Energy Savings Plan (ESP)

Johnson Controls Inc.

City of Cape May

643 Washington St, Cape May, NJ, 08204 **Date: February 5, 2016**

Johnson Controls

Table of Contents

Table of Contents

Johnson Controls

Section 1. Executive Summary

Various energy conservation measures were evaluated in the development of this Energy Savings Plan (ESP). Johnson Controls has performed field verifications, collected data and taken field measurements to ensure the development of the most cost effective solutions as well as accurate savings calculations. Various solutions were reviewed with the school district's administration to develop a set of Energy Conservation Measures (ECMs) that allow the school district to address the facility's priority items while reducing the total annual energy spend for the District. This study expands upon the original energy audit conducted by Dome-Tech, Inc. The original audit was used for cost estimates as well as an overall indication of the District needs.
Priority items include:

- Upgrade lighting throughout the City to LED lighting fixtures.
- Install Building Automation System in City Hall, Library and Welcome/Transportation Center to apply control strategies.
- Install an emergency generator in Elementary School.

Energy Savings

Energy saving calculations performed in the development of this ESP was completed using Microsoft Excel worksheets with Bin weather data to accurately model the building systems. Additional spreadsheets were used for measures that are not affected by the weather, such as lighting savings.

Benefits

The measures investigated in this Energy Savings Plan could result in an annual utility savings of 298,922 kWh of electricity and 8,574 therms of natural gas. The total utility cost savings is $953,150 over the life of the project. Additionally, these energy savings will result in a net reduction of greenhouse gases and will reduce the school district's carbon footprint by 432,654 lbs. of CO_2 annually. All these savings are achieved while improving the environment and renewing many items that have been in service beyond useful life expectancy

Section 2. Project Description

This Energy Savings Plan (ESP) addresses the following facilities:

City of Cape May	
Cape May City Hall	643 Washington Street, Cape May, NJ 08204
Franklin Street School	700 Franklin Street, Cape May, NJ 08204
Welcome/Transportation Center	609 Lafayette Street, Cape May, NJ 08204
Water Works Building	Park Boulevard & Canning House Lane, Cape May, NJ 08204
Fire House	712 Franklin Street, Cape May, NJ 08204
Public Works Complex	Park Boulevard & Canning House Lane, Cape May, NJ 08204
Library	110 Ocean Street, Cape May, NJ 08204
Nature Center 1	1610 Delaware Avenue, Cape May, NJ 08204
Nature Center 2	1612 Delaware Avenue, Cape May, NJ 08204
Cape May City Elementary School	921 Lafayette Street, Cape May, NJ 08204

Facility Description

Cape May City Hall

Background Information

The City Hall was built in 1917 and is a 22,479 square footage.

Building Occupancy

The building occupies approximately 50 employees including administrative personnel and police officers. The building is occupied from 8:30 am to 4:30 pm, Monday to Friday and closed on weekends. It is occasionally open for community events.

Envelope

The building is a three story brick building. The exterior wall is in fair condition with fading paint and bad bricks in some areas. The roof is flat and gray and made of wood deck.
Façade: Brick framed/window panels are in good condition.

Windows: The windows cover approximately 20% of the building areas. They are double pane, double hung windows with wood frames and in fair condition.

Exterior Doors: There are approximately eight (8) doors with wood/metal frames. The doors are in fair condition.

Lighting

Most of the lighting within the building consists of T8-32 watt linear fluorescent fixtures with electronic ballasts, and in most cases the number of lamps per fixture is two. Exterior lighting consists of six (6) of 250-watt metal halide wall-pack lamps.

Mechanical Systems

Heating Systems: There is one (1) Weil McLain cast iron sectional, natural gas fired steam boiler with a capacity of 2904 MBH.

Figure 2.1: Boilers

Cooling Systems: The building is cooled by sixteen (16) split AC units and three (3) heat pump units. The treasure office and licensing/F3 office in the 1st floor and the zoning office in the sub ground floor are served by heat pump units. All the other areas are served by split AC units with DX coils and remote condensers. The air is circulated through ventilation fans on the DX system.

Manufacturer Name	Floor	Areas/Equipment Served	Model #	Serial #
Trane	Sub ground	Construction/zoning	2TWB3024A1000AA	6243YHK3F
Trane	Sub ground	Court Room	2TTM3048A1000AA	121440BKAA
Sanyo	Sub ground	Elevator Room	C0911	87351
Sanyo	1st Floor	Tax Office	CH1822	96824
Sanyo	1st Floor	Tax Office	CH1822	94724
Payne	1st Floor	Treasure Office	PH10JA018-E	4903E09830

Johnson Controls

Manufacturer Name	Floor	Areas/Equipment Served	Model #	Serial #
Mitsubishi Electric	Sub ground	zoning	MUZ-GE24NA	2001190
Mitsubishi Electric	Sub ground	office by zoning	MUZ-A09NA	8005128T
Payne	1st Floor	Licensing /F3 Office	PA10JA042-B	1103E01141
Mitsubishi Electric	Sub ground	Jail Cell	MUZ-GA24NA	0000988T
York	Sub ground	Processing Room	E1FB018506A	EAEM004461
Trane	1st Floor	Entire Police Dept	2TTX4060B1000AA	6023MR91F
York	Sub ground	Bike Room	E1FB012S06A	EMDM470450
Duane	1st Floor	Auditorium	13ACD-060-230-15	1911G00486
Trane	2nd floor	OfficeT1/T2/T3/uniforms/storage/break room	2TWX4036B1000AA	5214PH41F
Trane XL	2nd floor	clerk's office/conference room/mayor's office	2TWX4048B1000AA	5105WT51F
Carrier	2nd floor	water/sewer office & assessor	24ACR342C300	3707E05928
Payne	1st and 2nd floor	Mail room/copier room/office T4	PA13NR024-H	3409X67060
Payne	2nd floor	City manager's office	PA12NA036-H	4705X75699

Controls Systems:
There is no automatic control system in the building. The heating and cooling equipment of the building are controlled by the manual thermostats in each room.

Domestic Hot Water Systems:
The building is served by one (1) American Water natural gas fired domestic hot water heater with a 70 gallon storage capacity.

Electrical Systems

Plug Load: The building has typical office equipment such as computers, copiers and printers which contribute to the plug load.

Johnson Controls

Franklin Street School

Background Information

The building was built in 1927 and is 10,676 square footage.

Building Occupancy

Majority of the building is unoccupied except for the recreation area, which is used for yoga class and opens from 9 am to 11 am, Monday to Friday.

Envelope

The building is a two story brick building and in fair condition. The brick in some areas is in poor condition and need re-pointing. The roof is flat and gray.
Windows: The windows cover approximately 20% of the building areas. They are single pane, double hung windows with wood frames and in fair condition.

Exterior Doors: There are approximately five (5) doors with wood frames. The doors are in fair condition.

Lighting

The gym area is lit by eight (8) T8 fixtures with two (2) 8' T8 lamps per fixture and three (3) fixtures with four (4) 2' T8 lamps.

Mechanical Systems

Heating Systems: The gym area is heated by four (4) wall-hung natural gas fired Reznor unit heaters.

Figure 2.2: Unit Heater

Cooling Systems/Ventilation System: The building is served by two (2) 8.5 ton Carrier packaged rooftop units equipped with DX cooling coils.

Figure 2.3: Carrier RTUs

Manufacturer Name	Floor	Model #	Serial #
Carrier	Ground	50TM-009-501	1303G40474

Controls Systems: There is no automatic control system in the building. The heating and cooling equipment of the building is controlled by manual thermostats.

Welcome Center

Background Information

The Welcome Center was built in 2001 with a major renovation in 2005 and is 2,000 square footage.

Building Occupancy

The building occupies approximately 2 employees in the welcome center in the first floor and 2 employees in the Chamber of Commerce in the second floor. The building is occupied from 9 am to 5 pm, 7 days a week in the summer and 10 am to 4 pm, 7 days a week in the winter.

Envelope

The building is a two story wood building and in good condition.
Roof: Roof is pitched and red wood deck with asphalt/aluminum.
Windows: The windows cover approximately 10% of the building areas. They are double pane, double hung windows with wood frames and in good condition.

Exterior Doors: There are approximately three (3) doors in good condition.

Lighting

The welcome area of the first floor is lit with 2 ft of 4 T8-32watt lamps and the office areas of the second floor is lit with 4 ft of 2 T8-32watt lamps. Exterior lighting consists of eleven (11) 70-watt metal halide lamps and twenty-one (21) 100-watt incandescent lamps.

Mechanical Systems

Heating Systems: There is one (1) natural gas fired Trane XR95 furnace rated at 100 MBH and 95% fuel efficiency.

Figure 2.4: Trane Furnace

Cooling Systems: The building is cooled by three (3) split Trane XR13 air conditioners. The model # and serial # are presented below:

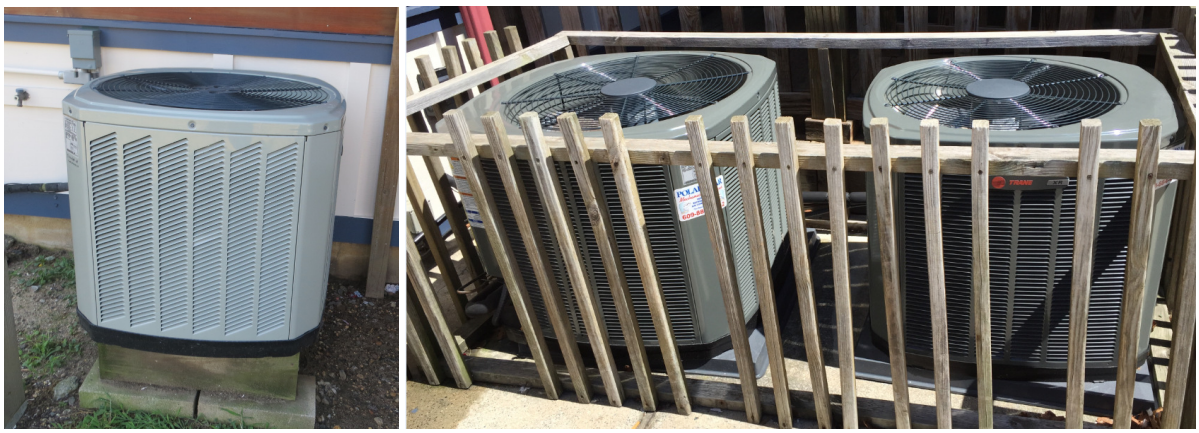


Figure 2.5: Trane Air Conditioners

Manufacturer Name	Model #	Serial #
Trane	4TTR3042D1000NA	15125P4H3F
Trane	4TTR3042D1000NA	15125P4H3F
Trane	4TTB3042D1000CA	14373TMP3F

Controls Systems:
There is no automatic control system in the building. The heating and cooling equipment of the building are controlled by the manual thermostats. The heating temperature setpoint is 68F and the cooling temperature setpoint is 72F.

Domestic Hot Water Systems:
The building is served by one (1) Rheem natural gas fired domestic hot water heater with a 40 gallon storage capacity and is rated at 34 kBtuh.

Water Works

Background Information

The building was built in 1926 and is 3,420 square footage.

Building Occupancy

The building occupies maximum of two (2) employee and uses as a municipal water supply building.

Envelope

The building is a two story brick building and in good condition.
Roof: Roof is flat and black wood deck.
Windows: The windows cover approximately 50% of the building areas. They are fixed double pane with wood frames and in good condition.

Exterior Doors: There are approximately two (2) metal frame doors and two (2) fiberglass garage bay doors.

Lighting

The main water process area is lit with T12-96 watt two (2) linear fluorescent lamps per fixture.

Mechanical Systems

Heating Systems: The water supply area is heated by two (2) Reznor natural gas fired unit heaters. The office area is heated by a Bryant Plus 95S natural gas fired heater.

Figure 2.6: Reznor Unit Heater

Cooling Systems: The office area is cooled by one (1) Bryant split air conditioner. The model # and serial # are presented below:

Figure 2.7: Bryant Air Conditioner

Manufacturer Name	Model #	Serial #
Bryant	116BNA030-A	1411E11744

Controls Systems:
There is no automatic control system in the building. The heating and cooling equipment of the building are controlled by the manual thermostat in the office.

Pumps:
There are nine (9) process pumps associated with the RO filtration system and CO2 system. Below listed the majority pumps:

Manufacturer Name	Quantity	HP/Unit	Model #	NEMA Efficiency
Robicon	3	200	na	94.5%
Baldor	2	3	35A13T123	82.5%
Magnetek	2	1.5	na	na
Baldor	2	1.5	84Z04008	74.5%

Fire House

Background Information

The building was built in 1960's and is 2,000 square footage.

Building Occupancy

The building occupies approximately 10 employees and operates 24x7 as a fire house.

Envelope

The building is a two story brick building with aluminum façade and in good condition. The roof is pitched and made of gray metal deck.
Windows: The windows cover approximately 10% of the building areas. They are operable windows with metal frames and in good condition.

Exterior Doors: There are approximately four (4) metal frame doors and seven (7) garage bay doors.

Lighting

Most of the lighting within the building consists of T8-32 watt linear fluorescent fixtures with electronic ballasts, and in most cases the number of lamps per fixture is two or four. Exterior lighting consists of 21 of 40-watt incandescent lamps.

Mechanical Systems

Heating Systems: There is one (1) Weil Mclain condensing natural gas fired hot water boiler with a capacity of 400 MBH and installed in 2013.

Figure 2.8: Boiler

Cooling Systems: The majority areas of the building is cooled by two (2) Mitsubishi and Unitary Products Group air conditioners. The dining room and the bedroom located on the second floor are cooled by two window AC units through one (1) Fujitsu air conditioner.

Manufacturer Name	Model #	Serial #
Mitsubishi Electric	MXZ-2A20NA	6003170T
FUJITSU	AOU24RLXFZ	LUN036190
Unitary Products Group	YCJF48S41S1A	W1L13339272

Figure 2.9: Air Conditioners

Controls Systems:

There is no automatic control system in the building. The heating and cooling equipment of the building are controlled by the manual thermostats.

Domestic Hot Water Systems:
The building is served by one (1) Ruud natural gas fired domestic hot water heater with a 70 gallon storage capacity and rated at 40 kBtuh.

Public Works Complex

Background Information

The building was built in 1970's and is 6,840 square footage.

Building Occupancy

The building is used as a Public Works facility and occupies two employees.

Envelope

The building is a one story aluminum facade building. The roof is pitched and yellow and made of metal deck.
Windows: The windows cover approximately 10% of the building areas. They are double pane windows with metal frames and in good condition.

Exterior Doors: There are approximately two (2) doors with metal frames and six (6) garage bay doors. The doors are in good condition.

Lighting

Most of the lighting within the office areas in the building consists of T8-32 watt linear fluorescent fixtures with electronic ballasts, and in most cases the number of lamps per fixture is two. The main area and mechanic area are lit with T12-96 watt two (2) linear fluorescent lamps per fixture. The storage and wash bay area consist of various metal halide lamps including 1000-watt, 250-watt and 400-watt.

Mechanical Systems

Heating Systems: The majority of the building is heated by one (1) Heil natural gas fired furnace with a capacity of 150 MBH. The carpenter room is heated by one (1) Carrier AHU with natural gas fired heater at a capacity of 60 MBH. The mechanical garage is heated by two (2) Reznor wall hung unit gas fired heaters. The garage spaces are heated by seven (7) infrared unit heaters.

Figure 2.10: Heil Furnace

Cooling Systems: The majority office area is cooled by one (1) Trane heat pump. The carpenter room is cooled and one (1) Carrier AHU. The lunch room is cooled by one (1) Electrolux window AC unit. Below is the details

Figure 2.11: Carpenter room Carrier AHU

Figure 2.12: Office area Trane heat pump

Manufacturer Name	Areas/Equipment Served	Model #	Serial #
Carrier	Carpenter room	na	na
Electrolux	Lunch room	LRA187MT2	KK2086122
Trane	Majority office areas	2TEC3F42A1000AA	6151N0k1V

Controls Systems:

There is no automatic control system in the building. The heating and cooling equipment of the building are controlled by the manual thermostats.

Library

Background Information

The building was built in 1900's and is 4,164 square footage.

Building Occupancy

The building is used as a public library and seasonally occupies 100 to 200 people per day. The building is open Monday, Wednesday and Friday from 9 am to 5 pm, Tuesday and Thursday from 9 am to 8 pm, and Saturdays from 9 am to 4 pm. The library is closed on Sundays and holidays.

Envelope

The building is a one story concrete block and stucco building. The roof is pitched and blue and with wood deck. The building is in good condition.
Windows: The windows cover approximately 20% of the building areas. They are double hung windows with wood frames and in good condition.

Exterior Doors: There are approximately three (3) doors with metal frames and are in good condition.

Lighting

Most of the lighting within the main areas in the building consists of T8-32 watt U Shape fluorescent fixtures with electronic ballasts and two lamps per fixture and 60 watt incandescent lamps. There are also a couple of 42 watt compact fluorescent lamps (CFL).

Mechanical Systems

Heating Systems: The majority of the building is heated by one (1) Weil Mclain cast iron sectional, natural gas fired hot water boiler with a capacity of 427 MBH. The board room/storage room/public restrooms are heated with electric baseboard.

Figure 2.13: Boiler

Cooling Systems: The building is cooled by two (2) York split A/C units. Below is the details

Figure 2.14: York A/C Units

Manufacturer Name	Model #	Serial #
York	YCJD60S43S3A	W1K0305799

Controls Systems:
The heating and cooling equipment of the building are remotely controlled by the County of Cape May with Johnson Controls' Building Automation System (BAS). There is no local access to the BAS.

Domestic Hot Water Systems:
The building is served by one (1) Ruud natural gas fired domestic hot water heater with a 70 gallon storage capacity and rated at 40 kBtuh.

Nature Center 1

Background Information

The building was built in 1990's and is 1,296 square footage.

Building Occupancy

The building is currently unoccupied and used occasionally for educational purposes.

Envelope

The building is one story and made of wood. The roof is pitched and gray and with wood deck and asphalt. The building is in good condition.
Windows: The windows cover approximately 10% of the building areas. They are double pane windows in good condition.

Exterior Doors: There are approximately three (3) doors with wood frames and are in good condition.

Lighting

Most of the lighting in the building consists of T8-32 watt linear fluorescent fixtures with electronic ballasts, and the number of lamps per fixture is two. The lab area is lit 60-watt Halogen and incandescent lamps.

The bathroom is lit with 26-watt Compact Fluorescent Lamps (CFLs). The exterior area is lit with 100-watt Halogen and 26-watt CFLs.

Mechanical Systems

Heating Systems: The building is heated by electric baseboard.

Controls Systems:
There is no automatic control system in the building. The heating equipment of the building is controlled by manual thermostats.

Domestic Hot Water Systems:
The building is served by one (1) State Select electric domestic hot water heater with a 40 gallon storage capacity and rated at 5.5 kW.

Nature Center 2

Background Information

The building was built in 2005 and is 1,876 square footage.

Building Occupancy

The building is used as a nature center and seasonally occupies up to 100 people a day. The first floor of the building is a shopping area and normally occupies one volunteer. The second floor is an office area and normally occupies two employees. The building is open Wednesday to Sunday from 10 am to 4 pm, and in the summer every day from 9 am to 4 pm.

Envelope

The building is a two story vinyl siding building and in good condition. The roof is pitched and gray and with wood deck and asphalt shingles.
Windows: The windows cover approximately 20% of the building areas. They are double pane windows with wood frames and in good condition.

Exterior Doors: There are approximately two (2) doors with wood frames and are in good condition.

Lighting

Most of the areas in the building are lit with various CFLs including 32-wawtt, 26-watt and 13-watt. The main area and education center in the 1st floor are lit with T8-32 watt two (2) linear fluorescent lamps per fixture. The other part of the education center and the main area of the 2nd floor are lit with 75-watt and 100-watt Halogen lamps. The exterior is lit with 60-watt incandescent lamps.

Mechanical Systems

Heating Systems: The building is heated by one (1) Bryant natural gas fired furnace.

Figure 2.15: Gas Furnace

Cooling Systems: The building is cooled by two (2) Arcoaire split A/C units. Each floor is served by one unit.

Figure 2.16: Arcoaire A/C Units

Manufacturer Name	Model #	Serial #
Arcoaire	NAC030AKC3	E042835494

Controls Systems:

There is no automatic control system in the building. The heating and cooling equipment of the building are controlled by a manual thermostat per floor.

Domestic Hot Water Systems:
The building is served by one (1) Bradford White natural gas fired domestic hot water heater with a 40 gallon storage capacity and rated at 40 kBtuh.

Elementary School

Background Information

The building was built in 1965 and with a major renovation in 2003. The building is 43,560 square footage.

Building Occupancy

The building is an elementary school and serves grades from Pre-K to Grade 6. It is occupied with 140 students and 80 staff. The school is operated from 7 am to 4 pm however with cleaning the school is normally operated as late as 9:30 pm, Monday to Friday. The school is closed on weekends and holidays.

Envelope

The building is a one story brick/block concrete building and in good condition. The roof is flat and made of black rubber and with concrete deck. The building is in good condition.
Windows: The windows cover approximately 20% of the building areas. They are double pane windows with metal frames and in good condition.

Exterior Doors: There are approximately 30 doors with metal frames and are in good condition.

Lighting

Most of the lighting in the school consists of T8-32 watt linear fluorescent fixtures with electronic ballasts, and in most cases the number of lamps per fixture is two, three and four. The gym is lit with T5-54 watt high output linear fluorescent fixtures with six (6) lamps per fixture. The auditorium is lit with 60-watt incandescent lamps and a couple of 100-watt incandescent lamps. The workshop is lit with T12-96 watt linear fluorescent fixtures with four lamps per fixture. The parking lot is lit with 400-watt high pressure sodium lamps.

Mechanical Systems

Heating Systems: The building is heated by two (2) Aerco Benchmark modular natural gas fired condensing boilers with 2,000 MBH capacity each. The boilers operate in a lead lag sequence and are served by a two (2) 3-HP heating hot water pumps that operate in a lead lag sequence and supply hot water to the school.

Figure 2.17: Condensing boilers

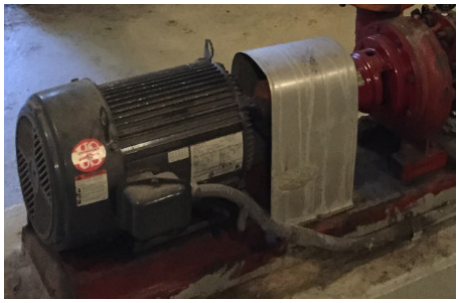


Figure 2.18: Hot water pump

Cooling Systems: The gym and auditorium are served by three (3) AAON packaged rooftop units which are equipped with DX cooling. Most of the perimeter spaces are served by AAF Unit Ventilators (UVs) which is one UV per space. The two classrooms 31 and 37 are served by four (4) Trane UVs where there are two UVs per room. All perimeters spaces are served by fan coil units (FCU) and unit heaters and equipped with hot water heating coils. Offices and classrooms are served by twenty-eight (28) split AC units. Most of the AC units use Carrier condensers with a couple of exceptions of Sanyo and Mitsubishi. Approximately 20 exhaust fans serve various areas including mechanical /boiler rooms, toilets and offices. Below lists the details.

Quantity	Manufacturer	Areas/Equipment Served	Model #	Serial #
3	AAON	Gym & Auditorium	CA0287	200009-CCCG0399
14	Carrier	16,14,library, 17,18,19,20,32,33,34,38,39,40	38CKS048300	2900E19414
1	Carrier	3 (computer lab)	38CKS018300	1900E13339
1	AirTemp	1	na	na
1	na	2	13ACD-036-230-17	1914F24862
1	Mitsubishi Electric	12	PU12Ek	na
2	na	11 & 13	na	na
1	Mitsubishi Electric	5&7	MUM18NW	na
1	Sanyo	9	C1251	407834
1	Sanyo	10	na	na
1	Sanyo	24	na	na
4	Trane	37 & 31	na	na

Figure 2.19: AAON RTUs

Controls Systems:

The heating and cooling equipment of the building are controlled by a Building Management System (Tridium JACE and Honeywell LON Controls). The occupied heating temperature setpoint is 68F and the occupied cooling temperature setpoint is 75F. The unoccupied heating temperature setpoint is 60F and the unoccupied cooling temperature setpoint is 85F.

Domestic Hot Water Systems:

Domestic hot water is supplied by a hot water storage tank which is fed by the Aerco boilers via a heat exchanger. The kitchen is served by one (1) Ruud, natural gas fired hot water heater.

Utility Baseline Analysis

Electric

Electrical energy is provided to City of Cape May through Atlantic City Electric (ACE) under the Monthly Generation Service (MSG) and the Annual Generation Service (AGS) tariffs. The street lighting is provided through Atlantic City Electric (ACE) under Contributed Street Lighting (CSL) tariff. The electric utility measures consumption in kilowatt-hours (kWh) and maximum demand in kilowatts (kW). One kWh usage is equivalent to 1000 watts running for one hour. One kW of electric demand is equivalent to 1000 watts running at any given time. The basic usage charges are shown as generation service and delivery charges along with several non-utility generation charges. The buildings have individual rates per kWh which were used in this report.

Natural Gas

The City of Cape May acquires its natural gas from South Jersey Gas (SJG). The gas utility measures consumption in cubic feet x 100 (CCF).

The following table shows City of Cape May building names, utility account numbers, electric tariffs, and the totalized annual consumption from September 2014 to August 2015.

Building Name	Electric Account No.	Electric Tariff	Gas Account No.
Cape May City Hall	55008791703	ASG Secondary	4-18-55-1290-1-5
Franklin Street School	55008839767	MSG Secondary	4-18-55-0950-1-8
Welcome/Transportation Center	55004829606	MSG Secondary	4-19-53-4484-0-8
Water Works Building	55009626114	ASG Secondary	4-16-52-0310-0-0
Fire House	55008792461	MSG Secondary	4-18-55-1270-1-9
Public Works Complex	55004760843	MSG Secondary	4-16-52-0055-0-9
Library	55012283069	MSG Secondary	4-19-52-0003-1-7

Building Name	Electric Account No.	Electric Tariff	Gas Account No.
Nature Center 1	55001146137	MSG Secondary	na
Nature Center 2	55001125743	MSG Secondary	4-18-54-8252-0-9
Cape May City Elementary School	55008982443	ASG Secondary	4-18-52-0850-1-2
Street Lights	55000498000 & 55003094798	CSL	na

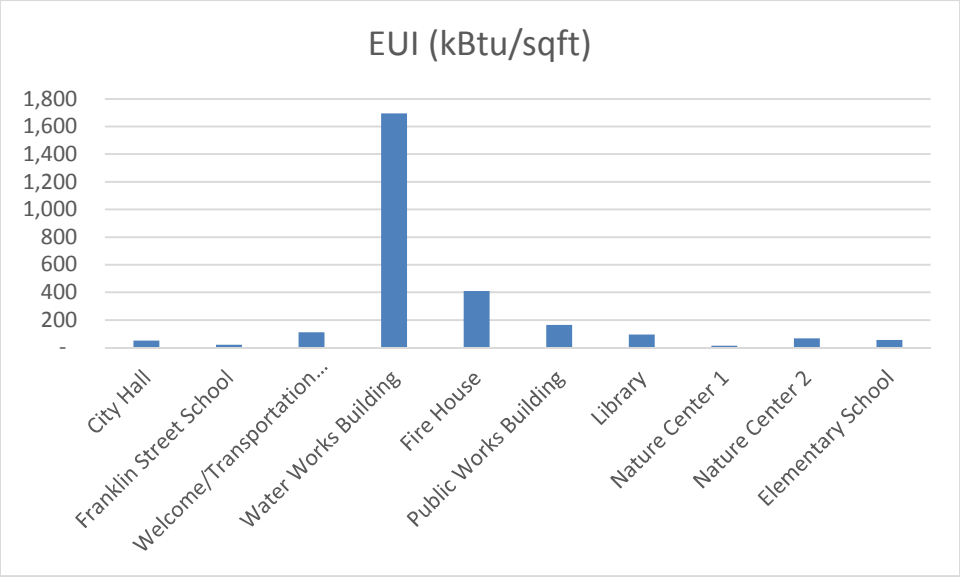
Energy Usage Summary

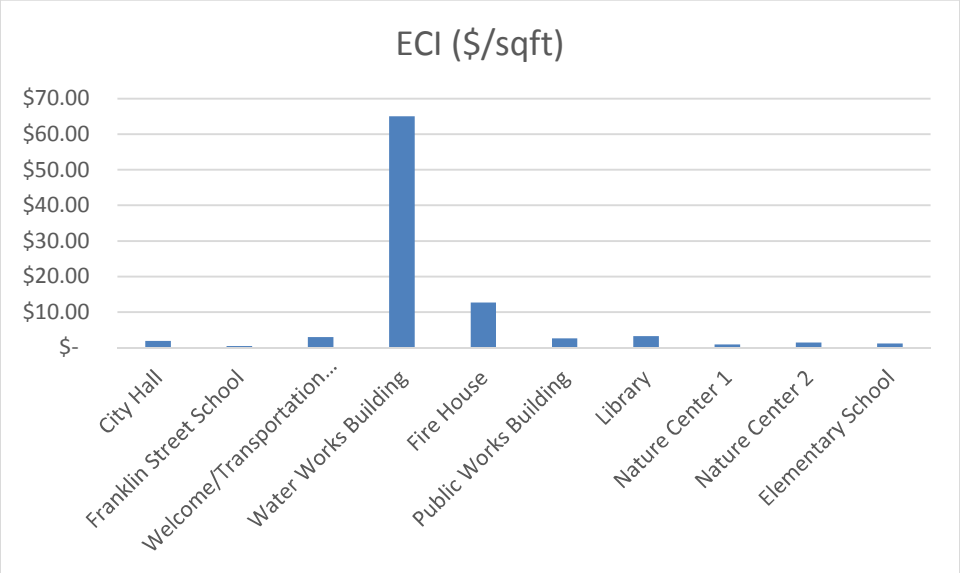
BUILDING	ANNUAL CONSUMPTION (KWH)	Annual DEMAND (KW)	ANNUAL TOTAL ELEC. COST ($)	ANNUAL CONSUMPTION (CCF)	ANNUAL GAS COST ($)	TOTAL ENERGY COST ($)
Cape May City Hall	272,704	709.8	$38,926	2,376	$ 3,394	$ 42,320
Franklin Street School	9,463	140.4	$1,808	1,875	$ 2,762	$ 4,570
Welcome/Transportation Center	20,887	76.4	$3,537	1,496	$ 2,308	$ 5,845
Water Works Building	1,624,600	3,628.0	$218,807	2,544	$ 3,606	$ 222,413
Fire House	120,160	332.8	$19,845	4,110	$ 5,564	$ 25,408
Public Works Complex	18,189	90.3	$3,470	10,719	$ 14,065	$ 17,535
Library	58,591	183.5	$10,769	1,931	$ 2,784	$ 13,553
Nature Center 1	5,291	79.6	$1,143			$ 1,143
Nature Center 2	5,286	45.3	$946	1,065	$ 1,731	$ 2,677
Cape May City Elementary School	220,600	1,211.1	$35,823	17,300	$ 14,682	$ 50,505
Street Lights*	62,530	na	$10,947	na	na	$10,947
TOTAL	**2,418,301**	**6,497**	**$346,021**	**43,416**	**$50,897**	**$396,918**

*The generation cost from September 2014 to June 2015 is not available.

