0.00 kg
SO2	681.35 kg	681.35 kg	0.00 kg	0.00 kg
NOx	85.86 kg	85.86 kg	0.00 kg	0.00 kg
Total:				
CO2	176,775.52 kg	165,651.68 kg	11,123.84 kg	439,349.75 kg
SO2	921.31 kg	888.57 kg	32.74 kg	1,293.16 kg
NOx	172.39 kg	160.58 kg	11.81 kg	466.32 kg

C. BMS Upgrade and Retro-Commissioning

NIST BLCC 5.3-15: Comparative Analysis
Consistent with Federal Life Cycle Cost Methodology and Procedures, 10 CFR, Part 436, Subpart A
Base Case: Existing
Alternative: BMS Upgrade and Retro-Commissioning
General Information

File Name:	T:\-=EME Projects=-\NYPA Energy Program\Adirondack Park Agency\ADK FEMP BLCC.xml
Date of Study:	Mon Jan 11 15:43:50 EST 2016
Project Name:	Adirondack Park Agency
Project Location:	New York
Analysis Type:	FEMP Analysis, Energy Project
Analyst:	Taylor Bastow
Base Date:	October 1, 2015
Service Date:	April 1, 2016
Study Period:	40 years 0 months(October 1, 2015 through September 30, 2055)
Discount Rate:	3%
Discounting Convention:	End-of-Year

Comparison of Present-Value Costs
PV Life-Cycle Cost

	Base Case	Alternative	Savings from Alternative
Initial Investment Costs:			
Capital Requirements as of Base Date	$0	$209,364	-$209,364
Future Costs:			
Energy Consumption Costs	$1,490,198	$1,159,670	$330,528
Energy Demand Charges	$0	$0	$0
Energy Utility Rebates	$0	$0	$0
Water Costs	$0	$0	$0
Recurring and Non-Recurring OM&R Costs	$0	$0	$0

Capital Replacements	$0	$0	$0
Residual Value at End of Study Period	$0	$0	$0
Subtotal (for Future Cost Items)	$1,490,198	$1,159,670	$330,528
Total PV Life-Cycle Cost	$1,490,198	$1,369,034	$121,164

Net Savings from Alternative Compared with Base Case

PV of Non-Investment Savings $330,528

- Increased Total Investment $209,364

Net Savings $121,164

Savings-to-Investment Ratio (SIR)

SIR = 1.58

Adjusted Internal Rate of Return

AIRR = 4.18%

Payback Period

Estimated Years to Payback (from beginning of Service Period)

Simple Payback occurs in year 16

Discounted Payback occurs in year 22

Energy Savings Summary

Energy Savings Summary (in stated units)

Energy	-----Average	Annual	Consumption-----	Life-Cycle
Type	Base Case	Alternative	Savings	Savings
Electricity	199,440.0 kWh	116,779.0 kWh	82,661.0 kWh	3,264,798.3 kWh
Distillate Fuel Oil (#1, #2)	8,539.8 Gal	7,806.7 Gal	733.1 Gal	28,954.3 Gal

Energy Savings Summary (in MBtu)

Energy	-----Average	Annual	Consumption-----	Life-Cycle
Type	Base Case	Alternative	Savings	Savings

Electricity	680.5 MBtu	398.5 MBtu	282.1 MBtu	11,140.0 MBtu
Distillate Fuel Oil (#1, #2)	1,296.1 MBtu	1,184.8 MBtu	111.3 MBtu	4,394.3 MBtu

Emissions Reduction Summary

Energy	-----Average	Annual	Emissions-----	Life-Cycle
Type	Base Case	Alternative	Reduction	Reduction
Electricity				
CO2	81,524.95 kg	47,735.67 kg	33,789.28 kg	1,334,549.28 kg
SO2	239.96 kg	140.50 kg	99.45 kg	3,928.05 kg
NOx	86.53 kg	50.67 kg	35.86 kg	1,416.48 kg
Distillate Fuel Oil (#1, #2)				
CO2	95,250.57 kg	87,073.89 kg	8,176.68 kg	322,948.21 kg
SO2	681.35 kg	622.86 kg	58.49 kg	2,310.13 kg
NOx	85.86 kg	78.49 kg	7.37 kg	291.11 kg
Total:				
CO2	176,775.52 kg	134,809.55 kg	41,965.96 kg	1,657,497.49 kg
SO2	921.31 kg	763.36 kg	157.94 kg	6,238.18 kg
NOx	172.39 kg	129.16 kg	43.23 kg	1,707.59 kg

D. Heating Hot Water Pump Upgrade

NIST BLCC 5.3-15: Comparative Analysis
Consistent with Federal Life Cycle Cost Methodology and Procedures, 10 CFR, Part 436, Subpart A
Base Case: Existing
Alternative: Hot Water Pump Upgrades
General Information

File Name:	T:\-=EME Projects=-\NYPA Energy Program\Adirondack Park Agency\ADK FEMP BLCC.xml
Date of Study:	Thu May 05 14:00:44 EDT 2016
Project Name:	Adirondack Park Agency
Project Location:	New York
Analysis Type:	FEMP Analysis, Energy Project
Analyst:	Taylor Bastow
Base Date:	October 1, 2015
Service Date:	April 1, 2016
Study Period:	40 years 0 months(October 1, 2015 through September 30, 2055)
Discount Rate:	3%
Discounting Convention:	End-of-Year

Comparison of Present-Value Costs
PV Life-Cycle Cost

	Base Case	Alternative	Savings from Alternative
Initial Investment Costs:			
Capital Requirements as of Base Date	$0	$24,716	-$24,716
Future Costs:			
Energy Consumption Costs	$1,490,198	$1,464,778	$25,420
Energy Demand Charges	$0	$0	$0
Energy Utility Rebates	$0	$0	$0
Water Costs	$0	$0	$0
Recurring and Non-Recurring OM&R Costs	$0	$0	$0

Capital Replacements	$0	$0	$0
Residual Value at End of Study Period	$0	$0	$0
Subtotal (for Future Cost Items)	$1,490,198	$1,464,778	$25,420
Total PV Life-Cycle Cost	$1,490,198	$1,489,494	$704

Net Savings from Alternative Compared with Base Case

PV of Non-Investment Savings $25,420

- Increased Total Investment $24,716

Net Savings $704

Savings-to-Investment Ratio (SIR)

SIR = 1.03

Adjusted Internal Rate of Return

AIRR = 3.07%

Payback Period
Estimated Years to Payback (from beginning of Service Period)

Simple Payback occurs in year 23

Discounted Payback occurs in year 39

Energy Savings Summary
Energy Savings Summary (in stated units)

Energy	-----Average	Annual	Consumption----	Life-Cycle
Type	Base Case	Alternative	Savings	Savings
Electricity	199,440.0 kWh	191,217.0 kWh	8,223.0 kWh	324,777.5 kWh
Distillate Fuel Oil (#1, #2)	8,539.8 Gal	8,539.8 Gal	0.0 Gal	0.0 Gal

Energy Savings Summary (in MBtu)

Energy	-----Average	Annual	Consumption-----	Life-Cycle
Type	Base Case	Alternative	Savings	Savings

Electricity	680.5 MBtu	652.5 MBtu	28.1 MBtu	1,108.2 MBtu
Distillate Fuel Oil (#1, #2)	1,296.1 MBtu	1,296.1 MBtu	0.0 MBtu	0.0 MBtu

Emissions Reduction Summary

Energy	-----Average	Annual	Emissions-----	Life-Cycle
Type	Base Case	Alternative	Reduction	Reduction
Electricity				
CO2	81,524.95 kg	78,163.64 kg	3,361.31 kg	132,759.09 kg
SO2	239.96 kg	230.06 kg	9.89 kg	390.76 kg
NOx	86.53 kg	82.96 kg	3.57 kg	140.91 kg
Distillate Fuel Oil (#1, #2)				
CO2	95,250.57 kg	95,250.57 kg	0.00 kg	0.00 kg
SO2	681.35 kg	681.35 kg	0.00 kg	0.00 kg
NOx	85.86 kg	85.86 kg	0.00 kg	0.00 kg
Total:				
CO2	176,775.52 kg	173,414.21 kg	3,361.31 kg	132,759.09 kg
SO2	921.31 kg	911.41 kg	9.89 kg	390.76 kg
NOx	172.39 kg	168.82 kg	3.57 kg	140.91 kg

E. Building Envelope Upgrades 1

NIST BLCC 5.3-15: Comparative Analysis
Consistent with Federal Life Cycle Cost Methodology and Procedures, 10 CFR, Part 436, Subpart A
Base Case: Existing
Alternative: Building Envelope Upgrades 1
General Information

File Name:	T:\-=EME Projects=-\NYPA Energy Program\Adirondack Park Agency\ADK FEMP BLCC.xml
Date of Study:	Mon May 02 16:31:32 EDT 2016
Project Name:	Adirondack Park Agency
Project Location:	New York
Analysis Type:	FEMP Analysis, Energy Project
Analyst:	Taylor Bastow
Base Date:	October 1, 2015
Service Date:	April 1, 2016
Study Period:	40 years 0 months(October 1, 2015 through September 30, 2055)
Discount Rate:	3%
Discounting Convention:	End-of-Year

Comparison of Present-Value Costs
PV Life-Cycle Cost

	Base Case	Alternative	Savings from Alternative
Initial Investment Costs:			
Capital Requirements as of Base Date	$0	$147,828	-$147,828
Future Costs:			
Energy Consumption Costs	$1,490,198	$1,354,091	$136,107
Energy Demand Charges	$0	$0	$0
Energy Utility Rebates	$0	$0	$0
Water Costs	$0	$0	$0
Recurring and Non-Recurring OM&R Costs	$0	$0	$0

Capital Replacements	$0	$0	$0
Residual Value at End of Study Period	$0	$0	$0
Subtotal (for Future Cost Items)	$1,490,198	$1,354,091	$136,107
Total PV Life-Cycle Cost	$1,490,198	$1,501,919	-$11,721

Net Savings from Alternative Compared with Base Case

PV of Non-Investment Savings	$136,107
- Increased Total Investment	$147,828
Net Savings	-$11,721

Savings-to-Investment Ratio (SIR)

SIR = 0.92

SIR is lower than 1.0; project alternative is not cost effective.

Adjusted Internal Rate of Return

AIRR = 2.79%

AIRR is lower than your discount rate; project alternative is not cost effective.

Payback Period

Estimated Years to Payback (from beginning of Service Period)

Discounted Payback never reached during study period.

Simple Payback occurs in year 27

Energy Savings Summary

Energy Savings Summary (in stated units)

Energy	-----Average	Annual	Consumption-----	Life-Cycle
Type	Base Case	Alternative	Savings	Savings
Electricity	199,440.0 kWh	199,458.0 kWh	-18.0 kWh	-710.9 kWh
Distillate Fuel Oil (#1, #2)	8,539.8 Gal	7,208.9 Gal	1,330.9 Gal	52,567.1 Gal

Energy Savings Summary (in MBtu)

Energy	-----Average	Annual	Consumption-----	Life-Cycle
Type	Base Case	Alternative	Savings	Savings

Electricity	680.5 MBtu	680.6 MBtu	-0.1 MBtu	-2.4 MBtu
Distillate Fuel Oil (#1, #2)	1,296.1 MBtu	1,094.1 MBtu	202.0 MBtu	7,978.0 MBtu

Emissions Reduction Summary

Energy	-----Average	Annual	Emissions-----	Life-Cycle
Type	Base Case	Alternative	Reduction	Reduction
Electricity				
CO2	81,524.95 kg	81,532.30 kg	-7.36 kg	-290.61 kg
SO2	239.96 kg	239.98 kg	-0.02 kg	-0.86 kg
NOx	86.53 kg	86.54 kg	-0.01 kg	-0.31 kg
Distillate Fuel Oil (#1, #2)				
CO2	95,250.57 kg	80,405.63 kg	14,844.94 kg	586,319.12 kg
SO2	681.35 kg	575.16 kg	106.19 kg	4,194.08 kg
NOx	85.86 kg	72.48 kg	13.38 kg	528.52 kg
Total:				
CO2	176,775.52 kg	161,937.94 kg	14,837.58 kg	586,028.52 kg
SO2	921.31 kg	815.14 kg	106.17 kg	4,193.23 kg
NOx	172.39 kg	159.02 kg	13.37 kg	528.21 kg

F. Building Envelope Upgrades 2

NIST BLCC 5.3-15: Comparative Analysis
Consistent with Federal Life Cycle Cost Methodology and Procedures, 10 CFR, Part 436, Subpart A
Base Case: Existing
Alternative: Building Envelope Upgrades 2
General Information

File Name:	T:\-=EME Projects=-\NYPA Energy Program\Adirondack Park Agency\ADK FEMP BLCC.xml
Date of Study:	Mon May 02 16:33:11 EDT 2016
Project Name:	Adirondack Park Agency
Project Location:	New York
Analysis Type:	FEMP Analysis, Energy Project
Analyst:	Taylor Bastow
Base Date:	October 1, 2015
Service Date:	April 1, 2016
Study Period:	40 years 0 months(October 1, 2015 through September 30, 2055)
Discount Rate:	3%
Discounting Convention:	End-of-Year

Comparison of Present-Value Costs
PV Life-Cycle Cost

	Base Case	Alternative	Savings from Alternative
Initial Investment Costs:			
Capital Requirements as of Base Date	$0	$35,220	-$35,220
Future Costs:			
Energy Consumption Costs	$1,490,198	$1,385,083	$105,115
Energy Demand Charges	$0	$0	$0
Energy Utility Rebates	$0	$0	$0
Water Costs	$0	$0	$0
Recurring and Non-Recurring OM&R Costs	$0	$0	$0

