

Investment Grade Audit –  
60% Report

City of Stamford, Connecticut

November 16, 2015



Binder: 85% post-consumer waste, 15% post-industrial waste

# 1. Executive Summary

ConEdison Solutions is pleased to present our 60% submission of the Investment Grade Audit Report to the City of Stamford (or “the City”). This submission reflects the latest configuration of Energy Conservation Measures (ECMs) based on our design development to date and the ongoing communication with the City during our bi weekly meetings to deliver value to the City.

## Recommended Energy- and Cost-Savings Solution for the City

The Energy-and Cost-Savings Solution prepared for the City identifies **\$21,188,859** in building improvements, including a comprehensive **tri-generation system** for the Stamford Government Center (the “SGC”) and **co-generation systems** at two (2) schools; each of these facilities will have black start capability, enhancing the City’s ability to serve the needs of its citizens during a loss of utility supplied electric power. ConEdison Solutions has also identified many other **innovative energy conservation measures** that will reduce energy costs. ConEdison Solutions will guarantee **annual savings of \$1,102,146 which, when coupled with expected incentives and rebates and a small capital contribution from the City,** will fund all of these resiliency and infrastructure improvement projects over the 15-year financing term, assuming a 2.5% interest rate.

Highlights of our scope include:

- **A tri-generation system** for the Stamford Government Center consisting of:
  - (1) 350 kW continuous-duty engine-generator with heat recovery to supply hot water which is used for heating and cooling.
  - (1) 300 kW stand-by generator to provide voltage and frequency stability and to provide back-up power during scheduled and unscheduled equipment downtimes.
  - (1) 100 Ton Absorption Chiller designed to match the thermal output of the trigeneration plant to produce chilled water
- **Combined Heat and Power systems** at two (2) schools to cogenerate electrical power and thermal energy in the form of hot water while allowing operation of critical school loads that serve as public emergency shelters during blackouts as well as reducing operating costs during normal operation.
- **A new Energy Management System (EMS) supervisory platform for all facilities and full retrofit of all existing pneumatically controlled facilities to full Direct Digital Controls.** This includes installing a new open-source, web-based EMS platform with full Direct Digital Controls that permits improved flexibility, monitoring and the capability to control City wide.

- Many other significant energy projects, including: **LED lighting retrofits, new condensing boiler, kitchen equipment upgrades, and solar PV.**

The financial summary for the proposed energy efficiency upgrades is displayed in Table 1.