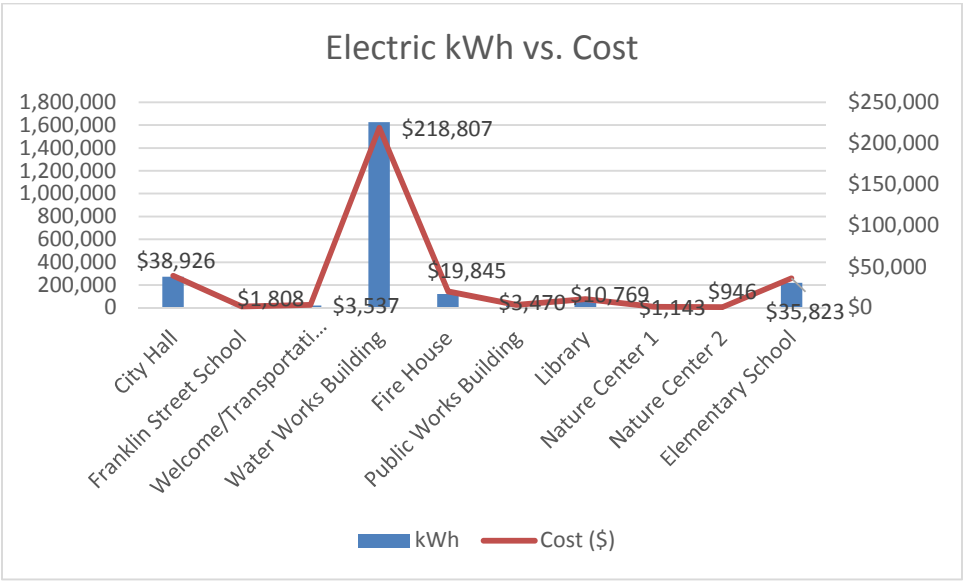
Johnson Controls

City of Cape May Energy Summary Analysis

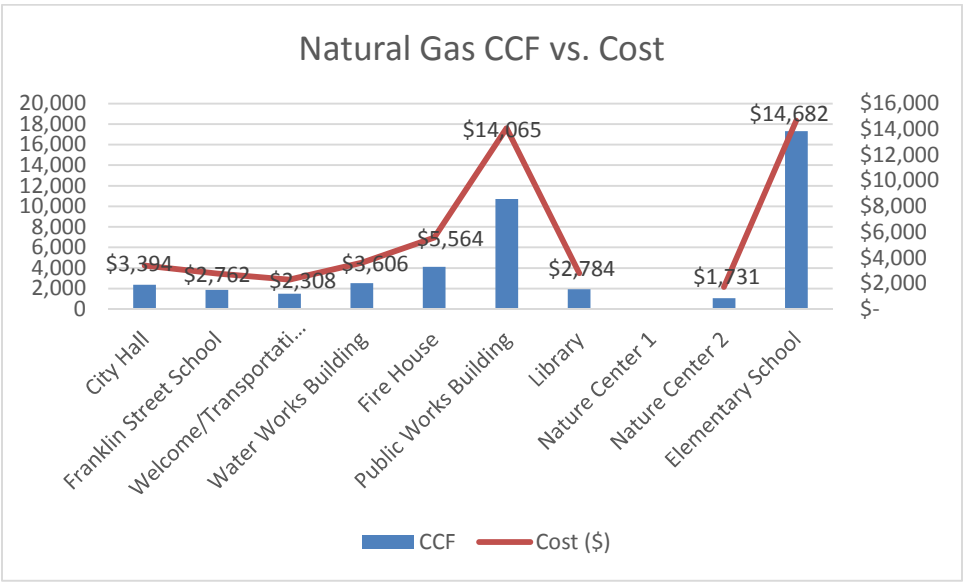




City of Cape May Energy Use Index (EUI) & Energy Cost Index (ECI) Analysis

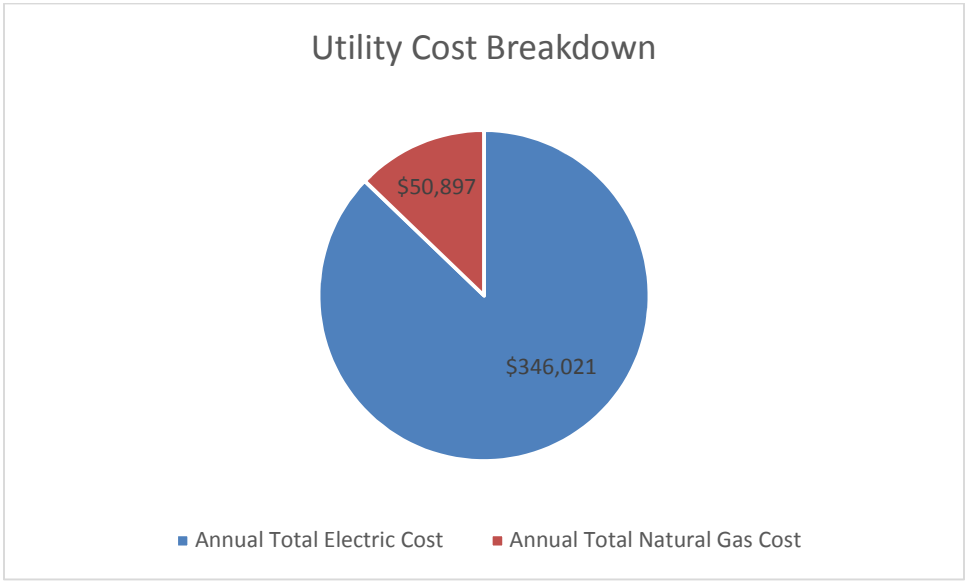


City of Cape May Electric Consumption versus Cost



City of Cape May Natural Gas Consumption versus Cost.

The pie chart below shows the distribtuion of these two energy sources relative to the entire projectenergy consumption. At 87% of the total consumption, electricity comprises a larger share of the energy usage.



City of Cape May Percentile Energy Cost Distribution

Marginal Rates

The utility rates identified below were used for purposes of calculating the dollar effect of the energy savings at City of Cape May.

Name of School	$/kWh	$/kW	$/CCF
Cape May City Hall	$0.122	$7.89	$ 1.43
Franklin Street School	$0.169	$1.50	$ 1.47
Welcome/Transportation Center	$0.164	$1.58	$ 1.54
Water Works Building	$0.117	$8.00	$ 1.42
Fire House	$0.161	$1.54	$ 1.35
Public Works Complex	$0.174	$3.36	$ 1.31
Library	$0.171	$3.94	$ 1.44
Nature Center 1	$0.193	$1.54	na
Nature Center 2	$0.165	$1.62	$ 1.63
Cape May City Elementary School	$0.120	$7.80	$ 0.85
Street Lights	$0.095	na	na
Total (Average)	**$0.123**	**$7.10**	**$ 1.17**

Utility Breakdown by Building

City Hall

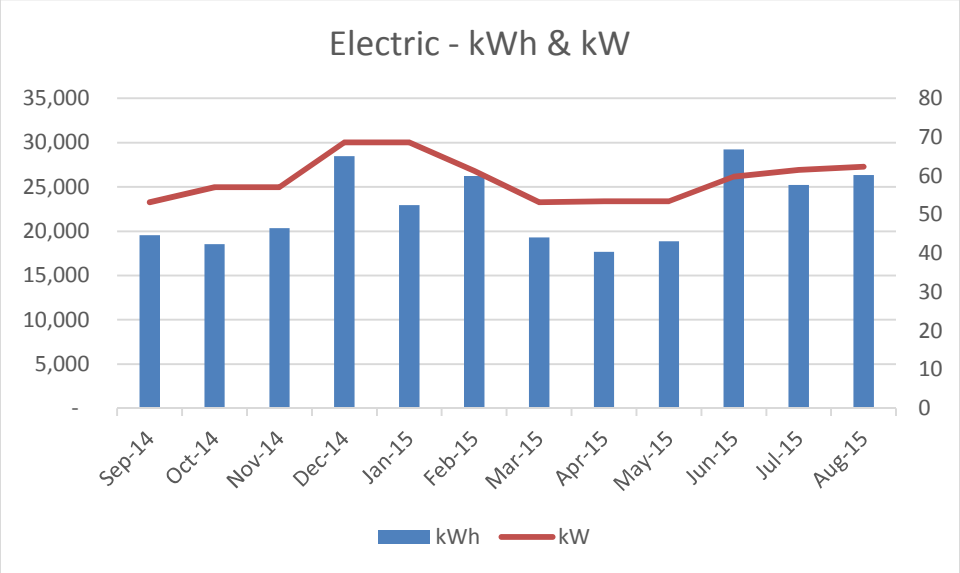
Electric Usage and Demand

A detailed look at the usage (kWh), demand (kW) and total electric cost per month in a typical year is shown below in table format.

Month	Monthly kWh	Monthly kW	Monthly $
Sep-14	19,564	53	$ 2,814
Oct-14	18,532	57	$ 2,743
Nov-14	20,359	57	$ 2,997
Dec-14	28,470	69	$ 4,158
Jan-15	22,962	69	$ 3,353
Feb-15	26,241	61	$ 3,727
Mar-15	19,285	53	$ 2,839
Apr-15	17,663	53	$ 2,613
May-15	18,848	53	$ 2,817
Jun-15	29,222	60	$ 3,878
Jul-15	25,208	62	$ 3,406
Aug-15	26,350	62	$ 3,582
Totals	**272,704**	**710**	**$ 38,926**

Based off of one year of utility bill information September 2014 to August 2015

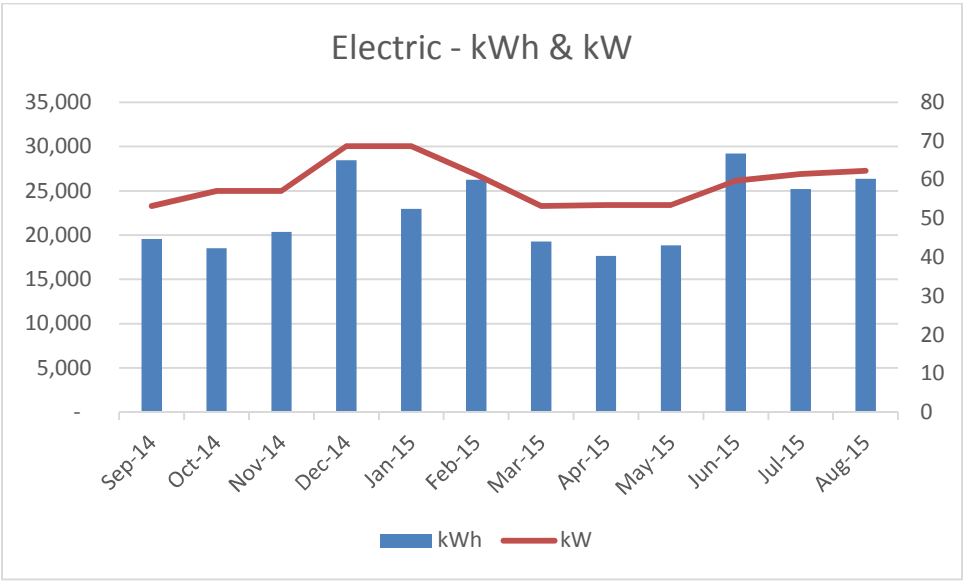
The figure below shows the usage (kW-secondary axis) and (kWh-primary axis) over the same one year period.



Energy Consumption from September 2014 to August 2015

The figure below shows the usage (kWh) and (Cost) over the same one year period.

Johnson Controls



Energy Consumption vs Cost from September 2014 to August 2015

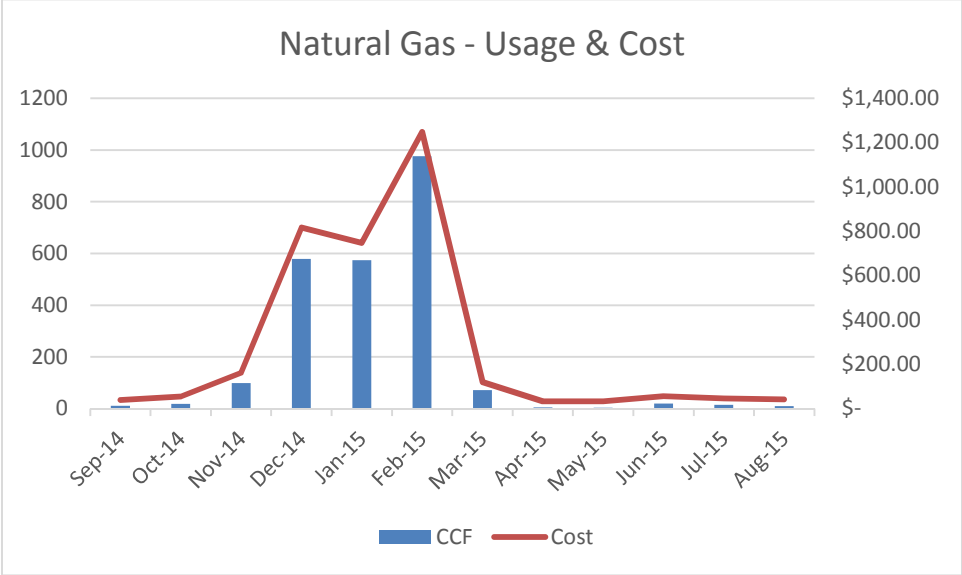
Natural Gas Usage

A detailed look at the consumption (CCF) and rate ($/CCF) monthly in a typical year is shown below in table format.

Month	Monthly CCF	Monthly Cost	$/CCF
Sep-14	11	$ 37.94	$ 3.45
Oct-14	18	$ 54.24	$ 3.01
Nov-14	98	$ 160.52	$ 1.64
Dec-14	579	$ 816.43	$ 1.41
Jan-15	574	$ 747.44	$ 1.30
Feb-15	976	$ 1,249.66	$ 1.28
Mar-15	71	$ 119.20	$ 1.68
Apr-15	4	$ 33.16	$ 8.29
May-15	3	$ 32.80	$ 10.93
Jun-15	19	$ 55.17	$ 2.90
Jul-15	14	$ 45.92	$ 3.28
Aug-15	9	$ 41.92	$ 4.66
Total	**2,376**	**$3,394**	**$1,43**

Based off of one year of utility bill information September 2014 to August 2015

The figure below shows the monthly consumption over the same time period. Notice that the usage peaks in the winter months when heating is necessary.



Natural Gas Consumption versus cost from September 2014 to August 2015

Franklin Street School

Electric Usage and Demand

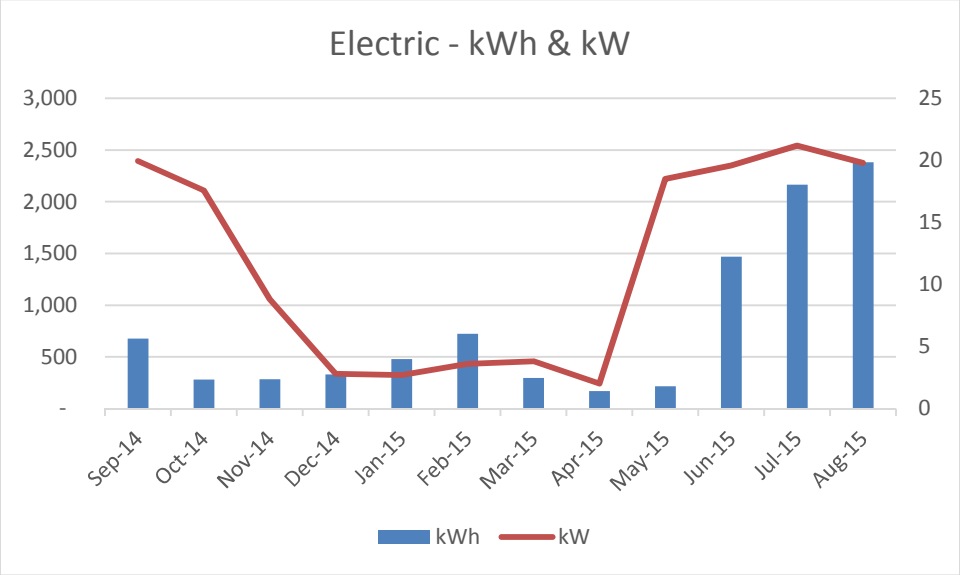
A detailed look at the usage (kWh), demand (kW) and total electric cost per month in a typical year is shown below in table format.

Month	Monthly kWh	Monthly kW	Monthly $
Sep-14	675	20	$147
Oct-14	281	18	$75
Nov-14	283	9	$64
Dec-14	329	3	$65
Jan-15	478	3	$88
Feb-15	723	4	$127
Mar-15	295	4	$59
Apr-15	170	2	$37
May-15	214	19	$69
Jun-15	1,468	20	$273
Jul-15	2,165	21	$387
Aug-15	2,382	20	$416
Totals	**9,463**	**140**	**$1,808**

Based off of one year of utility bill information September 2014 to August 2015.

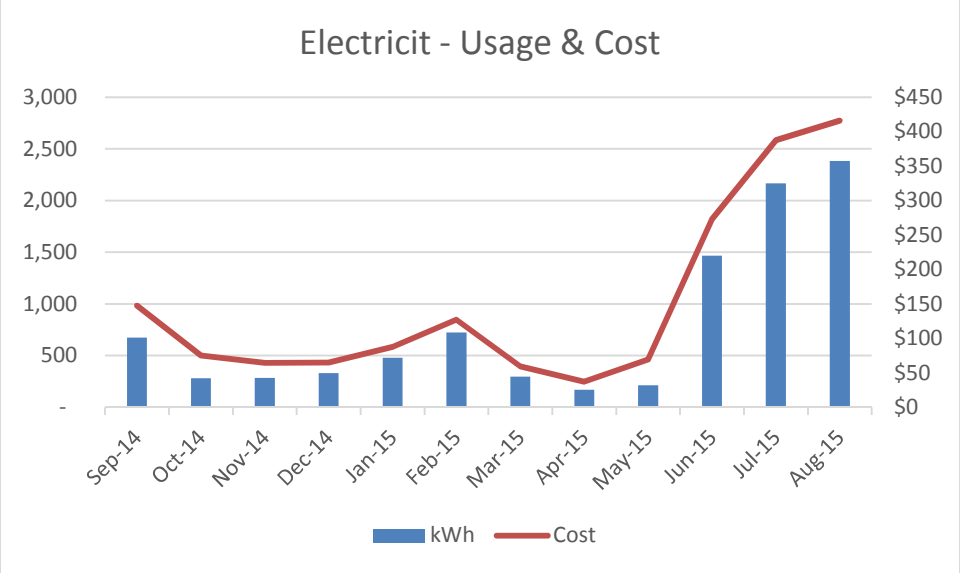
Johnson Controls

The figure below shows the usage (kW-secondary axis) and (kWh-primary axis) over the same one year period.



Energy Consumption from September 2014 to August 2015

The figure below shows the usage (kWh) and (Cost) over the same one year period.



Energy Consumption vs Cost from September 2014 to August 2015

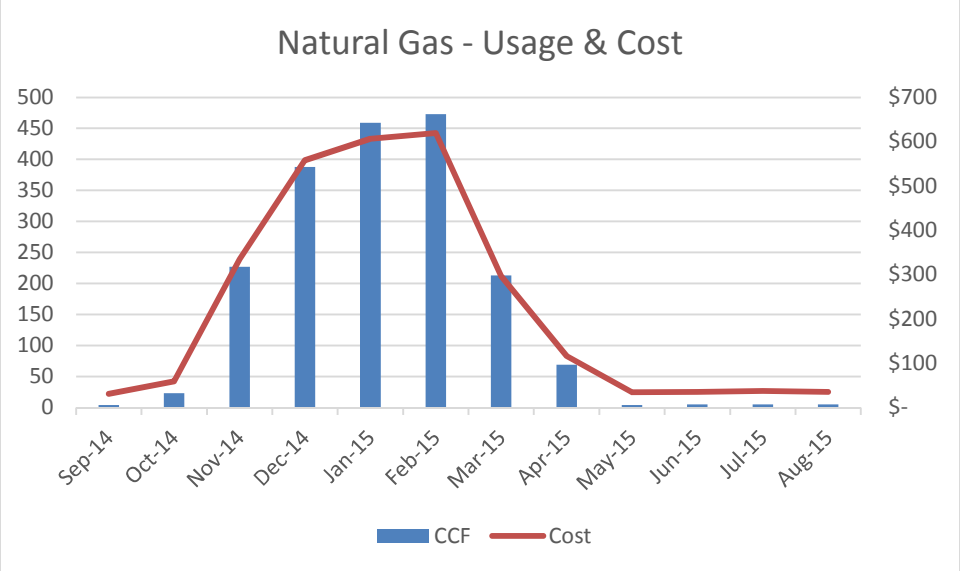
Natural Gas Usage

A detailed look at the consumption (CCF) and the dollar rate per (CCF) monthly in a typical year is shown below in table format

Month	Monthly CCF	Monthly Cost	$/CCF
Sep-14	4	$ 31	$ 7.75
Oct-14	23	$ 59	$ 2.57
Nov-14	227	$ 335	$ 1.47
Dec-14	388	$ 558	$ 1.44
Jan-15	459	$ 606	$ 1.32
Feb-15	473	$ 619	$ 1.31
Mar-15	213	$ 296	$ 1.39
Apr-15	69	$ 116	$ 1.68
May-15	4	$ 34	$ 8.51
Jun-15	5	$ 35	$ 7.05
Jul-15	5	$ 37	$ 7.42
Aug-15	5	$ 35	$ 7.04
Totals	**1,875**	**$2,762**	**$1.47**

Based off of one year of utility bill information September 2014 to August 2015

The figure below shows the monthly consumption over the same time period. Notice that the usage peaks in the winter months when heating is necessary.



Natural Gas Consumption versus cost from September 2014 to August 2015

Johnson Controls

Welcome/Transportation Center

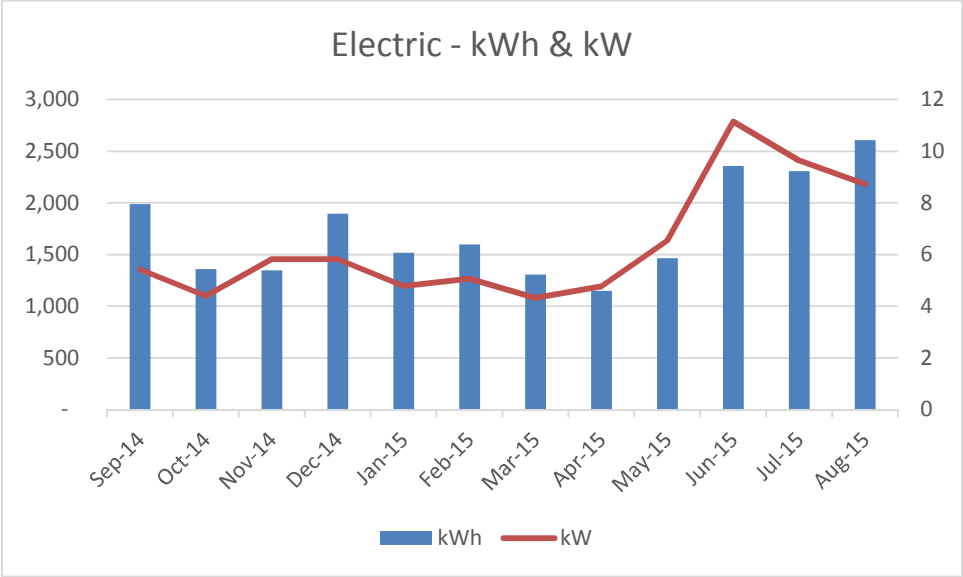
Electric Usage and Demand

A detailed look at the usage (kWh), demand (kW) and total electric cost per month in a typical year is shown below in table format.

Month	Monthly kWh	Monthly kW	Monthly $
Sep-14	1,987	5	$337
Oct-14	1,358	4	$229
Nov-14	1,346	6	$230
Dec-14	1,895	6	$320
Jan-15	1,518	5	$256
Feb-15	1,597	5	$270
Mar-15	1,306	4	$221
Apr-15	1,148	5	$196
May-15	1,463	7	$255
Jun-15	2,355	11	$401
Jul-15	2,307	10	$387
Aug-15	2,607	9	$436
Totals	**20,887**	**76**	**$3,537**

Based off of one year of utility bill information September 2014 to August 2015

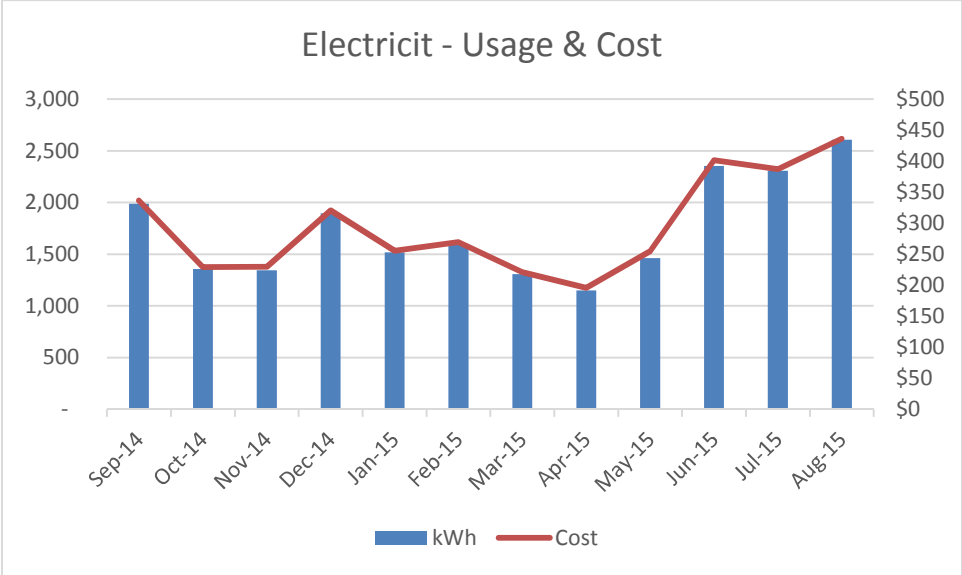
The figure below shows the usage (kW-secondary axis) and (kWh-primary axis) over the same one year period.



Energy Consumption from September 2014 to August 2015

Johnson Controls

The figure below shows the usage (kWh) and (Cost) over the same one year period.



Energy Consumption vs Cost from September 2014 to August 2015

Natural Gas Usage

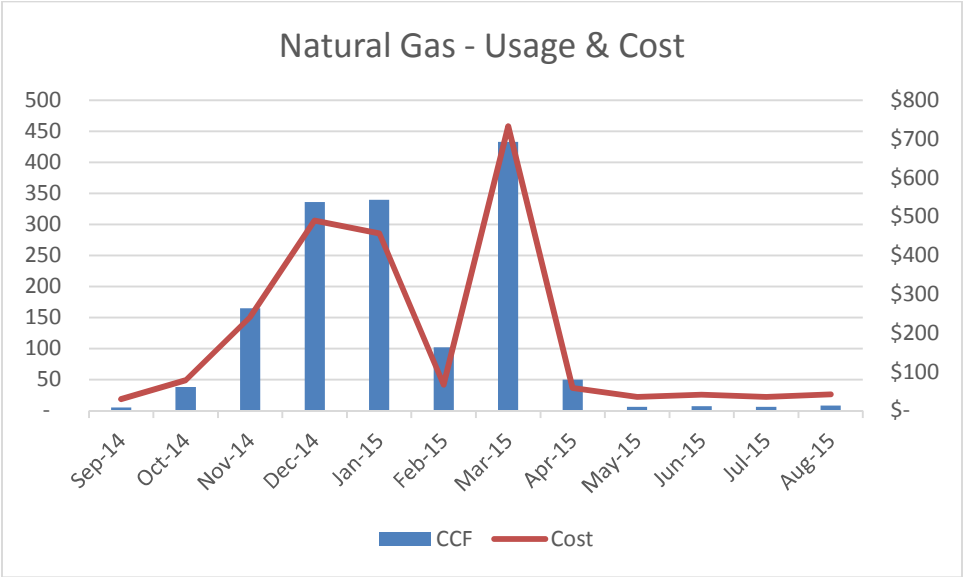
A detailed look at the consumption (CCF) and the dollar rate per (CCF) monthly in a typical year is shown below in table format

Month	Monthly CCF	Monthly Cost	$/CCF
Sep-14	5	$ 29	$ 5.88
Oct-14	38	$ 78	$ 2.06
Nov-14	165	$ 242	$ 1.46
Dec-14	336	$ 490	$ 1.46
Jan-15	340	$ 457	$ 1.34
Feb-15	102	$ 66	$ 0.65
Mar-15	433	$ 734	$ 1.69
Apr-15	50	$ 58	$ 1.16
May-15	6	$ 35	$ 5.91
Jun-15	7	$ 41	$ 5.80
Jul-15	6	$ 35	$ 5.89
Aug-15	8	$ 42	$ 5.26
Totals	**1,496**	**$2,308**	**$1.54**

Based off of one year of utility bill information September 2014 to August 2015

Johnson Controls

The figure below shows the monthly consumption over the same time period. Notice that the usage peaks in the winter months when heating is necessary.



Natural Gas Consumption versus cost from September 2014 to August 2015

Water Works Building

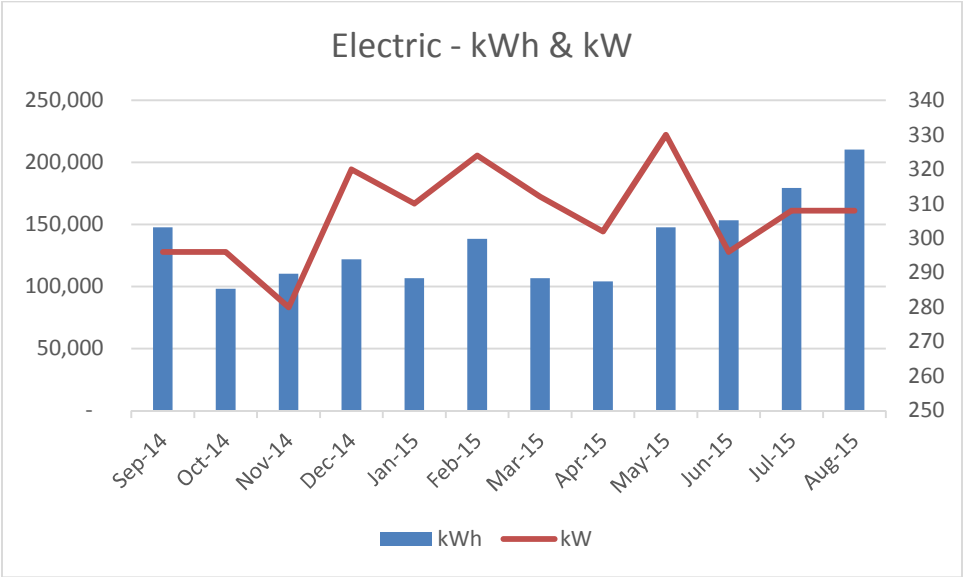
Electric Usage and Demand

A detailed look at the usage (kWh), demand (kW) and total electric cost per month in a typical year is shown below in table format.

Month	Monthly kWh	Monthly kW	Monthly $
Sep-14	147,600	296	$19,841
Oct-14	98,200	296	$13,860
Nov-14	110,200	280	$15,317
Dec-14	121,800	320	$17,427
Jan-15	106,600	310	$15,288
Feb-15	138,400	324	$18,904
Mar-15	106,600	312	$15,136
Apr-15	104,200	302	$14,694
May-15	147,800	330	$20,483
Jun-15	153,400	296	$19,445
Jul-15	179,400	308	$22,280
Aug-15	210,400	308	$26,131
Totals	**1,624,600**	**3,682**	**$218,807**

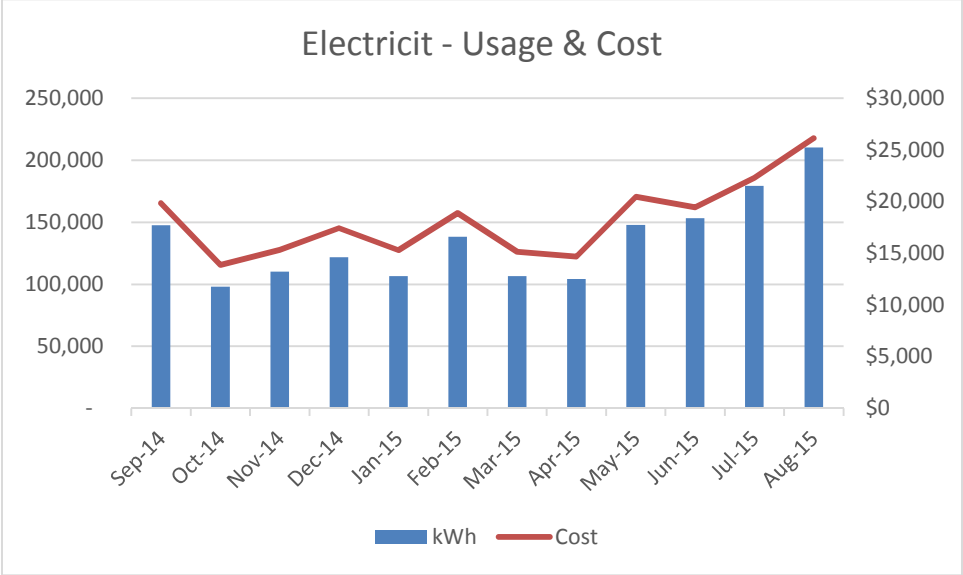
Based off of one year of utility bill information September 2014 to August 2015

The figure below shows the usage (kW-secondary axis) and (kWh-primary axis) over the same one year period.