Capital Replacements	$0	$0	$0
Residual Value at End of Study Period	$0	$0	$0
Subtotal (for Future Cost Items)	$1,490,198	$1,385,083	$105,115
Total PV Life-Cycle Cost	$1,490,198	$1,420,303	$69,895

Net Savings from Alternative Compared with Base Case

PV of Non-Investment Savings $105,115

- Increased Total Investment $35,220

Net Savings $69,895

Savings-to-Investment Ratio (SIR)

SIR = 2.98

Adjusted Internal Rate of Return

AIRR = 5.85%

Payback Period
Estimated Years to Payback (from beginning of Service Period)

Simple Payback occurs in year 11

Discounted Payback occurs in year 13

Energy Savings Summary
Energy Savings Summary (in stated units)

Energy	-----Average	Annual	Consumption-----	Life-Cycle
Type	Base Case	Alternative	Savings	Savings
Electricity	199,440.0 kWh	201,793.0 kWh	-2,353.0 kWh	-92,934.6 kWh
Distillate Fuel Oil (#1, #2)	8,539.8 Gal	7,441.2 Gal	1,098.6 Gal	43,389.0 Gal

Energy Savings Summary (in MBtu)

Energy	-----Average	Annual	Consumption-----	Life-Cycle
Type	Base Case	Alternative	Savings	Savings

Electricity	680.5 MBtu	688.5 MBtu	-8.0 MBtu	-317.1 MBtu
Distillate Fuel Oil (#1, #2)	1,296.1 MBtu	1,129.3 MBtu	166.7 MBtu	6,585.0 MBtu

Emissions Reduction Summary

Energy	-----Average	Annual	Emissions-----	Life-Cycle
Type	Base Case	Alternative	Reduction	Reduction
Electricity				
CO2	81,524.95 kg	82,486.78 kg	-961.83 kg	-37,988.83 kg
SO2	239.96 kg	242.79 kg	-2.83 kg	-111.81 kg
NOx	86.53 kg	87.55 kg	-1.02 kg	-40.32 kg
Distillate Fuel Oil (#1, #2)				
CO2	95,250.57 kg	82,997.53 kg	12,253.03 kg	483,948.74 kg
SO2	681.35 kg	593.70 kg	87.65 kg	3,461.80 kg
NOx	85.86 kg	74.82 kg	11.05 kg	436.24 kg
Total:				
CO2	176,775.52 kg	165,484.31 kg	11,291.20 kg	445,959.91 kg
SO2	921.31 kg	836.49 kg	84.82 kg	3,349.99 kg
NOx	172.39 kg	162.37 kg	10.02 kg	395.92 kg

G. Vending Machine Controls

NIST BLCC 5.3-15: Comparative Analysis
Consistent with Federal Life Cycle Cost Methodology and Procedures, 10 CFR, Part 436, Subpart A
Base Case: Existing
Alternative: Vending Machine Upgrades
General Information

File Name:	T:\-=EME Projects=-\NYPA Energy Program\Adirondack Park Agency\ADK FEMP BLCC.xml
Date of Study:	Mon Jan 11 15:44:19 EST 2016
Project Name:	Adirondack Park Agency
Project Location:	New York
Analysis Type:	FEMP Analysis, Energy Project
Analyst:	Taylor Bastow
Base Date:	October 1, 2015
Service Date:	April 1, 2016
Study Period:	40 years 0 months(October 1, 2015 through September 30, 2055)
Discount Rate:	3%
Discounting Convention:	End-of-Year

Comparison of Present-Value Costs
PV Life-Cycle Cost

	Base Case	Alternative	Savings from Alternative
Initial Investment Costs:			
Capital Requirements as of Base Date	$0	$1,213	-$1,213
Future Costs:			
Energy Consumption Costs	$1,490,198	$1,486,748	$3,450
Energy Demand Charges	$0	$0	$0
Energy Utility Rebates	$0	$0	$0
Water Costs	$0	$0	$0
Recurring and Non-Recurring OM&R Costs	$0	$0	$0

Capital Replacements	$0	$0	$0
Residual Value at End of Study Period	$0	$0	$0
Subtotal (for Future Cost Items)	$1,490,198	$1,486,748	$3,450
Total PV Life-Cycle Cost	$1,490,198	$1,487,961	$2,237

Net Savings from Alternative Compared with Base Case

PV of Non-Investment Savings $3,450

- Increased Total Investment $1,213

Net Savings $2,237

Savings-to-Investment Ratio (SIR)

SIR = 2.84

Adjusted Internal Rate of Return

ARR = 5.73%

Payback Period

Estimated Years to Payback (from beginning of Service Period)

Simple Payback occurs in year 9

Discounted Payback occurs in year 11

Energy Savings Summary

Energy Savings Summary (in stated units)

Energy Type	Average Base Case	Annual Alternative	Consumption Savings	Life-Cycle Savings
Electricity	199,440.0 kWh	198,324.0 kWh	1,116.0 kWh	44,077.8 kWh
Distillate Fuel Oil (#1, #2)	8,539.8 Gal	8,539.8 Gal	0.0 Gal	0.0 Gal

Energy Savings Summary (in MBtu)

Energy Type	Average Base Case	Annual Alternative	Consumption Savings	Life-Cycle Savings

Electricity	680.5 MBtu	676.7 MBtu	3.8 MBtu	150.4 MBtu
Distillate Fuel Oil (#1, #2)	1,296.1 MBtu	1,296.1 MBtu	0.0 MBtu	0.0 MBtu

Emissions Reduction Summary

Energy	-----Average	Annual	Emissions-----	Life-Cycle
Type	Base Case	Alternative	Reduction	Reduction
Electricity				
CO2	81,524.95 kg	81,068.76 kg	456.19 kg	18,017.65 kg
SO2	239.96 kg	238.61 kg	1.34 kg	53.03 kg
NOx	86.53 kg	86.05 kg	0.48 kg	19.12 kg
Distillate Fuel Oil (#1, #2)				
CO2	95,250.57 kg	95,250.57 kg	0.00 kg	0.00 kg
SO2	681.35 kg	681.35 kg	0.00 kg	0.00 kg
NOx	85.86 kg	85.86 kg	0.00 kg	0.00 kg
Total:				
CO2	176,775.52 kg	176,319.33 kg	456.19 kg	18,017.65 kg
SO2	921.31 kg	919.96 kg	1.34 kg	53.03 kg
NOx	172.39 kg	171.91 kg	0.48 kg	19.12 kg

H. Lighting Controls

NIST BLCC 5.3-15: Comparative Analysis
Consistent with Federal Life Cycle Cost Methodology and Procedures, 10 CFR, Part 436, Subpart A
Base Case: Existing
Alternative: Lighting Controls
General Information

File Name:	T:\-=EME Projects=-\NYPA Energy Program\Adirondack Park Agency\ADK FEMP BLCC.xml
Date of Study:	Mon Jan 11 15:44:29 EST 2016
Project Name:	Adirondack Park Agency
Project Location:	New York
Analysis Type:	FEMP Analysis, Energy Project
Analyst:	Taylor Bastow
Base Date:	October 1, 2015
Service Date:	April 1, 2016
Study Period:	40 years 0 months(October 1, 2015 through September 30, 2055)
Discount Rate:	3%
Discounting Convention:	End-of-Year

Comparison of Present-Value Costs
PV Life-Cycle Cost

	Base Case	Alternative	Savings from Alternative
Initial Investment Costs:			
Capital Requirements as of Base Date	$0	$25,351	-$25,351
Future Costs:			
Energy Consumption Costs	$1,490,198	$1,460,187	$30,011
Energy Demand Charges	$0	$0	$0
Energy Utility Rebates	$0	$0	$0
Water Costs	$0	$0	$0
Recurring and Non-Recurring OM&R Costs	$0	$0	$0

Capital Replacements	$0	$0	$0
Residual Value at End of Study Period	$0	$0	$0
Subtotal (for Future Cost Items)	$1,490,198	$1,460,187	$30,011
Total PV Life-Cycle Cost	$1,490,198	$1,485,538	$4,660

Net Savings from Alternative Compared with Base Case

PV of Non-Investment Savings	$30,011
- Increased Total Investment	$25,351
Net Savings	$4,660

Savings-to-Investment Ratio (SIR)

SIR = 1.18

Adjusted Internal Rate of Return

AIRR = 3.44%

Payback Period

Estimated Years to Payback (from beginning of Service Period)

Simple Payback occurs in year 20

Discounted Payback occurs in year 31

Energy Savings Summary

Energy Savings Summary (in stated units)

Energy Type	Average Base Case	Annual Alternative	Consumption Savings	Life-Cycle Savings
Electricity	199,440.0 kWh	188,766.0 kWh	10,674.0 kWh	421,582.8 kWh
Distillate Fuel Oil (#1, #2)	8,539.8 Gal	8,569.0 Gal	-29.2 Gal	-1,152.5 Gal

Energy Savings Summary (in MBtu)

Energy Type	Average Base Case	Annual Alternative	Consumption Savings	Life-Cycle Savings

Electricity	680.5 MBtu	644.1 MBtu	36.4 MBtu	1,438.5 MBtu
Distillate Fuel Oil (#1, #2)	1,296.1 MBtu	1,300.5 MBtu	-4.4 MBtu	-174.9 MBtu

Emissions Reduction Summary

Energy	-----Average	Annual	Emissions-----	Life-Cycle
Type	Base Case	Alternative	Reduction	Reduction
Electricity				
CO2	81,524.95 kg	77,161.74 kg	4,363.20 kg	172,330.11 kg
SO2	239.96 kg	227.11 kg	12.84 kg	507.23 kg
NOx	86.53 kg	81.90 kg	4.63 kg	182.91 kg
Distillate Fuel Oil (#1, #2)				
CO2	95,250.57 kg	95,576.03 kg	-325.47 kg	-12,854.67 kg
SO2	681.35 kg	683.68 kg	-2.33 kg	-91.95 kg
NOx	85.86 kg	86.15 kg	-0.29 kg	-11.59 kg
Total:				
CO2	176,775.52 kg	172,737.78 kg	4,037.74 kg	159,475.44 kg
SO2	921.31 kg	910.79 kg	10.51 kg	415.28 kg
NOx	172.39 kg	168.05 kg	4.34 kg	171.32 kg

I. Condensing Unit Upgrades

NIST BLCC 5.3-15: Comparative Analysis
Consistent with Federal Life Cycle Cost Methodology and Procedures, 10 CFR, Part 436, Subpart A
Base Case: Existing
Alternative: Condensing Unit Upgrade
General Information

File Name: T:\-=EME Projects=-\NYPA Energy Program\Adirondack Park Agency\ADK FEMP BLCC.xml

Date of Study: Mon Jan 11 15:44:46 EST 2016

Project Name: Adirondack Park Agency

Project Location: New York

Analysis Type: FEMP Analysis, Energy Project

Analyst: Taylor Bastow

Base Date: October 1, 2015

Service Date: April 1, 2016

Study Period: 40 years 0 months(October 1, 2015 through September 30, 2055)

Discount Rate: 3%

Discounting Convention: End-of-Year

Comparison of Present-Value Costs
PV Life-Cycle Cost

	Base Case	Alternative	Savings from Alternative
Initial Investment Costs:			
Capital Requirements as of Base Date	$0	$37,477	-$37,477
Future Costs:			
Energy Consumption Costs	$1,490,198	$1,477,178	$13,021
Energy Demand Charges	$0	$0	$0
Energy Utility Rebates	$0	$0	$0
Water Costs	$0	$0	$0
Recurring and Non-Recurring OM&R Costs	$0	$0	$0

Capital Replacements	$0	$0	$0
Residual Value at End of Study Period	$0	$0	$0
Subtotal (for Future Cost Items)	$1,490,198	$1,477,178	$13,021
Total PV Life-Cycle Cost	$1,490,198	$1,514,655	-$24,456

Net Savings from Alternative Compared with Base Case

PV of Non-Investment Savings	$13,021
- Increased Total Investment	$37,477
Net Savings	-$24,456

Savings-to-Investment Ratio (SIR)

SIR = 0.35

SIR is lower than 1.0; project alternative is not cost effective.

Adjusted Internal Rate of Return

AIRR = 0.31%

AIRR is lower than your discount rate; project alternative is not cost effective.

Payback Period

Estimated Years to Payback (from beginning of Service Period)

Simple Payback never reached during study period.

Discounted Payback never reached during study period.