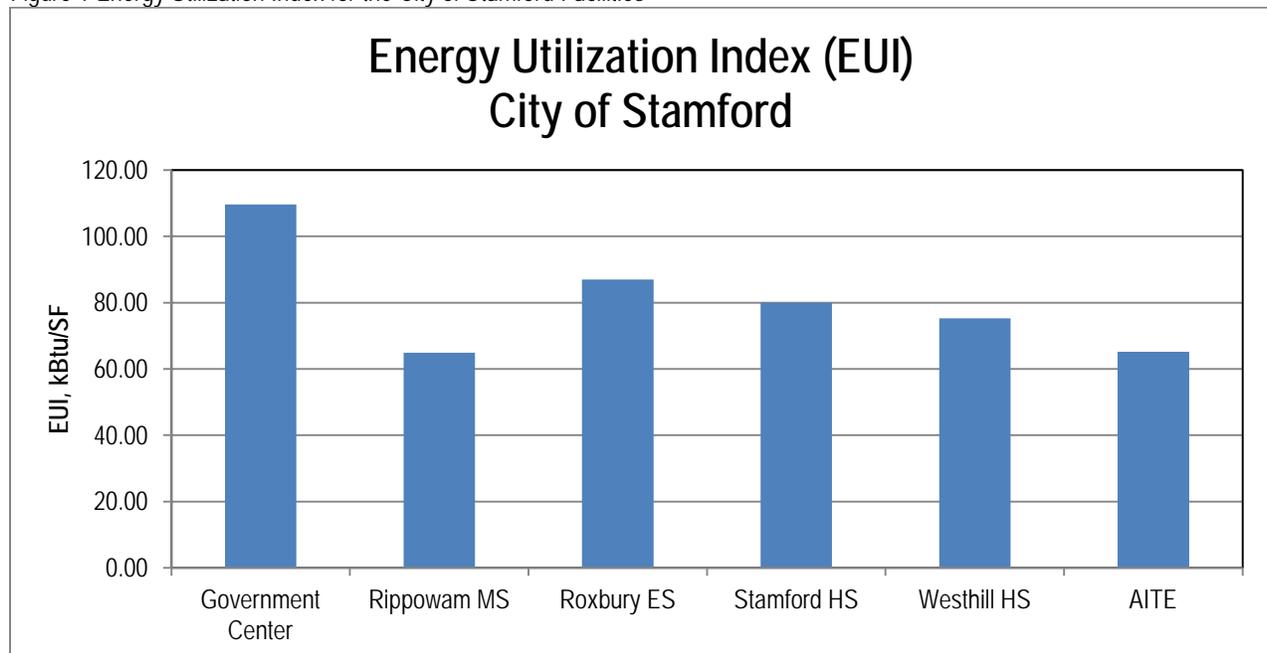
Table 1 Financial Summary

Project Category	Project Cost
Government Center Microgrid	\$3,065,137
High Efficiency Lighting Upgrades	\$3,961,654
Energy Management System Upgrades and Optimization	\$5,147,060
High Efficiency Boiler Replacement	\$1,386,761
Other Additional Measures	\$7,628,247
<b>Total Project Cost</b>	<b>\$21,188,859</b>
<i>Utility Rebates &amp; Incentives</i>	<i>(\$2,597,124)</i>
Annual Energy Savings in 2016 (based on baseline utility rates)	\$1,102,146

## Baseline Development

The following graph shows the EUI (expressed in kBtu) of current energy cost per square foot for each building.

Figure 1 Energy Utilization Index for the City of Stamford Facilities



The following normalized baseline is developed for measuring energy savings from the project:

Table 2 Baseline per Facility

Buildings	Address	Area, sq-ft	Electric, kWh	Natural Gas, CCF	Normal HDD	Water, kGal
Government Center	888 Washington Blvd Stamford CT 06901	272,000	5,169,842	121,762	5,814	6,505
Rippowam MS	381 HIGH RIDGE RD	227,700	1,302,598	103,387	5,814	646
Roxbury ES	751 W Hill Rd Stamford CT 06902	86,706	568,190	56,034	5,814	864
Stamford HS	55 Strawberry Hill Ave Stamford CT	381,408	3,308,942	192,060	5,814	1,682
Westhill HS	125 Roxbury Stamford CT 06902	407,807	4,013,645	170,053	5,814	3,517
AITE	411 High Ridge Road,	118,264	1,760,977	16,984	5,814	-
<b>Total</b>		<b>1,493,885</b>	<b>16,124,193</b>	<b>660,280</b>		<b>13,215</b>

The annual current cost of utility, paid by the City of Stamford is as follows:

Table 3 Utility Summary per Facility

Actual Cost - June 2014 through May 2015						
Buildings	Address	T&D Electric Cost	Commodity Electric Cost	Total Electric Cost	Nat Gas Cost	Total Cost
Government Center	888 Washington Blvd Stamford CT 06901	\$290,227	\$403,030	\$693,256	\$109,929	\$803,185
Rippowam MS	381 HIGH RIDGE RD	\$88,715	\$113,600	\$202,315	\$100,510	\$302,824
Roxbury ES	751 W Hill Rd Stamford CT 06902	\$45,540	\$52,200	\$97,740	\$45,759	\$143,499
Stamford HS	55 Strawberry Hill Ave Stamford CT	\$173,752	\$268,830	\$442,583	\$170,012	\$612,594
Westhill HS	125 Roxbury Stamford CT 06902	\$207,876	\$328,098	\$535,973	\$156,711	\$692,685
AITE	411 High Ridge Road,	\$96,168	\$150,000	\$246,168	\$23,150	\$269,318
<b>Total</b>		<b>\$902,278</b>	<b>\$1,315,758</b>	<b>\$2,218,035</b>	<b>\$606,071</b>	<b>\$2,824,106</b>

## Summary of Energy Conservation Measures proposed for each building

The energy conservation measures (ECMs) proposed by ConEdison Solutions at each building are summarized on this page and listed in detail on the following pages. For more information of the products recommended, how they will be installed and commissioned, please refer to the *ECM Scope of Work* section of this report.