Energy Consumption from September 2014 to August 2015

The figure below shows the usage (kWh) and (Cost) over the same one year period.



Energy Consumption vs Cost from September 2014 to August 2015

Johnson Controls

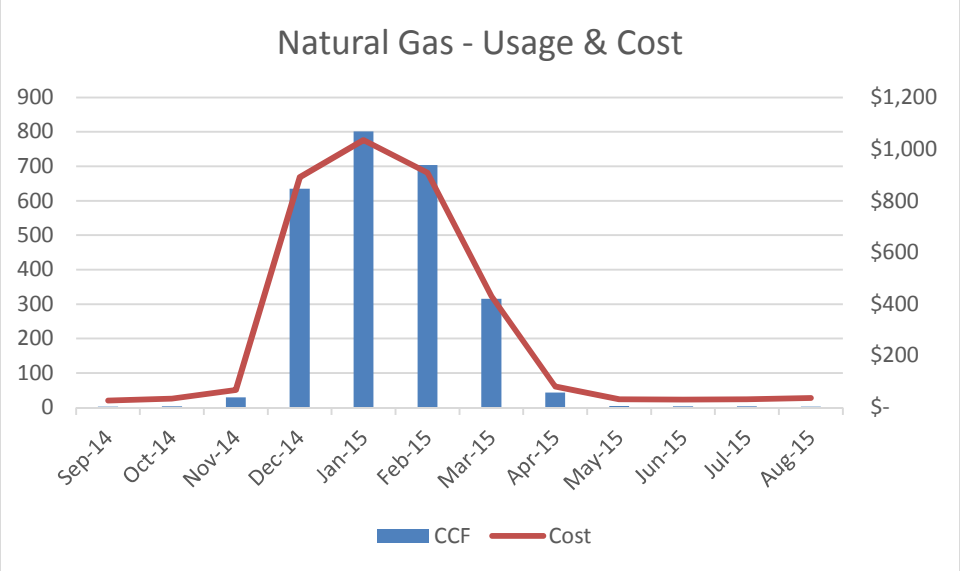
Natural Gas Usage

A detailed look at the consumption (CCF) and the dollar rate per (CCF) monthly in a typical year is shown below in table format

Month	Monthly CCF	Monthly Cost	$/CCF
Sep-14	2	$ 26	$ 13.09
Oct-14	3	$ 34	$ 11.39
Nov-14	29	$ 68	$ 2.35
Dec-14	635	$ 891	$ 1.40
Jan-15	801	$ 1,035	$ 1.29
Feb-15	704	$ 908	$ 1.29
Mar-15	315	$ 431	$ 1.37
Apr-15	43	$ 82	$ 1.90
May-15	4	$ 32	$ 8.04
Jun-15	3	$ 31	$ 10.28
Jul-15	3	$ 32	$ 10.59
Aug-15	2	$ 37	$ 18.34
Totals	**2,544**	**$3,606**	**$1.42**

Based off of one year of utility bill information September 2014 to August 2015

The figure below shows the monthly consumption over the same time period. Notice that the usage peaks in the winter months when heating is necessary.



Natural Gas Consumption versus cost from September 2014 to August 2015

Johnson Controls

Fire House

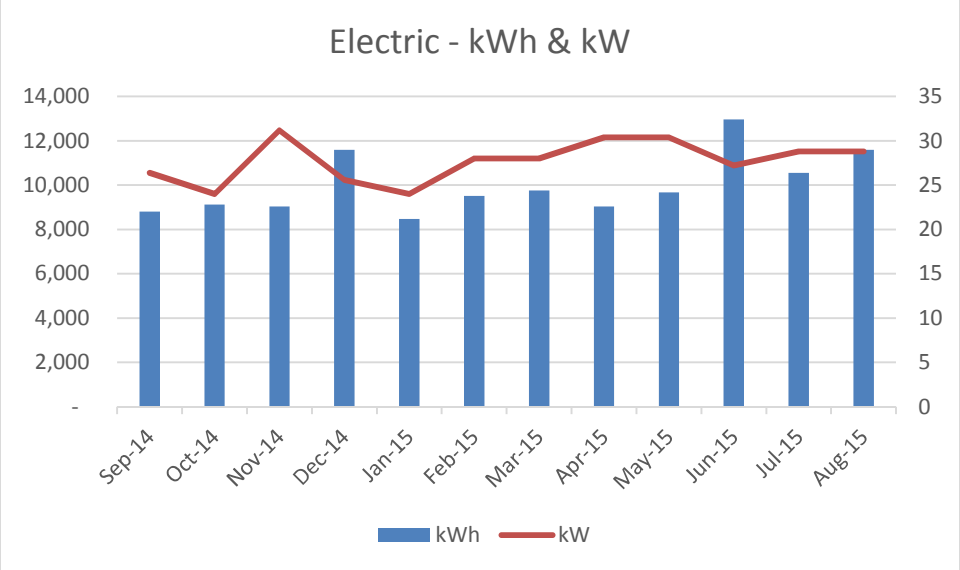
Electric Usage and Demand

A detailed look at the usage (kWh), demand (kW) and total electric cost per month in a typical year is shown below in table format.

Month	Monthly kWh	Monthly kW	Monthly $
Sep-14	8,800	26	$1,480
Oct-14	9,120	24	$1,504
Nov-14	9,040	31	$1,504
Dec-14	11,600	26	$1,914
Jan-15	8,480	24	$1,401
Feb-15	9,520	28	$1,576
Mar-15	9,760	28	$1,615
Apr-15	9,040	30	$1,499
May-15	9,680	30	$1,640
Jun-15	12,960	27	$2,100
Jul-15	10,560	29	$1,722
Aug-15	11,600	29	$1,890
Totals	**120,160**	**333**	**$19,845**

Based off of one year of utility bill information September 2014 to August 2015

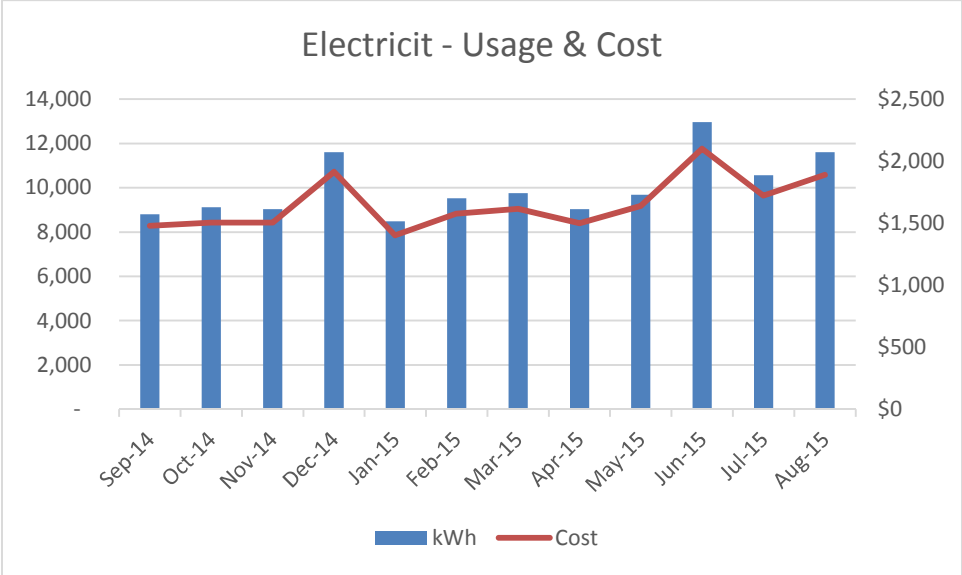
The figure below shows the usage (kW-secondary axis) and (kWh-primary axis) over the same one year period.



Energy Consumption from September 2014 to August 2015

Johnson Controls

The figure below shows the usage (kWh) and (Cost) over the same one year period.



Energy Consumption vs Cost from September 2014 to August 2015

Natural Gas Usage

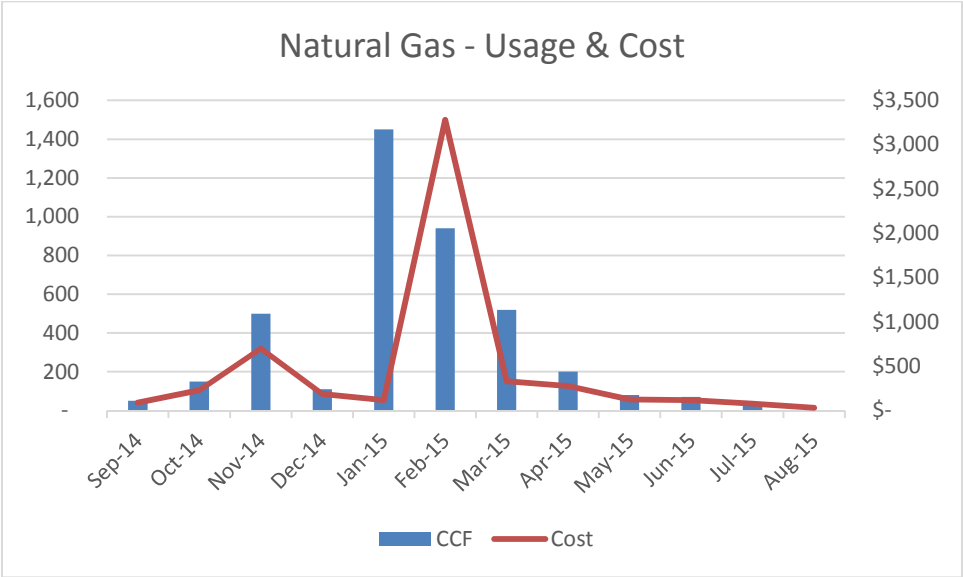
A detailed look at the consumption (CCF) and the dollar rate per (CCF) monthly in a typical year is shown below in table format

Month	Monthly CCF	Monthly Cost	$/CCF
Sep-14	50	$ 90	$ 1.80
Oct-14	150	$ 231	$ 1.54
Nov-14	500	$ 699	$ 1.40
Dec-14	110	$ 185	$ 1.68
Jan-15	1,450	$ 116	$ 0.08
Feb-15	940	$ 3,282	$ 3.49
Mar-15	520	$ 332	$ 0.64
Apr-15	200	$ 277	$ 1.38
May-15	80	$ 126	$ 1.58
Jun-15	70	$ 118	$ 1.69
Jul-15	40	$ 76	$ 1.90
Aug-15	-	$ 31	na
Totals	**4,110**	**$5,564**	**$1.35**

Based off of one year of utility bill information September 2014 to August 2015

Johnson Controls

The figure below shows the monthly consumption over the same time period. Notice that the usage peaks in the winter months when heating is necessary.



Natural Gas Consumption versus cost from September 2014 to August 2015

Public Works Building

Electric Usage and Demand

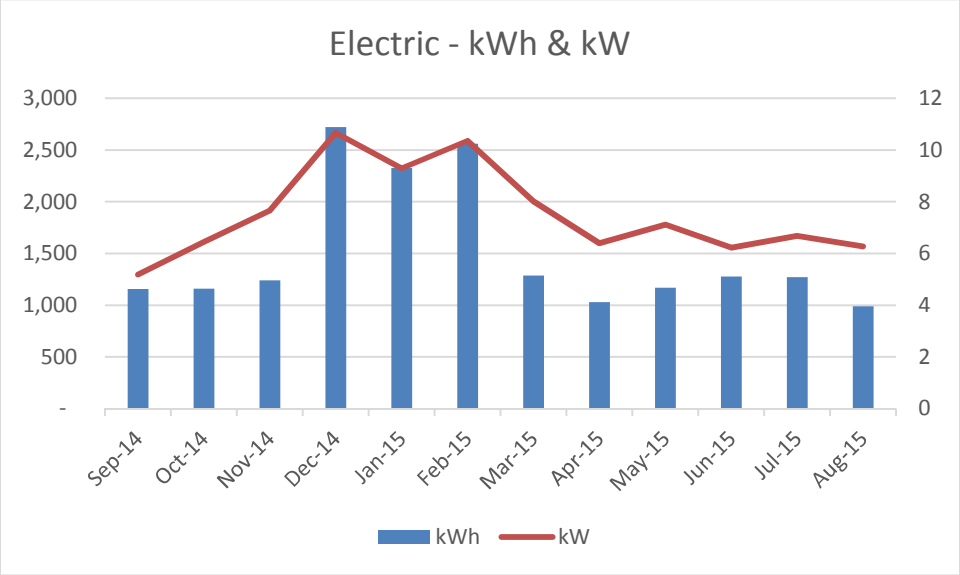
A detailed look at the usage (kWh), demand (kW) and total electric cost per month in a typical year is shown below in table format.

Month	Monthly kWh	Monthly kW	Monthly $
Sep-14	1,157	5	$213
Oct-14	1,160	6	$219
Nov-14	1,239	8	$238
Dec-14	2,722	11	$506
Jan-15	2,327	9	$429
Feb-15	2,563	10	$469
Mar-15	1,285	8	$247
Apr-15	1,030	6	$197
May-15	1,169	7	$231
Jun-15	1,277	6	$257
Jul-15	1,271	7	$257
Aug-15	989	6	$208
Totals	**18,189**	**90**	**$3,470**

Based off of one year of utility bill information September 2014 to August 2015

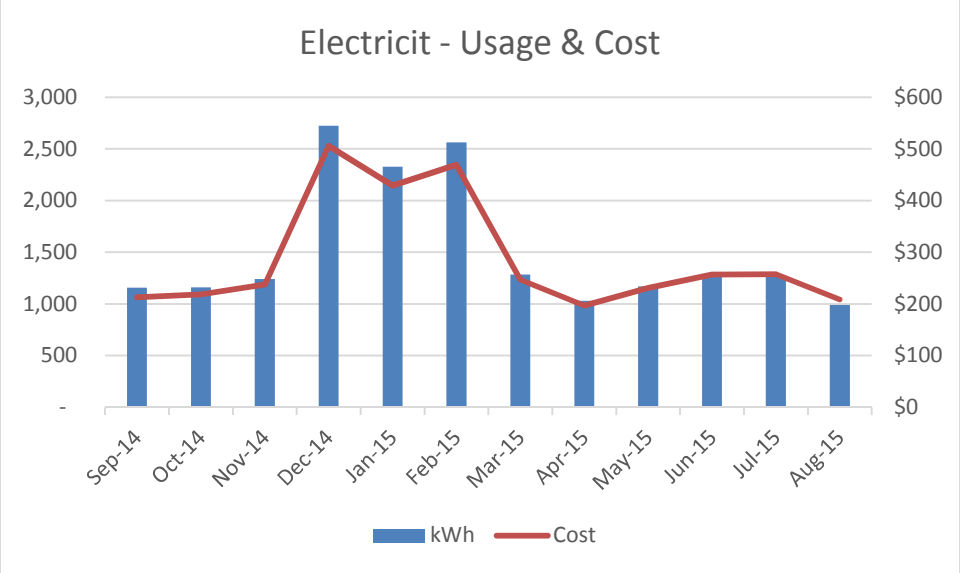
Johnson Controls

The figure below shows the usage (kW-secondary axis) and (kWh-primary axis) over the same one year period.



Energy Consumption from September 2014 to August 2015

The figure below shows the usage (kWh) and (Cost) over the same one year period.



Energy Consumption vs Cost from September 2014 to August 2015

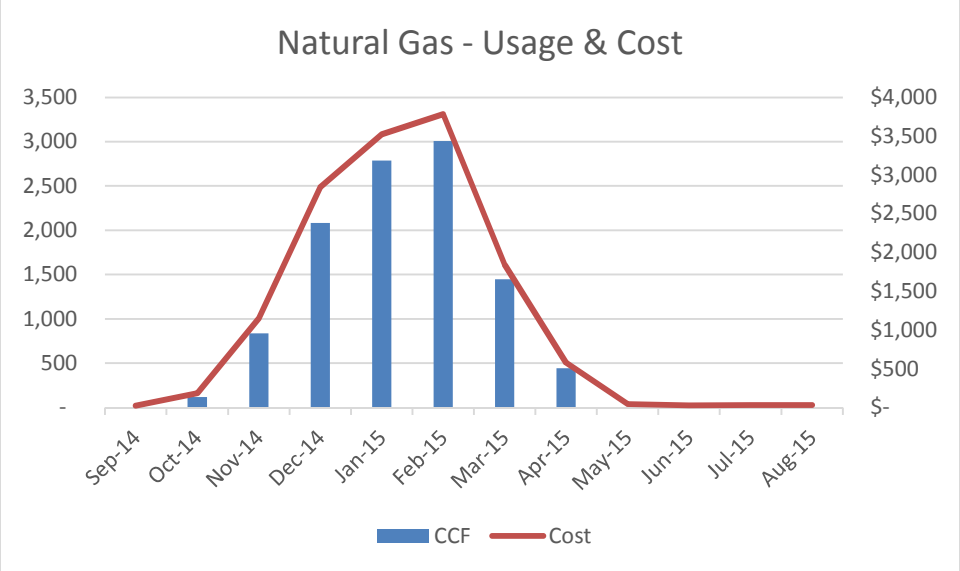
Natural Gas Usage

A detailed look at the consumption (CCF) and the dollar rate per (CCF) monthly in a typical year is shown below in table format

Month	Monthly CCF	Monthly Cost	$/CCF
Sep-14	-	$ 24	na
Oct-14	116	$ 186	$ 1.60
Nov-14	836	$ 1,150	$ 1.38
Dec-14	2,081	$ 2,841	$ 1.37
Jan-15	2,787	$ 3,523	$ 1.26
Feb-15	3,006	$ 3,784	$ 1.26
Mar-15	1,447	$ 1,844	$ 1.27
Apr-15	442	$ 577	$ 1.31
May-15	2	$ 44	$ 22.06
Jun-15	-	$ 29	na
Jul-15	2	$ 31	$ 15.29
Aug-15	-	$ 32	na
Totals	**10,719**	**$14,065**	**$1.31**

Based off of one year of utility bill information September 2014 to August 2015

The figure below shows the monthly consumption over the same time period. Notice that the usage peaks in the winter months when heating is necessary.



Natural Gas Consumption versus cost from September 2014 to August 2015

Johnson Controls

Library

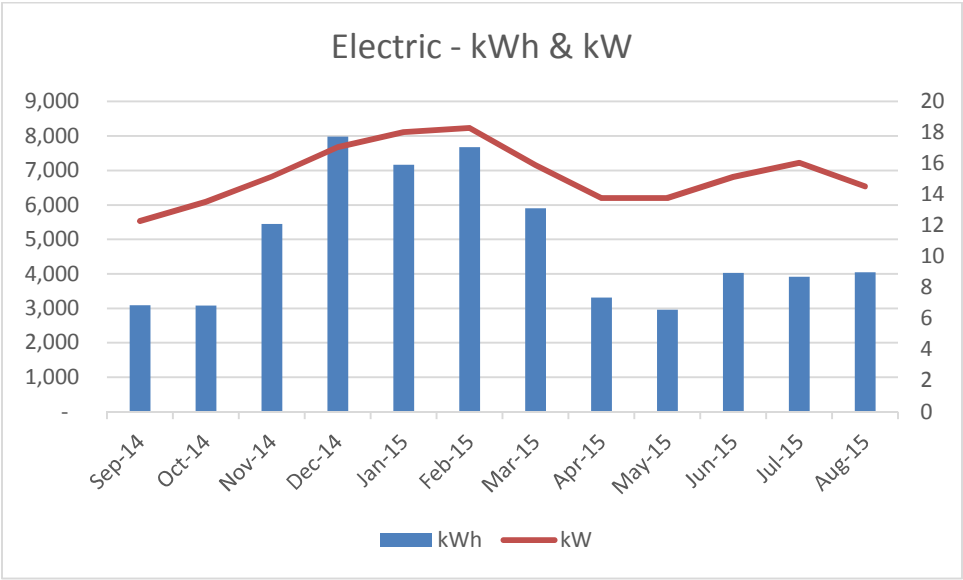
Electric Usage and Demand

A detailed look at the usage (kWh), demand (kW) and total electric cost per month in a typical year is shown below in table format.

Month	Monthly kWh	Monthly kW	Monthly $
Sep-14	3,084	12	$562
Oct-14	3,081	14	$568
Nov-14	5,446	15	$975
Dec-14	7,985	17	$1,419
Jan-15	7,165	18	$1,269
Feb-15	7,677	18	$1,362
Mar-15	5,902	16	$1,057
Apr-15	3,315	14	$607
May-15	2,955	14	$570
Jun-15	4,024	15	$799
Jul-15	3,916	16	$780
Aug-15	4,041	15	$799
Totals	**58,591**	**184**	**$10,769**

Based off of one year of utility bill information September 2014 to August 2015

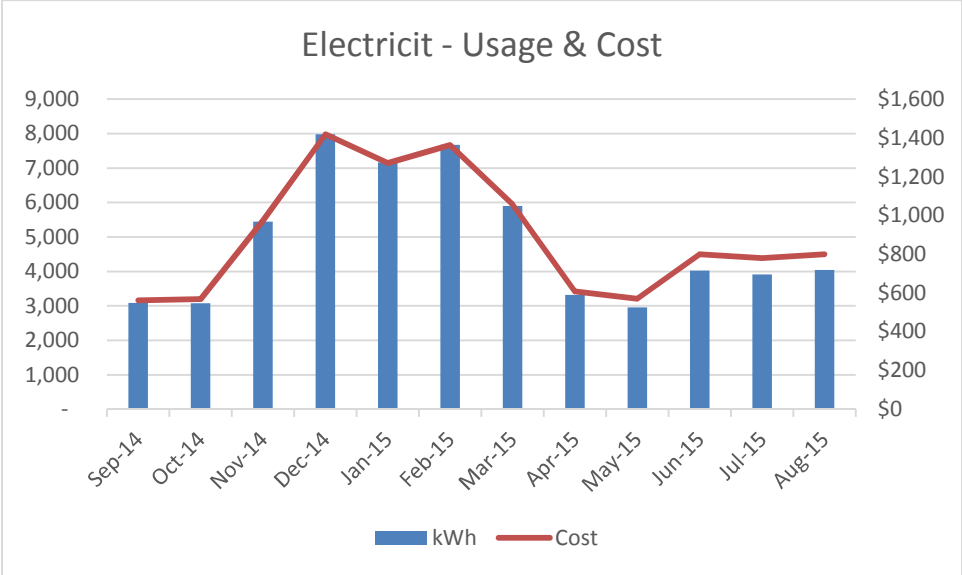
The figure below shows the usage (kW-secondary axis) and (kWh-primary axis) over the same one year period.



Energy Consumption from September 2014 to August 2015

Johnson Controls

The figure below shows the usage (kWh) and (Cost) over the same one year period.



Energy Consumption vs Cost from September 2014 to August 2015

Natural Gas Usage

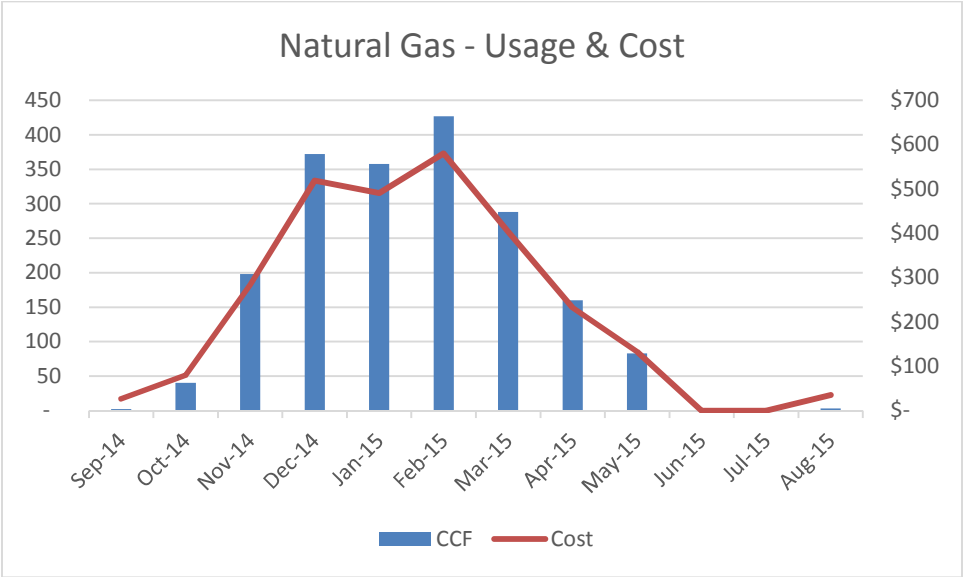
A detailed look at the consumption (CCF) and the dollar rate per (CCF) monthly in a typical year is shown below in table format

Month	Monthly CCF	Monthly Cost	$/CCF
Sep-14	2	$ 27	$ 13.32
Oct-14	40	$ 80	$ 1.99
Nov-14	198	$ 284	$ 1.44
Dec-14	372	$ 519	$ 1.39
Jan-15	358	$ 491	$ 1.37
Feb-15	427	$ 581	$ 1.36
Mar-15	288	$ 404	$ 1.40
Apr-15	160	$ 232	$ 1.45
May-15	83	$ 132	$ 1.59
Jun-15	-	$ -	na
Jul-15	-	$ -	na
Aug-15	3	$ 35	$ 11.61
Totals	**1,931**	**$2,784**	**$1.44**

Based off of one year of utility bill information September 2014 to August 2015

Johnson Controls

The figure below shows the monthly consumption over the same time period. Notice that the usage peaks in the winter months when heating is necessary.



Natural Gas Consumption versus cost from September 2014 to August 2015

Nature Center 1

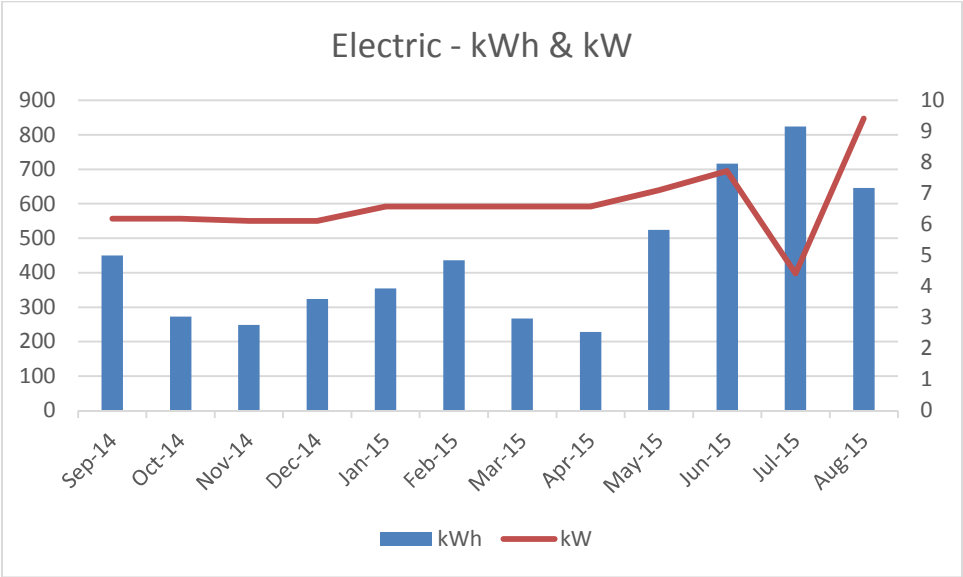
Electric Usage and Demand

A detailed look at the usage (kWh), demand (kW) and total electric cost per month in a typical year is shown below in table format.

Month	Monthly kWh	Monthly kW	Monthly $
Sep-14	450	6	$95
Oct-14	273	6	$62
Nov-14	248	6	$58
Dec-14	324	6	$74
Jan-15	354	7	$77
Feb-15	436	7	$92
Mar-15	267	7	$62
Apr-15	228	7	$54
May-15	524	7	$110
Jun-15	717	8	$153
Jul-15	824	4	$165
Aug-15	646	9	$141
Totals	**5,291**	**80**	**$1,143**

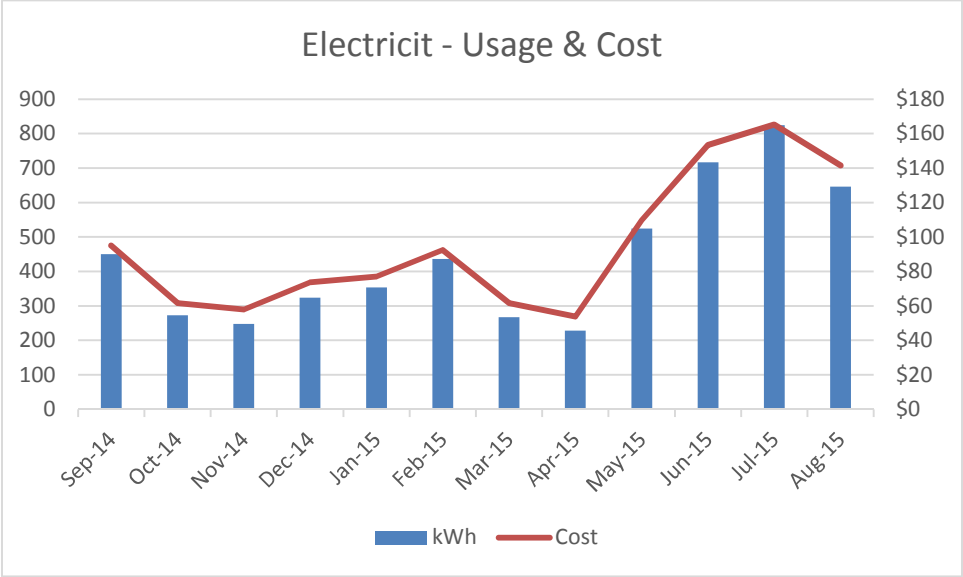
Based off of one year of utility bill information September 2014 to August 2015

The figure below shows the usage (kW-secondary axis) and (kWh-primary axis) over the same one year period.



Energy Consumption from September 2014 to August 2015

The figure below shows the usage (kWh) and (Cost) over the same one year period.



Energy Consumption vs Cost from September 2014 to August 2015

Johnson Controls

Nature Center 2

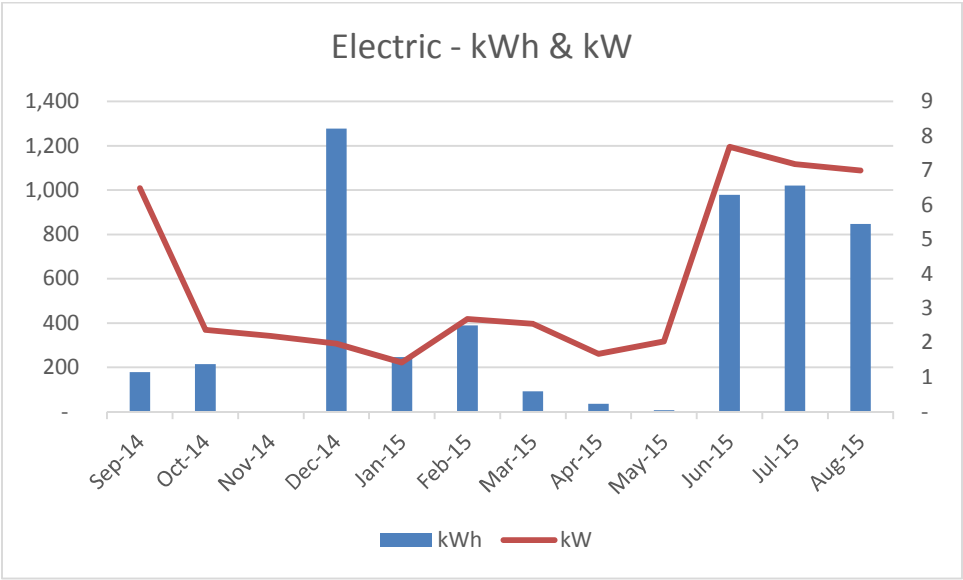
Electric Usage and Demand

A detailed look at the usage (kWh), demand (kW) and total electric cost per month in a typical year is shown below in table format.