Energy Savings Summary

Energy Savings Summary (in stated units)

Energy Type	Average Base Case	Annual Alternative	Consumption Savings	Life-Cycle Savings
Electricity	199,440.0 kWh	195,228.0 kWh	4,212.0 kWh	166,358.1 kWh
Distillate Fuel Oil (#1, #2)	8,539.8 Gal	8,539.8 Gal	0.0 Gal	0.0 Gal

Energy Savings Summary (in MBtu)

Energy Type	Average Base Case	Annual Alternative	Consumption Savings	Life-Cycle Savings

Electricity	680.5 MBtu	666.1 MBtu	14.4 MBtu	567.6 MBtu
Distillate Fuel Oil (#1, #2)	1,296.1 MBtu	1,296.1 MBtu	0.0 MBtu	0.0 MBtu

Emissions Reduction Summary

Energy	-----Average	Annual	Emissions-----	Life-Cycle
Type	Base Case	Alternative	Reduction	Reduction
Electricity				
CO2	81,524.95 kg	79,803.21 kg	1,721.74 kg	68,002.10 kg
SO2	239.96 kg	234.89 kg	5.07 kg	200.15 kg
NOx	86.53 kg	84.70 kg	1.83 kg	72.18 kg
Distillate Fuel Oil (#1, #2)				
CO2	95,250.57 kg	95,250.57 kg	0.00 kg	0.00 kg
SO2	681.35 kg	681.35 kg	0.00 kg	0.00 kg
NOx	85.86 kg	85.86 kg	0.00 kg	0.00 kg
Total:				
CO2	176,775.52 kg	175,053.78 kg	1,721.74 kg	68,002.10 kg
SO2	921.31 kg	916.24 kg	5.07 kg	200.15 kg
NOx	172.39 kg	170.56 kg	1.83 kg	72.18 kg

J. Data Center Cooling

NIST BLCC 5.3-15: Comparative Analysis
Consistent with Federal Life Cycle Cost Methodology and Procedures, 10 CFR, Part 436, Subpart A
Base Case: Existing
Alternative: Data Center Cooling
General Information

File Name:	T:\-=EME Projects=-\NYPA Energy Program\Adirondack Park Agency\ADK FEMP BLCC.xml
Date of Study:	Mon Jan 11 15:44:58 EST 2016
Project Name:	Adirondack Park Agency
Project Location:	New York
Analysis Type:	FEMP Analysis, Energy Project
Analyst:	Taylor Bastow
Base Date:	October 1, 2015
Service Date:	April 1, 2016
Study Period:	40 years 0 months(October 1, 2015 through September 30, 2055)
Discount Rate:	3%
Discounting Convention:	End-of-Year

Comparison of Present-Value Costs
PV Life-Cycle Cost

	Base Case	Alternative	Savings from Alternative
Initial Investment Costs:			
Capital Requirements as of Base Date	$0	$21,994	-$21,994
Future Costs:			
Energy Consumption Costs	$1,490,198	$1,501,837	-$11,639
Energy Demand Charges	$0	$0	$0
Energy Utility Rebates	$0	$0	$0
Water Costs	$0	$0	$0
Recurring and Non-Recurring OM&R Costs	$0	$0	$0

Capital Replacements	$0	$0	$0
Residual Value at End of Study Period	$0	$0	$0
Subtotal (for Future Cost Items)	$1,490,198	$1,501,837	-$11,639
Total PV Life-Cycle Cost	$1,490,198	$1,523,831	-$33,633

Net Savings from Alternative Compared with Base Case

PV of Non-Investment Savings	-$11,639
- Increased Total Investment	$21,994
Net Savings	-$33,633

NOTE: Meaningful SIR, AIRR and Payback can not be computed unless incremental savings and total savings are both positive.

Energy Savings Summary

Energy Savings Summary (in stated units)

Energy Type	Average Annual Consumption Base Case	Alternative	Savings	Life-Cycle Savings
Electricity	199,440.0 kWh	198,670.0 kWh	770.0 kWh	30,412.1 kWh
Distillate Fuel Oil (#1, #2)	8,539.8 Gal	8,539.8 Gal	0.0 Gal	0.0 Gal

Energy Savings Summary (in MBtu)

Energy Type	Average Annual Consumption Base Case	Alternative	Savings	Life-Cycle Savings
Electricity	680.5 MBtu	677.9 MBtu	2.6 MBtu	103.8 MBtu
Distillate Fuel Oil (#1, #2)	1,296.1 MBtu	1,296.1 MBtu	0.0 MBtu	0.0 MBtu

Emissions Reduction Summary

Energy Type	Average Annual Emissions Base Case	Alternative	Reduction	Life-Cycle Reduction
Electricity				

Capital Replacements	$0	$0	$0
Residual Value at End of Study Period	$0	$0	$0
Subtotal (for Future Cost Items)	$1,490,198	$1,164,911	$325,287
Total PV Life-Cycle Cost	$1,490,198	$1,508,023	-$17,825

Net Savings from Alternative Compared with Base Case

PV of Non-Investment Savings $325,287

- Increased Total Investment $343,112

Net Savings -$17,825

Savings-to-Investment Ratio (SIR)

SIR = 0.95

SIR is lower than 1.0; project alternative is not cost effective.

Adjusted Internal-Rate of Return

AIRR = 2.86%

AIRR is lower than your discount rate; project alternative is not cost effective.

Payback Period

Estimated Years to Payback (from beginning of Service Period)

Discounted Payback never reached during study period.

Simple Payback occurs in year 25

Energy Savings Summary

Energy Savings Summary (in stated units)

Energy Type	Average Annual Consumption: Base Case	Alternative	Savings	Life-Cycle Savings
Electricity	199,440.0 kWh	94,213.0 kWh	105,227.0 kWh	4,156,070.4 kWh
Distillate Fuel Oil (#1, #2)	8,539.8 Gal	8,539.8 Gal	0.0 Gal	0.0 Gal

Energy Savings Summary (in MBtu)

Energy Type	Average Annual Consumption: Base Case	Alternative	Savings	Life-Cycle Savings

Electricity	680.5 MBtu	321.5 MBtu	359.0 MBtu	14,181.1 MBtu
Distillate Fuel Oil (#1, #2)	1,296.1 MBtu	1,296.1 MBtu	0.0 MBtu	0.0 MBtu

Emissions Reduction Summary

Energy	-----Average	Annual	Emissions-----	Life-Cycle
Type	Base Case	Alternative	Reduction	Reduction
Electricity				
CO2	81,524.95 kg	38,511.38 kg	43,013.57 kg	1,698,873.92 kg
SO2	239.96 kg	113.35 kg	126.60 kg	5,000.39 kg
NOx	86.53 kg	40.88 kg	45.65 kg	1,803.17 kg
Distillate Fuel Oil (#1, #2)				
CO2	95,250.57 kg	95,250.57 kg	0.00 kg	0.00 kg
SO2	681.35 kg	681.35 kg	0.00 kg	0.00 kg
NOx	85.86 kg	85.86 kg	0.00 kg	0.00 kg
Total:				
CO2	176,775.52 kg	133,761.95 kg	43,013.57 kg	1,698,873.92 kg
SO2	921.31 kg	794.70 kg	126.60 kg	5,000.39 kg
NOx	172.39 kg	126.74 kg	45.65 kg	1,803.17 kg

L. Appliance Upgrades

NIST BLCC 5.3-15: Comparative Analysis
Consistent with Federal Life Cycle Cost Methodology and Procedures, 10 CFR, Part 436, Subpart A
Base Case: Existing
Alternative: Appliance Upgrades
General Information

File Name:	T:\-=EME Projects=-\NYPA Energy Program\Adirondack Park Agency\ADK FEMP BLCC.xml
Date of Study:	Mon Jan 11 15:45:26 EST 2016
Project Name:	Adirondack Park Agency
Project Location:	New York
Analysis Type:	FEMP Analysis, Energy Project
Analyst:	Taylor Bastow
Base Date:	October 1, 2015
Service Date:	April 1, 2016
Study Period:	40 years 0 months(October 1, 2015 through September 30, 2055)
Discount Rate:	3%
Discounting Convention:	End-of-Year

Comparison of Present-Value Costs
PV Life-Cycle Cost

	Base Case	Alternative	Savings from Alternative
Initial Investment Costs:			
Capital Requirements as of Base Date	$0	$1,928	-$1,928
Future Costs:			
Energy Consumption Costs	$1,490,198	$1,488,575	$1,623
Energy Demand Charges	$0	$0	$0
Energy Utility Rebates	$0	$0	$0
Water Costs	$0	$0	$0
Recurring and Non-Recurring OM&R Costs	$0	$0	$0

Capital Replacements	$0	$0	$0
Residual Value at End of Study Period	$0	$0	$0
Subtotal (for Future Cost Items)	$1,490,198	$1,488,575	$1,623
Total PV Life-Cycle Cost	$1,490,198	$1,490,503	-$305

Net Savings from Alternative Compared with Base Case

PV of Non-Investment Savings	$1,623
- Increased Total Investment	$1,928
Net Savings	-$305

Savings-to-Investment Ratio (SIR)

SIR = 0.84

SIR is lower than 1.0; project alternative is not cost effective.

Adjusted Internal Rate of Return

AIRR = 2.56%

AIRR is lower than your discount rate; project alternative is not cost effective.

Payback Period

Estimated Years to Payback (from beginning of Service Period)

Discounted Payback never reached during study period.

Simple Payback occurs in year 28

Energy Savings Summary

Energy Savings Summary (in stated units)

Energy Type	Average Annual Consumption: Base Case	Alternative	Savings	Life-Cycle Savings
Electricity	199,440.0 kWh	198,915.0 kWh	525.0 kWh	20,735.5 kWh
Distillate Fuel Oil (#1, #2)	8,539.8 Gal	8,539.8 Gal	0.0 Gal	0.0 Gal

Energy Savings Summary (in MBtu)

Energy Type	Average Annual Consumption: Base Case	Alternative	Savings	Life-Cycle Savings

Electricity	680.5 MBtu	678.7 MBtu	1.8 MBtu	70.8 MBtu
Distillate Fuel Oil (#1, #2)	1,296.1 MBtu	1,296.1 MBtu	0.0 MBtu	0.0 MBtu

Emissions Reduction Summary

Energy	-----Average	Annual	Emissions-----	Life-Cycle
Type	Base Case	Alternative	Reduction	Reduction
Electricity				
CO2	81,524.95 kg	81,310.34 kg	214.60 kg	8,476.05 kg
SO2	239.96 kg	239.33 kg	0.63 kg	24.95 kg
NOx	86.53 kg	86.30 kg	0.23 kg	9.00 kg
Distillate Fuel Oil (#1, #2)				
CO2	95,250.57 kg	95,250.57 kg	0.00 kg	0.00 kg
SO2	681.35 kg	681.35 kg	0.00 kg	0.00 kg
NOx	85.86 kg	85.86 kg	0.00 kg	0.00 kg
Total:				
CO2	176,775.52 kg	176,560.91 kg	214.60 kg	8,476.05 kg
SO2	921.31 kg	920.68 kg	0.63 kg	24.95 kg
NOx	172.39 kg	172.16 kg	0.23 kg	9.00 kg

M. Recommended Measures

NIST BLCC 5.3-15: Comparative Analysis
Consistent with Federal Life Cycle Cost Methodology and Procedures, 10 CFR, Part 436, Subpart A
Base Case: Existing
Alternative: Recommended Measures
General Information

File Name:	T:\-=EME Projects=-\NYPA Energy Program\Adirondack Park Agency\ADK FEMP BLCC.xml
Date of Study:	Mon May 02 16:34:46 EDT 2016
Project Name:	Adirondack Park Agency
Project Location:	New York
Analysis Type:	FEMP Analysis, Energy Project
Analyst:	Taylor Bastow
Base Date:	October 1, 2015
Service Date:	April 1, 2016
Study Period:	40 years 0 months(October 1, 2015 through September 30, 2055)
Discount Rate:	3%
Discounting Convention:	End-of-Year

Comparison of Present-Value Costs
PV Life-Cycle Cost

	Base Case	Alternative	Savings from Alternative
Initial Investment Costs:			
Capital Requirements as of Base Date	$0	$480,829	-$480,829
Future Costs:			
Energy Consumption Costs	$1,490,198	$754,338	$735,860
Energy Demand Charges	$0	$0	$0
Energy Utility Rebates	$0	$0	$0
Water Costs	$0	$0	$0
Recurring and Non-Recurring OM&R Costs	$0	$0	$0

Capital Replacements	$0	$0	$0
Residual Value at End of Study Period	$0	$0	$0
Subtotal (for Future Cost Items)	$1,490,198	$754,338	$735,860
Total PV Life-Cycle Cost	$1,490,198	$1,235,167	$255,031

Net Savings from Alternative Compared with Base Case

PV of Non-Investment Savings	$735,860
- Increased Total Investment	$480,829
Net Savings	$255,031

Savings-to-Investment Ratio (SIR)

SIR = 1.53

Adjusted Internal Rate of Return

AIRR = 4.10%

Payback Period
Estimated Years to Payback (from beginning of Service Period)

Simple Payback occurs in year 17

Discounted Payback occurs in year 24

Energy Savings Summary
Energy Savings Summary (in stated units)

Energy Type	Average Base Case	Annual Alternative	Consumption Savings	Life-Cycle Savings
Electricity	199,440.0 kWh	65,279.0 kWh	134,161.0 kWh	5,298,854.4 kWh
Distillate Fuel Oil (#1, #2)	8,539.8 Gal	5,400.9 Gal	3,138.9 Gal	123,975.5 Gal

Energy Savings Summary (in MBtu)

Energy Type	Average Base Case	Annual Alternative	Consumption Savings	Life-Cycle Savings

Electricity	680.5 MBtu	222.7 MBtu	457.8 MBtu	18,080.4 MBtu
Distillate Fuel Oil (#1, #2)	1,296.1 MBtu	819.7 MBtu	476.4 MBtu	18,815.4 MBtu

Emissions Reduction Summary

Energy	-----Average	Annual	Emissions-----	Life-Cycle
Type	Base Case	Alternative	Reduction	Reduction
Electricity				
CO2	81,524.95 kg	26,684.05 kg	54,840.90 kg	2,166,008.95 kg
SO2	239.96 kg	78.54 kg	161.42 kg	6,375.33 kg
NOx	86.53 kg	28.32 kg	58.21 kg	2,298.98 kg
Distillate Fuel Oil (#1, #2)				
CO2	95,250.57 kg	60,239.92 kg	35,010.65 kg	1,382,788.72 kg
SO2	681.35 kg	430.91 kg	250.44 kg	9,891.42 kg
NOx	85.86 kg	54.30 kg	31.56 kg	1,246.48 kg
Total:				
CO2	176,775.52 kg	86,923.97 kg	89,851.54 kg	3,548,797.67 kg
SO2	921.31 kg	509.45 kg	411.86 kg	16,266.75 kg
NOx	172.39 kg	82.62 kg	89.77 kg	3,545.46 kg

X. Specification Sheets

A. Sylvania T8 LED

www.sylvania.com/LED

ULTRA HE LED T8 Retrofit Kits

Key Features & Benefits

- Lumen package
  - Up to 1150 lumens @ 10W
  - Up to 2450 lumens @ 19W
  - Up to 2450 lumens @ 22W
- CCT: 3500K, 3500K, 4100K, 5000K
- Beam angle: 150°
- Universal input 120-277V, 50/60Hz (external driver) & 347V, 50/60Hz (external driver)
- THD <20%, power factor >0.90
- G13 medium bi-pin base
- Long life 60,000 hour life (L70)
- Installation of the retrofit kit does not void the existing luminaire UL listing
- 5 year warranty (12 hour burn cycle), 3 year warranty (16 hour burn cycle), 5 year warranty (24 hour burn cycle)
- Reduces energy consumption up to 35%
- No warm-up time, instant on with full light output and stable lamp to lamp color
- Glass free, vibration and impact resistant
- No UV emission
- Suitable for dry and damp locations (cannot come in direct contact with water)
- Designlights Consortium® (DLC) qualified

The SYLVANIA ULTRA HE LED T8 retrofit kits are an energy saving and longer life alternative to replace traditional fluorescent T12 or T8 lamps. Compared to traditional fluorescent lamps, ULTRA HE LED T8 lamps offer higher efficacy and equivalent light output.