**Stamford Government Center**

Microgrid + Tri-Generation Plant  
New chilled water system with absorption chiller, LED lighting and controls, Full EMCS/DDC upgrades, kitchen equipment conversion from electric to gas, Water conservation



**Rippowam Middle School**

Full EMCS/DDC upgrades, LED lighting systems and controls, Water conservation; AITE Ice Storage - operationalize



**Roxbury Elementary School**

Full EMCS/DDC upgrades, LED lighting systems and controls, Water conservation

City of Stamford: Street Lighting Conversion to LEDs



**Westhill High School**

Combined Heat and Power (CHP) with heat recovery and black start capability, Full EMCS/DDC upgrades and graphical interface, LED lighting systems and controls, Water Conservation



**Stamford High School**

Combined Heat and Power (CHP) with heat recovery and black start capability, Boiler replacement, Full EMCS/DDC upgrades and graphical interface, LED lighting systems and controls

Table 4 ECM Summary Table

ECM #	ECM Name	Facility	Description
1	Government Center Microgrid	Government Center	Tri-Generation Plant/Microgrid to provide Combined Cooling, Heating and Power to Government Center. Includes one 350 kW engine, one 300 kW standby engine, generator paralleling bus and switchgear, one 100 tons absorption chiller, new chilled water distribution system, and five (5) new fan coil units for the ECC. The Microgrid features: (1) stand-alone operation of the SGC, (2) ability to provide emergency power to Clinton Manor and/or Post House
2	High Efficiency Lighting Upgrades	Government Center	Replace/retrofit existing lighting fixtures with all-new LED fixtures or lamps. We propose to retrofit approximately 24,000 fixtures with new 12W TLED lamps; we propose to install new controls such as occupancy sensors and daylight harvesting where practical.
		Rippowam MS	
		Roxbury ES	
		Stamford HS	
		Westhill HS	
3	Energy Management System Upgrades and Optimization	Government Center	Install a single platform, open-source, BAC-net web-based Energy Management System with improved graphics to provide visual indications of generation outputs and heat recovery rates. Improved sequence of operations will reduce the energy consumption while improving comfort. The following strategies will be included: Scheduling, Heating/Cooling lockouts, HVAC Diagnostics, Demand Controlled Ventilation, Utility Power Demand Limiting, Optimized controls for AHUs. A key feature will be a "Snow Day" button for all Schools and the Government Center.
		Rippowam MS	
		Roxbury ES	
		Stamford HS	
		Westhill HS	
4	High Efficiency Boiler Replacement	Westhill HS	Remove one existing hot water boiler to make space for two (2) new cogeneration units.
		Stamford HS	Remove two (2) steam boilers; replace with one high efficiency condensing boiler, and two (2) new cogeneration units. Upgrade all ancillary equipment necessary for the conversion.
5	HVAC Upgrades	Government Center	Replace ventilation (100% OA) units with high efficiency, heat recovery units.
6	Combined Heat and Power System (CHP) for Schools	Stamford HS	Install Combined Heat and Power system (200 kW, inverter based generator/engine with heat recovery). Rewire building for increased resiliency when operating on emergency power.
		Westhill HS	Install Combined Heat and Power system (200 kW, inverter based generator/engine with heat recovery). Rewire building for increased resiliency when operating on emergency power.