Month	Monthly kWh	Monthly kW	Monthly $
Sep-14	178	6	$47
Oct-14	214	2	$46
Nov-14	-	2	$9
Dec-14	1,278	2	$85
Jan-15	247	1	$51
Feb-15	389	3	$78
Mar-15	92	3	$25
Apr-15	35	2	$13
May-15	6	2	$9
Jun-15	979	8	$202
Jul-15	1,021	7	$206
Aug-15	847	7	$174
Totals	**5,286**	**45**	**$946**

Based off of one year of utility bill information September 2014 to August 2015

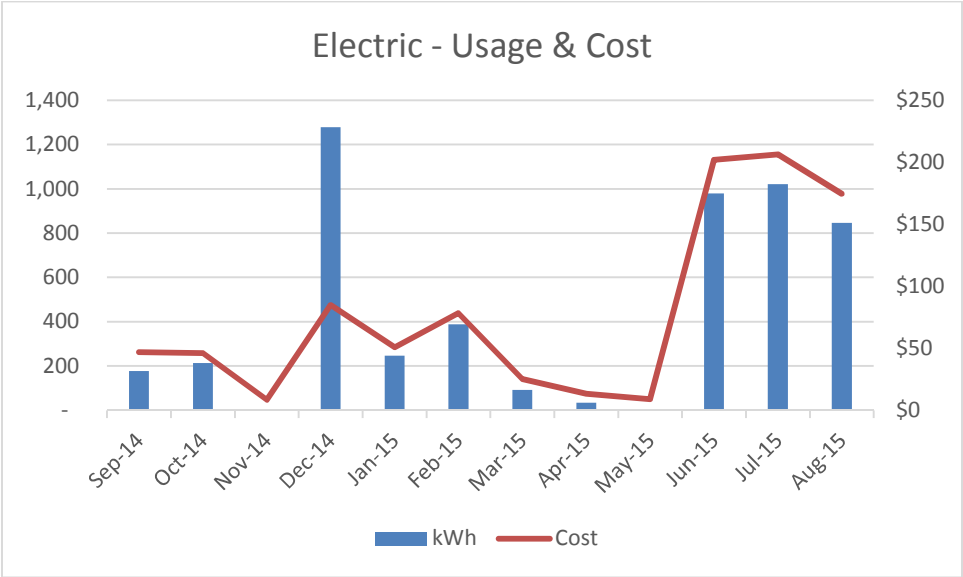
The figure below shows the usage (kW-secondary axis) and (kWh-primary axis) over the same one year period.



Energy Consumption from September 2014 to August 2015

The figure below shows the usage (kWh) and (Cost) over the same one year period.

Johnson Controls



Energy Consumption vs Cost from September 2014 to August 2015

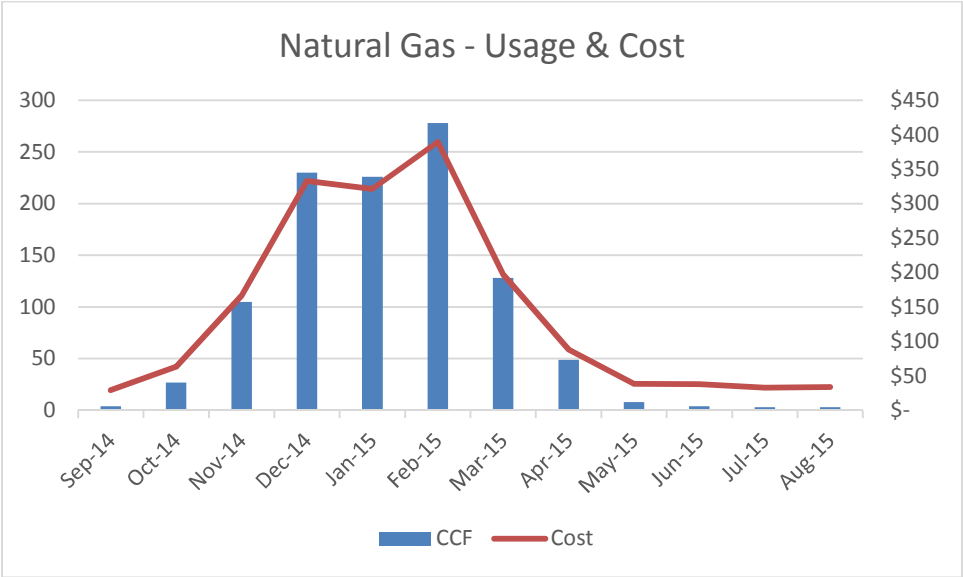
Natural Gas Usage

A detailed look at the consumption (CCF) and the dollar rate per (CCF) monthly in a typical year is shown below in table format

Month	Monthly CCF	Monthly Cost	$/CCF
Sep-14	4	$ 29	$ 7.30
Oct-14	27	$ 63	$ 2.33
Nov-14	105	$ 167	$ 1.59
Dec-14	230	$ 333	$ 1.45
Jan-15	226	$ 321	$ 1.42
Feb-15	278	$ 390	$ 1.40
Mar-15	128	$ 197	$ 1.54
Apr-15	49	$ 88	$ 1.80
May-15	8	$ 38	$ 4.78
Jun-15	4	$ 38	$ 9.51
Jul-15	3	$ 33	$ 10.96
Aug-15	3	$ 34	$ 11.29
Totals	**1,065**	**$1,731**	**$1.63**

Based off of one year of utility bill information September 2014 to August 2015

The figure below shows the monthly consumption over the same time period. Notice that the usage peaks in the winter months when heating is necessary.



Natural Gas Consumption versus cost from September 2014 to August 2015

Elementary School

Electric Usage and Demand

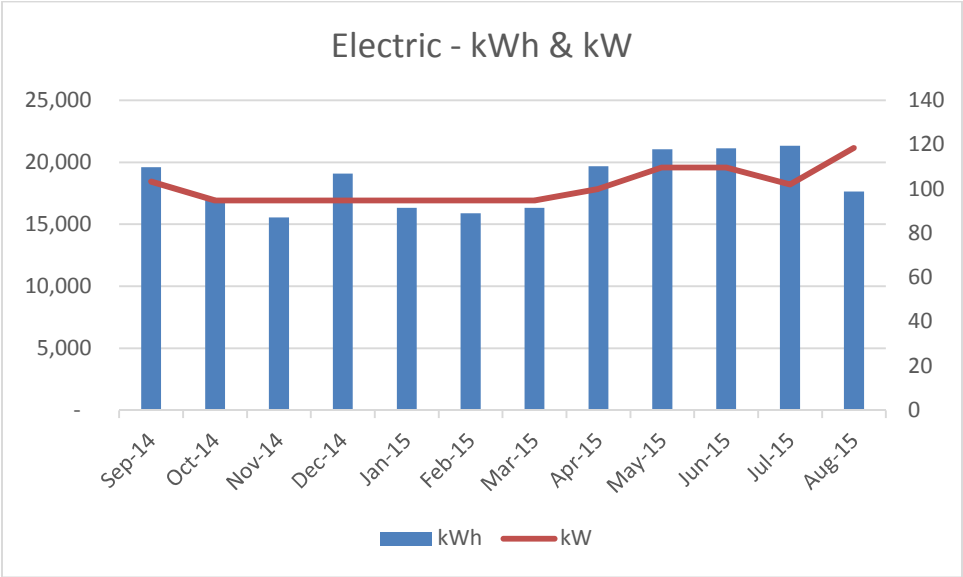
A detailed look at the usage (kWh), demand (kW) and total electric cost per month in a typical year is shown below in table format.

Month	Monthly kWh	Monthly kW	Monthly $
Sep-14	19,600	103	$ 3,026
Oct-14	17,040	95	$ 2,704
Nov-14	15,560	95	$ 2,599
Dec-14	19,080	95	$ 3,186
Jan-15	16,320	95	$ 2,568
Feb-15	15,880	95	$ 2,605
Mar-15	16,320	95	$ 2,711
Apr-15	19,680	100	$ 3,034
May-15	21,040	110	$ 3,383
Jun-15	21,120	110	$ 3,484
Jul-15	21,320	102	$ 3,447
Aug-15	17,640	118	$ 3,075
Totals	**220,600**	**1,211**	**$35,823**

Based off of one year of utility bill information September 2014 to August 2015

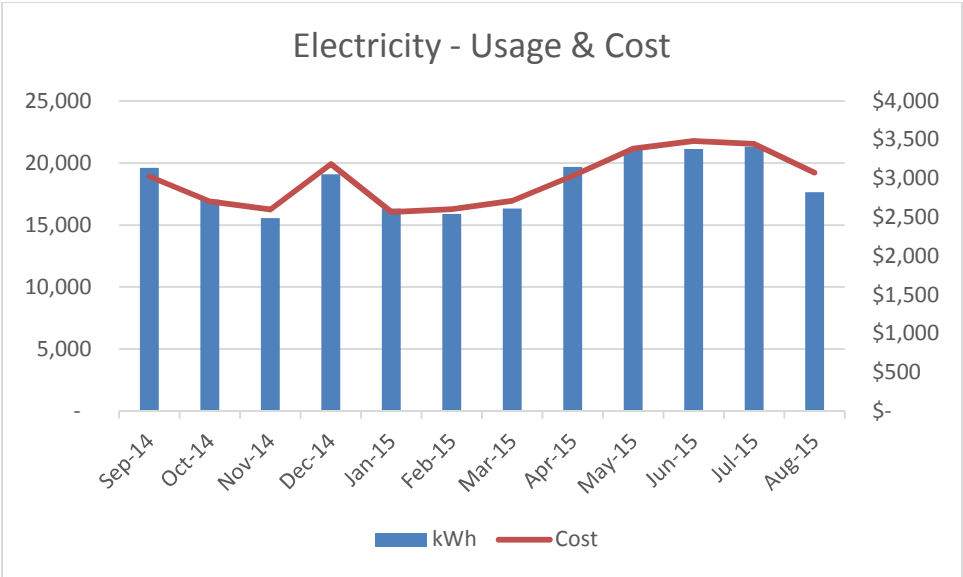
The figure below shows the usage (kW-secondary axis) and (kWh-primary axis) over the same one year period.

Johnson Controls



Energy Consumption from September 2014 to August 2015

The figure below shows the usage (kWh) and (Cost) over the same one year period.



Energy Consumption vs Cost from September 2014 to August 2015

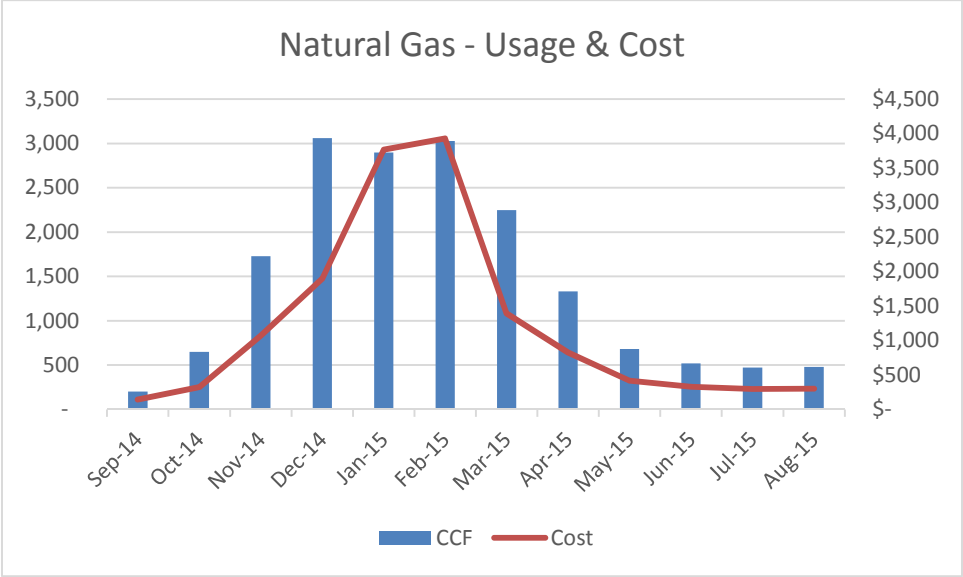
Natural Gas Usage

A detailed look at the consumption (CCF) and the dollar rate per (CCF) monthly in a typical year is shown below in table format

Month	Monthly CCF	Monthly Cost	$/CCF
Sep-14	200	$ 143	$ 0.71
Oct-14	650	$ 322	$ 0.50
Nov-14	1,730	$ 1,071	$ 0.62
Dec-14	3,060	$ 1,896	$ 0.62
Jan-15	2,900	$ 3,768	$ 1.30
Feb-15	3,030	$ 3,933	$ 1.30
Mar-15	2,250	$ 1,390	$ 0.62
Apr-15	1,330	$ 824	$ 0.62
May-15	680	$ 417	$ 0.61
Jun-15	520	$ 326	$ 0.63
Jul-15	470	$ 293	$ 0.62
Aug-15	480	$ 298	$ 0.62
Totals	**17,300**	**$14,682**	**$0.85**

Based off of one year of utility bill information September 2014 to August 2015

The figure below shows the monthly consumption over the same time period. Notice that the usage peaks in the winter months when heating is necessary.



Natural Gas Consumption versus cost from September 2014 to August 2015

Johnson Controls

Utility Escalation Rates

For purposes of calculating the extended value of the energy savings of this project, the following utility escalation rates have been used.

Energy					
Electric Consumption		Annual Electric Demand		Natural Gas	
Escalation Rate	Start Year of Escalation	Escalation Rate	Start Year of Escalation	Escalation Rate	Start Year of Escalation
2.2%	Year 1	2.2%	Year 1	2.4%	Year 1

Section 3. Financial Impact

Energy Savings and Cost Summary

The table below provides a summary of the costs and savings associated with the measures recommended in the Energy Savings Plan. The savings have been calculated based on the savings methodology detailed throughout this report and included in the appendix of this report. Costs for each measure have been estimated based on project implementation experience and industry standards. Year 1 won't start until the installation of Energy Conservation Measures is completed.

ID #	Energy Conservation Measure	Total ECM Cost	Year 1 Utility Savings	Simple Payback	Installation Plan	Recommend for Installation
1	Building Management System - City Hall, Library & Welcome/ Transportation Center	$88,518	$6,657	13.60	Public Bidding	X
2	Existing BAS Modification - Elementary School	$43,276	$3,158	14.01	Public Bidding	X
3	Computer Management System - Elementary School	$1,600	$7,900	0.21	JCI Implement	X
4	Demand Response Energy Efficiency Credit - City Wide	$1	$-	0.00	JCI Implement	X
5	Emergency Generator Installation - Elementary School	$308,174	$-	0.00	Public Bidding	X
6	Pipe Insulation and Blankets - City Hall	$8,049	$644	12.79	JCI Implement	X
7	Pipe Insulation and Blankets - Fire House	$7,474	$654	11.70	JCI Implement	X
8	Building Envelope Improvements - City Hall	$4,074	$247	16.86	Public Bidding	X
9	Building Envelope Improvements - Fire House	$14,743	$ 982	15.37	Public Bidding	X
10	Building Envelope Improvements - Franklin Street School	$3,749	$320	12.00	Public Bidding	X
11	Building Envelope Improvements - Library	$2,673	$184	14.89	Public Bidding	X
12	Building Envelope Improvements - Nature Center 1	$2,138	$146	14.97	Public Bidding	X
13	Building Envelope Improvements - Water Works Building	$5,824	$332	17.99	Public Bidding	X
14	Building Envelope Improvements - Welcome/ Transportation Center	$5,314	$279	19.47	Public Bidding	X
15	LED Lighting Replacement/Retrofits - City Hall	$59,041	$4,564	13.22	Public Bidding	X
16	LED Lighting Replacement/Retrofits - Elementary School	$88,725	$3,420	26.52	Public Bidding	X

ID #	Energy Conservation Measure	Total ECM Cost	Year 1 Utility Savings	Simple Payback	Installation Plan	Recommend for Installation
17	LED Lighting Replacement/Retrofits - Fire House	$16,838	$3,404	5.05	Public Bidding	X
18	LED Lighting Replacement/Retrofits - Library	$10,113	$3,322	3.11	Public Bidding	X
19	LED Lighting Replacement/Retrofits - Nature Center 1	$5,382	$744	7.39	Public Bidding	X
20	LED Lighting Replacement/Retrofits - Nature Center 2	$6,977	$376	18.97	Public Bidding	X
21	LED Lighting Replacement/Retrofits - Water Works Building	$8,725	$508	17.56	Public Bidding	X
22	LED Lighting Replacement/Retrofits - Welcome/ Transportation Center	$9,902	$1,802	5.62	Public Bidding	X
23	Plug Load Controls - City Hall	$3,917	$ 937	4.27	JCI Implement	X
24	Plug Load Controls - Elementary School	$8,374	$832	10.29	JCI Implement	X
25	Plug Load Controls - Library	$675	$44	15.55	JCI Implement	X
26	Premium Efficient Motors - Elementary School	$4,549	$244	19.04	JCI Implement	X
27	Programmable Thermostats Installation - Franklin Street School, Nature Center 2 & Public Works Complex	$11,671	$ 6,352	1.88	Public Bidding	X
28	Street Lighting Retrofits - City Wide	$28,936	$3,486	8.48	Public Bidding	X
29	Walk-In Cooler Controls - Elementary School	$3,082	$2,358	1.34	JCI Implement	X
30	Vehicle Charging Station - ChargePoint - Elementary School*	$24,195	$-	-	JCI Implement	X

*No energy savings are associated with the ECM 30 Vehicle Charging Station in Elementary School.

Operational Savings Estimates

The lighting retrofits recommended for this project will reduce the amount of lamps that need to be replaced each year due to the longer lasting lamps and new technology fixtures. The LED lighting recommended for the interior fixtures will last much longer than the current fluorescent T8 lighting and will generate material cost savings.

A brief description of the operational savings estimated for this project is included below. The operational savings will not be escalated.

Operational Savings for Financial Model		
ECM Description	**Annual Savings**	
LED Lighting Replacement/Retrofits - City Hall	$	2,701
LED Lighting Replacement/Retrofits - Elementary School	$	4,059
LED Lighting Replacement/Retrofits - Fire House	$	770
LED Lighting Replacement/Retrofits - Library	$	463
LED Lighting Replacement/Retrofits - Nature Center 1	$	246
LED Lighting Replacement/Retrofits - Nature Center 2	$	319
LED Lighting Replacement/Retrofits - Water Works Building	$	399
LED Lighting Replacement/Retrofits - Welcome/ Transportation Center	$	453
Totals	**$**9,412	

Potential Revenue Generation Estimates

Rebates

As part of the ESP for City of Cape May the rebates and incentives have been investigated which include:

- NJ Smart Start Equipment Incentives

The estimated incentive amount for each program is listed below. Upon final selection of project scope and award of subcontractor bids, the incentive applications will be filed.

NJ Smart Start Equipment Incentives

The NJ Smart Start Equipment Incentives provide prescriptive rebates for defined retrofits. Incentives are applied on a unit by unit basis for making energy efficiency upgrades. The table below summarizes the equipment incentives which will be applied for at City of Cape May:

Energy Conservation Measure	Estimated Incentive	
LED Lighting Replacement/Retrofits - City Hall	$	10,735
LED Lighting Replacement/Retrofits - Elementary School	$	16,300
LED Lighting Replacement/Retrofits - Fire House	$	2,775
LED Lighting Replacement/Retrofits - Library	$	1,270
LED Lighting Replacement/Retrofits - Nature Center 1	$	930
LED Lighting Replacement/Retrofits - Nature Center 2	$	1,325
LED Lighting Replacement/Retrofits - Welcome/ Transportation Center	$	1,235
Totals	**$34,570**	

Demand Response Energy Efficiency Credit

The LED Lighting Upgrades recommended for the City will be eligible for the Energy Efficiency Credit available through PJM. The Energy Efficiency Credit pays consumers based on the permanent load reduction through the installation of energy efficiency measures. The following table summarizes the

available Demand Response Incentives available due to the lighting upgrades at all buildings at the City of Cape May.

Demand Response Energy - Efficiency Credit		
PJM Payment Year	**Approved Load (kW)**	**Annual Customer Capacity Benefit**
2016/2017	39.5	$556
2017/2018	39.5	$688
2018/2019	39.5	$1,585
2019/2020	39.5	$643
Totals		**$3,472**

Business Case for Recommended Project

City of Cape May ESIP

Financing Summary

Construction Sell Price	$ 786,709
Capital Contribution	
Rebates	-
Grants	100,000
Constr Sell Price Based Fee	23,601
Customer-Controlled Contingency	
Miscellaneous Fees	75,000
Loan Structure	Lease
Contract Term - Years	15
Loan Payment Frequency	Annual
Interest Rate	3.25%
Total Financed Amount	$ 785,310

Financial Analysis

Scenario Manager	
Select Scenario	15 Year Project

Note:
Cash flows presented in this report are to be used for modeling purposes only. Final interest rates and actual cash flows will be determined at the time of project closing when final terms and conditions are executed.

Business Case Summary

		Measured Savings	Non-measured Savings			Total Savings	Loan Payment	Performance Management	Balance
		Utility Savings	Demand Response	Operational Savings	Rebate				
Construction	Year 0	$ 4,393	$ -	$ -	$ -	$ 4,393	$ -	$ -	$ 4,393
Performance Years	Year 1	$ 53,897	$ 556	$ 9,412	$ 34,570	$ 98,434	$ 92,614	$ 5,031	$ 790
	Year 2	$ 55,107	$ 688	$ 9,412	$ -	$ 65,206	$ 59,115	$ 5,283	$ 809
	Year 3	$ 56,344	$ 1,585	$ 9,412	$ -	$ 67,340	$ 60,954	$ 5,547	$ 840
	Year 4	$ 57,609	$ 643	$ 9,412	$ -	$ 67,664	$ 66,819	$ -	$ 845
	Year 5	$ 58,902	$ -	$ 9,412	$ -	$ 68,314	$ 67,460	$ -	$ 854
	Year 6	$ 60,225	$ -	$ -	$ -	$ 60,225	$ 59,352	$ -	$ 873
	Year 7	$ 61,577	$ -	$ -	$ -	$ 61,577	$ 60,684	$ -	$ 893
	Year 8	$ 62,960	$ -	$ -	$ -	$ 62,960	$ 62,047	$ -	$ 913
	Year 9	$ 64,374	$ -	$ -	$ -	$ 64,374	$ 63,440	$ -	$ 933
	Year 10	$ 65,819	$ -	$ -	$ -	$ 65,819	$ 64,865	$ -	$ 954
	Year 11	$ 67,297	$ -	$ -	$ -	$ 67,297	$ 66,322	$ -	$ 976
	Year 12	$ 68,809	$ -	$ -	$ -	$ 68,809	$ 67,811	$ -	$ 998
	Year 13	$ 70,354	$ -	$ -	$ -	$ 70,354	$ 69,334	$ -	$ 1,020
	Year 14	$ 71,934	$ -	$ -	$ -	$ 71,934	$ 70,891	$ -	$ 1,043
	Year 15	$ 73,550	$ -	$ -	$ -	$ 73,550	$ 72,296	$ -	$ 1,254
Total	Σ	$ 953,150	$ 3,472	$ 47,058	$ 34,570	$ 1,038,250	$ 1,004,003	$ 15,860	$ 18,387

Incentive Breakout for Recommended Project

Year	NJ Smart Start	Demand Response Energy Efficiency Credit	Total
1	$34,570	$556	**$35,126**
2	$0	$688	**$688**
3	$0	$1,585	**$1,585**
4	$0	$643	**$643**
TOTAL	**$34,570**	**$3,472**	**$38,042**

Greenhouse Gas Reductions

City of Cape May ESIP

The Project's reduced emissions would be equivalent to:

CO2 sequestered by in urban scenario.	101,931	**tree seedlings grown for 10 years**
CO2 sequestered by	848	**acres of pine or fir forest.**
CO2 emissions from	760	**passenger vehicles.**
CO2 emissions from	9,245	**barrels of oil consumed.**
CO2 emissions from the energy of one year.	338	**homes for**
CO2 emissions from burning	21	**coal railcars.**

Source:
JCI Online GHG Calculator
All carbon equivalencies extracted directly from the EPA website.
"Greenhouse Gas Equivalencies Calculator." Clean Energy. U.S. Environmental Protection Agency. <www.epa.gov/cleanenergy/energy-resources/calculator.html> (May 2013).

AVOIDED EMISSIONS	Total Electric Savings	Total Natural Gas Savings	Total Annual Avoided Emissions
Annual Unit Savings	**298,922 kWh**	**8,574 CCF**	
NO_X	284 lbs.	79 lbs.	363 lbs.
SO_2	661 lbs.	0 lbs.	661 lbs.
CO_2	332,338 lbs.	100,316 lbs.	432,654 lbs.

Section 4. Potential Energy Conservation Measures

ECM #1, #2 & #27 - Building Management System – City Hall, Library & Welcome/Transportation Center, Existing BAS Modification – Elementary School, & Programmable Thermostats Installation – Franklin St School, Nature Center 2 & Public Works Complex

ECM Summary

The building management system allows the buildings to schedule their HVAC systems to operate only when absolutely necessary (based on occupancy, outside conditions, etc.). Additionally, a good building management system allows building personnel to monitor each system's performance, in order to identify potential improvements that can be implemented over time.

Existing System City Hall and Welcome/Transportation

Currently there is no building management system in these two buildings.

Existing System at Library

The building is managed by the Cape May County through Johnson Controls' Metasys building management system. There is no local access to the system.

Existing System at Elementary School

The building is managed by Tridium JACE and Honeywell LON Control system. The building personnel is able to access the system remotely and capable of scheduling and programming the temperature setpoints in the system.

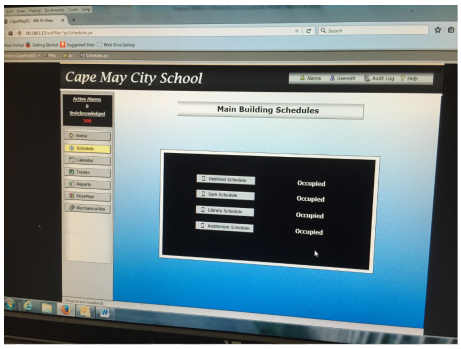


Figure 20 - Screenshot of Building Automation System in Elementary School

Facilities Recommended for this Measure

- City Hall
- Library
- Welcome/Transportation Center
- Elementary School
- Franklin St School
- Natural Center 2
- Public Works Complex

Scope of Work

General

- Provide and install Metasys BACnet controls on equipment and system listed below. A network supervisory panel shall be connected to customer's network for remote PC access, monitoring and scheduling of the listed HVAC equipment.
- Metasys Server PC – ADS
  - Provide and install a dedicated Metasys ADS Server PC, external monitor 19" and connect to customer's network and integrated to each building controls. System software to include Graphics Plus package. Graphical displays will be created and installed for all primary HVAC systems.
- Commissioning Support
- Site logistics and Part Time Project Management
- Customer training: 2 days – on site training

City Hall

AC Units

Install new Metasys FEC Controller and the following points:

Control Points:

- Unit Command
- Unit Status
- Cooling/Heating Outputs
- Changeover (Heat Pumps only)
- Discharge Air Temperature
- Zone Temperature Sensor

Control Strategies

- Zone temperature control
- Scheduling and monitoring

Steam Boiler Room

Install new Metasys NCE Network Supervisory Control Panel and the following points.

Connect to customer's LAN/WAN switch for BAS remote monitoring.

Control Points:

- Boiler Enable/Disable
- Boiler Status
- Boiler Alarm
- Steam Pressure Sensor
- Outside Air Temp
- Domestic Hot Water Temp
- Domestic Hot Water Pump Status

Control Strategies

- Scheduling and monitoring
- Boiler system enable/disable based on outside air temperature

Occupied Mon - Fri 8 am – 4:30 pm.

a. Heating Occupied Set Point = 70°F
b. Heating Un-Occupied Set Point = 60°F
c. Cooling Occupied Set Point = 72°F
d. Cooling Un-Occupied Set Point = 80°F

Welcome/Transportation Center

AC Units

Install new Metasys FEC Controller and the following points:

Control Points:

- Unit Command
- Unit Status
- Cooling/Heating Outputs
- Changeover (Heat Pumps only)
- Discharge Air Temperature
- Zone Temperature Sensor

Control Strategies

- Zone temperature control
- Scheduling and monitoring

Utility Closet

Install new Metasys NCE network supervisory panel and connect to customer's LAN/WAN network.

Occupied 1/1 to 4/30 & 10/16 – 12/31, Mon - Sun 9 am – 4 pm.

5/1 – 10/15, Mon – Sun 8 am – 5 pm

a. Heating Occupied Set Point = 68°F
b. Heating Un-Occupied Set Point = 60°F
c. Cooling Occupied Set Point = 72°F
d. Cooling Un-Occupied Set Point = 80°F

Library

AC Units and Hot Water Boiler System

Integrate the existing Metasys controls (currently supervised by the county government) into the New Metasys ADS Server PC provided above. No savings claimed.

Elementary School

The following two (2) ECMs shall be added to the existing Building Automation System.

1. Classroom Unit Ventilators – four (4) Unit Ventilators serving two (2) classrooms 31 & 37

Install new Direct Digital Controls and the following points (replacing the existing pneumatic controls).

Control Points:

- Unit Command
- Unit Status
- Hot Water Control Valve (Modulating Electric)
- Damper Actuator (Modulating Electric)
- Discharge Air Temperature
- Zone Temperature Sensor

Control Strategies

- Zone temperature control
- Scheduling and monitoring

Classrooms and Offices Occupancy Schedules 1/1 to 6/30 & 9/1 – 12/31, Mon – Fri, 8 am – 3:30 pm.

7/1 – 8/31, Off

a. Heating Occupied Set Point = 68°F
b. Heating Un-Occupied Set Point = 60°F
c. Cooling Occupied Set Point = 75°F
d. Cooling Un-Occupied Set Point = 85°F

2. Boiler BAS Integration

Provide and install new Interface board (if required) to integrate the Boiler system control panel to the existing BAS system. Map available points (up to 50 boiler data points) to existing Building Automation System and provide new boiler system graphic.

Franklin St School

Four (4) Standalone Programmable Thermostats will be provided and installed to control two (2) Roof Top Units and four (4) Unit Heaters.

Occupied 1/1 to 12/31, Mon - Sat 8 am – 10:30 am, Sun off

a. Heating Occupied Set Point = 72°F
b. Heating Un-Occupied Set Point = 60°F
c. Cooling Occupied Set Point = 72°F
d. Cooling Un-Occupied Set Point = 80°F

Nature Center 2

Two (2) Standalone Programmable Thermostats will be provided and installed to control two (2) AC Units.

Occupied 1/1 to 4/15 & 9/16 – 12/31, Wed - Sun 9 am – 4 pm, Mon - Tue off

4/16 – 9/15, Mon – Sun 8 am – 4 pm

a. Heating Occupied Set Point = 70°F
b. Heating Un-Occupied Set Point = 60°F
c. Cooling Occupied Set Point = 74°F
d. Cooling Un-Occupied Set Point = 80°F

Public Works Complex

Four (4) Standalone Programmable Thermostats will be provided and installed to control four (4) split AC Units.