Lamp requires dedicated external driver and non-shunted G13 medium bi-pin lamp holders which are included in the retrofit kit.

For retrofit application, lamps and drivers are offered together as 1-lamp, 2-lamp, 3-lamp and 4-lamp retrofit kits.

Product Offering

Length	Lumen Output	Wattage	Color Temperature	CRI
2ft	Up to 1150	10	3500K, 3500K, 4100K, 5000K	≥82
4ft	Up to 2450	19	3500K, 3500K, 4100K, 5000K	≥82
4ft	Up to 2450	22	3500K, 4100K, 5000K	≥82

Application Information

Applications

- Counter/frozen case
- Case lighting
- Display case
- Reverse merchandiser
- High Bay
- Feeding range
- Tunnels

Application Notes

1. For ULTRA HE T8 LED lamp is designed to use a dedicated external driver and G13 medium bi-pin non-shunted lamp holders.
2. Operating temperature range between -4°F and 122°F (-20°C and 50°C).
3. Suitable for use in dry and damp environments.
4. The ULTRA HE T8 lamp kit is compatible with the Bodine emergency inverter model ELP2-20 and the 2-lamp, 3-lamp and 4-lamp kits are compatible with the Bodine model ELP2-100.
5. Maximum mounting distance between tube and driver is 10 feet.
6. For detailed warranty information, please see www.sylvania.com
7. NSF certified Food Zone (Non-Contact), Splash Zone and Non-Food Zone.

Specifications and Certifications

E127386 (lamp)
E320895 (driver)
E350299

SYLVANIA

LED29HR11 3-15

Specification Data

Catalog #	Type
Project	
Comments	
Prepared by	

Specifications

Energy Data

Ambient Operating Temperature: [illegible]
EMI/RFI: [illegible]
Input Voltage: [illegible]
Input Frequency: [illegible]
Input Power: [illegible]
Input Current @ 120Vac: [illegible]
Input Current @ 277Vac: [illegible]
Power Factor: [illegible]
THD: [illegible]

Lighting Data

Lumen Output: [illegible]
Lumens per Watt: [illegible]
Correlated Color Temperature (CCT): [illegible]
Color Rendering Index (CRI): [illegible]
BF: [illegible]

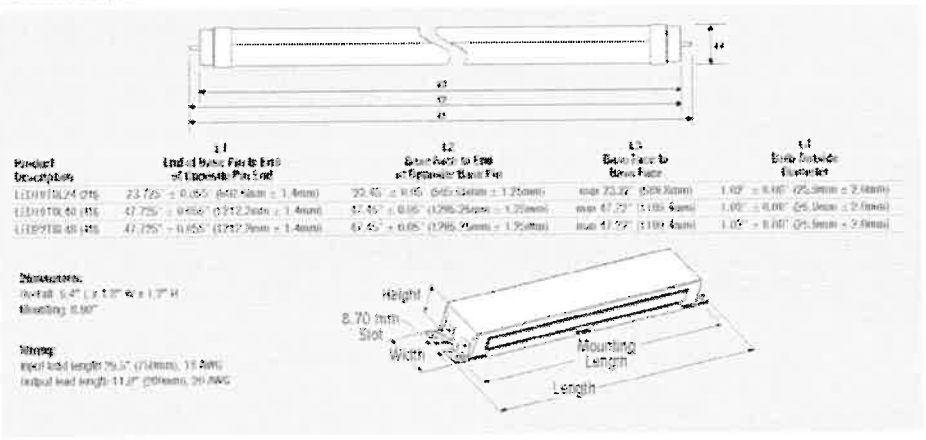
Ordering Information

Item Number	Ordering Abbreviation	Input Voltage (V)	Length (in)	Lamp Power (W)	System Power (W)	Lumens per Lamp	LPW	Color Temp	CRI	Beam Angle	No. of Lamps	No. of Drivers	No. of Lamp Holders	DLC (Y/N)
[illegible]	[illegible]	120-277	24	10	20	1100	110	3000K	82	150	2	1 Non-Dimmable Driver	4	Y
[illegible]	[illegible]	120-277	24	10	20	1100	110	3500K	83	150	2	1 Non-Dimmable Driver	4	Y
[illegible]	[illegible]	120-277	24	10	20	1100	110	4100K	85	150	2	1 Non-Dimmable Driver	4	Y
[illegible]	[illegible]	120-277	24	10	20	1150	115	5000K	83	150	2	1 Non-Dimmable Driver	4	Y
[illegible]	[illegible]	120-277	48	19	38	2350	124	3000K	82	150	2	1 Non-Dimmable Driver	4	Y
[illegible]	[illegible]	120-277	48	19	38	2350	124	3500K	83	150	2	1 Non-Dimmable Driver	4	Y
[illegible]	[illegible]	120-277	48	19	38	2350	124	4100K	85	150	2	1 Non-Dimmable Driver	4	Y
[illegible]	[illegible]	120-277	48	19	38	2450	129	5000K	83	150	2	1 Non-Dimmable Driver	4	Y
[illegible]	[illegible]	120-277	24	10	10	1100	110	3000K	82	150	1	1 Non-Dimmable Driver	2	Y
[illegible]	[illegible]	120-277	24	10	10	1100	110	3500K	83	150	1	1 Non-Dimmable Driver	2	Y
[illegible]	[illegible]	120-277	24	10	10	1100	110	4100K	85	150	1	1 Non-Dimmable Driver	2	Y
[illegible]	[illegible]	120-277	24	10	10	1150	115	5000K	83	150	1	1 Non-Dimmable Driver	2	Y
[illegible]	[illegible]	120-277	48	19	19	2350	124	3000K	82	150	1	1 Non-Dimmable Driver	2	Y
[illegible]	[illegible]	120-277	48	19	19	2350	124	3500K	83	150	1	1 Non-Dimmable Driver	2	Y
[illegible]	[illegible]	120-277	48	19	19	2350	124	4100K	85	150	1	1 Non-Dimmable Driver	2	Y
[illegible]	[illegible]	120-277	48	19	19	2450	129	5000K	83	150	1	1 Non-Dimmable Driver	2	Y
[illegible]	[illegible]	120-277	24	10	30	1100	110	3000K	82	150	3	1 Non-Dimmable Driver	6	Y
[illegible]	[illegible]	120-277	24	10	30	1100	110	3500K	83	150	3	1 Non-Dimmable Driver	6	Y
[illegible]	[illegible]	120-277	24	10	30	1100	110	4100K	85	150	3	1 Non-Dimmable Driver	6	Y
[illegible]	[illegible]	120-277	24	10	30	1100	110	5000K	83	150	3	1 Non-Dimmable Driver	6	Y
[illegible]	[illegible]	120-277	48	22	44	2350	107	3500K	83	150	2	1 (0-10V) Dimmable Driver	4	N
[illegible]	[illegible]	120-277	48	22	44	2350	107	4100K	85	150	2	1 (0-10V) Dimmable Driver	4	N
[illegible]	[illegible]	120-277	48	22	44	2450	111	5000K	83	150	2	1 (0-10V) Dimmable Driver	4	N
[illegible]	[illegible]	347	48	19	38	2350	113	3500K	83	150	2	1 Non-Dimmable Driver	4	Y
[illegible]	[illegible]	347	48	19	38	2350	113	4100K	85	150	2	1 Non-Dimmable Driver	4	Y
[illegible]	[illegible]	347	48	19	38	2450	113	5000K	83	150	2	1 Non-Dimmable Driver	4	Y
[illegible]	[illegible]	120-277	48	19	58	2350	121	3000K	82	150	3	1 Non-Dimmable Driver	6	Y
[illegible]	[illegible]	120-277	48	19	58	2350	121	3500K	83	150	3	1 Non-Dimmable Driver	6	Y
[illegible]	[illegible]	120-277	48	19	58	2350	121	4100K	85	150	3	1 Non-Dimmable Driver	6	Y
[illegible]	[illegible]	120-277	48	19	58	2450	127	5000K	83	150	3	1 Non-Dimmable Driver	6	Y
[illegible]	[illegible]	120-277	48	19	76	2350	121	3000K	82	150	4	1 Non-Dimmable Driver	8	Y
[illegible]	[illegible]	120-277	48	19	76	2350	121	3500K	83	150	4	1 Non-Dimmable Driver	8	Y
[illegible]	[illegible]	120-277	48	19	76	2350	121	4100K	85	150	4	1 Non-Dimmable Driver	8	Y
[illegible]	[illegible]	120-277	48	19	76	2450	126	5000K	83	150	4	1 Non-Dimmable Driver	8	Y

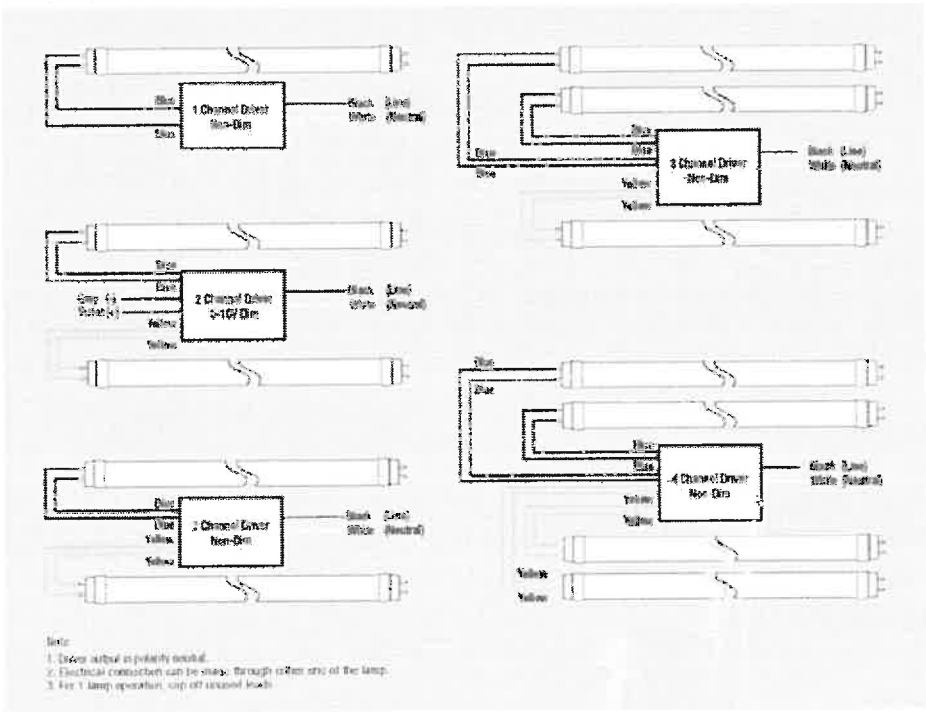
Ordering Guide

LED	10	T8 /	1	24 /	F /	1	X	2	HE /	8	35 /	UNV
LED	Wattage	Lamp Type	Length	24 inches Overall Length	Frosted Lens	1 Driver Kit		2 Lamps Kit	High Efficiency	CRI 8x	Color Temperature 35 = 3500K	Universal Voltage

Assembly Diagram



Wiring Diagram

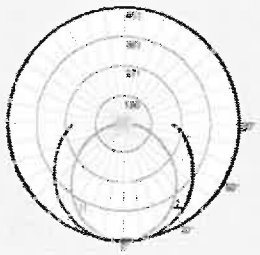


Photometric Information

Illuminance at a Distance

	Center Beam Illuminance	Beam Width	
		Along ⊥	Across ⊥
5.0 ft	10.4 fc	17.1 ft	19.6 ft
10 ft	2.6 fc	34.4 ft	212.9 ft
20 ft	1.1 fc	51.5 ft	319.6 ft

Polar Chart



Total Lumen Distribution

Zone	Lumens	% Lamp
0-30	382	17
0-40	580	28
0-60	1082	53
0-90	1647	80
60-90	565	27
0-180	2052	100

Photometric information for LED19/41/835/T5/HE/ESO/UNV, 1 lamp operation

Warranty

OSRAM

SYLVANIA

B. Deco D400-LED Exterior Fixture

LED lighting

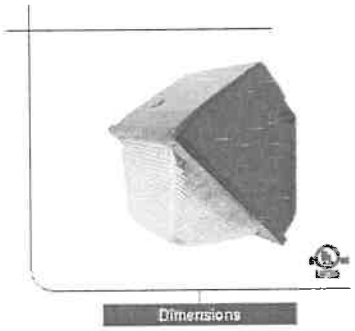
DECO digital™ lighting systems

D400-LED
Small Wall Pack

Transforming tomorrow's lighting....today!