Occupied 1/1 to 12/31 Mon – Fri, 6 am – 3:30 pm, Sat – Sun, off

a. Heating Occupied Set Point = 70°F
b. Heating Un-Occupied Set Point = 60°F
c. Cooling Occupied Set Point = 72°F
d. Cooling Un-Occupied Set Point = 80°F

General - Clarifications & Exclusions

Clarifications:

- One (1) Year Warranty on parts and labor.
- State prevailing wage scale for labor.
- JCI wiring standards
- Sales Tax included
- Clean up of trade waste
- Graphics shall be included for each mechanical system. Main system graphics shall include navigation links to individual system graphic.
- All work based on normal workday (7:30 to 4:30 pm), any premium time is excluded.
- New wiring shall be plenum rated in accessible spaces, conduit (EMT) in mechanical spaces, and rigid conduit in outdoor areas.
- New control valves, thermal wells and pressure taps shall be installed by mechanical contractor control wiring to be installed by JCI (electrical) contractor.
- The final LAB connection to the physical Ethernet switch, firewall and IP port addressing shall be the owner's responsibility.
- Any existing safety devices to be reused and assumed to be functioning properly.
- Life Safety Fire Alarm System interconnection or interface wiring is excluded.
- Boiler Control Panel shall remain.

Exclusions:

- All HVAC retrofit, recommissioning and installation of new dampers is excluded.
- Air and Water system balancing is excluded.
- Cutting, patching, sealing and painting is excluded.
- Cost to correct any deficiencies associated with any existing equipment is excluded.
- Any hazardous waste including but not limited to asbestos, PCB's chemical compounds, etc., if discovered during work on this project will be reported directly to the owner, but JCI excludes any work associated with the removal or treatment of these types of waste materials. Work will stop if any of these materials are found and will not resume until the area is deemed safe to continue work.

Savings Methodology

Savings were calculated from the Excel-based Bin-calc. Savings result from implementing night setback temperatures and adjusting occupied heating and cooling set-points.

Maintenance Requirements

Follow manufacturers' recommendations for preventative maintenance. It is recommended that the City continue with the planned service agreement in order to keep the building automation system in proper working order.

Benefits

- Electric and natural gas energy savings.
- Improved occupant comfort

ECM #3 – Computer Management System

ECM Summary

Personal computers' (PCs) energy consumption waste within a facility is very often ignored. PCs are typically left on by the users even if they are not being used. Johnson Controls proposes to reduce this wasted energy through implementing a program that automatically and centrally manages power settings through a network based program.

With the help and cooperation of the school, JCI installed and deployed the software on a sample of 34 computers in October 2015. The software ran between October 23 and October 29 and determined the baseline time when the computers operated in low power was 4 hrs./day/PC. Then a power scheme preferred by the school was applied to the same computers and determined the post-retrofit time when the computers operated in low power was 21.4 hrs./day/PC. Therefore the average operating hours per PC per day operated in low power was improved by 17.4 hrs. with the application of the program.

Facilities Recommended for this Measure

- Elementary School

Scope of Work

- JCI will install the server and its clients for the personal computer power management system.
- A total of 113 networked desktop computers will be affected.
- JCI will initiate a pre-installation planning meeting to confirm any relevant network characteristics and define the project's timeline and responsibilities. The client software will be deployed, implemented and configured on the school's network either remotely or manually.
- Once installed, the JCI team will train the customer's system administrators and reporting tool users.
- The JCI team will help assure the school's success through our annual maintenance program for a period of three years. This provides our customers with ongoing technical support, software updates and upgrades, and an annual Network Energy Analysis to confirm the most effective use of the system and allow for any incremental changes.

Savings Methodology

Energy savings results from installing the equipment and controlling the connected loads during periods when the workstation is unoccupied. In general, JCI uses the following approach to determine savings for this specific measure:

Savings Calculation Method		
Baseline Energy Usage (kWh / yr)	=	Existing Computer Watts x Baseline Operating Hours / yr x 1 kW / 1000 Watts
Post- Retrofit Energy Usage (kWh / yr)	=	Existing Computer Watts x Hours with PC management / yr x 1 kW / 1000 Watts
Energy Savings (kWh / yr)	=	Baseline Energy Usage – Post-Retrofit Energy Usage

Maintenance Requirements

Update software as needed.

Benefits

- Save electricity

ECM #4 – Demand Response - Energy Efficiency Credit

This measure is a service contract that facilitates customer participation in the PJM Energy Efficiency Demand Response Program. PJM Energy Efficiency is defined as a permanent reduction in electric energy consumption in return for payments from the electric power markets. A customer that has recently installed more efficient devices/equipment or implemented more efficient processes or systems, that exceed industry standards at the time of the implementations can participate in the PJM Energy Efficiency program.

PJM Energy Efficient Program payments are independent of the local utilities payments. A customer that implemented energy efficiency retrofits receives benefits from lower demand charges (by lowering their electricity consumption), rebates from local utilities and/or the PJM Energy Efficiency program. Energy Efficiency retrofits that would qualify for the PJM Energy Efficiency Program include implementation of lighting retrofits, appliances, air conditioning installations, building insulation or process improvements, and permanent load shifts that will not be dispatched on the price or other factors.

A customer with a permanent reduction qualifies for up to four consecutive years of revenue for the same energy efficiency measures. The four-year mark starts from the completion year of the project.

Facilities Recommended for this Measure

- City Hall
- Library
- Fire House
- Welcome Center
- Nature Center 1
- Nature Center 2
- Elementary School
- Public Works Complex
- Franklin St School

ECM #5 – Emergency Generator Installation

ECM Summary

The Elementary School will be used as a shelter in emergency scenarios therefore the emergency power generator is necessary to keep constant source of electricity.

Facilities Recommended for this Measure

- Elementary School

Scope of Work

- Furnish a 175 kW Cummins outdoor natural gas generator, annunciator, 800 amp transfer switch, panel SGP, and panel SGP2.

Exclusions

- Qualify not included: Excavation, concrete, pad, fence, gas piping,
- 800 amp normal breaker is assumed to be existing.
- Migration of old to new during normal working hours.
- Migration accomplished via reroute or junction box with splice.
- No lighting shown on drawings.
- Assume 1" for controls to generator.

- No engineering included, no fire alarm, no roof work, no GTVSS shown.

Savings Methodology

No savings claimed.

ECM #6 & #7 - Pipe Insulation and Blankets

ECM Summary

Non-insulated pipelines and associated valves and fittings carrying thermal fluids because heat loss where not intended and result in excess fuel consumption, as well as discomfort in occupied areas. Valves and fittings without insulation were observed throughout the buildings and installation of new insulation is recommended. Installation of the proper amount of insulation will not only conserve energy but will also improve safety by reducing the chance for burns on hot piping or slipping due to condensate on a pipe.

Facilities Recommended for this Measure

- City Hall
- Fire House

Scope of Work

Piping insulation thickness will be added based on the following table:

Iron Pipe Size	Copper Tubing Size	Insulation Thickness
½" -6"	5/8" – 4 1/8"	½"
½" – 24"	5/8"- 6 1/8"	1"
½" – 24"	5/8" – 6 1/8"	1 ½"
½" – 24"	1 1/8" – 6 1/8"	2"
1" – 24"	1 3/8" – 6 1/8"	2 ½"
1" – 24"	1 3/8" – 6 1/8"	3"
1 ½" – 24"	Na	3 ½"
3" - 24"	Na	4"
3" - 24"	Na	4 ½"
3" – 20"	na	5"

- Insulation type:
  - Micro-Lok HP Fiber Glass, ASTM C547, Type I, k value of 0.23 at 75 degrees F.
  - Jacket: The all-service (ASJ) vapor-retarder jacket includes a longitudinal, self-sealing closure lap. The jackect system is adhered to each fiber glass section using a specially formulated adhesive to ensure jacket securement.
- A detailed line-by-line scope of work has been included in the Appendix with the associated energy savings calculations for the insulation.
- Pricing assumes local state prevailing wage rates.

- Pricing includes sales tax
- Pricing includes bonding.
- Pricing includes labor warranty of one year for workmanship

Exclusions

- Pricing excludes concealed conditions, asbestos or lead paint abatement
  - Given the age of the buildings, asbestos and/or lead paint should be anticipated in some or all of the locations.
- Pricing excludes tax on labor, state/county/municipal fees/permits.
- Proposal pricing assumes the base building envelope proposal will be awarded and constructed at the same time as the pipe insulation proposal.

The following tables indicate the scope of work for each building:

Location	Heat Source	Location	Length (ft)	Pipe Diameter (in)	Insulation Thickness
City Hall	Steam	Boiler Room	12	2.5	1.5
City Hall	Steam	Boiler Room	6	4	2
City Hall	Steam	Boiler Room	3	5	2
City Hall	Steam	Boiler Room	39	3	1.5
City Hall	Steam	Boiler Room	15	1.5	1.5
City Hall	Steam	Boiler Room	33	1.5	1.5
Fire House	Hot Water	Boiler Room	21	2	1.5
Fire House	Hot Water	Boiler Room	12	1.5	1.5
Fire House	Hot Water	Boiler Room	9	1.25	1
Fire House	Hot Water	Boiler Room	90	1	1
Fire House	Hot Water	Boiler Room	140	0.5	1

Savings Methodology

The savings were calculated utilizing 3E Plus software. Several assumptions were made including that the pipe was in heating hot water service with a surface temperature of approximately 180F. The hours of hot water piping operation were approximately 4357 hours in a year. It was assumed that there is currently no insulation on the pipe.

Benefits

- Save natural gas

ECM #8, #9, #10, #11, #12, #13 & #14 – Building Envelope Improvements

ECM Summary

Infiltration drives energy costs higher by allowing unconditioned outside air to enter the building, thus adding to the building load and causing additional unnecessary heating and cooling loads. Each building within the scope was surveyed in order to identify potential improvements for outside air infiltration reduction. The main observations are listed below:

- Door weather strip
  - Existing weather strip on single and double doors was found to be missing or in poor condition on the majority of the exterior doors evaluated in the city. Air penetrations could be visibly seen and felt along the doors. The penetrations were also verified using smoke pencil testing. The installation of new polyethylene clad urethane foam weather strip is recommended to seal the edges of exterior doors; including strike side, hinge side and header. Brush seals are also recommended to be installed to seal exterior door bases and double door center astragals. Doors where existing weather strip and/or sweeps were found to be in good condition are excluded from this proposal.
- Overhead door seals
  - The existing overhead door seals were found to be in poor condition. Air penetrations were found along the headers and sides of all of the overhead doors; further air penetrations were also found along the base of select overhead doors as well. The installation of oversized polypropylene brushes are recommended along overhead door side and head edges. Where air penetrations were also observed along the door base, the installation of EPDM synthetic rubber bulbs is also recommended.
- Sealing building penetrations
  - Numerous building penetrations were also found at the Elementary School. Building penetrations were found along rooftop unsealed fans and along the roof access hatch. Existing seals in these locations were found to be either missing or deteriorated resulting in air penetrations. These penetrations could be visibly seen and/or felt. Verification via smoke pencil testing was also performed as well. It is recommended to seal these penetrations with either elastomeric polyurethane sealant or polyurethane foam sealant. Areas that can be sealed from the buildings interior are typically recommended to be sealed with the polyurethane foam sealant; while areas that require seals from the exterior, where the sealant will be exposed to weather, are typically recommended to be sealed with elastomeric polyurethane sealant.
- Sealing roof/wall connections
  - The roof/wall connections were also found to be another prevalent source of air penetrations. A portion of this connection was found to be unsealed in the Elementary School. It is recommended to seal these penetrations with polyurethane foam sealant. Areas that have a wide joint to fill at this connection may also require the use of extruded closed-cell polyethylene foam backer rod or extruded polystyrene rigid foam insulation to properly seal the void.

Facilities Recommended for this Measure

- City Hall
- Fire House
- Franklin St School
- Library
- Nature Center 1
- Water Works Building
- Welcome/Transportation Center

Scope of Work

A building envelope audit was performed for the entire City of Cape May. The results of the audit were the identification of several areas of envelope deficiency. The deficient areas were tabulated and their savings potential calculated.

Location	Door Weather Strip (Double)	Door Weather Strip (Single)	Door Weather Strip (Garage)
City Hall	3	2	
Fire House	1	6	7
Franklin St School	1	6	
Library		5	
Nature Center 1		4	
Water Works Building	2		2
Welcome /Transportation Center	3	3	1
Total	10	26	10

Savings Methodology

The energy savings derived from this measure are a result of the heating and cooling systems (DX cooling and boilers) not having to work as hard to achieve the desired environmental conditions. The amount of savings is dependent on the existing building conditions and the amount of air leakage under the current operating conditions.

Energy savings are based on the ASHRAE crack method calculations. If the process reveals any variation in the as-built conditions, then savings will be adjusted accordingly. Determination of air current air leakage rates is based on many factors, including:

- Linear feet of cracks
- Square feet of openings
- Stack coefficient
- Shield class
- Average wind speed
- Heating or cooling set point
- Average seasonal ambient temperatures

Savings due to infiltration reduction:
The following equation is based on the ASHRAE crack method:

Heat loss per hour: $\dot{q}$ = 1.08 x Q x ΔT

Where Q represents the airflow in cubic feet per minute (CFM) and is calculated in the following manner:

$$Q = A_{crack} \times \sqrt{(C_s \Delta T + C_w V^2}$$

In this equation, A_{crack} represents the crack area in square inches to be reduced. The other values in the equation are standard for these buildings and are based on shelter class, height, and local wind speed.

Cw = wind coefficient = 0.0104 average

V = wind speed = 8.8 average mph

Cs = stack coefficient = 0.0299 (two-story typical)

ΔT = temperature difference = Tout – Tin

ΔT is calculated by subtracting the average outdoor air temperature per hour from the indoor temperature, using 24 data points per month to accurately account for weather variances, and subsequently calculating airflow and heat loss for each set of data. Therefore, 288 data points are used, and Δt is the number of hours each data point represents. The total heat loss is calculated as follows:

$$q = \sum_{x=1}^{288} 1.08 \times A_{crack} \times \sqrt{C_s (T_{out} - T_{in}) + C_w V^2} \times (T_{out} - T_{in}) \times \Delta t$$

Maintenance

After the building envelopes have been improved, operations and maintenance should be reduced, due to improved space conditions and lower humidity during the cooling season. The maintenance staff should maintain the newly installed equipment per manufacturers' recommendations. The manufacturer specification sheets will be provided for exact maintenance requirements.

Benefits

- Electrical energy savings
- Fuel energy savings
- Increased thermal comfort

ECM #15, #16, #17, #18, #19, #20, #21 & #22– LED Lighting Replacement/Retrofits

ECM Summary

Since the advent of energy efficient T8 lighting (with electronic ballast), there have been several generations of improvements to interior lighting. Today, the LED lamps offers an opportunity to lower energy consumption in areas lit by the standard 32 or 28-watt T8 and 40-watt T12.

The standardization to LED lighting in all areas of the City will allow for reduced lighting maintenance throughout the project life and will provide consistent light levels throughout the City.

Facilities Recommended for this Measure

- City Hall
- Elementary School
- Fire House
- Library
- Nature Center 1
- Nature Center 2
- Water Works Building
- Welcome/Transportation Center

Interior Lighting

- City Hall

Floor	Room	Existing Lighting Fixtures	Existing Qty.	Proposed Lighting Fixtures	Proposed Qty.
1st floor	Auditorium	4ft, F32 T8 2 Lamp Strip	1	4ft LED Wrap	1
1st floor	Finance	4ft, F32 T8 2 Lamp Strip	17	4ft LED Wrap	17
1st floor	Finance 2	2x4, 2 Lamp, F32 T8 Prismatic	10	2x4 Relight Kit	10
1st floor	Halls	2x4, 3 Lamp, F32 T8 Prismatic	7	2x4 Relight Kit	7
1st floor	Mail room	4ft, F32 T8 2 Lamp Strip	3	4ft LED Wrap	3
1st floor	Police dept.	2x4, 3 Lamp, F32 T8 Parabolic	17	2x4 Relight Kit	17
1st floor	Police dept.	4ft, 2 Lamp, F32 T8 Wrap	8	4ft LED Wrap	8
1st floor	Shade tree office	4ft, F32 T8 2 Lamp Strip	4	4ft LED Wrap	4
1st floor	Tax Assessor	2x4, 2 Lamp, F32 T8 Prismatic	3	2x4 Relight Kit	3
1st floor	Tax Assessor	4ft, F32 T8 2 Lamp Strip	3	4ft LED Wrap	3
1st floor	Treasurer's office	4ft, F32 T8 2 Lamp Strip	1	4ft LED Wrap	1

Floor	Room	Existing Lighting Fixtures	Existing Qty.	Proposed Lighting Fixtures	Proposed Qty.
1st floor	Treasurer's office	4ft 4l f32 wrap	10	4ft LED Wrap	10
Basement	Bathrooms	2x4, 4 Lamp, F32 T8 Parabolic	6	2x4 Relight Kit	6
Basement	Constructio n office	2x4, 2 Lamp, F32 T8 Prismatic	3	2x4 Relight Kit	3
Basement	Constructio n office	4ft, 4 Lamp, F32 T8 Wrap	2	4ft LED Wrap	2
Basement	Constructio n office	4ft, 2 Lamp, F32 T8 Wrap	7	4ft LED Wrap	7
Basement	Court room	2x4, 4 Lamp, F32 T8 Prismatic	18	2x4 Relight Kit	18
Basement	Court room	2x4, 2 Lamp, F32 T8 Prismatic	12	2x4 Relight Kit	12
Basement	Court room	4ft, 2 Lamp, F32 T8 Wrap	2	4ft LED Wrap	2
Basement	Court room	4ft, 4 Lamp, F32 T8 Wrap	2	4ft LED Wrap	2
Basement	Court room	4ft, F32 T8 2 Lamp Strip	1	4ft LED Wrap	1
Basement	Halls	4ft, 2 Lamp, F32 T8 Wrap	4	4ft LED Wrap	4
Basement	Police	4ft, 2 Lamp, F32 T8 Wrap	19	4ft LED Wrap	19
EXT	Wall Mt	250w Metal Halide	6	LED Wall pack	6
Floor 2	Animal control	4ft, 2 Lamp, F32 T8 Wrap	6	4ft LED Wrap	6
Floor 2	City managers	4ft, 2 Lamp, F32 T8 Wrap	3	4ft LED Wrap	3
Floor 2	City managers	4ft, 4 Lamp, F32 T8 Wrap	3	4ft LED Wrap	3
Floor 2	Clerk	2x4, 2 Lamp, F32 T8 Prismatic	12	2x4 Relight Kit	12
Floor 2	Clerk	4ft, 2 Lamp, F32 T8 Wrap	24	4ft LED Wrap	24
Floor 2	Halls	4ft, 2 Lamp, F32 T8 Wrap	1	4ft LED Wrap	1
Floor 2	Halls	4ft, 4 Lamp, F32 T8 Wrap	3	4ft LED Wrap	3
Floor 2	Lunch room	4ft, 2 Lamp, F32 T8 Wrap	7	4ft LED Wrap	7
Floor 2	Water/ sewer	4ft, 2 Lamp, F32 T8 Wrap	12	4ft LED Wrap	12
Stairwells	Stairwells	4ft, 4 Lamp, F32 T8 Wrap	2	4ft LED Wrap	2
Stairwells	Stairwells	4ft, 2 Lamp, F32 T8 Wrap	2	4ft LED Wrap	2
1st floor	Auditorium	100w A19 Incandescent	10	Lamps: 1 9.5A19/LED	10
1st floor	Police dept.	CFL 23w	6	Lamps: 1 9.5A19/LED	6
Basement	Bathrooms	2FT, F17 T8 1 Lamp Strip	2	Lamps: 2 LED 2' Tube 40K	4

Floor	Room	Existing Lighting Fixtures	Existing Qty.	Proposed Lighting Fixtures	Proposed Qty.
Basement	Court room	60w A19 Incandescent	1	Lamps: 1 9.5A19/LED	1
Basement	Police	CFL 13w	8	Lamps: 1 9.5A19/LED	8
Floor 2	Animal control	CFL 23w	3	Lamps: 1 9.5A19/LED	3
Floor 2	City managers	2ft 2l f32 t8	4	Lamps: 2 LED 2' Tube 40K	8
Floor 2	City managers	60w A19 Incandescent	1	Lamps: 1 9.5A19/LED	1
Total			276		282

- Elementary School

Floor	Room	Existing Lighting Fixtures	Existing Qty.	Proposed Lighting Fixtures	Proposed Qty.
1st floor	31	2x4, 3 Lamp, F32 T8 Prismatic	10	2x4 Relight Kit	10
1st floor	32	4ft, 2 Lamp, F32 T8 Wrap	12	4ft LED Wrap	12
1st floor	32	4ft, F32 T8 2 Lamp Strip	6	4ft LED Wrap	6
1st floor	34	4ft, 2 Lamp, F32 T8 Wrap	12	4ft LED Wrap	12
1st floor	34	4ft, F32 T8 2 Lamp Strip	6	4ft LED Wrap	6
1st floor	35	2x4, 2 Lamp, F32 T8 Prismatic	3	2x4 Relight Kit	3
1st floor	37	2x4, 3 Lamp, F32 T8 Prismatic	10	2x4 Relight Kit	10
1st floor	38	4ft, 2 Lamp, F32 T8 Wrap	12	4ft LED Wrap	12
1st floor	38	4ft, F32 T8 2 Lamp Strip	6	4ft LED Wrap	6
1st floor	39	4ft, F32 T8 2 Lamp Strip	6	4ft LED Wrap	6
1st floor	39	4ft, 2 Lamp, F32 T8 Wrap	12	4ft LED Wrap	12
1st floor	40	4ft, 2 Lamp, F32 T8 Wrap	12	4ft LED Wrap	12
1st floor	40	4ft, F32 T8 2 Lamp Strip	6	4ft LED Wrap	6
1st floor	Administrative principal	2x4, 4 Lamp, F32 T8 Prismatic	4	2x4 Relight Kit	4
1st floor	Auditorium	2x4, 4 Lamp, F32 T8 Prismatic	8	2x4 Relight Kit	8
1st floor	Auditorium	4ft, F32 T8 1 Lamp Strip	3	4ft LED Wrap	3
1st floor	Boiler	4ft, 2 Lamp, F32 T8 Wrap	10	4ft LED Wrap	10
1st floor	Gym	4ft, FP54 HO T5 6 Lamp	12	LED Highbay 1500LM	12
1st floor	Hall	2x4, 4 Lamp, F32 T8 Prismatic	3	2x4 Relight Kit	3
1st floor	Kitchen	4ft, 2 Lamp, F32 T8 Wrap	4	4ft LED Wrap	4

Floor	Room	Existing Lighting Fixtures	Existing Qty.	Proposed Lighting Fixtures	Proposed Qty.
1st floor	Library	2x4, 2 Lamp, F32 T8 Prismatic	12	2x4 Relight Kit	12
1st floor	Library	4ft, 2 Lamp, F32 T8 Wrap	45	4ft LED Wrap	45
1st floor	Nurses	4ft, 2 Lamp, F32 T8 Wrap	5	4ft LED Wrap	5
1st floor	Reception	2x4, 4 Lamp, F32 T8 Prismatic	9	2x4 Relight Kit	9
1st floor	Reception	4ft, F32 T8 1 Lamp Strip	1	4ft LED Wrap	1
1st floor	Reception	4ft, 2 Lamp, F32 T8 Wrap	3	4ft LED Wrap	3
1st floor	Room 1	4ft, 2 Lamp, F32 T8 Wrap	12	4ft LED Wrap	12
1st floor	Room 1	4ft, F32 T8 2 Lamp Strip	6	4ft LED Wrap	6
1st floor	Room 14	4ft, 2 Lamp, F32 T8 Wrap	16	4ft LED Wrap	16
1st floor	Room 15	4ft, F32 T8 1 Lamp Strip	4	4ft LED Wrap	4
1st floor	Room 16	4ft, 2 Lamp, F32 T8 Wrap	16	4ft LED Wrap	16
1st floor	Room 2	4ft, F32 T8 2 Lamp Strip	6	4ft LED Wrap	6
1st floor	Room 2	4ft, 2 Lamp, F32 T8 Wrap	12	4ft LED Wrap	12
1st floor	Shop	8ft, F96 T12HO 2 Lamp Industrial	4	8ft LED Strip (Lowbay)	4
1st floor	Teachers' lounge	4ft, 2 Lamp, F32 T8 Wrap	8	4ft LED Wrap	8
Exterior	Parking	400w High Pressure Sodium	5	LED 400w Metal Halide Shoebox Replacement	5
1st floor	Auditorium	100w BR40 Incandescent	6	Lamps: 1 9.5A19/LED	6
1st floor	Auditorium	60w A19 Incandescent	60	Lamps: 1 9.5A19/LED	60
1st floor	Auditorium	75w PAR 38 Incandescent	1	Lamps: 1 9.5A19/LED	1
1st floor	Boys room	26w 4 pin CFL	2	Lamps: 1 13W LED replacement for vertical long 4 pin 26WCFL 4000 k	2
1st floor	Girls room	26w 4 pin CFL	2	Lamps: 1 13W LED replacement for vertical long 4 pin 26WCFL 4000 k	2
1st floor	Hallway A	2x2 f17 2l	10	Lamps: 2 LED INSTANTFIT 2'	20
1st floor	Hallway B	2x2 f17 2l	11	Lamps: 2 LED INSTANTFIT 2'	22
1st floor	Nurses	26w 4 pin CFL	2	Lamps: 1 13W LED replacement for	2

Floor	Room	Existing Lighting Fixtures	Existing Qty.	Proposed Lighting Fixtures	Proposed Qty.
				vertical long 4 pin 26WCFL 4000 k	
1st floor	Nurses	2x2, 2 Lamp U Tube F32 Prismatic	2	Lamps: 2 LED INSTANTFIT 2'	4
Total			417		440

- Fire House

Room	Existing Lighting Fixtures	Existing Qty.	Proposed Lighting Fixtures	Proposed Qty.
garage	4ft, 2 Lamp, F34 T12 Wrap	4	4ft LED Wrap	4
garage	4ft, FP54 HO T5 6 Lamp	12	LED Highbay 1500LM	12
garage	4ft, F32 T8 2 Lamp Strip	5	ZL1N 50K 5000LM	5
kitchen	2x4, 4 Lamp, F32 T8 Prismatic	2	2x4 Relight Kit	2
Main Lounge	2x4, 4 Lamp, F32 T8 Prismatic	11	2x4 Relight Kit	11
office	2x4, 4 Lamp, F32 T8 Prismatic	1	2x4 Relight Kit	1
storage	2x4, 4 Lamp, F32 T8 Prismatic	2	2x4 Relight Kit	2
DECO Wall MT	40w Candlebra Incandescent	21	Lamps: 1 LED LAMP	21
office	40w A19 Incandescent	7	Lamps: 1 9.5A19/LED	7
Fireman's Hall	40w Candlebra Incandescent	21	Lamps: 1 LED LAMP	21
Fireman's Hall	75w BR30 Incandescent	14	Lamps: 1 LED BR30 9.5W	14
Total		100		100

- Library

Existing Lighting Fixtures	Existing Qty.	Proposed Lighting Fixtures	Proposed Qty.
2x2, 2 Lamp U Tube F32 Prismatic	66	Lamps: 2 LED 2' Tube	132
60w A19 Incandescent	57	Lamps: 1 9.5A19/LED	57
CFL 42W	4	Lamps: 1 9.5A19/LED	4
Total	127		193

- Nature Center 1

Space	Existing Lighting Fixtures	Existing Qty.	Proposed Lighting Fixtures	Proposed Qty.
Lab	4ft, 2 Lamp, F32 T8 Wrap	2	4ft LED Wrap	2
Lobby	4ft, 2 Lamp, F32 T8 Wrap	12	4ft LED Wrap	12
Bathroom	CFL 26W	8	Lamps: 1 LED BR40 12W	8
Exterior	100w PAR38 Halogen	6	Lamps: 1 LED BR40 12W	6
Exterior	CFL 26W	10	Lamps: 1 LED BR40 12W	10
Lab	60w A19 Incandescent	2	Lamps: 1 9.5A19/LED	2
Lab	60w PAR38 Halogen	4	Lamps: 1 LED BR40 12W	4
Total		44		44

- Nature Center 2

Floor	Space	Existing Lighting Fixtures	Existing Qty.	Proposed Lighting Fixtures	Propose d Qty.
1st floor	Bathroom	4ft, 2 Lamp, F32 T8 Wrap	2	4ft LED Wrap	2
1st floor	Education center	4ft, 2 Lamp, F32 T8 Wrap	6	4ft LED Wrap	6
1st floor	Main area	4ft, F32 T8 1 Lamp Strip	1	4ft LED Wrap	1
1st floor	Main area	4ft, 2 Lamp, F32 T8 Wrap	8	4ft LED Wrap	8
1st floor	Bathrooms	CFL 26W	8	Lamps: 1 LED BR40 12W	8
1st floor	Education center	75w PAR38 Halogen	6	Lamps: 1 LED BR40 12W	6
1st floor	Exterior	60w A19 Incandescent	4	Lamps: 1 19A21 LED Lamp	4
1st floor	Main area	50w MR16 Halogen	3	Lamps: 1 LED MR 16	3
1st floor	Main area	CFL 26W	6	Lamps: 1 LED BR40 12W	6
1st floor	Main area	CFL 32W 1-Lamp	2	Lamps: 1 19A21 LED Lamp	2
2nd floor	Main area	100w PAR38 Halogen	8	Lamps: 1 LED BR40 12W	8
2nd floor	Main area	70w Metal Halide	1	Lamps: 1 19A21 LED Lamp	1
2nd floor	Main area	CFL 13w	15	Lamps: 1 19A21 LED Lamp	15
2nd floor	Main area	CFL 32W 1-Lamp	3	Lamps: 1 19A21 LED Lamp	3
	Total		73		73

- Water Works

Existing Lighting Fixtures	Existing Qty.	Proposed Lighting Fixtures	Proposed Qty.
4ft, 2 Lamp, F32 T8 Wrap	6	4ft LED Wrap	6
100w A19 Incandescent	6	Lamps: 1 9.5A19/LED	6
Total	12		12

- Welcome / Transportation Center

Floor	Room	Existing Lighting Fixtures	Existing Qty.	Proposed Lighting Fixtures	Proposed Qty.
1st floor	Bathrooms	4ft, 2 Lamp, F32 T8 Wrap	8	4ft LED Wrap	8
1st floor	Welcome area	2x4, 4 Lamp, F32 T8 Prismatic	11	2x4 Relight Kit	11
2nd floor	Offices	4ft, 2 Lamp, F32 T8 Wrap	13	4ft LED Wrap	13
1st floor	Bathrooms	4ft, F32 T8 1 Lamp Strip	2	Lamps: 1 LED T8 4' Tube	2
1st floor	Welcome area	2x2, 2 Lamp U Tube F32 Prismatic	4	Lamps: 2 LED INSTANTFIT 16.5W U-LAMP	8
2nd floor	Offices	60w A19 Incandescent	1	Lamps: 1 19A21 LED Lamp	1
Exterior	Exterior	100w A19 Incandescent	21	Lamps: 1 19A21 LED Lamp	21
Exterior	Exterior	70w Metal Halide	11	Lamps: 1 19A21 LED Lamp	11
Total			71		75

The retrofit involves the removal and disposal of existing lamps, fixture cleaning, and the installation of new lamps (and fixtures where applicable). This measure will improve the energy efficiency of lighting fixtures, improve the overall quality of lighting, maintain appropriate levels of lighting, and reduce lighting system maintenance costs in the buildings.

All lighting work will be installed in a thoughtful manner with careful consideration of any personal belongings and surrounding equipment. Clean-up will take place at the end of each shift with all vacuuming,

dusting, and trash removal being completed before leaving the premises. Interior lighting scope of work will be performed outside of regular office/ school hours if necessary.

All used lamps will be boxed at the end of each shift. Lamps will be recycled or disposed of according to local environmental regulations.