Job Information
Type:
Catalog #:
Project:
Comments:
Prepared by:

Buy American Act COMPLIANT



Dimensions

Description

The D400-LED with its low profile, compact design is excellent for security accent and perimeter lighting in areas such as building facades, entrance ways, garage doors, indoor parking garages, tunnels, overpasses and alleys.

Application

- Heavy duty two piece, die-cast aluminum housing
- Specular anodized aluminum reflector
- Silicone gasketing provides protection against moisture
- Mounts directly to 3½" octagon or 4" square outlet box
- ½" NPS tapped holes provided in three locations for surface conduit entry or optional photo control
- Dark bronze polyester powder coated finish for impact, corrosion and UV resistance
- UL 1598 listed for wet locations
- Integral cast in aluminum hinges permit complete removal of lens frame assembly without tools
- Clear prismatic borosilicate glass refractor is thermal and shock resistant
- Borosilicate glass will not yellow
- Great for desert hot climate zones
- Approx. Weight: 8 lbs.
- Standard color is bronze, also available in black and white. Contact factory for custom finishes.

LED Lighting | DECO™ | LIGHTING

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LED lighting

DECO digital™

D400-LED

Small Wall Pack

Transforming tomorrow's lighting...today!

Job Information
Type
Catalog #
Project
Comments:
Prepared by:

ORDERING INFORMATION:

Example: (D400-LED-20-50-UNV-WH-WSF)

D400-LED – [ ] – [ ] – [ ] – [ ] – [ ]

Series	Wattage/Lumens	Color Temp.	Voltage	Finish	Options
Small Wall Pack	10 - 10 watt/700*	40 - 4000*	UNV - 120-277V	BZ - Bronze	HP - Mounting Plate
	20 - 20 watt/2,540*	50 - 5000*	347 - 347V	BL - Black	PC - Photocell
	30 - 30 watt/3,810*		480 - 480V	WH - White	WSF - Wired Single Fuse*
	40 - 40 watt/5,080*			GU - Custom	WDF - Wired Double Fuse*
					WG - Wire Guard
					GS - Glare Shield
					EL20 - Emergency LED

* Standard Color Temperature

LED Lighting DECO™ LIGHTING

C. Deco D823-LED Exterior Fixture

DECO digital®

Powered By: NICHIA

D823-LED
23" Area Light

lighting facts | DLC | Buy American Act COMPLIANT

Digitize your light.

Job Information	
Type:	
Catalog #:	
Project:	
Comments:	
Prepared by:	

LED Lighting

Description

The D823-LED 23" floodlight is the right choice for applications requiring high levels, excellent beam utilization, and smooth distribution making the D823-LED ideal for tennis courts, building perimeters and large parking lots. This versatile luminaire can be aimed as a floodlight, or mounted 90° for traditional shoebox applications. The one piece die cast aluminum door has two captive stainless steel fasteners and can be removed from the die cast aluminum housing for easy maintenance.

D823-LED

Features

- Extruded silicone rubber gasket for long life
- UL 1598 listed for wet locations
- Standard color is bronze, also available in black and white. Contact factory for custom finishes.
- EPA 2.23
- Energy Star Rated
- DLC listed
- Dark Sky Friendly when used with Type III/IV, V reflectors (at 90° full cutoff position)
- Surge protection 2kVa standard

Dimensions

Quick Ship

Ordering Information:

Example: (D823-LED-80-30-UNV-T5-YM-BZ-WDF)

D823-LED – [ ] – [ ] – [ ] – [ ] – [ ] – [ ] – [ ]

Series	Wattage/Lumens	Color Temp	Voltage	Optics	Mounting	Finish	Options
23" Area Light	120 120W/15360	30 3000K	UNV 120-277V	T2 Type 2	YM Yoke Mount	BZ Bronze	SM Smart Dim
	140 140W/17920	35 3500K	347 347V	T3M Type 3	LYM Large Yoke Mount	BL Black	PC Photocell
	160 160W/20480	40 4000K	480 480V	Type 4	SF Slip Fitter	WH White	PT3 [illegible]
	180 180W/23040	50 5000K	Step-Down Transformer used for 480V [illegible]	T5 Type 5	PM8 Pole Mount 8	CU Custom	PT6 [illegible]
	200 200W/25600				PM10 Pole Mount 10		WSF Wired Single Fuse
	240 240W/30720				PM12 Pole Mount 12		WDF Wired Double Fuse
	260 [illegible]				PM18 Pole Mount 18		PG Polycarbonate Lens Guard
	280 [illegible]				WM Wall Mount Bracket		HK Heavy Duty Adjustable [illegible]
	300 [illegible]				RPM Round Pole Mount		BF Baffle
[illegible]							GS Glare Shield
							WG Wire Guard
							SS Stainless Steel Screws
							PIR Passive Infrared Sensor
							MS Motion Sensor (with Dimming)
							SG Surge Protection [illegible]

Digitize your light.

©2014 Deco Lighting, www.getdeco.com T: (800) 613-DECO F: (310) 366-6855
Note: Specifications subject to change without notice. Rev Date: 6/2/15 #5

DECO® | LIGHTING

DECO digital®

Powered By: NICHIA

D823-LED

23" Area Light

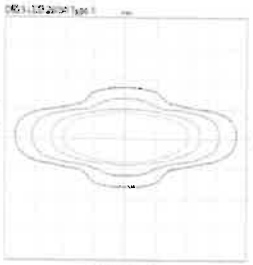
Job Information	
Type:	
Catalog #:	
Project:	
Comments:	
Prepared by:	

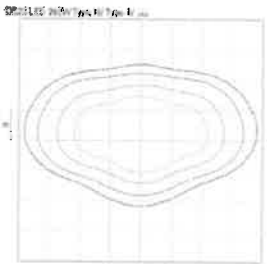
Digitize your light.

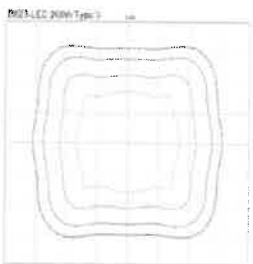
LED Lighting

DECO | LIGHTING

Photometric Data







Performance Data

CRI:	80+			
CCT:	3000K, 3500K, 4000K, 5000K			
Warranty:	10 yr. Limited Warranty			
Dimming:	Available with 0-10V inputs dimming down to 10%			
Operating Temperature:	0°-65°C Max Ambient			
L70 Rating:	100,000+ Hours			
EPA:	2.23			
IP Rating:	IP65			
Driver Current:	700mA			
BUG Rating:	Type 2	B4	U2	G3
	Type 3/Type 4	B4	U2	G4
	Type 5	B5	U2	G3

Delivered Light Output and Equivalency Chart

HID to LED Replacement		
Initial Lumens Delivered	LED	HID Replacement
15240 lm	120W	400W
25400 lm	200W	750W
30480 lm	240W	1000W

*For mounting heights over 25ft consult factory

Digitize your light.

DECO digital®

Powered By NICHIA

D823-LED

23" Area Light

Digitize *your* light.™

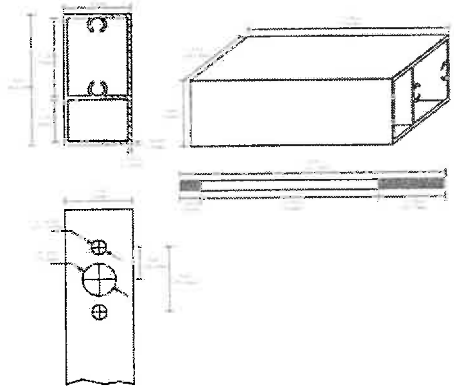
Job Information

Type:	
Catalog #:	
Project:	
Comments:	
Prepared by:	

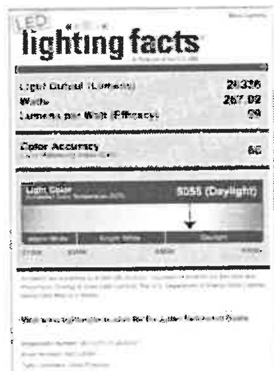
LED Lighting

DECO® | LIGHTING

Pole Mount Drilling Pattern

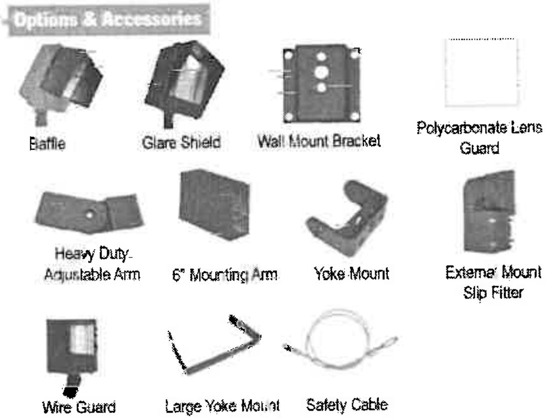


Lighting Facts



260W LED

Options & Accessories



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XI. Utility Bills

A. National Grid

nationalgrid

NYS APA
SARA PLACID RD
RAYBROOK NY 12977

BILLING PERIOD Jan 3, 2014 to Feb 3, 2014

PAGE 2 of 3

ACCOUNT NUMBER 46012-75105

PLEASE PAY BY Mar 1, 2014

AMOUNT DUE $ 3,353.62

Choosing an Energy Supplier: You can choose who supplies your energy. No matter which energy supplier you choose, National Grid will continue to deliver energy to you safely, efficiently and reliably. We will also continue to provide your customer service, including emergency response and storm restoration. National Grid is dedicated to creating an open energy market that lets you choose from a variety of competitive energy suppliers, who may offer different pricing options. For information on authorized energy suppliers and how to choose, please visit us online at www.nationalgridus.com/energychoice

DETAIL OF CURRENT CHARGES

Delivery Services

Type of Service	Current Reading	Previous Reading	= Difference	x Meter Multiplier	x	Total Usage
Energy	8343 Actual	8119 Actual	224	80		17920 kWh
				Total Energy Usage		17920 kWh
				Billed Energy Usage		17920 kWh
Demand	25.32 Actual	24.79 Actual	0.53	80		42.4 kW
				Total Demand Usage		42.4 kW
				Billed Demand Usage		42.4 kW

METER NUMBER 32953299 NEXT SCHEDULED READ DATE Mar 6
SERVICE PERIOD Jan 3 - Feb 3 NUMBER OF DAYS IN PERIOD 31 METERING TYPE Secondary
RATE Electric SC2D VOLTAGE DELIVERY LEVEL 0 - 2.2 kv

Customer			52.52
Demand	9.41	x 42.4 kW	398.98
SBC/RPS	0.007911	x 17920 kWh	141.76
Incr State Assessment	0.9	x 42.4 kW	38.16
Legacy Transition Chrg	-0.002295	x 17920 kWh	-41.13
Transmission Rev Adj	0.00006	x 17920 kWh	1.08
RDM	-0.42580647	x 42.4 kW	-18.05
Market Settlement	0.00029	x 17920 kWh	5.20
		Total Delivery Services	**$ 578.52**

Supply Services

SUPPLIER National Grid

Electricity Supply	0.13988	x 17920 kWh	2,506.65
Merchant Function	0.00106508	x 17920 kWh	19.09
ESRM	0.013915	x 17920 kWh	249.36
		Total Supply Services	**$ 2,775.10**

nationalgrid

NYS APA
SARA PLACID RD
RAYBROOK NY 12977

Feb 3, 2014 to Mar 4, 2014

ACCOUNT NUMBER	PLEASE PAY BY	AMOUNT DUE
46012-75105	Mar 30, 2014	$ 2,822.62

Choosing an Energy Supplier You can choose who supplies your energy. No matter which energy supplier you choose, National Grid will continue to deliver energy to you safely, efficiently and reliably. We will also continue to provide your customer service, including emergency response and storm restoration. National Grid is dedicated to creating an open energy market that lets you choose from a variety of competitive energy suppliers, who may offer different pricing options. For information on authorized energy suppliers and how to choose, please visit us online at www.nationalgridus.com/energychoice

DETAIL OF CURRENT CHARGES

Delivery Services

Type of Service	Current Reading	-	Previous Reading	=	Difference	x	Meter Multiplier	=	Total Usage
Energy	8547 *Actual*		8343 *Actual*		204		80		16320 kWh
							Total Energy Usage		16320 kWh
							Billed Energy Usage		16320 kWh
Demand	25.83 *Actual*		25.32 *Actual*		0.51		80		40.8 kW
							Total Demand Usage		40.8 kW
							Billed Demand Usage		40.8 kW

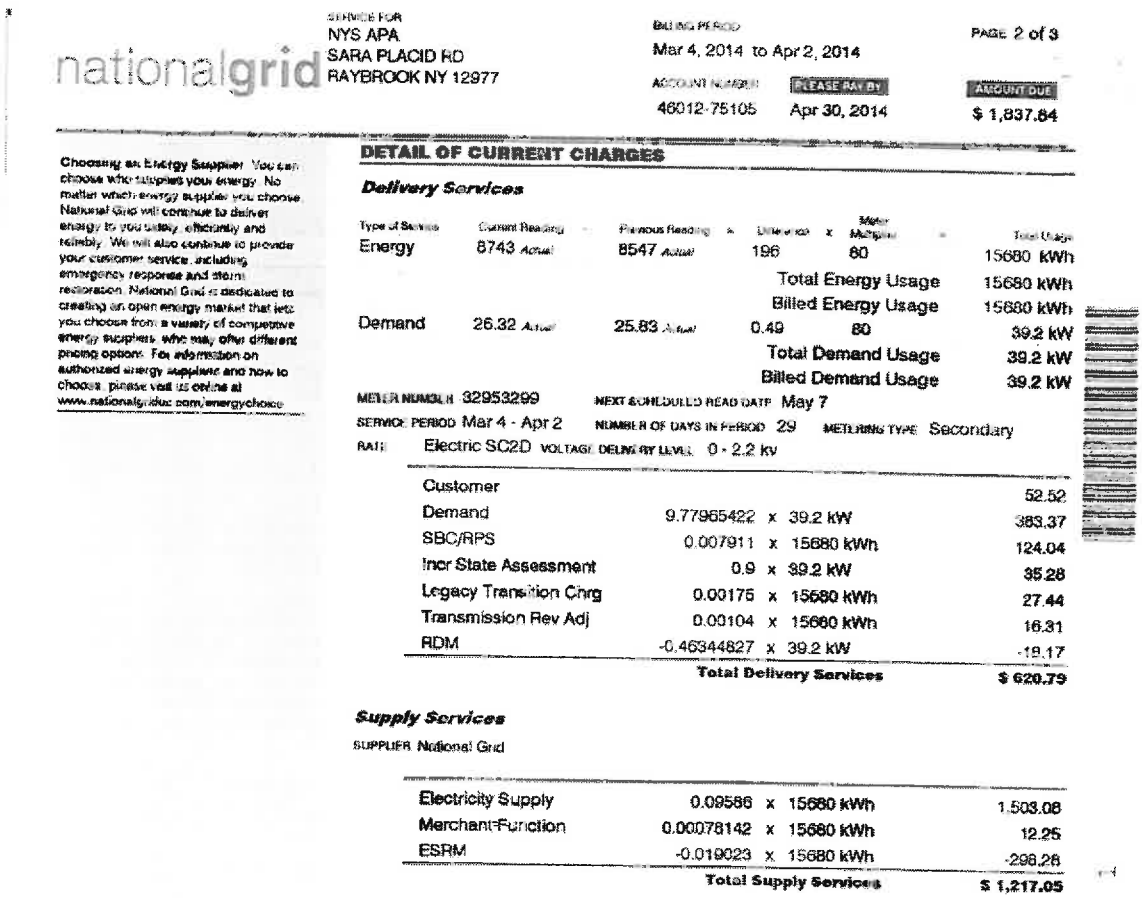
METER NUMBER 32953299 NEXT SCHEDULED READ DATE Apr 4
SERVICE PERIOD Feb 3 - Mar 4 NUMBER OF DAYS IN PERIOD 29 METERING TYPE Secondary
RATE Electric SC2D VOLTAGE DELIVERY LEVEL 0 - 2.2 kv

Customer			52.52
Demand	9.45689654	x 40.8 kW	385.84
SBC/RPS	0.007911	x 16320 kWh	129.11
Incr State Assessment	0.9	x 40.8 kW	36.72
Legacy Transition Chrg	-0.003952	x 16320 kWh	-64.50
Transmission Rev Adj	-0.00222	x 16320 kWh	-36.23
RDM	-0.56	x 40.8 kW	-22.85
		Total Delivery Services	**$ 480.61**

Supply Services

SUPPLIER National Grid

Electricity Supply	0.11484	x 16320 kWh	1,874.19
Merchant Function	0.00090529	x 16320 kWh	14.76
ESRM	0.02776	x 16320 kWh	453.04
		Total Supply Services	**$ 2,342.01**



nationalgrid

SERVICE FOR
NYS APA
SARA PLACID RD
RAYBROOK NY 12977

BILLING PERIOD
Mar 4, 2014 to Apr 2, 2014

PAGE 2 of 3

ACCOUNT NUMBER
46012-75105

PLEASE PAY BY
Apr 30, 2014

AMOUNT DUE
$ 1,837.84

Choosing an Energy Supplier You can choose who supplies you energy. No matter which energy supplier you choose National Grid will continue to deliver energy to you safely, efficiently and reliably. We will also continue to provide your customer service, including emergency response and storm restoration. National Grid is dedicated to creating an open energy market that lets you choose from a variety of competitive energy suppliers who may offer different pricing options. For information on authorized energy suppliers and how to choose, please visit us online at www.nationalgridus.com/energychoice

DETAIL OF CURRENT CHARGES

Delivery Services

Type of Service	Current Reading	Previous Reading	Difference	x	Meter Multiplier	=	Total Usage
Energy	8743 Actual	8547 Actual	196	x	80	=	15680 kWh
					Total Energy Usage		15680 kWh
					Billed Energy Usage		15680 kWh
Demand	26.32 Actual	25.83 Actual	0.49	x	80	=	39.2 kW
					Total Demand Usage		39.2 kW
					Billed Demand Usage		39.2 kW

METER NUMBER 32953299 NEXT SCHEDULED READ DATE* May 7
SERVICE PERIOD Mar 4 - Apr 2 NUMBER OF DAYS IN PERIOD 29 METERING TYPE Secondary
RATE Electric SC2D VOLTAGE DELIVERY LEVEL 0 - 2.2 kv

Customer			52.52
Demand	9.77965422	x 39.2 kW	383.37
SBC/RPS	0.007911	x 15680 kWh	124.04
Incr State Assessment	0.9	x 39.2 kW	35.28
Legacy Transition Chrg	0.00175	x 15680 kWh	27.44
Transmission Rev Adj	0.00104	x 15680 kWh	16.31
RDM	-0.46344827	x 39.2 kW	-18.17
		Total Delivery Services	**$ 620.79**

Supply Services

SUPPLIER National Grid

Electricity Supply	0.09586	x 15680 kWh	1,503.08
Merchant Function	0.00078142	x 15680 kWh	12.25
ESRM	-0.019023	x 15680 kWh	-298.28
		Total Supply Services	**$ 1,217.05**

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Billing Period: Apr 2, 2014 to May 5, 2014

ACCOUNT NUMBER	PLEASE PAY BY	AMOUNT DUE
46012-75105	May 31, 2014	$ 3,173.52

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DETAIL OF CURRENT CHARGES

Delivery Services

Type of Service	Current Reading -	Previous Reading =	Difference x	Multiplier =	Total Usage
Energy	8940 *Actual*	8743 *Actual*	197	80	15760 kWh
				Total Energy Usage	15760 kWh
				Billed Energy Usage	15760 kWh
Demand	26.76 *Actual*	26.32 *Actual*	0.44	80	35.2 kW
				Total Demand Usage	35.2 kW
				Billed Demand Usage	35.2 kW

METER NUMBER 32953299 NEXT SCHEDULED READ DATE Jun 6
SERVICE PERIOD Apr 2 - May 5 NUMBER OF DAYS IN PERIOD 33 METERING TYPE Secondary
RATE Electric SC2D VOLTAGE DELIVERY LEVEL 0 - 2.2 kv

Customer		52.52
Demand	10.18 x 35.2 kW	358.33
SBC/RPS	0.007911 x 15760 kWh	124.67
Incr State Assessment	0.9 x 35.2 kW	31.68
Legacy Transition Chrg	0.000101 x 15760 kWh	1.59
Transmission Rev Adj	-0.00023 x 15760 kWh	-3.62
RDM	0.03454543 x 35.2 kW	1.22
	Total Delivery Services	**$ 566.39**

Supply Services

SUPPLIER National Grid

Electricity Supply	0.04904 x 15760 kWh	772.67
Merchant Function	0.00045662 x 15760 kWh	7.20
ESRM	-0.000684 x 15760 kWh	-10.78
	Total Supply Services	**-$ 769.29**

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SERVICE FOR
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BILLING PERIOD
May 5, 2014 to Jun 4, 2014

ACCOUNT NUMBER	PLEASE PAY BY	AMOUNT DUE
46012-75105	Jul 2, 2014	$ 1,215.19

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DETAIL OF CURRENT CHARGES

Delivery Services

Type of Service	Current Reading	Previous Reading	= Difference	x Meter Multiplier	= Total Usage
Energy	9139 *Actual*	8940 *Actual*	199	80	15920 kWh
				Total Energy Usage	15920 kWh
				Billed Energy Usage	15920 kWh
Demand	27.53 *Actual*	26.76 *Actual*	0.77	80	61.6 kW
				Total Demand Usage	61.6 kW
				Billed Demand Usage	61.6 kW

METER NUMBER 32953299 NEXT SCHEDULED READ DATE Jul 7
SERVICE PERIOD May 5 - Jun 4 NUMBER OF DAYS IN PERIOD 30 METERING TYPE Secondary
RATE Electric SC2D VOLTAGE DELIVERY LEVEL 0 - 2.2 kv

Customer		52.52
Demand	10.16 x 61.6 kW	627.06
SBC/RPS	0.007911 x 15920 kWh	125.95
Incr State Assessment	0.9 x 61.6 kW	55.44
Legacy Transition Chrg	0.000948 x 15920 kWh	15.09
Transmission Rev Adj	-0.00236 x 15920 kWh	-37.57
RDM	0.19 x 61.6 kW	11.70
	Total Delivery Services	**$ 850.21**

Supply Services

SUPPLIER National Grid

Electricity Supply	0.05494 x 15920 kWh	874.64
Merchant Function	0.00049489 x 15920 kWh	7.88
ESRM	-0.032509 x 15920 kWh	-517.54
	Total Supply Services	**$ 364.98**

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Jun 4, 2014 to Jul 2, 2014

ACCOUNT NUMBER	PLEASE PAY BY	AMOUNT DUE
46012-75105	Aug 1, 2014	$ 2,131.20

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DETAIL OF CURRENT CHARGES

Delivery Services

Type of Service	Current Reading	Previous Reading	= Difference	x Meter Multiplier	= Total Usage
Energy	9357 *Actual*	9139 *Actual*	218	80	17440 kWh
				Total Energy Usage	17440 kWh
				Billed Energy Usage	17440 kWh
Demand	28.31 *Actual*	27.53 *Actual*	0.78	80	62.4 kW
				Total Demand Usage	62.4 kW
				Billed Demand Usage	62.4 kW

METER NUMBER 32953299 NEXT SCHEDULED READ DATE Aug 6
SERVICE PERIOD Jun 4 - Jul 2 NUMBER OF DAYS IN PERIOD 28 METERING TYPE Secondary
RATE Electric SC2D VOLTAGE DELIVERY LEVEL 0 - 2.2 kv

Customer		52.52
Demand	10.18 x 62.4 kW	635.24
SBC/RPS	0.007911 x 17440 kWh	137.97
Incr State Assessment	0.82999998 x 62.4 kW	51.79
Legacy Transition Chrg	0.000081 x 17440 kWh	1.41
Transmission Rev Adj	-0.00205 x 17440 kWh	-35.75
RDM	0.19 x 62.4 kW	11.86
	Total Delivery Services	**$ 855.04**

Supply Services

SUPPLIER National Grid

Electricity Supply	0.06506 x 17440 kWh	1,134.65
Merchant Function	0.00056029 x 17440 kWh	9.77
ESRM	0.007554 x 17440 kWh	131.74
	Total Supply Services	**$ 1,276.16**

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BILLING PERIOD
Jul 2, 2014 to Aug 4, 2014

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ACCOUNT NUMBER	PLEASE PAY BY	AMOUNT DUE
46012-75105	Aug 30, 2014	$ 1,897.76

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DETAIL OF CURRENT CHARGES

Delivery Services

Type of Service	Current Reading	-	Previous Reading	=	Difference	x	Meter Multiplier	=	Total Usage
Energy	9597 *Actual*		9357 *Actual*		240		80		19200 kWh
							Total Energy Usage		19200 kWh
							Billed Energy Usage		19200 kWh
Demand	29.07 *Actual*		28.31 *Actual*		0.76		80		60.8 kW
							Total Demand Usage		**60.8 kW**
							Billed Demand Usage		**60.8 kW**

METER NUMBER 32953299 NEXT SCHEDULED READ DATE Sep 4
SERVICE PERIOD Jul 2 - Aug 4 NUMBER OF DAYS IN PERIOD 33 METERING TYPE Secondary
RATE Electric SC2D VOLTAGE DELIVERY LEVEL 0 - 2.2 kv

Customer		52.52
Demand	10.18 x 60.8 kW	618.95
SBC/RPS	0.007911 x 19200 kWh	151.90
Incr State Assessment	-0.08 x 60.8 kW	-4.86
Legacy Transition Chrg	0.00029 x 19200 kWh	5.57
Transmission Rev Adj	-0.00199 x 19200 kWh	-38.21
RDM	0.19 x 60.8 kW	11.55
	Total Delivery Services	**$ 797.42**

Supply Services

SUPPLIER National Grid

Electricity Supply	0.05769 x 19200 kWh	1,107.65
Merchant Function	0.00051238 x 19200 kWh	9.84
ESRM	-0.000893 x 19200 kWh	-17.15
	Total Supply Services	**$ 1,100.34**