Savings Methodology

In general, savings calculations for lighting retrofits are calculated using the following methodology:

Savings Calculation Method		
Baseline Energy Usage (kWh / yr)	=	Existing Fixture Watts x Operating Hours / yr x 1 kW / 1000 Watts
Estimated Energy Usage (kWh / yr)	=	Proposed Fixture Watts x Op. Hours/yr x 1 kW / 1000 Watts
Energy Savings (kWh / yr)	=	Baseline Energy Usage – Estimated Energy Usage

Maintenance

Lighting will need to be replaced in order to provide consistent light quality throughout the buildings. It is recommended to conduct group re-lamping on regularly scheduled intervals in order to minimize maintenance requirements.

Benefits

- Electrical energy savings
- Reduced lamp replacement for 5 to 10 years for LEDs

ECM #23, #24 & #25 – Plug Load Controls

ECM Summary

Office equipment is regularly left in the 'on' state at all times allowing the individual machine to revert to the 'Sleep' mode based on an internal timer. This measure will plug the office equipment into a networkable device that will allow for scheduling of the plugged in equipment.

Facilities Recommended for this Measure

- City Hall
- Elementary School
- Library

Scope of Work

- JCI recommends utilizing specialty wall sockets from BERT that have software to track real-time electrical usage of your appliances. The software also allows you to use your web browser to view this usage and automatically turn on/off any and all appliances plugged into these outlets.

Equipment	City Hall	Elementary School	Library
Projector		11	
Large Printer/Copier	7	4	1
Medium Printer/Copier	2	7	
Printer-Monitor Combo	12	12	4
Water Fountain	3		
Soda Machine	1		
TVs	3		
Lab Monitor Combo (4 monitors per BERT)		6	1
Laptop Charging Station		3	
Hot/Cold Water Dispenser		2	
LES-7001IR Classroom Voice Amplifier		4	
Stage Audio Rack		1	
TVs		1	
TOTAL	**28**	**51**	**6**

Savings Methodology

Savings are calculated using the following methodology for all devices plugged in:

Savings Calculation Method

Baseline Energy Usage (kWh / yr) = Average kW x Baseline Weekly Hours x 4.348 wks/mo. x Months/yr

Proposed Energy Usage (kWh/ yr) = Average kW x Proposed Weekly Hours x 4.348 wks/mo. x Months/yr

Electrical Savings (kWh/ yr) = Baseline Energy Usage – Proposed Energy Usage

Where

Baseline weekly hours = 168 hrs/wk

Proposed weekly hours = 50 hrs/wk for City Hall, 40 hrs/wk for Elementary School and 69 hrs/wk for Library

Months/Yr = 10 months for Elementary School & 12 months for City Hall and Library

Maintenance Requirements

Periodically the equipment should be checked to ensure proper operation.

Benefits

- Electrical energy savings

ECM #26 – Premium Efficient Motors

ECM Summary

Presently the building is served with two (2) 3-HP hot water pumps located in the boiler room. The pumps deliver constant volume hot water. Replacing the existing standard efficiency hot water pumps with premium efficiency pumps will allow for a more efficient operation of the heating system and reduce electric consumption.

Facilities Recommended for this Measure

- Elementary School

Scope of Work

Replace two (2) existing 3-HP hot water pump motors with new 3-HP premium efficiency Motors

- Remove and dispose of two (2) existing 3-HP hot water pump standard efficiency motors.
- Reconnect wiring to new motors.

Savings Methodology

In general, savings are calculated using Excel-based Bincalc. The equation presented below is used along with bin temperatures to equate building load and calculate pump savings.

Motor Savings, kWh	kWh reduced = (Pump kW) x (EFLH) /(standard efficiency) - (Pump kW) x (EFLH)/(premium efficiency) Where EFLH = Effective Full Load Hours

Maintenance Requirements

Follow manufacturers' recommendations for preventative maintenance on motors.

Benefits

- Electricity savings

ECM #28 – Street Lighting Retrofits

ECM Summary

Existing high pressure sodium (HPS) street lighting fixtures will be replaced with newer technology LED type fixtures. The LED fixtures have a much longer life and improved light quality throughout the entire life of the lamp than the existing HPS lamps. This will provide energy savings as well as provide a safe environment around the city.

Facilities Recommended for this Measure

- City Wide

Scope of Work

Existing Lighting Fixtures	Existing Qty.	Proposed Lighting Fixtures	Proposed Qty.
100W COBRA HPS UG	8	30W Corn Cobb	8
150W COBRA HPS UG	1	40W LED Corn Cobb	1
100W TRADITIONAIRE HPS UG	2	30W Corn Cobb	2
50W COBRA HPS OH Wood pole	6	15W LED Corn Cobb	6
70W COBRA HPS OH Wood pole	5	20 W LED Corn Cobb	5
100W COBRA HPS OH Wood pole	16	30W Corn Cobb	16
150W COBRA HPS OH Wood pole	46	40W LED Corn Cobb	46
250W FLOOD/PROFILE HPS OH	5	80W LED Corn Cobb	5
400W FLOOD/PROFILE HPS OH	1	150W LED Corn Cobb	1
Total	90		90

Savings Methodology

In general, savings calculations for lighting retrofits are calculated using the following methodology:

Savings Calculation Method		
Baseline Energy Usage (kWh / yr)	=	Existing Fixture Watts x Operating Hours / yr x 1 kW / 1000 Watts
Estimated Energy Usage (kWh / yr)	=	Proposed Fixture Watts x Op. Hours/yr x 1 kW / 1000 Watts
Energy Savings (kWh / yr)	=	Baseline Energy Usage – Estimated Energy Usage

Johnson Controls

Where
Annual operating hours = 4200 hrs/yr

ECM #29 – Walk-In Cooler Controls

ECM Summary

The kitchen in the Elementary School contains one walk-in cooler. The fans in the evaporator boxes run at normal speed at all times, even if the thermostat is not calling for a cooling cycle. Installing a controller will monitor the temperature on both the intake and the exhaust of the evaporator fan unit. When the temperature of the exhaust is equal to the intake temp, the controller will reduce the speed of the fans to save energy and reduce costs. When the compressor turns back on the meet the thermostat requirements, the controllers will return the fans to normal speed. Savings are a result of reduced run time of evaporator fans. The equipment in Elementary School is in the table below.

Equipment	Manufacturer	Model	Serial #	Volts	Amps
Evaporator	HeatCraft	LET090BJ	D00G03207	230	8.7
Fans	BOHN	na	na	na	na

Facilities Recommended for this Measure

- Elementary School

Scope of Work

- Furnish and install Cooler Control System
- Provide programming.
- Provide start up and warranty.
- Provide training for maintenance personnel

Savings Methodology

Savings are calculated using the following methodology:

Energy savings will result from both reducing the fan power and the efficient control of the evaporator fans. In general, JCI uses the following approach to determine savings for this specific measure:

Existing kW	= Listed Equipment Amperage x Voltage of Equipment
Cost per kWh	= Baseline Utility Analysis- $/kWh
Existing Cost of Electric Energy	= Existing kW x Cost per kWh x Effective Full Load Hours
Proposed Cost of Electric Energy	= Proposed kW x Cost per kWh x Full Load Hours Using Control
	= Existing Electric Costs – Proposed Electric Costs

Energy Savings $	

Maintenance Requirements

Periodically the equipment should be checked to ensure proper operation.

Benefits

- Electrical energy savings

ECM #30 – Vehicle Charging Station – Charge Point

ECM Summary

JCI recommends installing a vehicle charging station – Charge Point in Elementary School. It is the best in-class Electric Vehicle (EV) charging hardware and has the largest, most robust, feature-rich network in the world. The Charge Point focuses exclusively on networked charging stations and associated services.

Facilities Recommended for this Measure

- Elementary School

Scope of Work

- Installation & Infrastructure Materials:
- Install one (1) ChargePoint Dual port CT4021 at Elementary School.
  - Supply and install overcurrent protection and underground conduit circuitry between existing electrical service and new chargers.
  - Supply and install one (1) footing for new charger.
  - Remove and replace existing sidewalk for conduit and footing installation.
  - Supply and install two (2) new "EV Parking Only" sign adjacent to new charger.
  - Supply and install two (2) new bollards in front of charger.
  - Supply ECO-Green color striping in EV charging parking spaces.
  - One (1)-CPSUPPORT-ACTIVE-Station Activation and Configuration Service.
  - One (1)-CT4000-SITEVALID-On-site Validation of electrical capacity, transformers, panels, breakers, wiring, cellular coverage, and that station meets all ChargePoint published requirements. (Required to qualify for CT4000-ASSURE program).
  - Electrical and building permits.
- ChargePoint Hardware
  - One (1)-CT4021-GW1 – Dual Output/Gateway/Bollard Mount/Cord Management
  - One (1)-CT4001-CCM-Bollard Mounting Kit
  - One (1)-CTSW-SAS-COMM-1- One (1) Year Commercial ChargePoint Network Service Plan.
  - One (1)-CT4000-ASSURE-One (1)-year Parts & On-site Labor to repair or replace any manufacturing defect. Includes remote monitoring of station and proactive repair dispatch. *Complete management of EV Station configuration. Unlimited Pricing, Access, and Visibility policy changes. Unlimited Adds and Changes to station groups. 24/7/365

station monitoring. Monthly summary and Quarterly detailed reports. Combined with ChargePoint Assure provides 98% uptime guaranteed and 1 business day response. (Site Validation Required)
    - *Extended Assure programs are available upon request*

Notes:

- Electrical/Building permit applications and inspector coordination are included in this proposal.
- Engineering and/or zoning approval if required shall be the responsibility of the owner.
- Electric Vehicle Charger shall be located directly behind curb with two (2) hi-visibility bollards located in front of unit.
- Backfill of excavated areas shall be native soil. First 4" of grass shall be temporarily removed to excavate trench and re-installed after compaction is complete.
- All work shall be completed during normal working hours.
- All new work installed by TPBECI is guaranteed to pass inspection and carries a 1-year workmanship warranty and a manufacturer's limited warranty on parts.

Savings Methodology

No savings claimed.

Section 5. Measurement and Verification

Measurement & Verification (M&V) Methodologies

This section contains a description of the types of Measurement and Verification (M&V) methodologies that Johnson Controls will use to guarantee the performance of this project. They have been developed and defined by International Performance Measurement and Verification Protocol (IPMVP).
There are four guarantee options that may be used to measure and verify the performance of a particular energy conservation measure. Each one is described below.

Option A – Retrofit Isolation: Key Parameter Measurement

Energy savings is determined by field measurement of the key parameters affecting the energy use of the system(s) to which an improvement measure was applied separate from the energy use of the rest of the facility. Measurement frequency ranges from short-term to continuous, depending on the expected variations in the measured parameter, and the length of the reporting period.

Measurement of key parameters means that those parameters not selected for field measurement will be estimated. Estimates can be based on historical data, manufacturer's specifications, or engineering judgment. Documentation of the source or justification of the estimated parameter will be described in the M&V plan in the contract. Energy savings is determined through engineering calculations of the baseline and post-retrofit energy used based on the combination of measured and estimated parameters, along with any routine adjustments.

Option B – Retrofit Isolation: All Parameter Measurement

Like Option A, energy savings is determined by field measurement of the energy use of the systems to which an improvement measure was applied separate from the energy use of the rest of the facility. However, all of the key parameters affecting energy use are measured; there are no estimated parameters used for Option B. Measurement frequency ranges from short-term to continuous, depending on the expected variations in the savings and the length of the reporting period. Energy savings is determined through engineering calculations of the baseline and post-retrofit energy used based on the measured parameters, along with any routine adjustments.

Johnson Controls

Option C – Whole Building Metering/Utility Bill Comparisons

Option C involves the use of utility meters or whole building sub-meters to assess the energy performance of a total building. Option C assesses the impact of any type of improvement measure, but not individually if more than one is applied to an energy meter. This option determines the collective savings of all improvement measures applied to the part of the facility monitored by the energy meter. Also, since whole building meters are used, savings reported under Option C include the impact of any other change made in facility energy use (positive or negative).

Option C may be used in cases where there is a high degree of interaction between installed improvement measures or between improvement measures and the rest of the building or the isolation and measurement of individual improvement measures is difficult or too costly.

This Option is intended for projects where savings are expected to be large enough to be discernable from the random or unexplained energy variations that are normally found at the level of the whole facility meter. The larger the savings, or the smaller the unexplained variations in the baseline, the easier it will be to identify savings. Also, the longer the period of savings analysis after installing the improvement measure, the less significant is the impact of short-term unexplained variations. Typically, savings should be more than 20% of the baseline energy use if they are to be separated from the noise in the baseline data.

Periodic inspections should be made of all equipment and operations in the facility after the improvement measure installation. These inspections will identify changes from baseline conditions or intended operations. Accounting for changes (other than those caused by the improvement measures) is the major challenge associated with Option C-particularly when savings are to be monitored for long periods.

Savings are calculated through analysis of whole facility utility meter or sub-meter data using techniques from simple comparison to regression analysis.

Option D – Calibrated Simulation

Option D involves the use of computer simulation software to predict energy use, most often in cases where baseline data does not exist. Such simulation models must be calibrated so that it predicts an energy use and demand pattern that reasonably matches actual utility consumption and demand data from either the base-year or a post-retrofit year.

Option D may be used to assess the performance of all improvement measures in a facility, akin to Option C. However, different from Option C, multiple runs of the simulation in Option D allow estimates of the savings attributable to each improvement measure within a multiple improvement measure project.

Option D may also be used to assess just the performance of individual systems within a facility, akin to Option A and B. In this case, the system's energy use must be isolated from that of the rest of the facility by appropriate meters.

Savings are calculated using energy use simulation models, calibrated with hourly or monthly utility billing data and/or end-use metering.

Selecting M&V Options for a Specific Project

The tailoring of your specific M&V option is based on the level of M&V precision required to obtain the desired accuracy level in the savings determination and is dependent on:

- The complexity of the Energy Conservation Measure
- The potential for changes in performance
- The measured savings value.

The challenge of the M&V plan is to balance three related elements:

- The cost of the M&V Plan
- Savings certainty
- The benefit of the particular conservation measure.

Savings can also be non-measured. If savings are non-measured, these savings are mutually agreed upon as achieved at substantial completion of the respective facility improvement measure and shall not be measured or monitored during the term of the performance contract. Non-measured energy savings are limited to no more than 10-15% of the overall project savings.

Recommended Performance Verification Methods

Johnson Controls' performance verification methods are designed to provide the facility's administration with the level of M&V necessary to protect them from an under-performing ECM, yet have a minimal impact on the project's financial success.

The selection of the M&V methods to be used is based on the criteria as detailed by IPMVP and Johnson Controls' experience with hundreds of successful performance contracts in the K-12, state, and local government sectors. Following is a table illustrating how the savings of the major energy conservation measures proposed for this project will be verified.

ECM Description	Measurement and Verification Method - Summary	Detail of M&V Methodology
Building Management System	**Option A:** Baseline consumption and demand determined through computer simulation and verified using utility data. Post retrofit consumption and demand taken from computer simulation calibrated with actual operating conditions from the building management system.	**Pre M&V**: Accepted engineering practices/building simulations will be used to calculate energy consumption baselines. Pre-installation measurements will be taken, including temperature and occupancy hours. All calculations will be calibrated. **Post M&V**: Various control points within the building management system will be trended and/or totalized. This data will be used to verify that all control strategies are in place and functioning as intended. If differences are found due to the fault of Johnson Controls, savings will be adjusted accordingly. **Energy Savings**: The savings generated by the building model will be used for calculations. If differences occur between the as-built condition and the original design, the as-built conditions will be input into the model and savings will be re-calculated.
Existing BAS Modification	**Option A:** Baseline consumption and demand determined through computer simulation and verified using utility data. Post retrofit consumption and demand taken from computer simulation calibrated with actual operating conditions from the building management system.	**Pre M&V**: Accepted engineering practices/building simulations will be used to calculate energy consumption baselines. Pre-installation measurements will be taken, including temperature and occupancy hours. All calculations will be calibrated. **Post M&V**: Various control points within the building management system will be trended and/or totalized. This data will be used to verify that all control strategies are in place and functioning as intended. If differences are found due to the fault of Johnson Controls, savings will be adjusted accordingly. **Energy Savings**: The savings generated by the building model will be used for calculations. If differences occur between the as-built condition and the original design, the as-built conditions will be input into the model and savings will be re-calculated.

ECM Description	Measurement and Verification Method - Summary	Detail of M&V Methodology
Computer Power Management	**Option A:** Baseline and post-retrofit computer operating hours in low power will be tracked through the software. This data along with power readings in different modes will be used to calculate the savings.	**Pre M&V:** The pre-retrofit computer operation hour in low power was determined by installing the software and testing a sample of computers. **Post M&V:** The post retrofit computer operation hour in low power will be tracked through the software. **Energy Savings:** Based on the difference in actual computer operating hours in low power, energy savings will be calculated.
Pipe Insulation/Blankets	**Option A:** Savings are from installing pipe insulation and insulation blankets.	**Pre M&V:** The surface temperature and the size of the space requiring insulation installation were measured during the field audit. **Post M&V:** Following installation, the size and the surface temperature of the space where the insulation is installed will be verified. **Energy Savings:** Savings are from a reduction in heat loss through uninsulated pipes and valves.
Building Envelope Improvements	**Non-Measured:** Existing envelope deficiencies will be documented based on collected field data to provide a baseline for evaluating the effectiveness of the air barrier system. Post-retrofit verifications of improvements will be documented.	**Pre M&V:** The magnitude of the air infiltration caused by cracks and joint deficiencies was determined by field surveys. **Post M&V:** The areas identified for weatherization improvements will be verified to be complete through visual inspections and as-built documentation. A yearly infrared survey of the buildings, when seasonally appropriate, will be conducted for each year the M&V agreement is in effect. **Energy Savings:** Energy savings will be based on the ASHRAE crack method calculations. If the commissioning process reveals any variation in the as-built conditions, then savings will be adjusted accordingly.
LED Lighting Replacement/Retrofits	**Option A:** One-time pre and post-retrofit kW measurement. Burn hours determined using logger data collected in the field.	**Pre M&V**: Lighting power readings will be taken on a sample of lighting fixtures. Lighting burn hours were measured through the use of light loggers. **Post M&V**: Lighting power readings will be taken on a sample of lighting fixtures. Measurements will occur once at the outset of the agreement. "Occupied" hours logged during the baseline data collection will be used as the post-installation burn hours. **Energy Savings**: Energy savings will be calculated using the actual measured wattage reduction and measured burn-hours.

ECM Description	Measurement and Verification Method - Summary	Detail of M&V Methodology
Plug Load Controls	**Option A**: Savings are from the reduced operating hours of the plugged in equipment.	**Pre M&V:** Quantity of plug load devices was determined in the field survey. kW test was performed on a couple of plug load equipment. **Post M&V:** Once the installation is complete, the plug load control devices will be inspected to ensure proper operation. During the guarantee term, actual operating conditions will be downloaded from a sample of plug load devices to verify equipment schedules are still in place and equipment is being turned off. **Energy Savings:** Savings are from the reduced operating hours of the plugged in equipment.
Premium Efficient Motors	**Non-Measured** The savings are from replacing standard efficient motors with premium efficient motors.	**Pre M&V**: Nameplate of the motors were used to determine the baseline kWh consumption. **Post M&V**: Once the installation is complete, the hot water pumps will be inspected to ensure proper operation. **Energy Savings**: The savings are from replacing standard efficient motors with premium efficient motors.
Programmable Thermostats Installation	**Non-Measured:** Savings are from resetting temperature setpoint during unoccupied period.	**Pre M&V**: Nameplate of the HVAC equipment serving the spaces where the programmable thermostats will be installed were collected to determine the baseline heating and cooling consumption **Post M&V**: Once the installation is complete, the programmable thermostats will be inspected to ensure proper operation. The temperature setpoint during the occupied and unoccupied periods will be verified to ensure they match what is proposed. **Energy Savings**: Savings are from resetting temperature setpoint during unoccupied period.
Street Lighting Retrofits	**Non-Measured:** Savings are from the lower kWh consumption of LED lighting fixtures.	**Pre M&V**: Quantity of the street lights fixtures that need to be replaced was provided in RFP document and verified with utility bills. The type of HPS lighting fixtures was verified with utility bills. **Post M&V**: Once the installation is complete, the final as-built will be used to ensure the expected lighting fixtures are installed. **Energy Savings**: Savings are from the lower kWh consumption of LED lighting fixtures.
Walk-In Cooler Controls	**Non-Measured:** Savings are from lower fan speed and reduced kWh consumption.	**Pre M&V**: The nameplate of walk-in cooler was documented to determine the baseline kWh consumption. **Post M&V**: Once the installation is complete, the programmable thermostats will be inspected to ensure proper operation. **Energy Savings**: Savings are from lower fan speed and reduced kWh consumption.

Measurement and Verification Services

Measurement and Verification Services will be provided in association with the guarantee provided by Johnson Controls. The guarantee will be in effect for each year that the City elects to participate in the Measurement and Verification Services. The cost of the measurement and verification services is included in the business case in the "Annual Services" column as outlined in the table below:

Year	Annual Amount ($/Yr)
1	$5,031
2	$5,283
3	$5,547
Total	**$15,860**

JCI will provide the M&V Services set forth below in connection with the Assured Performance Guarantee.

- During the Installation Period, a JCI Performance Engineer will track Measured Project Benefits. JCI will report the Measured Project Benefits achieved during the Installation Period, as well as any Non-Measured Project Benefits applicable to the Installation Period, to Customer within 60 days of the commencement of the Guarantee Term.
- Within 60 days of each anniversary of the commencement of the Guarantee Term, JCI will provide Customer with an annual report containing:
  - An executive overview of the project's performance and Project Benefits achieved to date;
  - A summary analysis of the Measured Project Benefits accounting; and
  - Depending on the M&V Option, a detailed analysis of the Measured Project Benefits calculations.
- During the Guarantee Term, a JCI Performance Engineer will monitor the on-going performance of the Improvement Measures, as specified in this Agreement, to determine whether anticipated Measured Project Benefits are being achieved. The Performance Engineer will visit Customer regularly and assist Customer on-site or remotely, with respect to the following activities:
  - review of information furnished by Customer from the facility management system to confirm that control strategies are in place and functioning;
  - Advise Customer's designated personnel of any performance deficiencies based on such information;
  - coordinate with Customer's designated personnel to address any performance deficiencies that affect the realization of Measured Project Benefits; and
  - Inform Customer of opportunities to further enhance project performance and of opportunities for the implementation of additional Improvement Measures.
  - Track utility bills on a quarterly basis to determine current utility rate costs and to identify any billing anomalies.
- For specified Improvement Measures, JCI will:
  - Conduct pre and post installation measurements required under this Agreement;
  - Confirm the building management system employs the control strategies and set points specified in this Agreement; and

- Analyze actual as-built information and adjust the Baseline and/or Measured Project Benefits to conform to actual installation conditions (e.g., final lighting benefits calculations will be determined from the as-built information to reflect the actual mix of retrofits encountered during installation).
- Confirm that the appropriate metering and data points required to track the variables associated with the applicable Improvement Measures' benefits calculation formulas are established; and
- Set up appropriate data capture systems (e.g., trend and totalization data on the facility management system) necessary to track and report Measured Project Benefits for the applicable Improvement Measure.

Section 6. Customer Support

Maintenance Impacts/ On-Going Service

New pieces of equipment that are installed as part of the ESIP project will be provided with the standard manufacturer warranty. Once installation of the equipment is complete, the remaining warranty period will be transferred to City of Cape May; any warranty issues will be handled directly with the equipment manufacturer rather than with Johnson Controls.

The installation of the recommended measures will reduce the amount of emergency maintenance required by the district through the installation of new equipment; however, preventative maintenance is still required in order to ensure the correct operation of the equipment for the expected lifetime. A service agreement cannot be included as part of this project per the New Jersey Local Finance Notice 2009-11. Once the scope is finalized and bids are received, Johnson Controls will assist the District in preparing bids for any preventative service agreement that is felt necessary for the new equipment. The service agreement will cover recommended maintenance per each equipment manufacturer. Training on the proper maintenance and operation of each piece of equipment has also been included as part of the ESIP project which will allow the District to complete the majority of maintenance and repair in-house in order to utilize District resources.

In order to ensure the District is fully capable of achieving the energy savings and fully utilizing the new HVAC and Building Automation Systems, Johnson Controls has included training for district employees.

Johnson Controls recommends the District go out to bid for the following 3rd party service contracts in order to achieve the continuous savings throughout the term of the Energy Savings Improvement Program:

- Building Automation Service Agreement including updates to subscription services
- Cogeneration Service Agreement to allow for emergency service and preventative maintenance on the new cogeneration systems. In order to receive the incentives for the cogeneration system, a 10-year maintenance contract must be in place. Johnson Controls has shown the savings paying for this maintenance agreement, but has not included the agreement within the ESIP.

Services for lighting upgrades and standard HVAC maintenance, such as filter changes, can be completed by District staff.

Design and Compliance Issues

City of Cape May will enlist Barnickel Engineering Corp. to oversee and complete all design engineering for the purposes of public bidding of the work as well as completing construction drawings.

As part of the Energy savings Plan development, Johnson Controls completed a thorough analysis of the building electrical and mechanical systems including light level readings throughout the spaces. The existing light levels are typically within 10-20% of current Illumination Engineering Society (IES) recommendations which is reasonable given the varying age of lamps throughout the District. The proposed lighting solution will continue to adhere to current IES and NJ Education Code guidelines for light levels which in many cases may increase the current light levels to the spaces. At this time, Johnson Controls did not observe any compliance issues in the development of this Energy Savings Plan.

Customer Risks

Asbestos reports will be obtained for all schools as part of Johnson Controls' safety policy. Based on the reports, asbestos materials will have to be abated prior to any work being performed. If any additional asbestos is found during the installation of the measures, Johnson Controls will stop work and notify the School District. Any work associated with testing or remediation of asbestos containing material will be the responsibility of City of Cape May. Based on the asbestos reports provided, we feel this is a low risk item.

The NJ SmartStart and Demand Response Energy Efficiency Credit outline the anticipated incentive amounts to City of Cape May. If the programs change or the incentive amounts differ, City of Cape May will be responsible to make up the difference in received incentives for the financing. The difference could result from over performance of energy conservation measures, other rebates/ incentives that may be available, restructuring the loan payment for years 1 and 2, or capital contributions by the City.

Section 7: Implementation Schedule

A preliminary installation schedule for the measures implemented as part of the ESP is included below to provide a reasonable expectation for the timeline of construction. Once final bids are received and financing of the project is complete, the installation will be finalized in much greater detail and reviewed with the team from City of Cape May to ensure agreement. A high level review of the next steps in the process is shown below as well as the estimated time frame to complete each step:

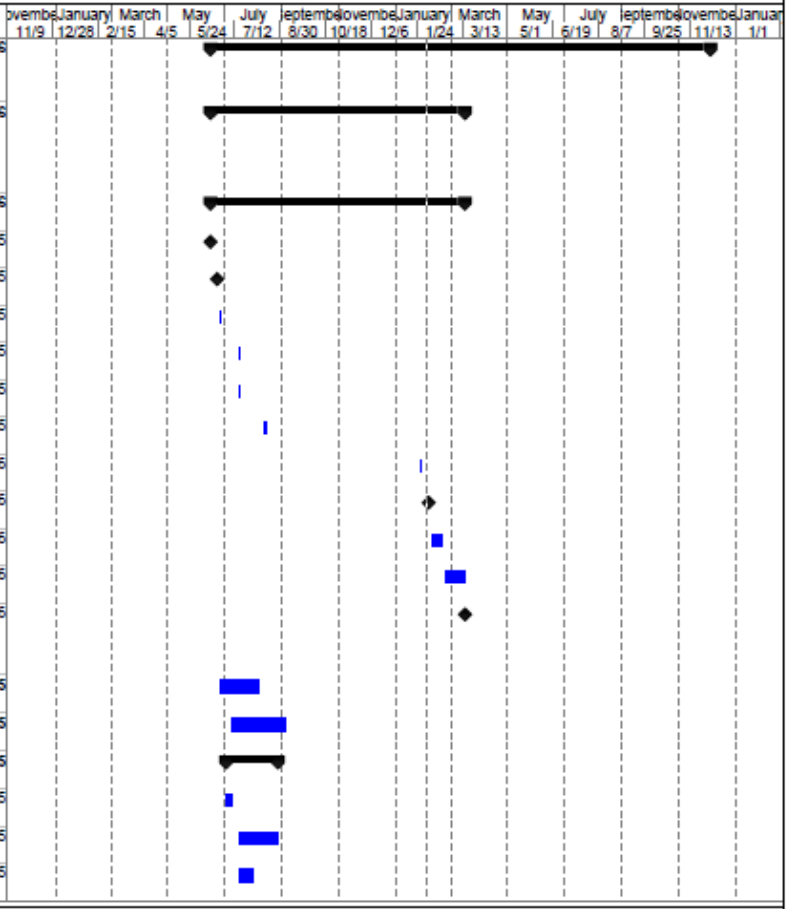
- Accept Energy Savings Plan Pending necessary Reviews – February 5, 2016
- Complete Third Party Engineering Review of Energy Savings Plan – 2 weeks
- Complete Board of Public Utilities Review of Energy Savings Plan – 14 days
- Approval resolution to contract with Johnson Controls: March 15, 2016
- Financing of project: 30 days
- Complete 100% design drawings and bid specifications – March – April 2016
- Public bidding for Sub-Contractors – April - May 2016
- Installation – June 2016

The project plan on the following page details the Installation Phase schedule.