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Aug 4, 2014 to Sep 2 2014

ACCOUNT NUMBER	PLEASE PAY BY	AMOUNT DUE
46012-75105	Sep 28, 2014	$ 1,764.68

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DETAIL OF CURRENT CHARGES

Delivery Services

Type of Service	Current Reading	Previous Reading	Difference	x	Meter Multiplier	=	Total Usage
Energy	9803 *Actual*	9597 *Actual*	206		80		16480 kWh
					Total Energy Usage		16480 kWh
					Billed Energy Usage		16480 kWh
Demand	29.82 *Actual*	29.07 *Actual*	0.75		80		60.0 kW
					Total Demand Usage		60.0 kW
					Billed Demand Usage		60.0 kW

METER NUMBER 32953299 NEXT SCHEDULED READ DATE Oct 3
SERVICE PERIOD Aug 4 - Sep 2 NUMBER OF DAYS IN PERIOD 29 METERING TYPE Secondary
RATE Electric SC2D VOLTAGE DELIVERY LEVEL 0 - 2.2 kV

Customer		52.52
Demand	10.18 x 60 kW	610.80
SBC/RPS	0.007911 x 16480 kWh	130.38
Incr State Assessment	-0.08 x 60 kW	-4.80
Legacy Transition Chrg	0.0002 x 16480 kWh	3.30
Transmission Rev Adj	-0.00286 x 16480 kWh	-47.13
RDM	0.19 x 60 kW	11.40
	Total Delivery Services	**$ 756.47**

Supply Services

SUPPLIER National Grid

Electricity Supply	0.05441 x 16480 kWh	896.68
Merchant Function	0.00049132 x 16480 kWh	8.09
ESRM	0.006277 x 16480 kWh	103.44
	Total Supply Services	**$ 1,008.21**

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BILLING PERIOD
Sep 2, 2014 to Oct 1, 2014

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ACCOUNT NUMBER	PLEASE PAY BY	AMOUNT DUE
46012-75105	Oct 29, 2014	$ 3,246.63

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DETAIL OF CURRENT CHARGES

Delivery Services

Type of Service	Current Reading	Previous Reading	Difference	x Meter Multiplier	= Total Usage
Energy	9990 *Actual*	9803 *Actual*	187	80	14960 kWh
				Total Energy Usage	14960 kWh
				Billed Energy Usage	14960 kWh
Demand	30.55 *Actual*	29.82 *Actual*	0.73	80	58.4 kW
				Total Demand Usage	58.4 kW
				Billed Demand Usage	58.4 kW

METER NUMBER 32953299 NEXT SCHEDULED READ DATE Nov 4
SERVICE PERIOD Sep 2 - Oct 1 NUMBER OF DAYS IN PERIOD 29 METERING TYPE Secondary
RATE Electric SC2D VOLTAGE DELIVERY LEVEL 0 - 2.2 kv

Customer		52.52
Demand	10.18 x 58.4 kW	594.52
SBC/RPS	0.0079223 x 14960 kWh	118.52
Incr State Assessment	-0.08 x 58.4 kW	-4.67
Legacy Transition Chrg	0.00242 x 14960 kWh	36.20
Transmission Rev Adj	-0.00315 x 14960 kWh	-47.12
RDM	0.19 x 58.4 kW	11.10
	Total Delivery Services	**$ 761.02**

Supply Services

SUPPLIER National Grid

Electricity Supply	0.05024 x 14960 kWh	751.59
Merchant Function	0.00046486 x 14960 kWh	6.96
ESRM	-0.002518 x 14960 kWh	-37.67
	Total Supply Services	**$ 720.88**

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BILLING PERIOD
Oct 1, 2014 to Oct 31, 2014

ACCOUNT NUMBER	PLEASE PAY BY	AMOUNT DUE
46012-75105	Nov 28, 2014	$ 1,094.81

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DETAIL OF CURRENT CHARGES

Delivery Services

Type of Service	Current Reading	Previous Reading	Difference	x Meter Multiplier	= Total Usage
Energy	10173 *Actual*	9993 *Actual*	180	80	14640 kWh
				Total Energy Usage	14640 kWh
				Billed Energy Usage	14640 kWh
Demand	31.01 *Actual*	30.55 *Actual*	0.46	80	36.8 kW
				Total Demand Usage	36.8 kW
				Billed Demand Usage	36.8 kW

METER NUMBER 32953299 NEXT SCHEDULED READ DATE Dec 5
SERVICE PERIOD Oct 1 - Oct 31 NUMBER OF DAYS IN PERIOD 30 METERING TYPE Secondary
RATE Electric SC2D VOLTAGE DELIVERY LEVEL 0 - 2.2 kV

Customer		52.52
Demand	10.18 x 36.8 kW	374.63
SBC/RPS	0.008239 x 14640 kWh	120.62
Incr State Assessment	-0.08 x 36.8 kW	-2.94
Legacy Transition Chrg	0.001906 x 14640 kWh	27.90
Transmission Rev Adj	-0.00333 x 14640 kWh	-48.75
RDM	0.19 x 36.8 kW	6.99
	Total Delivery Services	**$ 530.97**

Supply Services

SUPPLIER National Grid

Electricity Supply	0.04192 x 14640 kWh	613.71
Merchant Function	0.00041048 x 14640 kWh	6.01
ESRM	-0.003817 x 14640 kWh	-55.88
	Total Supply Services	**$ 563.84**

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BILLING PERIOD
Oct 31, 2014 to Dec 3, 2014

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ACCOUNT NUMBER	PLEASE PAY BY	AMOUNT DUE
46012-76105	Dec 31, 2014	$ 1,401.37

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DETAIL OF CURRENT CHARGES

Delivery Services

Type of Service	Current Reading	Previous Reading	Difference	x Meter Multiplier	= Total Usage
Energy	10386 Actual	10173 Actual	213	80	17040 kWh
				Total Energy Usage	17040 kWh
				Billed Energy Usage	17040 kWh
Demand	31.50 Actual	31.01 Actual	0.49	80	39.2 kW
				Total Demand Usage	39.2 kW
				Billed Demand Usage	39.2 kW

METER NUMBER 32953299 NEXT SCHEDULED READ DATE Jan 7
SERVICE PERIOD Oct 31 - Dec 3 NUMBER OF DAYS IN PERIOD 33 METERING TYPE Secondary
RATE Electric SC2D VOLTAGE DELIVERY LEVEL 0 - 2.2 kv

Customer		52.52
Demand	10.18 x 39.2 kW	399.05
SBC/RPS	0.008239 x 17040 kWh	140.40
Incr State Assessment	-0.08 x 39.2 kW	-3.14
Legacy Transition Chrg	0.000841 x 17040 kWh	14.33
Transmission Rev Adj	-0.00309 x 17040 kWh	-52.65
RDM	0.19 x 39.2 kW	7.45
	Total Delivery Services	**$ 557.96**

Supply Services

SUPPLIER National Grid

Electricity Supply	0.04678 x 17040 kWh	797.13
Merchant Function	0.00044222 x 17040 kWh	7.53
ESRM	0.002274 x 17040 kWh	38.75
	Total Supply Services	**$ 843.41**

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BILLING PERIOD
Dec 3, 2014 to Jan 5, 2015

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ACCOUNT NUMBER	PLEASE PAY BY	AMOUNT DUE
46012-75105	Jan 31, 2015	$ 2,666.46

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DETAIL OF CURRENT CHARGES

Delivery Services

Type of Service	Current Reading	Previous Reading	Difference	x	Meter Multiplier	=	Total Usage
Energy	10612 Actual	10386 Actual	226		80		18080 kWh
					Total Energy Usage		18080 kWh
					Billed Energy Usage		18080 kWh
Demand	31.96 Actual	31.50 Actual	0.46		80		36.8 kW
					Total Demand Usage		36.8 kW
					Billed Demand Usage		36.8 kW

METER NUMBER 32953299 NEXT SCHEDULED READ DATE ON OR ABOUT Feb 5
SERVICE PERIOD Dec 3 - Jan 5 NUMBER OF DAYS IN PERIOD 33 METERING TYPE Secondary
RATE Electric SC2D VOLTAGE DELIVERY LEVEL 0 - 2.2 kv

Customer		52.52
Demand	10.18 x 36.8 kW	374.63
SBC/RPS	0.00818687 x 18080 kWh	148.02
Incr State Assessment	0.08 x 36.8 kW	-2.94
Legacy Transition Chrg	0.000007 x 18080 kWh	-0.13
Transmission Rev Adj	0.0028 x 18080 kWh	50.62
RDM	0.19 x 36.8 kW	6.99
	Total Delivery Services	**$ 528.47**

Supply Services

SUPPLIER National Grid

Electricity Supply	0.04087 x 18080 kWh	738.93
Merchant Function	0.00040824 x 18080 kWh	7.38
ESRM	0.000682 x 18080 kWh	12.33
	Total Supply Services	**$ 758.64**

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SERVICE AT ITS PEAK

P.O. Box 355 • 17 Junction Road
Malone, New York 12953-0355

Phone 483-FUEL (3835) • Fax 483-2005

Invoice

Account # 3908-1

DATE 01/09/2014

BILL TO
ADIRONDACK PARK AGENCY
PO BOX 99 ATTN:AMY HALL
RAY BROOK, NY 12977

SITE
ADIRONDACK PARK AGENCY
1133 NYS RTE 86
RAY BROOK, NY 12977

Invoice # 847514 Invoice Type: Regular

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Date	Ref #	Transaction	Comments	Amount
01-09-2014	260250	FO STATE BID	1099.80@ 3.3233	$3,654.97

Pd 1/15/14
VISA

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JAN 13 20[illegible]
ADIRONDACK PARK AGENCY

Invoice total: $3,654.97

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P.O. Box 355 • 17 Junction Road
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Phone 483-FUEL (3835) • Fax 483-2005

Invoice

DATE
01/24/2014

Account # 3908-1

BILL TO
ADIRONDACK PARK AGENCY
PO BOX 99 ATTN AMY HALL
RAY BROOK, NY 12977

SITE
ADIRONDACK PARK AGENCY
1133 NYS RTE 86
RAY BROOK, NY 12977

Invoice # **850923** Invoice Type: **Regular**

TEAR HERE PLEASE RETURN THIS PORTION WITH YOUR PAYMENT AMOUNT ENCLOSED $_____

Date	Ref #	Transaction	Comments	Amount
01-24-2014	266031	FO STATE BID	841.50 @ 3.4019	$2,862.70

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JAN 2[illegible] 2014
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Pd 1/24/14
VISA

Invoice total: **$2,862.70**

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Malone, New York 12953-0355

Phone 483-FUEL (3835) • Fax 483-2005

Invoice

DATE
02/04/2014

Account # 3908-1

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PO BOX 99 ATTN:AMY HALL
RAY BROOK, NY 12977

SITE
ADIRONDACK PARK AGENCY
1133 NYS RTE 86
RAY BROOK, NY 12977

Invoice # 853788 Invoice Type: Regular

TEAR HERE PLEASE RETURN THIS PORTION WITH YOUR PAYMENT AMOUNT ENCLOSED $_____

Date	Ref #	Transaction	Comments	Amount
02-04-2014	261051	FO STATE BID	600.00 @ 3.6622	$2,197.32

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FEB 10 2014
ADIRONDACK PARK AGENCY

pd 2/12/14

Invoice total: $2,197.32

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FURNACES • HOT WATER HEATERS
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AND BURNER SERVICE

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Adirondack ENERGY
SERVICE AT ITS PEAK

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Malone, New York 12953-0355
Phone 483-FUEL (3835) • Fax 483-2005

Invoice

Account # 3908-1

DATE 02/19/2014

BILL TO
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PO BOX 99 ATTN:AMY HALL
RAY BROOK, NY 12977

SITE
ADIRONDACK PARK AGENCY
1133 NYS RTE 86
RAY BROOK, NY 12977

Invoice # 856473 Invoice Type: Regular

▼ TEAR HERE PLEASE RETURN THIS PORTION WITH YOUR PAYMENT AMOUNT ENCLOSED $_____

Date	Ref #	Transaction	Comments	Amount
02-19-2014	262289	FO STATE BID	700.00 @ 3.554	$2,487.80

RECEIVED
FEB 21 2014
ADIRONDACK PARK AGENCY

Invoice total: $2,487.80

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FURNACES • HOT WATER HEATERS
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SERVICE AT ITS PEAK

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DATE
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RAY BROOK, NY 12977

SITE
ADIRONDACK PARK AGENCY
1133 NYS RTE 86
RAY BROOK, NY 12977

Invoice # 859853 Invoice Type: Regular

TEAR HERE PLEASE RETURN THIS PORTION WITH YOUR PAYMENT AMOUNT ENCLOSED $

Date	Ref #	Transaction	Comments	Amount
03-05-2014	263232	FO STATE BID	850.00 @ 3.504	$2,978.40

RECEIVED
MAR 07 2014
ADIRONDACK PARK AGENCY

Invoice total: $2,978.40

Page 1 of 1

HEATING OIL • DIESEL • GASOLINE
ADIRONDACK ENERGY PRODUCTS INC.
PO BOX 355,17 JUNCTION ROAD
MALONE, NY 12953-0355
(518) 483 FUEL (3835)

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SERVICE & INSTALLATION
AUTOMATIC DELIVERY • BUDGET PLANS

24HR EMERGENCY DELIVERY
AND BURNER SERVICE

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SERVICE AT ITS PEAK

P.O. Box 355 • 17 Junction Road
Malone, New York 12953-0355

Phone 483-FUEL (3835) • Fax 483-2005

Invoice

DATE
03/19/2014

Account # 3908-1

BILL TO
ADIRONDACK PARK AGENCY
PO BOX 99 ATTN:AMY HALL
RAY BROOK, NY 12977

SITE
ADIRONDACK PARK AGENCY
1133 NYS RTE 86
RAY BROOK, NY 12977

Invoice # 862781 Invoice Type: Regular

TEAR HERE PLEASE RETURN THIS PORTION WITH YOUR PAYMENT AMOUNT ENCLOSED $_____

Date	Ref #	Transaction	Comments	Amount
03-19-2014	250643	FO STATE BID	699.80 @ 3.294	$2,305.14

RECEIVED
MAR 24 2014
ADIRONDACK PARK AGENCY

Invoice total: **$2,305.14**

ADIRONDACK ENERGY PRODUCTS INC. Page 1 of 1 (518) 483 FUEL (3835)

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ADIRONDACK ENERGY PRODUCTS INC.
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Invoice

Account # 3908-1

DATE
04/02/2014

BILL TO
ADIRONDACK PARK AGENCY
PO BOX 99 ATTN:AMY HALL
RAY BROOK, NY 12977

SITE
ADIRONDACK PARK AGENCY
1133 NYS RTE 86
RAY BROOK, NY 12977

Invoice # 866041 Invoice Type: Regular

TEAR HERE PLEASE RETURN THIS PORTION WITH YOUR PAYMENT AMOUNT ENCLOSED $_____

Date	Ref #	Transaction	Comments	Amount
04-02-2014	257569	FO STATE BID	599.80 @ 3.239	$1,942.75
04-02-2014	257569	NORA FEE	599.80 @ .002	$1.20

PD 4/9/14
VISA

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APR - 7 2014
ADIRONDACK PARK AGENCY

Invoice total: $1,943.95

ADIRONDACK ENERGY PRODUCTS INC. Page 1 of 1 (518) 483 FUEL (3835)

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AND BURNER SERVICE
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Invoice

Account # 3908-1

DATE 04/30/2014

BILL TO
ADIRONDACK PARK AGENCY
PO BOX 99 ATTN:AMY HALL
RAY BROOK, NY 12977

SITE
ADIRONDACK PARK AGENCY
1133 NYS RTE 86
RAY BROOK, NY 12977

Invoice # 869487 Invoice Type: Regular

TEAR HERE PLEASE RETURN THIS PORTION WITH YOUR PAYMENT AMOUNT ENCLOSED $_____

Date	Ref #	Transaction	Comments	Amount
04-30-2014	258441	FO STATE BID	600.00 @ 3.2665	$1,959.90
04-30-2014	258441	NORA FEE	600.00 @ .002	$1.20

RECEIVED
MAY 0 7 2014
ADIRONDACK PARK AGENCY

pd 5/9/14
VISA

Invoice total: **$1,961.10**

ADIRONDACK ENERGY PRODUCTS INC. Page 1 of 1 (518) 483 FUEL (3835)

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PROPANE • KEROSENE
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AND BURNER SERVICE

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SERVICE AT ITS PEAK

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Account # 3908-1

DATE
10/07/2014

BILL TO
ADIRONDACK PARK AGENCY
PO BOX 99 ATTN:AMY HALL
RAY BROOK, NY 12977

SITE
ADIRONDACK PARK AGENCY
1133 NYS RTE 86
RAY BROOK, NY 12977

Invoice # 884113 Invoice Type: Regular

▼ TEAR HERE PLEASE RETURN THIS PORTION WITH YOUR PAYMENT AMOUNT ENCLOSED $

Date	Ref #	Transaction	Comments	Amount
10-07-2014	256109	FO STATE BID	899.70 @ 2.8225	$2,539.40
10-07-2014	256109	NORA FEE	899.70 @ .002	$1.80

pd 10/10/14
VISA

RECEIVED
OCT 2014
ADIRONDACK PARK AGENCY

Invoice total: $2,541.20

ADIRONDACK ENERGY PRODUCTS INC. Page 1 of 1 (518) 483 FUEL (3835)

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PROPANE · KEROSENE
HEATERS
SERVICE & INSTALLATION
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AND BURNER SERVICE

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PO BOX 355,17 JUNCTION ROAD
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(518) 483 FUEL (3835)

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SERVICE AT ITS PEAK

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Malone, New York 12953-0355

Phone 483-FUEL (3835) Fax 483-2005

Account # 3908-1

DATE
10/21/2014

BILL TO
ADIRONDACK PARK AGENCY
PO BOX 99 ATTN:AMY HALL
RAY BROOK, NY 12977

SITE
ADIRONDACK PARK AGENCY
1133 NYS RTE 86
RAY BROOK, NY 12977

Invoice # 885530 Invoice Type: Regular

TEAR HERE PLEASE RETURN THIS PORTION WITH YOUR PAYMENT AMOUNT ENCLOSED $_____

Date	Ref #	Transaction	Comments	Amount
10-21-2014	256790	FO STATE BID	150.00 @ 2.6235	$393.53
10-21-2014	256790	NORA FEE	150.00 @ .002	$0.30

RECEIVED
OCT 28 2014
ADIRONDACK PARK AGENCY

pd 10/23/14
VISA

Invoice total: **$393.83**

ADIRONDACK ENERGY PRODUCTS INC. Page 1 of 1 (518) 483 FUEL (3835)

GRIFFITH ENERGY
A Superior Plus Company

INVOICE

Please pay in full by 1/8/2015
Late fee assessed on 1/28/2015

Invoice Amount $349.58

How to contact us:
1-(518)-561-1020
24 hours a day, 7 days a week.

Local Customer Service Center:
GRIFFITH ENERGY
A SUPERIOR PLUS COMPANY
4736 ROUTE 9 PO BOX 947
PLATTSBURGH, NY, 12901-0947

Invoice

Invoice Date: December 29, 2014
Account Number: 2234623
Invoice Number: 604169
Previous Balance: $0.00

Summary of your account

ADIRONDACK PARK AGENCY
RE: /1133 NYS ROUTE 86/./RAYBROOK NY Tank # T001

DATE	GALLONS	PRODUCT	TICKET#	PPG	TOTAL
12/9/2014	147.1	HEATING FUEL #2	604169	@ $2.3765	$349.58

Total Invoice $349.58

RECEIVED
DEC 31 2014
ADIRONDACK PARK AGENCY

Billing Disputes Address:
GRIFFITH ENERGY
1870 South Winton Road
Rochester NY 14618

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FEIN 16-0736353
DvID: 0003064086

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Important Messages: A service charge of 1.5% per month (18% annual percentage rate) will be assessed on all invoice amounts not paid within terms.

We appreciate your business! If payment has been made, please disregard.

For Your Records: Payment Amount:_____ Check #:_____ Date:_____

GRIFFITH ENERGY
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PLATTSBURGH, NY, 12901-0947

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ADIRONDACK PARK AGENCY
PO BOX 99
RAYBROOK, NY 12977

Account No.	Invoice No.	Invoice Date
2234623	604169	December 29, 2014

Invoice Amount due $349.58

If payment has been made, please disregard.
PLEASE MAKE CHECKS PAYABLE TO:

GRIFFITH ENERGY
PO Box 1365
Dept 1
Buffalo, NY 14240-1365

Amount enclosed $

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Page 2 of 2

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Please pay in full by 1/8/2015
Late fee assessed on 1/28/2015

Invoice Amount $950.60

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A SUPERIOR PLUS COMPANY
4736 ROUTE 9 PO BOX 947
PLATTSBURGH, NY, 12901-0947

Invoice

Invoice Date: December 29, 2014
Account Number: 2234623
Invoice Number: 97640
Previous Balance: $0.00

Summary of your account

ADIRONDACK PARK AGENCY
RE: ./1133 NYS ROUTE 86/./RAYBROOK NY Tank # T001

DATE	GALLONS	PRODUCT	TICKET#	PPG	TOTAL
12/9/2014	400	HEATING FUEL #2	97640	@ $2.3765	$950.60
Total Invoice					$950.60

RECEIVED
DEC 31 2014
ADIRONDACK PARK AGENCY

Billing Disputes Address.
GRIFFITH ENERGY
1570 South Winton Road
Rochester NY 14618

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FEIN 16-0736353
DvID: 0003064086

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For Your Records: Payment Amount:_____ Check #:_____ Date:_____

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Account No.	Invoice No.	Invoice Date
2234623	97640	December 29, 2014

Invoice Amount due $950.60

BILL ENCLOSED

If payment has been made, please disregard.
-PLEASE MAKE CHECKS PAYABLE TO:

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4736 ROUTE 9 PO BOX 947
PLATTSBURGH, NY, 12901-0947

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GRIFFITH ENERGY
PO Box 1365
Dept 1
Buffalo, NY 14240-1365

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AR1167241 1229 0 000070 000079 2/2 11 P1

ADIRONDACK PARK AGENCY
PO BOX 99
RAYBROOK, NY 12977

Amount enclosed $

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www.superiorplusenergy.com/griffith/

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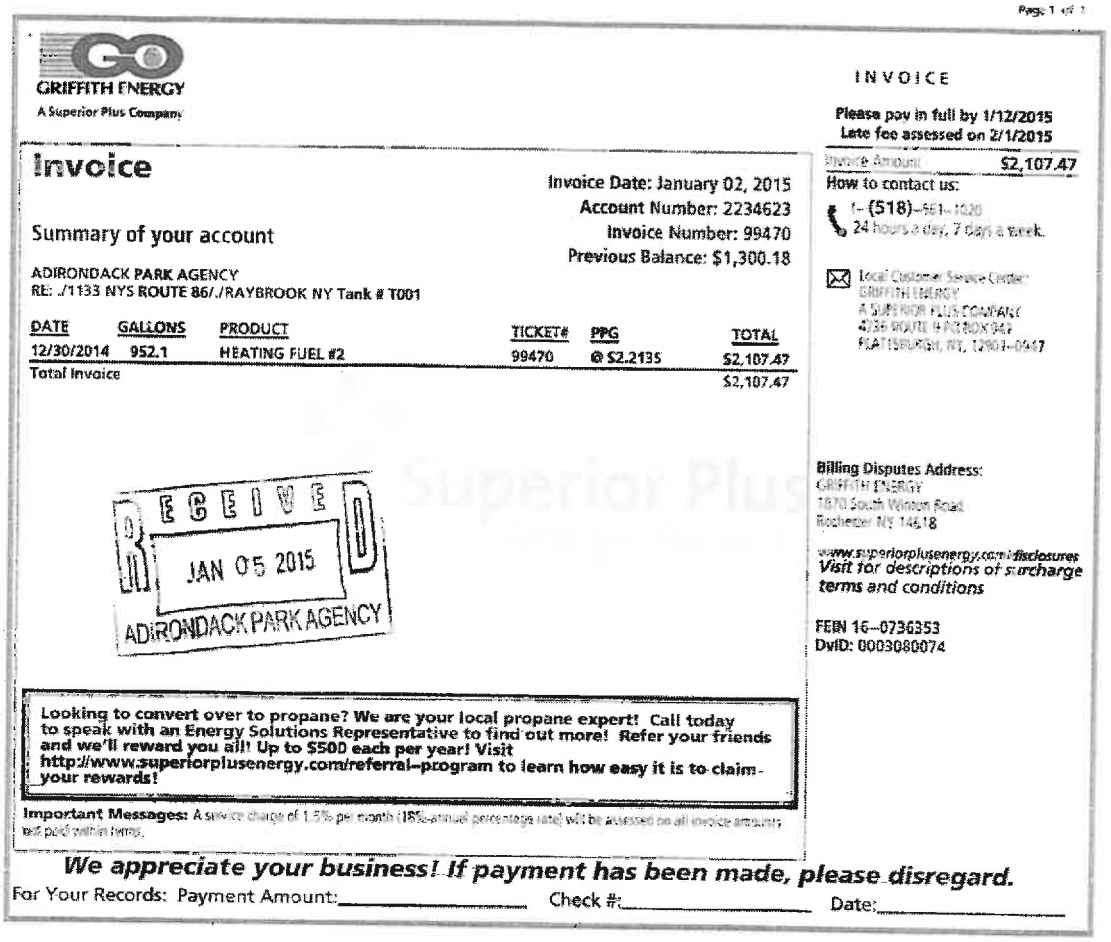

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INVOICE

Please pay in full by 1/12/2015
Late fee assessed on 2/1/2015

Invoice Amount $2,107.47

How to contact us:
1-(518)-561-1020
24 hours a day, 7 days a week.

Local Customer Service Center:
GRIFFITH ENERGY
A SUPERIOR PLUS COMPANY
4736 ROUTE 9 PO BOX 947
PLATTSBURGH, NY, 12901-0947

Invoice

Invoice Date: January 02, 2015
Account Number: 2234623
Invoice Number: 99470
Previous Balance: $1,300.18

Summary of your account

ADIRONDACK PARK AGENCY
RE: ./1133 NYS ROUTE 86/./RAYBROOK NY Tank # T001

DATE	GALLONS	PRODUCT	TICKET#	PPG	TOTAL
12/30/2014	952.1	HEATING FUEL #2	99470	@ $2.2135	$2,107.47
Total Invoice					$2,107.47

RECEIVED
JAN 05 2015
ADIRONDACK PARK AGENCY

Billing Disputes Address:
GRIFFITH ENERGY
1670 South Winton Road
Rochester NY 14618

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FEIN 16-0736353
DvID: 0003080074

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GRIFFITH ENERGY
A Superior Plus Company

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Account No.	Invoice No.	Invoice Date
2234623	99470	January 02, 2015

Invoice Amount due $2,107.47

BILL ENCLOSED

If payment has been made, please disregard.
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PLATTSBURGH, NY, 12901-0947

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