Johnson Controls

City of Cape May City
ESP Development & Installation Schedule

ID	Task Name	Start	Finish
1	**City of Cape May City**	Tue 6/16/15	Mon 12/5/16
2	**Phase 1: Investment Grade Audit/ Energy Savings Plan**	Tue 6/16/15	Tue 3/15/16
3	Major Milestone	Tue 6/16/15	Tue 3/15/16
4	Municipality Vote to Select ESCO for ESP	Tue 6/16/15	Tue 6/16/15
5	Signed Investment Grade Audit Agreement	Mon 6/22/15	Mon 6/22/15
6	Customer Kick-off Workshop	Thu 6/25/15	Thu 6/25/15
7	ECM Verification Workshop	Thu 7/16/15	Thu 7/16/15
8	Baseline Utility Workshop	Thu 7/16/15	Thu 7/16/15
9	Measurement & Verification Workshop	Thu 8/13/15	Thu 8/13/15
10	Business Case Workshop	Wed 1/27/16	Wed 1/27/16
11	IGEA Results Presented to Municipality	Fri 2/5/16	Fri 2/5/16
12	3rd Party Engineering Review	Tue 2/9/16	Fri 2/19/16
13	Submit Energy Savings Plan to BPU for Rev	Thu 2/25/16	Tue 3/15/16
14	Municipality Approval & Acceptance of ESP & JCI Contract	Tue 3/15/16	Tue 3/15/16
15	**Detailed Site Visits**	Thu 6/25/15	Thu 8/6/15
16	**Scope Design & Construction Cost Estimati**	Thu 7/9/15	Thu 9/3/15
17	**Detailed Energy Analysis**	Thu 7/2/15	Thu 8/27/15
18	Update Utility Bills	Thu 7/2/15	Thu 7/9/15
19	Energy Saving Calculations	Thu 7/16/15	Thu 8/27/15
20	**Field Measurements**	Thu 7/16/15	Thu 7/30/15



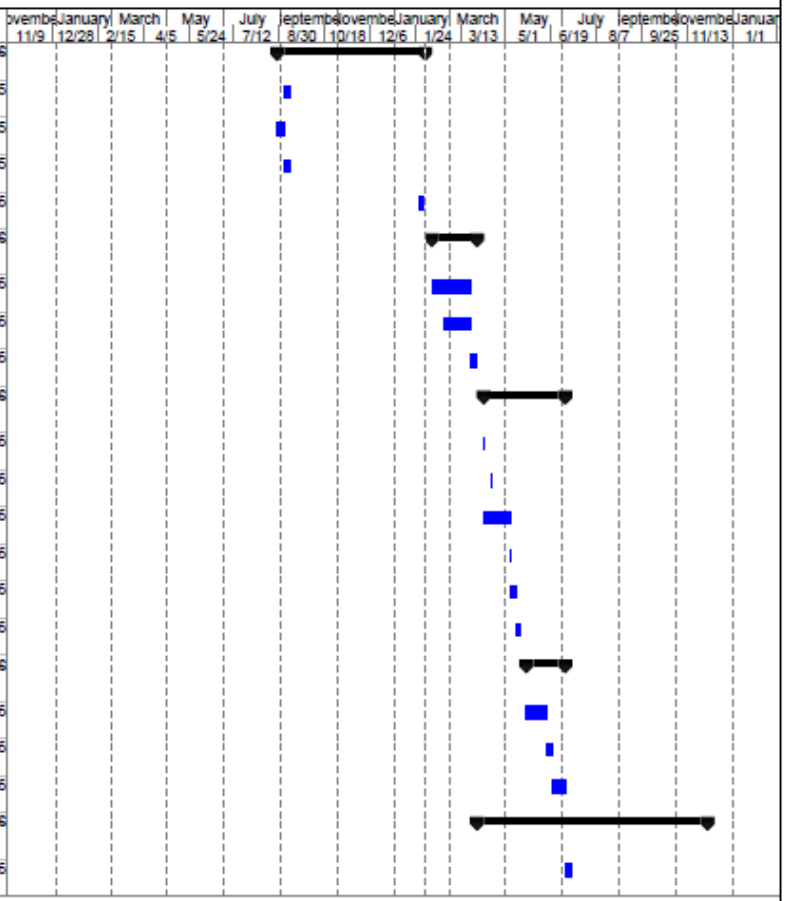
Page 1 Thu 2/4/16

Johnson Controls

Johnson Controls

City of Cape May City
ESP Development & Installation Schedule

ID	Task Name	Start	Finish
21	**ESP Report Development**	**Thu 8/27/15**	**Wed 2/3/16**
22	Detailed Scope Write-up	Thu 9/3/15	Thu 9/10/15
23	Detailed Energy Savings Analysis	Thu 8/27/15	Thu 9/3/15
24	Develop Preliminary Business Case	Thu 9/3/15	Thu 9/10/15
25	Energy Savings Plan Appendix	Thu 1/28/16	Wed 2/3/16
26	**Phase 2: Design**	**Thu 2/11/16**	**Wed 3/30/16**
27	Final Design Engineering	Thu 2/11/16	Wed 3/23/16
28	Bid Specification Development	Thu 2/25/16	Wed 3/23/16
29	Final Design Review Workshop	Thu 3/24/16	Wed 3/30/16
30	**Phase 3: Procurement**	**Thu 4/7/16**	**Mon 7/4/16**
31	Advertise Bids	Thu 4/7/16	Thu 4/7/16
32	Pre-Proposal Conference & Site Visits	Fri 4/15/16	Fri 4/15/16
33	Bid Duration for Subcontractors	Thu 4/7/16	Thu 5/5/16
34	Opening of Bids	Fri 5/6/16	Fri 5/6/16
35	Evaluation of Bids with Municipality	Fri 5/6/16	Fri 5/13/16
36	Subcontractor Selection	Fri 5/13/16	Mon 5/16/16
37	**Project Financing**	**Mon 5/23/16**	**Mon 7/4/16**
38	RFP For Financing	Mon 5/23/16	Mon 6/13/16
39	Evaluation of Financing RFPs	Mon 6/13/16	Mon 6/20/16
40	Close on Financing	Mon 6/20/16	Mon 7/4/16
41	**Phase 4: Construction**	**Thu 3/31/16**	**Mon 12/5/16**
42	Issue Subcontracts	Mon 7/4/16	Mon 7/11/16



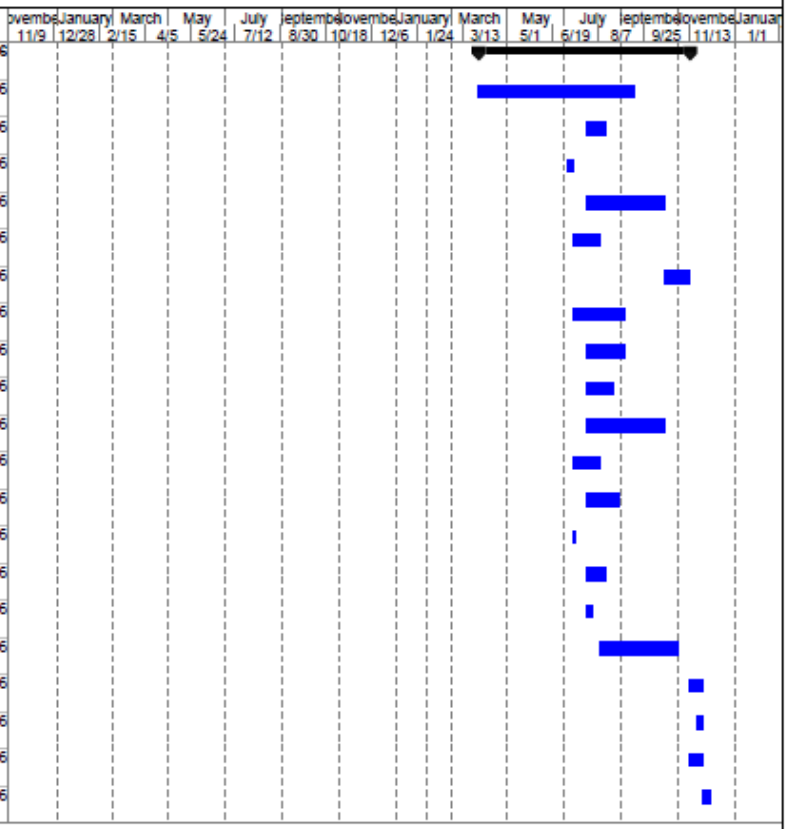
Page 2 Thu 2/4/16

Johnson Controls

Johnson Controls

City of Cape May City
ESP Development & Installation Schedule

ID	Task Name	Start	Finish
43	**Pre- Construction Activities**	**Thu 3/31/16**	**Mon 11/14/16**
44	Pay for Performance/ Rebate Support	Thu 3/31/16	Wed 9/14/16
45	Planning / Engineering	Mon 7/25/16	Mon 8/15/16
46	Shop Drawing Approval	Mon 7/4/16	Mon 7/11/16
47	Building Automation Systems	Mon 7/25/16	Mon 10/17/16
48	PC Power Management	Mon 7/11/16	Tue 8/9/16
49	Demand Response	Mon 10/17/16	Mon 11/14/16
50	Emergency Generator Installation	Mon 7/11/16	Mon 9/5/16
51	Pipe Insulation and Blankets	Mon 7/25/16	Mon 9/5/16
52	Building Envelope	Mon 7/25/16	Mon 8/22/16
53	LED Lighting Retrofit	Mon 7/25/16	Mon 10/17/16
54	Plug Load Controls	Mon 7/11/16	Mon 8/8/16
55	Premium Efficiency Motors	Mon 7/25/16	Mon 8/29/16
56	Programmable Thermostat Installation	Mon 7/11/16	Tue 7/12/16
57	Street Lighting Retrofit	Mon 7/25/16	Mon 8/15/16
58	Walk-In Cooler Box Controls	Mon 7/25/16	Mon 8/1/16
59	Vehicle Charging Station	Mon 8/8/16	Mon 10/31/16
60	Punch List Items	Mon 11/14/16	Mon 11/28/16
61	Equipment Initial Training	Mon 11/21/16	Mon 11/28/16
62	System Commissioning	Mon 11/14/16	Mon 11/28/16
63	Project Close Out	Mon 11/28/16	Mon 12/5/16



Page 3 Thu 2/4/16

Johnson Controls

Section 8. Sample Energy Performance Contract

A sample Energy Performance Contract has been provided electronically to the City for review.

Appendix 1. Energy Conservation Measures Investigated But Not Recommended at This Time

ECM – Demand Control Ventilation

ECM Summary

The Demand Control Ventilation strategy allows HVAC equipment to monitor space CO2 to regulate the amount of ventilation air admitted into the space. The CO2 sensors continually monitor the air in the conditioned space to track occupancy and optimally operate the HVAC equipment to meet the ventilation rates required. The HVAC equipment automatically increases ventilation when CO2 concentrations in a zone rise above the setpoint and decrease ventilation when CO2 concentration drops below the setpoint.

Facilities Recommended for this Measure

- Elementary School

Existing System at Elementary School

The building is managed by Tridium JACE and Honeywell LON Control system.

Scope of Work

- Install low leakage motorized dampers and attach them to the grills of existing three (3) RTUs serving gym and auditorium spaces.
- Provide and install the following new control points to the existing digital control system.

Control Points:

- Modulating Damper actuators (quantity = 3)
- Return Air Duct Mounted Carbon Dioxide Sensor

Control Strategies

- Economizer Control
- Demand Control Ventilation

This ECM was not included in the baseline financial analysis because of a high payback.

ECM – Boiler Replacement

ECM Summary

JCI recommends replacing existing one (1) 427MBH Input gas hot water heating boiler with one (1) new Lochinvar KBN301 (300MBH Input, 93% Efficiency) condensing gas fired heating hot water boiler.

Facilities Recommended for this Measure

- Library

Scope of Work

- Demolition and Removal Work
  - Disconnect, remove and properly dispose of existing one (1) Weil McLain 427MBH Gas HW boiler.
  - Disconnect, remove and properly dispose of HW piping to nearest isolation valves or as required for new installation.
  - Disconnect, remove and properly dispose of gas flue as required and cap off chimney opening.
  - Disconnect, remove and properly dispose of all other materials or debris related to this project.

- New Installation Work
  - Provide and install one (1) new Westinghouse Model WBRENG301 96% Efficient (290,000BTU output, 10:1 turndown) high efficiency gas fired condensing HW Boiler.
  - The condensing boiler to have an output capacity of 290 MBH.
  - Modulating burner with a turndown ratio of 10:1 or higher.
  - New boiler includes BACnet Boiler Management System Module.
  - Provide U.L. labeled burner(s).
  - New boiler shall be located in the existing location with hot water piping and all other piping extended as required for connection. New piping will be installed from the new boiler and tied into the existing supply and return piping.
  - Install boiler based on manufacturer's installation procedures.
  - Provide and install new PVC flue venting as required.
  - Provide Valve Tags and ID Chart, Labeling and Directional Arrows.
  - Start-up, checkout and verify all modes (stages) of operation including measurement and verification of "part load" and "full load" efficiencies.
  - Reuse existing piping, pipe fittings, pipe hangers, isolation valves, strainers, check valves, thermal wells, and pressure sensor wells where feasible and equipment serviceable.
  - Asbestos removal is responsibility of others.

This ECM was not included in the baseline financial analysis because of a high payback.

ECM – Domestic Hot Water Heater Replacement

ECM Summary

JCI recommends replacing one (1) 199,000BTU, 78 Gallon Gas DHW heater with new Westinghouse 199MBH, 80 Gallon, 96% Efficient Direct Vent Water Heater.

Facilities Recommended for this Measure

- Elementary School

Scope of Work

Install one (1) Westinghouse Model WCGM80NG199 (199,000BTU, 80 Gallon) 96% high efficiency condensing commercial gas fired hot water heater.

- Includes new hot and cold water shut off valves, piping connections, insulating of new pipe and fittings, reconnecting of gas line, electrical, new relief drain piping to floor and installation of new PVC intake and exhaust vent piping.
- New PVC vent piping will be installed out through existing combustion air vent. Remaining opening of wall combustion air vent will be permanently sealed off.
- All existing main piping, circulating pump, tempering valve, check vale, etc. to remain.

This ECM was not included in the baseline financial analysis because of a high payback.

ECM – Heat Pump Upgrade

ECM Summary

JCI recommends replacing the existing split AC units/condensers with high efficiency units to save electric consumption and improve occupant comfort as well.

Facilities Recommended for this Measure

- City Hall
- Elementary School
- Public Works

Scope of Work

City Hall

The replacement of (5) existing split systems will consist of replacing the following units:

- Sub Ground Level – Elevator Room: Replace one (1) existing 9,000 Btu Sanyo mini split heat pump system with new high efficiency Johnson Controls R-410A model DHMF09CSM42Q1 indoor unit and model DHMF09NWM42Q1 outdoor unit.
- First Floor Level – Tax Office: Replace two (2) existing 12,000 Btu Sanyo mini split heat

pump systems with (2) new high efficiency Johnson Controls R-410A model DHMF12NWM42Q1 indoor units and model DHMF12CSM42Q1 outdoor units.

- First Floor Level – Treasurer Office: Replace one (1) 1.5 Ton / 18,000 Btu PAYNE DX split type heat pump system with (1) new high efficiency Johnson Controls model YHJD18S41S7 heat pump unit and one (1) model AHE24B3XH21, 2 ton horizontal indoor fan coil unit with 3kW back up electric heat.
- First Floor Level – Licensing / F3 Office: Replace one (1) 3.5 Ton, 42,000Btu PAYNE DX split type heat pump system with (1) new high efficiency Johnson Controls model YHJD42S41S4 heat pump unit and (1) model AHE48D3XH21, 4 ton horizontal indoor fan coil unit with 5kW back up electric heat.

- Reclaim the refrigerant for the existing five (5) split type R-22 heat pump / cooling systems, disconnect all piping, ducting and wiring and remove. All equipment and materials to be disposed of properly at approved disposal site.
- New composite outside unit pads will be set over existing concrete to elevate new units.
- Install new flush kits for five (5) existing refrigerant lines which will be used for the new systems. Refrigerant lines will include the use of Vulcan LOKRING (or equal) compression fittings and will include the use of nitrogen to purge the lines for any brazing that needs to be done. All lines will be pressure tested and approved prior to charging systems with refrigerant.
- Furnish & Install new fused outdoor disconnects for outdoor units, reconnect existing electric to new indoor units.
- Furnish & Install all new insulated condensate piping to reconnect existing drain lines to new units. New auxiliary drain pans will be installed for the two (2) new ducted split heat pump systems.
- Furnish & Install new custom fabricated insulated sheet metal ducting to reconnect existing duct systems to two (2) new ducted split heat pump systems.
- Furnish & Install two (2) Honeywell F-100 high efficiency media air cleaners for new ducted split heat pump systems.

Elementary School

Replace twenty (20) 3 ton and one (1) 1.5 Ton, R-22 roof mounted condensers with new 14SEER, R-410A condensers and new Unit Ventilators with DX cooling coils and hot water heating coils.

New installation to include following equipment:

- Twenty (20) Johnson Controls model YCJF36S41S1 (3 ton, R-410A, 14SEER, 208/230-1-60) condenser units set on roof with new approved roof pads.
- Twenty (20) Johnson Controls / Magic Aire (3 ton, R-410A) unit ventilators with DX cooling coil and hot water heating coil.
- One (1) Johnson Controls model YCJF18S41S1 (1.5 ton, R-410A, 14SEER, 208/230-1-60) condenser unit set on roof with new approved roof pad.
- One (1) Johnson Controls / Magic Aire (1.5 ton, R-410A) unit ventilator with DX cooling coil and hot water heating coil.

New Unit Ventilators to include the following:

- 115/60/1Ph main power connection
- 21 7/8" deep cabinets with linear bar type discharge grilles and sixteen gauge exterior panels in

choice of standard colors
- ECM high efficiency fan motors
- DX cooling coil (4 row)
- Hot water heating coil (1 row)
- Throwaway 2" pleated filters. Insulated fresh / return air dampers
- Return air front / Outside air with rear opening, full adapter back
- Standard 1" end panels
- Factory authorized check, test and start up, owner instruction provided

New installation to consist of the following:

- Existing refrigerant lines will be re-used and include new flush kits to flush out lines before connecting to new indoor and outdoor units.
- Reconnect existing electrical to new equipment including new fused disconnects for condenser units.
- Reconnect existing hot water piping to new hot water coils with new shutoff valves as required.
- Reconnect existing refrigerant piping to new condensers and unit ventilators; all piping will be nitrogen purged during all brazing and tested for leaks prior to connecting to new equipment.
- Reconnect drain lines to new unit ventilators.
- Allowance is included for general carpentry to adapt new unit ventilators to shelving in each classroom.

Public Works

Replace the existing Carrier 2.5 ton packaged gas heating and electric cooling unit on ground with new Johnson Controls model PCG4A300752X1 (2.5 ton, 14SEER, 75MBH, 208/230-1-60) high efficiency packaged gas / electric unit.

New installation to include the following:

- New custom fabricated internally lined sheet metal ducting to connect new outdoor unit to existing supply and return ducting. All new ducting joints will be mastic sealed and coated with silver duct coating.
- Concrete lintels will be installed to set new unit on.
- Reconnect gas piping to new unit.
- Furnish & Install new fused disconnect for packaged unit.
- Furnish & Install new Honeywell F-100 16X25 1400CFM high efficiency media air cleaner to replace existing filter grille mounted on return duct located inside on return duct. (Note: this area is a wood shop and creates excessive dust)

This ECM was not included in the baseline financial analysis because of a high payback.

ECM - Pipe Insulation and Blankets

ECM Summary

Non-insulated pipelines and associated valves and fittings carrying thermal fluids because heat loss where not intended and result in excess fuel consumption, as well as discomfort in occupied areas. Valves and fittings without insulation were observed throughout the buildings and installation of new insulation is recommended. Installation of the proper amount of insulation will not only conserve energy but will also improve safety by reducing the chance for burns on hot piping or slipping due to condensate on a pipe.

Facilities Recommended for this Measure

- Library

Scope of Work

Piping insulation thickness will be added based on the following table:

Iron Pipe Size	Copper Tubing Size	Insulation Thickness
½" -6"	5/8" – 4 1/8"	½"
½" – 24"	5/8"- 6 1/8"	1"
½" – 24"	5/8" – 6 1/8"	1 ½"
½" – 24"	1 1/8" – 6 1/8"	2"
1" – 24"	1 3/8" – 6 1/8"	2 ½"
1" – 24"	1 3/8" – 6 1/8"	3"
1 ½" – 24"	Na	3 ½"
3" - 24"	Na	4"
3" - 24"	Na	4 ½"
3" – 20"	na	5"

- Insulation type:
  - Micro-Lok HP Fiber Glass, ASTM C547, Type I, k value of 0.23 at 75 degrees F.
  - Jacket: The all-service (ASJ) vapor-retarder jacket includes a longitudinal, self-sealing closure lap. The jackect system is adhered to each fiber glass section using a specially formulated adhesive to ensure jacket securement.
- A detailed line-by-line scope of work has been included in the Appendix with the associated energy savings calculations for the insulation.
- Pricing assumes local state prevailing wage rates.
- Pricing includes sales tax
- Pricing includes bonding.
- Pricing includes labor warranty of one year for workmanship

All insulation will be performed in the boiler room of the library:

Length (ft)	Pipe Diameter (in)	Insulation Thickness
12	1.5	1.5
81	1	1.5
3	0.75	1.5

Johnson Controls

Length (ft)	Pipe Diameter (in)	Insulation Thickness
36	0.5	1
9	1.25	1.5
12	0.5	0.5
3	2	1.5
27	0.625	0.5

The pipe insulation in the library was not included in the baseline financial analysis because of a high payback.

ECM – Building Envelope Improvements

ECM Summary

Infiltration drives energy costs higher by allowing unconditioned outside air to enter the building, thus adding to the building load and causing additional unnecessary heating and cooling loads. Each building within the scope was surveyed in order to identify potential improvements for outside air infiltration reduction. The main observations are listed below:

- Door weather strip
  - Existing weather strip on single and double doors was found to be missing or in poor condition on the majority of the exterior doors evaluated in the city. Air penetrations could be visibly seen and felt along the doors. The penetrations were also verified using smoke pencil testing. The installation of new polyethylene clad urethane foam weather strip is recommended to seal the edges of exterior doors; including strike side, hinge side and header. Brush seals are also recommended to be installed to seal exterior door bases and double door center astragals. Doors where existing weather strip and/or sweeps were found to be in good condition are excluded from this proposal.
- Overhead door seals
  - The existing overhead door seals were found to be in poor condition. Air penetrations were found along the headers and sides of all of the overhead doors; further air penetrations were also found along the base of select overhead doors as well. The installation of oversized polypropylene brushes are recommended along overhead door side and head edges. Where air penetrations were also observed along the door base, the installation of EPDM synthetic rubber bulbs is also recommended.
- Sealing building penetrations
  - Numerous building penetrations were also found at the Elementary School. Building penetrations were found along rooftop unsealed fans and along the roof access hatch. Existing seals in these locations were found to be either missing or deteriorated resulting in air penetrations. These penetrations could be visibly seen and/or felt. Verification via smoke pencil testing was also performed as well. It is recommended to seal these penetrations with either elastomeric polyurethane sealant or polyurethane foam sealant. Areas that can be sealed from the buildings interior are typically recommended to be sealed with the polyurethane foam sealant; while areas that require seals from the exterior, where the sealant will be exposed to weather, are typically recommended to be sealed with elastomeric polyurethane sealant.
- Sealing roof/wall connections

- The roof/wall connections were also found to be another prevalent source of air penetrations. A portion of this connection was found to be unsealed in the Elementary School. It is recommended to seal these penetrations with polyurethane foam sealant. Areas that have a wide joint to fill at this connection may also require the use of extruded closed-cell polyethylene foam backer rod or extruded polystyrene rigid foam insulation to properly seal the void.

Facilities Recommended for this Measure

- Elementary School
- Nature Center 2
- Public Works

Scope of Work

A building envelope audit was performed for the entire City of Cape May. The results of the audit were the identification of several areas of envelope deficiency. The deficient areas were tabulated and their savings potential calculated.

Location	Door Weather Strip (Double)	Door Weather Strip (Single)	Door Weather Strip (Garage)	Roof Hatch Penetration	Duct to Curb (LnFt)	Roof Wall (LnFt)
Elementary School	4	28		1	128	130
Nature Center 2		5				
Public Works	1	9	12			
Total	5	42	12	1	128	130

The building envelope improvement in these buildings was not included in the baseline financial analysis because of a high payback.

ECM – LED Lighting Replacement/Retrofits

ECM Summary

Since the advent of energy efficient T8 lighting (with electronic ballast), there have been several generations of improvements to interior lighting. Today, the LED lamps offers an opportunity to lower energy consumption in areas lit by the standard 32 or 28-watt T8 and 40-watt T12.

The standardization to LED lighting in all areas of the City will allow for reduced lighting maintenance throughout the project life and will provide consistent light levels throughout the City.

Facilities Recommended for this Measure

- Franklin St School
- Public Works

Interior Lighting

- Franklin St School

Floor	Room	Existing Lighting Fixtures	Existing Qty.	Proposed Lighting Fixtures	Proposed Qty.
1st floor	Gym	2x4, 4 Lamp, F32 T8 Prismatic	3	2x4 Relight Kit	3
1st floor	Gym	8ft, F59 T8 2 Lamp Strip	8	8ft LED Strip (Lowbay)	8
1st floor	Gym	CFL 23w	2	Lamps: 1 9.5A19/LED	2
Total			13		13

- Public Works

Floor	Room	Existing Lighting Fixtures	Existing Qty.	Proposed Lighting Fixtures	Proposed Qty.
1st floor	Bay	2x4, 2 Lamp, F32 T8 Prismatic	1	2x4 Relight Kit	1
1st floor	Bay	4ft, 2 Lamp, F32 T8 Wrap	1	4ft LED Wrap	1
1st floor	Carpenter	4ft, 2 Lamp, F32 T8 Wrap	3	4ft LED Wrap	3
1st floor	Constructio n	2x4, 4 Lamp, F32 T8 Prismatic	4	2x4 Relight Kit	4
1st floor	Equipment storage	4ft, 2 Lamp, F32 T8 Wrap	6	4ft LED Wrap	6
1st floor	Equipment storage	8ft, F96 T12HO 2 Lamp Strip	3	8ft LED Strip (Lowbay)	3
1st floor	Equipment storage	250w Metal Halide	5	LED 250W Metal Halide Shoebox Replacement	5
1st floor	Equipment storage	400w Metal Halide	3	LED 250W Metal Halide Shoebox Replacement	3
1st floor	Lifeguard storage	1000w Metal Halide	1	EHO 533W	1
1st floor	Lunch room	8ft, F59 T8 2 Lamp Strip	4	8ft LED Strip (Lowbay)	4
1st floor	Main area	2x4, 2 Lamp, F32 T8 Prismatic	11	2x4 Relight Kit	11
1st floor	Main area	4ft, 2 Lamp, F32 T8 Wrap	11	4ft LED Wrap	11
1st floor	Main area	4ft, 2 Lamp, F34 T12 Wrap	2	4ft LED Wrap	2
1st floor	Main area	8ft, F96 T12 2 Lamp Strip	5	8ft LED Strip (Lowbay)	5
1st floor	Mechanic	2x4, 2 Lamp, F32 T8 Prismatic	1	2x4 Relight Kit	1
1st floor	Mechanic	4ft, 2 Lamp, F32 T8 Wrap	1	4ft LED Wrap	1
1st floor	Mechanic	8ft, F96 T12 2 Lamp Strip	8	8ft LED Strip (Lowbay)	8
1st floor	Wash bay	1000w Metal Halide Wall Mount	4	EHO 533W	4
2nd floor	Main area	2x4, 4 Lamp, F32 T8 Prismatic	1	2x4 Relight Kit	1

Floor	Room	Existing Lighting Fixtures	Existing Qty.	Proposed Lighting Fixtures	Proposed Qty.
2nd floor	Main area	4ft, 2 Lamp, F32 T8 Wrap	5	4ft LED Wrap	5
2nd floor	Main area	8ft, F59 T8 2 Lamp Strip	4	8ft LED Strip (Lowbay)	4
1st floor	Bay	4ft, F32 T8 2 Lamp Strip	1	Lamps: 2 LED T8 4' Tube	2
1st floor	Bay	8ft, F32 T8 4 Lamp Strip	3	Lamps: 4 LED T8 4' Tube	12
1st floor	Carpenter	4ft, F32 T8 2 Lamp Strip	7	Lamps: 2 LED T8 4' Tube	14
1st floor	Equipment storage	4ft, F32 T8 2 Lamp Strip	1	Lamps: 2 LED T8 4' Tube	2
1st floor	Equipment storage	8ft, F32 T8 4 Lamp Strip	13	Lamps: 4 LED T8 4' Tube	52
1st floor	Lunch room	4ft, F32 T8 2 Lamp Strip	4	Lamps: 2 LED T8 4' Tube	8
1st floor	Mechanic	8ft, F32 T8 4 Lamp Strip	7	Lamps: 4 LED T8 4' Tube	28
1st floor	Mechanic	CFL 13w	1	Lamps: 1 9.5A19/LED	1
1st floor	Wash bay	8ft, F32 T8 4 Lamp Strip	2	Lamps: 4 LED T8 4' Tube	8
2nd floor	Main area	60w A19 Incandescent	1	Lamps: 1 9.5A19/LED	1
2nd floor	Main area	CFL 32W	2	Lamps: 1 9.5A19/LED	2
Total			126		214

The LED lighting replacement/retrofit in these buildings was not included in the baseline financial analysis because of a high payback.

ECM – Premium Efficient Motors

ECM Summary

The water treatment plant is served by three (3) 200 HP Robicon motors and some small motors less than 5 HP. The Robicon motors were installed in 1996 and was Premium Efficiency motors. However, the efficiency decreases as ages. The small motors are standard efficiency motors and JCI recommends replacing them with Premium Efficiency motors.

Facilities Recommended for this Measure

- Water Works

Scope of Work

Replace three (3) 200HP Motors with Premium Efficiency Motors. These new premium efficiency motors are replacing existing motors that are identical premium efficiency motors.

New installation to include the following:

- Removal of three (3) original 200HP motors
- Furnish & Install three (3) U.S. Motor 'Custom Made' 200HP vertical solid shaft premium efficiency motors that operate the reverse osmosis pumps. New motors are equipped with upgraded variable frequency drive features that include a shaft current brush and insulated upper thrust bearing carrier.

Exclusions:

- Any shaft replacements
- Any electrical repairs or modifications
- Any pump repairs
- Any site restoration i.e.; painting
- Any other work than noted above

Replace four (4) 1.5HP Motors with Premium Efficiency Motors

New installation to include the following:

- Removal of four (4) original 1.5HP motors
- Furnish & Install four (4) New 1.5HP Premium Efficiency Inverter Duty Motors

Exclusions:

- Excludes any work or costs related to detecting possibility of asbestos found during construction; testing and abatement.

This ECM was not included in the baseline financial analysis because of a high payback.

ECM - Programmable Thermostats Installation

ECM Summary

JCI recommends installing programmable thermostats which are able to reset temperature setpoint during unoccupied period. By doing so, the electric cooling and naturel gas heating consumption will be reduced.

Facilities Recommended for this Measure

- City Hall
- Welcome/Transportation Center

Scope of Work

City Hall
Install sixteen (16) programmable thermostats to control sixteen (16) split AC units.

Welcome/Transportation Center

Install three (3) Programmable Thermostats to control (3) AC units.

This ECM is in lieu of ECM 40 however this ECM does not allow the building personnel view the occupancy schedules and temperature setpoint on a building automation system. Therefore this ECM was not included in the baseline financial analysis.

ECM – Garage Bay Doors Replacement

ECM Summary

The Public Works building was evaluated for overhead door replacements. Replacing garage doors is a capital expense that will improve a building's envelope. Improvements to the thermal efficiencies of garage doors will aid in slowing the conduction of heat through walls. Additional savings will be achieved through the installation of new brushes and bulbs, by reducing air gaps around garage door perimeters.

Facilities Recommended for this Measure

- Public Works

Scope of Work

Remove and replace six (6) existing overhead garage doors

- South Wall
  - Install one (1) 9'X7' Thermacore 592 Insulated Steel Overhead Door – Solid
  - Install one (1) 12'X12' Thermacore 592 Insulated Steel Overhead Door – 3'24"X7" Lite
- East Wall
  - Install two (2) 12'X12' Thermacore 592 Insulated Steel Overhead Door – 2 Full ½" Tempered Insulated Glass Vision Sections
- North Wall
  - Install one (1) 10'X10' Thermacore 592 Insulated Steel Overhead Door – Solid
  - Install one (1) 12'X12' Thermacore 592 Insulated Steel Overhead Door – 3'24"X7" Lite

Inclusions

- Pricing assumes local state prevailing wage rates.
- Pricing includes sales tax.
- Pricing includes bonding.
- Pricing includes labor warranty of one year for workmanship.

- Savings calculations are based on provided utility rates in energy study.

Exclusions

- Pricing excludes concealed conditions, asbestos or lead paint abatement.
  - Given the age of the buildings, asbestos and / or lead paint should be anticipated in some or all of the locations.
  - Testing and / or abatement should be assumed a necessary expense associated with the window replacements.
- Pricing excludes tax on labor, state/county/municipal fees/permits.
- Proposal pricing assumes the base building envelope proposal will be awarded and constructed at the same time as the garage door replacement proposal.

This ECM was not included in the baseline financial analysis because of a high payback.

ECM – RTU SEER Upgrade

ECM Summary

The gym and auditorium spaces are served by three (3) 10 ton AAON units with DX cooling and hot water heating coils. By replacing the existing AAON units with high SEER RTUs, the electric cooling savings will be achieved.

Facilities Recommended for this Measure

- Elementary School

Scope of Work

Replace three (3) AAON 10 Ton split DX air handlers and hot water heating coils with three (3) new Johnson Control DX fan coil units, HW heating coils and new mixing boxes.

Demolition and Removal Work

- Reclaim refrigerant from systems, disconnect power, sheet metal ducting, refrigerant lines, condensate piping and remove from building.
- Properly dispose of all other materials or debris related to this project.

New Installation Work

- Furnish and Install three (3) Johnson Control Model J10YCC00A2GLC4 (10 ton, 11.9SEER, R-410A, 203/230/3) Series 20 Condenser Units set on new roof blocking.
  Units to include: HACR Circuit Breaker / Disconnect, Coil Guard, Low Ambient Control, Simplicity SE Controller with Gateway to BACnet MS/TP (Programmable to Modbus or N2)
- Furnish and Install three (3) Johnson Control Model AHI-40 (10 Ton, R-410A DX Coil, 4,000CFM, 208/230/3) Horizontal Belt Drive DX Fan Coil Units suspended from ceiling steel bar joists.

Units to include: Mixing Box with Linkage, Spring External Vibration Isolators, Hot Water Heating Coil, 30% (MERV 8) 2" Pleated Disposable Filters, Galvanized Drain Pan, Disconnect Switch, Starter, Premium Efficiency Motor with one spare belt, Condensate Float Switch.

- For the gym area, Furnish and Install two (2) all new custom fabricated sheet metal ducting systems installed along ceiling of gym using four (4) Titus High Velocity Drum Type Supply Diffusers for each 10 ton unit. New custom return ducting will connect from air handle and installed down inside corner of gym with two (2) steel low intake return air grilles to improve comfort levels of gymnasium.
- For the auditorium area, Furnish and Install new custom fabricated internally lined sheet metal supply ducting to connect existing main supply air duct. Fan coil unit is located on mezzanine and pulls air from auditorium through transfer grilles in doors and back to the air handler unit. New return ducting will consist of new ducting to connect outside air to new mixing box. Outside air ducting will be externally insulated from wall to air handler unit.
- Reconnect existing power wiring to new condensers and fan coil units.
- Furnish and Install new condensate drain lines
- Furnish and Install new insulated copper refrigerant piping from each fan coil unit to each new condenser unit. Line sets to include liquid line driers.
- Furnish and Install new hot water pipe and fittings to connect existing hot water lines to new fan coil unit hot water coils.
- Startup test and air balance systems.

This ECM was not included in the baseline financial analysis because of a high payback.

ECM – Upgrade to Energy Star Kitchen Equipment

ECM Summary

The kitchen in Fire House and Franklin St School uses non Energy Star certified refrigerators and dishwashers. By upgrading to Energy Star certified refrigerators and dishwashers, about 9-10% energy consumption will be saved.

Facilities Recommended for this Measure

- Fire House
- Franklin St School

Scope of Work

- Remove the existing two (2) refrigerators, one (1) dishwasher in Fire House and one (1) refrigerator in Franklin St School
- Install Energy Star certified refrigerators and dishwasher.

This ECM was not included in the baseline financial analysis because the City had the upgrade covered under other maintenance projects.

ECM – Academy of Energy Education

In combination with a Johnson Controls performance contract, the Academy of Energy Education program teaches individuals to modify their behavior which results in greater energy efficiency. The Academy is a proven way to deliver curriculum-enhancing programs that combine the study of exploratory science, energy and math with real world experience offering young students the opportunity to have fun while learning about energy in a wide variety of curriculum-enhancing packages. The Academy offers a comprehensive approach to energy education with a focus on sustainability.

In partnership with National Energy Foundation (NEF), a non-profit organization dedicated to the development, dissemination, and implementation of supplementary educational materials, programs, and courses, Johnson Controls developed the Academy of Energy Education. It is designed to educate and involve students in energy conservation at school and home.

The Academy training and materials go hand in hand to help educators efficiently use Academy materials and learn how they correlate with state/national standards. In addition to curriculum programs and training, Academy customers receive access to the Academy of Energy website. The website offers K12 curriculum, K12 and community awareness activities, training resources, blogs, competitions, and educational libraries.

Solar Energy in Action, grades K-12, this interdisciplinary program includes learning activities for the elementary and secondary levels plus a supply kit that students may use to investigate solar energy and its uses. Additional supplemental instructional materials include the Renewable Energy Sources poster and accompanying Energist, the Electrical Generation poster and Energist, the Energy Basics CD, and the Eye Chart poster. This program can stand alone or serve as an excellent complement to Energy Fun, Energy Fundamentals, Energy Action Technology, or Energy Action Patrol.

Wind Energy in Action, grades 4-12, this interdisciplinary program includes learning activities for the elementary and secondary levels plus a kit which enables the teacher and students in cooperative learning groups to investigate the complexities of electrical generation while building and testing model wind turbines for their classroom. This program can stand alone or serve as an excellent complement to Energy Fundamentals, Energy Action Technology and Energy Action Patrol.

Externship, for college undergraduates, provides students with up to 100 hours of career-related work experience at a Johnson Controls office while obtaining three semester hours of college credit. This experience will offer students an on-site, hands-on opportunity to think about a career in the energy field. Whether a student has interest in technology, engineering, sales, administration, etc. this course will assist with workforce development decisions for the student and Johnson Controls.

Academy Geothermal: grades 4-12, is an interdisciplinary program that includes activities for the elementary and secondary levels. A supply kit is provided that includes materials to conduct the investigations that explore geothermal energy and its applications. Additional resources include the 23" X 35"Geothermal Energy Poster, an instructional poster that teachers about geothermal energy: history, technologies, residential and commercial applications, careers and the future of geothermal energy. Students will be guided through a series of activities. For example, the activity titled: "Inside Our Earth", describes the layers of the earth and some of the source for heat when using geothermal energy.

Academy Renewables: grades K-12, is an interdisciplinary collection of all three energy sources: solar, wind and geothermal. This comprehensive green energy collection provides curriculum and supplies to teach students all three of these important energy sources. The Academy Renewable Kit includes the complete Academy Solar, Academy Wind and Academy Geothermal Kits, and all of the activity supplies that support the inquiry based activities.

Academy Water: K-12, is a family of interdisciplinary curriculum materials designed to guide teachers through water basics, elementary water activities and then secondary activities that also include an exploration of technologies associated with water. The hydrologic cycle is explored as well as electric generation with water. Some of the activities are: Water in Your Own Backyard, Waterproof Savings, Building Water Turbines.

This ECM was not included in the baseline financial analysis because of no savings claimed.

ECM – RO Plant Measures

ECM Summary

JCI interviewed the operating personnel of the RO water plant and investigated a couple of opportunities of improving the operation in the RO Plant.

Facilities Recommended for this Measure

- Water Works

Scope of Work

Below lists the options of improving the operation in the plant:

- Install an Energy Recovery Device (ERD) retrofit system. However, there may be a very tight piping manifold installation and very likely there may be changes to the existing RO system.

- Optimize the overall operation of the entire plant which will result in both energy and chemical savings as well as a bit more production.
- Install a web-based SCADA and Energy Monitoring System.

This ECM was not included in the baseline financial analysis because of long payback period.

ECM – Solar Battery Backup for Emergency Power

ECM Summary

JCI recommends installing solar battery backup system in Water Works building to support emergency power. When the grid is running properly, the building will use power generated from the grid. In the event of grid blackouts, the system will switch to "off-rid mode" drawing power stored in the battery bank to power the building and use the solar panels to recharge the battery bank.

Facilities Recommended for this Measure

- Water Works

Scope of Work

- Install 200 kW ground-mounted solar panels on the ground by the building.

This ECM was not included in the baseline financial analysis because of long payback period.

ECM – Variable Refrigerant Flow

ECM Summary

JCI investigated the HVAC system of City Hall and determined the load required to heat and cool the building. Based on the information collected, JCI recommends replacing the existing cooling equipment including heat pumps and split AC units and heating equipment including the steam boilers with a Variable Refrigerant Flow (VRF) system.

Facilities Recommended for this Measure

- City Hall

Scope of Work

Furnish and install GREE VRF System with total cooling / heating capacity of 54 tons and new 5 ton high velocity heat pump system to replace Auditorium system. (VRF systems do not have high velocity fan coils and to save on costs for replacing entire Auditorium duct system we are including replacing equipment only with new high efficiency units and reconnect to existing air distribution system).

Installation will consist of performing and including the following:

Three (3) 10 ton and three (3) 8 ton VRF outdoor units connected to twenty-three (23) new indoor units. The system was designed to incorporate 18 tons per floor with one (1) 8 ton and one (1) 10 ton designated per floor area. All six (6) new outdoor and twenty-three (23) new indoor units will be connected using BACnet and controlled using wireless thermostat controls.

New indoor VRF units are a combination of horizontal ducted fan coils, wall / ceiling mounted and floor console type.

One (1) 5 ton high velocity heat pump system for Auditorium to replace existing high velocity system.

- General contractor will prepare work areas inside building by removing the necessary ceiling tiles to access for demolition of existing and installation of all new equipment, ducting, electrical and piping. Upon completion of work, all ceilings will be replaced using same tiles.
- Reclaim the refrigerant for the existing twenty (20) split type R-22 heat pump / cooling systems, disconnect all piping, ducting and wiring and remove. All equipment and materials to be disposed of properly at approved disposal site.
- New 6 inch concrete pads will be formed and poured for the six (6) new outdoor VRF heat pump units and new Auditorium high velocity heat pump unit all located on the left side of building where majority of units are currently located.
- Furnish and Install six (6) complete sets of insulated copper refrigerant lines with branches connecting each outdoor unit to designated indoor units as per drawing.
- Refrigerant piping will be installed from each outdoor unit into building and run above ceilings inside the building to connect twenty-three (23) indoor units. Exterior piping will be run up exterior wall from each outdoor unit into building for each floor. All lines, wiring and drains will be covered with enclosures. Refrigerant lines will include the use of Vulcan LOKRING (or equal) compression fittings and will include the use of nitrogen to purge the lines for any brazing that needs to be done. All lines will be pressure tested and approved prior to charging systems with refrigerant.
- Furnish and Install three (3) 80A, 208/230V/3Ph and three (3) 100A, 208/230/3Ph line voltage circuits for outdoor VRF units to connect to existing electrical panels inside building. Includes new circuit breakers at panel, wiring run in conduit and new fused outdoor disconnects for each unit.
- Furnish and install all new interconnect wiring from outdoor units to indoor units.
- Furnish and install all new insulated condensate piping from each indoor unit to nearby drain or to the outside.
- Furnish and install new insulated sheet metal ducting to connect existing to new fan coil units and all new ducting including ceiling diffusers and return grilles for new units being added.
- Furnish and install new custom fabricated insulated sheet metal ducting to connect new high velocity fan coil to existing sheet metal ducting. New outside disconnect will be installed with all existing wiring reconnected to new units.
- Furnish and install new refrigerant piping to connect new indoor and outdoor units of Auditorium high velocity system.

This ECM was not included in the baseline financial analysis because of long payback period.

ECM – Vehicle Charging Station – Charge Point

ECM Summary

JCI recommends installing a vehicle charging station – Charge Point in Welcome/Transportation Center. It is the best in-class Electric Vehicle (EV) charging hardware and has the largest, most robust, feature-rich network in the world. The Charge Point focuses exclusively on networked charging stations and associated services.

Facilities Recommended for this Measure

- Welcome/Transportation Center

Scope of Work

- Installation & Infrastructure Materials:
- Install one (1) ChargePoint Dual port CT4021 Welcome/Transportation Center.
  - Supply and install overcurrent protection and underground conduit circuitry across asphalt road between existing electrical service and new chargers. Asphalt shall be saw-cut, patched, and sealed at joints.
  - Supply and install one (1) footing for new charger.
  - Remove and replace existing sidewalk for conduit and footing installation.
  - Supply and install two (2) new "EV Parking Only" sign adjacent to new charger.
  - Supply and install two (2) new bollards in front of charger.
  - Supply ECO-Green color striping in EV charging parking spaces.
  - One (1)-CPSUPPORT-ACTIVE-Station Activation and Configuration Service.
  - One (1)-CT4000-SITEVALID-On-site Validation of electrical capacity, transformers, panels, breakers, wiring, cellular coverage, and that station meets all ChargePoint published requirements. (Required to qualify for CT4000-ASSURE program).
  - Electrical and building permits.
- ChargePoint Hardware
  - One (1)-CT4021-GW1 – Dual Output/Gateway/Bollard Mount/Cord Management
  - One (1)-CT4001-CCM-Bollard Mounting Kit
  - One (1)-CTSW-SAS-COMM-1- One (1) Year Commercial ChargePoint Network Service Plan.
  - One (1)-CT4000-ASSURE-One (1)-year Parts & On-site Labor to repair or replace any manufacturing defect. Includes remote monitoring of station and proactive repair dispatch. *Complete management of EV Station configuration. Unlimited Pricing, Access, and Visibility policy changes. Unlimited Adds and Changes to station groups. 24/7/365 station monitoring. Monthly summary and Quarterly detailed reports. Combined with ChargePoint Assure provides 98% uptime guaranteed and 1 business day response. (Site Validation Required)
  - *Extended Assure programs are available upon request*

Notes:

- Electrical/Building permit applications and inspector coordination are included in this proposal.
- Engineering and/or zoning approval if required shall be the responsibility of the owner.

Johnson Controls

- Electric Vehicle Charger shall be located directly behind curb with two (2) hi-visibility bollards located in front of unit.
- Backfill of excavated areas shall be native soil. First 4" of grass shall be temporarily removed to excavate trench and re-installed after compaction is complete.
- All work shall be completed during normal working hours.
- All new work installed by TPBECI is guaranteed to pass inspection and carries a 1-year workmanship warranty and a manufacturer's limited warranty on parts.

This ECM was not included in the baseline financial analysis because of high installation cost and no savings claimed.

ECM – Hybrid Outdoor Lighting

ECM Summary

JCI recommends installing hybrid outdoor lighting fixtures in the parking lot of the Elementary School. The hybrid outdoor lighting fixtures includes solar panels, wind turbine system and LED lighting fixtures. The LED lighting fixtures make use of the electric generated from the solar panels and wind turbine system therefore there is no need to purchase the electric from the grid.

There are two hybrid outdoor lighting options:

1. Replace one (1) parking lot pole lighting fixture with one (1) hybrid outdoor lighting fixture for education purpose.
2. Replace existing five (5) parking lot pole lighting fixture with five (5) hybrid outdoor lighting fixtures.

Facilities Recommended for this Measure

- Elementary School

Scope of Work

Installation of Option 1 is presented below:

Each one (1) hybrid outdoor lighting fixture includes:

Pole:
Each hexagon shaped 6063 aluminum pole is foundry extruded from a PSRE custom designed die.

- The Pole height is 16' with a diameter of 5" OD (flat to flat) and wall thickness of 1/8".
- The exterior of the pole will be custom powder coated.

Led Array:
The LED Array is pyramid shaped which is uniquely suitable for the PSRE light fixture.

- Light Angle – 360%
- Life Span – 50,000hrs
- Power - 20w
- Lumens – 2,200lm
- Voltage – 12vdc
- Light Color – Cool White 6500K

Wind Turbine:
The Vertical Axis Wind Turbine (VAWT) is designed and manufactured by PSRE.

- The 6 poly carbonate blades (clear or tinted) are 38" in length by approx. 5" in width.
- The blades are mounted to two spindles that are machined from dense PVC.
- All mounting hardware is stainless steel.
- The copper (powder coated) turbine shaft is 40" in length by 1" in diameter.

Turbine Generator:
The Generator is Disc type.

- The output power is 75w max ac 3 phase
- The nominal rated power is 50w.
- Max wind speed is 100mph.
- The working wind speed is 9-50mph

Solar Panel Frame:
The Solar Panel Frame is designed and manufactured by PSRE.

- The decorative frame is machined from dense PVC.
- All mounting hardware is stainless steel.

Solar Panel:
PSRE uses Flexible Solar Panels because of their durability, lighter weight and decorative versatility.

- Cell Type - Mono Crystalline
- Output Voltage – 12vdc
- Peak Power output 100w
- Efficiency is approx. 23%
- The panel dimensions are approx. 42" x 22".

Charge Controller:
The charge controller is Hybrid (Wind/Solar).

- The output is 12vdc.

Battery Storage:
The batteries are Lifep04 lithium deep cycle.

- The output is 12vdc.
- There are 4 - 10ah batteries for a total capacity of 40ah.

Ground Mount Requirements:
The leveled pole sleeve will be set in concrete.

- The round hole will be 30" deep and 18" in diameter.
- The PVC sleeve will also be filled with concrete.

This ECM was not included in the baseline financial analysis because of long payback period.

Appendix 2. Energy Savings Calculations

Energy Savings

Energy savings were calculated using an Excel based bin calculation workbook developed by Johnson Controls; all savings calculations and field measurements will be provided electronically.

Operational Savings

New LED Fixtures

Annual operational savings are calculated based on the reduced amount of material needed for replacement of the lighting system. This is calculated by comparing the existing lifetime of the T8, HID and halogen lamps to the new lifetime of LED lighting. The calculations are based on replacements of T8 fixtures every three years, T8 ballasts every 5 years, HID lamps every 5 years and halogen lamps being replaced every 2 years.

This methodology is used to determine the annual savings through the replacement of all lamp types with new LED lamps and fixtures. The fixture warranty associated with each of these replacements is 10 years. Operational savings have been claimed for a total of 5 years per the BPU regulations.

Operational Savings Summary

The table below summarized the savings from LED lighting replacement/retrofit. Any preventative maintenance or service contracts that will remain were not factored into this analysis. The operational savings will not be escalated.

Operational Savings for Financial Model	
ECM Description	**Annual Savings**
LED Lighting Replacement/Retrofits - City Hall	$2,701
LED Lighting Replacement/Retrofits - Elementary School	$4,059
LED Lighting Replacement/Retrofits - Fire House	$770
LED Lighting Replacement/Retrofits - Library	$463
LED Lighting Replacement/Retrofits - Nature Center 1	$246
LED Lighting Replacement/Retrofits - Nature Center 2	$319
LED Lighting Replacement/Retrofits - Water Works Building	$399
LED Lighting Replacement/Retrofits - Welcome/ Transportation Center	$453
Totals	**$9,412**

Johnson Controls

Appendix 3. Detailed Scope Descriptions

Detailed Scope Descriptions are available electronically due to the size of the files.

Appendix 4. Field Measurements

Field measurements are available electronically due to the size of the files.

Appendix 5. Recommended Project – ESP

ID #	Energy Conservation Measure	Total ECM Cost	Year 1 Utility Savings	Simple Payback	Installation Plan	Recommend for Installation
1	Building Management System - City Hall, Library & Welcome/ Transportation Center	$88,518	$6,657	13.60	Public Bidding	X
2	Existing BAS Modification - Elementary School	$43,276	$3,158	14.01	Public Bidding	X
3	Computer Management System - Elementary School	$1,600	$7,900	0.21	JCI Implement	X
4	Demand Response Energy Efficiency Credit - City Wide	$1	$	0.00	JCI Implement	X
5	Emergency Generator Installation - Elementary School	$308,174	$	0.00	Public Bidding	X
6	Pipe Insulation and Blankets - City Hall	$8,049	$644	12.79	JCI Implement	X
7	Pipe Insulation and Blankets - Fire House	$7,474	$654	11.70	JCI Implement	X
8	Building Envelope Improvements - City Hall	$4,074	$247	16.86	Public Bidding	X
9	Building Envelope Improvements - Fire House	$14,743	$ 982	15.37	Public Bidding	X
10	Building Envelope Improvements - Franklin Street School	$3,749	$320	12.00	Public Bidding	X
11	Building Envelope Improvements - Library	$2,673	$184	14.89	Public Bidding	X
12	Building Envelope Improvements - Nature Center 1	$2,138	$146	14.97	Public Bidding	X
13	Building Envelope Improvements - Water Works Building	$5,824	$332	17.99	Public Bidding	X
14	Building Envelope Improvements - Welcome/ Transportation Center	$5,314	$279	19.47	Public Bidding	X
15	LED Lighting Replacement/Retrofits - City Hall	$59,041	$4,564	13.22	Public Bidding	X
16	LED Lighting Replacement/Retrofits - Elementary School	$88,725	$3,420	26.52	Public Bidding	X
17	LED Lighting Replacement/Retrofits - Fire House	$16,838	$3,404	5.05	Public Bidding	X
18	LED Lighting Replacement/Retrofits - Library	$10,113	$3,322	3.11	Public Bidding	X
19	LED Lighting Replacement/Retrofits - Nature Center 1	$5,382	$744	7.39	Public Bidding	X
20	LED Lighting Replacement/Retrofits - Nature Center 2	$6,977	$376	18.97	Public Bidding	X

Johnson Controls

ID #	Energy Conservation Measure	Total ECM Cost	Year 1 Utility Savings	Simple Payback	Installation Plan	Recommend for Installation
21	LED Lighting Replacement/Retrofits - Water Works Building	$8,725	$508	17.56	Public Bidding	X
22	LED Lighting Replacement/Retrofits - Welcome/ Transportation Center	$9,902	$1,802	5.62	Public Bidding	X
23	Plug Load Controls - City Hall	$3,917	$ 937	4.27	JCI Implement	X
24	Plug Load Controls - Elementary School	$8,374	$832	10.29	JCI Implement	X
25	Plug Load Controls - Library	$675	$44	15.55	JCI Implement	X
26	Premium Efficient Motors - Elementary School	$4,549	$244	19.04	JCI Implement	X
27	Programmable Thermostats Installation - Franklin Street School, Nature Center 2 & Public Works Complex	$11,671	$ 6,352	1.88	Public Bidding	X
28	Street Lighting Retrofits - City Wide	$28,936	$3,486	8.48	Public Bidding	X
29	Walk-In Cooler Controls - Elementary School	$3,082	$2,358	1.34	JCI Implement	X
30	Vehicle Charging Station - ChargePoint - Elementary School*	$24,195	$-	-	JCI Implement	X

* No energy savings are associated with ECM 30 – Vehicle Charging Station – ChargePoint in Elementary School.

Demand Response/ Energy Rebates – District Wide		
Rebate #	**ECM Description**	**Total Project Rebates**
1	Demand Response – Energy Efficiency Credit	$3,472
2	NJ Smart Start Rebates – LED Lighting Replacement/Retrofits	$34,570
	Total Project	**$38,042**

Johnson Controls

ID #	Energy Conservation Measure	Electric Savings		Energy Electric Demand Savings		Natural Gas Savings		Total Annual Utility
		$	kWh	$	kW	$	CCF	$
1	Building Management System - City Hall, Library & Welcome/ Transportation Center	$3,171	23,106	$0		$3,486	2,296	$6,657
2	Existing BAS Modification - Elementary School	$2,361	19,253	$0		$797	916	$3,158
3	Computer Management System - Elementary School	$7,900	64,413	$0		$0		$7,900
4	Demand Response Energy Efficiency Credit - City Wide	$0		$0		$0		$0
5	Emergency Generator Installation - Elementary School	$0		$0		$0		$0
6	Pipe Insulation and Blankets - City Hall	$0		$0		$644	440	$644
7	Pipe Insulation and Blankets - Fire House	$0		$0		$654	473	$654
8	Building Envelope Improvements - City Hall	$34	269	$0		$214	146	$247
9	Building Envelope Improvements - Fire House	$72	439	$0		$910	658	$982
10	Building Envelope Improvements - Franklin Street School	$58	336	$0		$262	174	$320
11	Building Envelope Improvements - Library	$32	182	$0		$152	103	$184
12	Building Envelope Improvements - Nature Center 1	$146	740	$0		$0		$146
13	Building Envelope Improvements - Water Works Building	$0		$0		$332	228	$332
14	Building Envelope Improvements - Welcome/ Transportation Center	$54	321	$0		$226	143	$279
15	LED Lighting Replacement/Retrofits - City Hall	$3,887	31,174	$677	7	$0		$4,564
16	LED Lighting Replacement/Retrofits - Elementary School	$2,384	19,435	$1,036	13	$0		$3,420
17	LED Lighting Replacement/Retrofits - Fire House	$3,291	20,001	$113	6	$0		$3,404

Johnson Controls

ID #	Energy Conservation Measure	Electric Savings		Energy Electric Demand Savings		Natural Gas Savings		Total Annual Utility
		$	kWh	$	kW	$	CCF	$
18	LED Lighting Replacement/Retrofits - Library	$3,032	17,352	$290	6	$0		$3,322
19	LED Lighting Replacement/Retrofits - Nature Center 1	$725	3,677	$19	1	$0		$744
20	LED Lighting Replacement/Retrofits - Nature Center 2	$336	1,993	$40	2	$0		$376
21	LED Lighting Replacement/Retrofits - Water Works Building	$370	3,092	$138	1	$0		$508
22	LED Lighting Replacement/Retrofits - Welcome/ Transportation Center	$1,782	10,634	$19	1	$0		$1,802
23	Plug Load Controls - City Hall	$937	7,511	$0		$0		$937
24	Plug Load Controls - Elementary School	$832	6,785	$0		$0		$832
25	Plug Load Controls - Library	$44	254	$0		$0		$44
26	Premium Efficient Motors - Elementary School	$244	1,991	$0		$0		$244
27	Programmable Thermostats Installation - Franklin Street School, Nature Center 2 & Public Works Complex	$1,883	10,826	$0		$4,470	2,997	$6,352
28	Street Lighting Retrofits - City Wide	$3,486	35,910	$0		$0		$3,486
29	Walk-In Cooler Controls - Elementary School	$2,358	19,228	$0		$0		$2,358
30	Vehicle Charging Station - ChargePoint - Elementary School*	$0		$0		$0		$0
Total		$39,419	298,922	$2,333	37	$12,145	8,574	$53,897

Business Case for Recommended Project

FORM VI

ESCO's PRELIMINARY ENERGY SAVINGS PLAN (ESP):
ESCO's PRELIMINARY ANNUAL CASH FLOW ANALYSIS FORM
CITY OF CAPE MAY - ENERGY SAVING IMPROVEMENT PROGRAM

ESCO NAME: **Johnson Controls**

Note: Respondents must use the following assumptions in all financial calculations:

(a) The cost of all types of energy should be assumed to inflate at **2.4% gas, 2.2% electric per year**; and

1. Term of Agreement: **15 years (180 Months)**
2. Construction Period [2] (months): **12 months**
3. Cash Flow Analysis Format:

Project Cost [1]: **$786,709** Interest Rate to Be Used for Proposal Purposes: 3.25%

Year	Annual Energy Savings	Annual Operational Savings	Energy Rebates/ Incentives	Total Annual Savings	Annual Project Costs	Board Costs	Annual Service Costs [3]	Net Cash Flow to Client	Cumulative Cash Flow
Installation	$4,393	$0	$0	$4,393	$0	$0	$0	$4,393	$4,393
1	$53,897	$9,412	$35,126	$98,434	$92,614	$97,645	$5,031	$790	$5,182
2	$55,107	$9,412	$688	$65,206	$59,115	$64,397	$5,283	$809	$5,991
3	$56,344	$9,412	$1,585	$67,340	$60,954	$66,501	$5,547	$840	$6,831
4	$57,609	$9,412	$643	$67,664	$66,819	$66,819	$0	$845	$7,676
5	$58,902	$9,412	$0	$68,314	$67,460	$67,460	$0	$854	$8,530
6	$60,225	$0	$0	$60,225	$59,352	$59,352	$0	$873	$9,403
7	$61,577	$0	$0	$61,577	$60,684	$60,684	$0	$893	$10,296
8	$62,960	$0	$0	$62,960	$62,047	$62,047	$0	$913	$11,209
9	$64,374	$0	$0	$64,374	$63,440	$63,440	$0	$933	$12,143
10	$65,819	$0	$0	$65,819	$64,865	$64,865	$0	$954	$13,097
11	$67,297	$0	$0	$67,297	$66,322	$66,322	$0	$976	$14,073
12	$68,809	$0	$0	$68,809	$67,811	$67,811	$0	$998	$15,070
13	$70,354	$0	$0	$70,354	$69,334	$69,334	$0	$1,020	$16,091
14	$71,934	$0	$0	$71,934	$70,891	$70,891	$0	$1,043	$17,134
15	$73,550	$0	$0	$73,550	$72,296	$72,296	$0	$1,254	$18,387
Totals	**$953,150**	**$47,058**	**$38,042**	**$1,038,250**	**$1,004,003**	**$1,019,863**	**$15,860**	**$18,387**	**$18,387**

NOTES:

(1) Includes: Hard costs and project service fees defined in ESCO's PROPOSED "FORM V"

(2) No payments are to be made by Board during the construction period

(3) This figure should equal the value indicated on the ESCOs PROPOSED "FORM V". DO NOT include in the Financed Project Costs.

(4) Project Cost is inclusive of Professional Fee of $75,000 soft cost

Johnson Controls

Appendix 6. Third Party Energy Savings Plan Review (Hatch Mott MacDonald) Comments & Correspondence

1. Baseline Energy Usage

In order to determine the projected amount of energy savings, an accurate assessment of the existing energy use is required. Johnson Controls has included Utility bills as the basis for this baseline. HMM has reviewed tables included in the report. The tables appear accurate with the exception of the list of Tariffs for electric billing. The street lighting should be listed as Atlantic City Electric Tariff CSE or CSL. The energy usage (kWh) and costs included for this line item appear accurate and in line with the costs for this Tariff. In addition, the report indicates that there is no control system in several of the buildings. The report should note that there is no automatic control system in these buildings.

Response:

The facility description was updated to include "there is no automatic control system in these buildings". The electric tariff of street lighting is listed as Atlantic City Electric Tariff CSL.

2. Financial Impact Review

Johnson Controls has identified the proposed installation plan in a table on page 55 of the report. This plan includes items which require public bidding and items for JCI implementation directly. JCI should clarify the scheduling requirements for public bidding with the city and confirm that the schedule will allow the year one savings indicated in that table. Some adjustments may be required to the year one savings to account for any design bid and build time required to fully implement those ECMs.

Response:

Johnson Controls added a sentence on page 55 above the installation plan "Year 1 won't start until the installation of Energy Conservation Measures is completed".

3. ECM Review

The ECMs are grouped into several categories such as, Building Controls, Building envelope improvements and lighting retrofits.

The building controls items seem to match out discussions and reviews to date. However, the setpoint for cooling included in the report is 72 deg. F. The NJ State Energy Code requires a setpoint of 75 deg. F.

Lighting retrofits are described in detail for 8 separate ECMs. JCI should confirm that lighting levels are not being reduced in any areas. In the schools the levels in the classrooms and corridors must meet the requirements of the New Jersey State Uniform Construction Code. The lighting requirements are detailed in NJAC 6A:26-6.3(g) or Guide for Educational Facilities Lighting ANSI/IES RP2-00. The information is also contained in NJDCA Bulletin 00-3, revised in January, 2014. JCI should provide calculations to confirm that the required lighting levels will be met with the new fixtures and or relamping of existing fixtures.

Response:

During the IGA phase, JCI interviewed building employees and installed temperature loggers to determine the temperature setpoint. The cooling setpoint of 72 deg. F was based on the interview and logger result and satisfied occupant comfort.

In the bid specifications for the Lighting Upgrades, all applicable requirements are included to ensure the spaces meet code. During the installation of lighting, JCI will measure the lighting levels of proposed lighting fixtures to ensure the lighting level of proposed lighting fixtures meet the requirements of NJAC 6A:26-6.3(g) or Guide for Educational Facilities Lighting ANSI/IES RP2-00 or NJDAC Bulletin 00-3. Below is the screenshot of the lighting level requirement from NJAC 6A:26-6.3(g).

(g) Lighting requirements shall be as follows:

1. Installed artificial lighting intensity shall comply with the following minimum footcandles, which shall be maintained on the task at any time:

Installed Lighting Intensity Locations	Minimum Acceptable Footcandles
Classrooms and instructional areas - study halls, lecture rooms, art rooms, offices, libraries, conference rooms, work rooms, shops, laboratories, and secondary school cafeterias	50
Drafting, typing, and sewing rooms	70
Reception rooms, gymnasiums, auditoriums, primary school cafeterias, all-purpose rooms, and swimming pools	30
Locker rooms, washrooms, toilet rooms, corridors containing lockers, and stairways	10
Corridors without lockers and storerooms	5
Classrooms for the partially sighted	70

4. Measurement and Verification (M&V) Review

HMM has reviewed the proposed M&V plan submitted by JCI. The plan details four options for quantifying the savings. Many of the proposed ECMs would be difficult if not impossible to measure directly. The methods proposed by JCI vary for each ECM. The methods proposed are acceptable. One item to note is to confirm that the measurement method for the one time Demand Reduction of power load complies with the PJM requirements. JCI should verify this prior to implementation since it is an important source of revenue for the overall project.

Response:

JCI Demand Response program will verify the one time power load demand reduction and ensure it complies with the PJM requirement.