ECM #	ECM Name	Building	Description
7	Water Efficiency Upgrades	Government Center	Install high-efficiency, low flow, indoor plumbing fixtures. Replacing older flush valves on toilets and urinals with low flow water consuming devices. Adjust urinals to 0.6 to 1.5 gallons per flush, and toilets to 1.28 to 1.6 gpf. Automated sensor valves to toilets, urinals and faucets as a convenience enhancement.
		Rippowam MS	
		Roxbury ES	
		Stamford HS	
		Westhill HS	
8	Resiliency at Schools	Rippowam MS	Install additional Automatic Transfer Switches, fed from existing emergency generators or from new cogeneration units, and do electrical rewiring necessary to keep key areas such as Gymnasiums, Cafeteria, Toilets, Auditorium, etc. functional during emergency, for the school to serve as an emergency shelter.
		Stamford HS	
		Westhill HS	
9	Kitchen Upgrade	Rippowam MS	Install kitchen hood exhaust sensors and VFD controls. This application of demand controlled ventilation provides savings for many hours when cooking appliances are idle or lightly used.
		Stamford HS	
		Westhill HS	
10	Kitchen Conversion from Electric to Gas	Government Center	Convert existing kitchen equipment from electric to natural gas. Scope includes the replacement of the following equipment: Flat-top stove with new 6 burner gas range and oven; Flat brazier with new 40 gal gas kettle; Dual bowl Fry-o-lator with new double gas burners/controls; Double convection oven with double "Combi" steamer/oven; Combination griddle and Char broiler with new double gas griddle and gas Char broiler.
11	Vending Machine Controls	Government Center	Install vending machine controls throughout the schools and Government Center. Vending machine controls utilize a custom passive infrared sensor to power down the unit when vacant without compromising the vended product.
		Rippowam MS	
		Stamford HS	
		Westhill HS	
12	Walk-in Cooler Controls	Government Center	Install one walk-in cooler controller per school. It enables the fans to operate at low speeds when active cooling is not required; thus, generating energy savings.
		Rippowam MS	
		Roxbury ES	
		Stamford HS	
		Westhill HS	

ECM #	ECM Name	Building	Description
13	Weatherization	Government Center	Install weather-stripping to stop or reduce air leakage from the building. Includes weather-stripping all exterior doors identified during our walk through, and window caulking.
		Rippowam MS	
		Roxbury ES	
		Stamford HS	
		Westhill HS	
14	Indoor Pool Cover	Westhill HS	Install new pool blanket and 4 new automatic reel systems with auto stop. Pool covers save money by conserving energy, chemicals and reducing wear and tear on the natatorium. Automatic reel systems make using the blanket easy, thereby assuring daily use.
15	Solar Photovoltaics Power Purchase Agreement	Roxbury ES	Install solar photovoltaic system through a third party power purchase agreement (PPA) with the City of Stamford. The electricity generated will be sold to the City at a discount rate. Estimated solar capacity to be installed: Roxbury ES: 187kW; Westhill HS: 828kW, and Davenport School 329kW
		Westhill HS	
		Davenport School	
16	Asbestos Handling/Abatement	Government Center	ConEdison <i>Solutions</i> will perform asbestos abatement and disposal services, if required.
		Rippowam MS	
		Roxbury ES	
		Stamford HS	
		Westhill HS	
17	Government Center DX Units Retrofit	Government Center	Retrofit original Trane DX air-conditioning units through the manufacturer, with a long term service agreement
18	City of Stamford Street Lighting	City of Stamford	Relamp approximately 5200 street lighting fixtures with new LED GE Cobra Head fixtures
19	Operationalize AITE Ice Storage System	Rippowam MS / AITE	Investigate the necessary changes required to operationalize the AITE Ice Storage System

## Utility Incentives

We have proposed approximately **\$2.60 million in financial incentives** to support ConEdison Solutions' proposed resiliency enhancements and energy conservation measures. These incentives are based on potential electric and gas utility programs and special grants for combined heat and power (CHP) systems from the Department of Energy and Environmental Protection (DEEP). An additional potential grant to encourage Microgrid systems may be provided by DEEP (program was just instituted at the time of this writing). All incentives will go to the City of Stamford and its Schools, to reduce the overall cost of the proposed measures.

***Note on Power Purchase Agreements and Managed Energy Services Agreements:***

ConEdison Solutions is proposing to install solar photovoltaic panels at various buildings through a third party Power Purchase Agreement with the City of Stamford. Under this agreement, the selected third party will provide all funding necessary to install the panels on roofs and retain the ownership and maintenance of these panels. It will sell the electricity produced to the City of Stamford on a fixed rate, monthly basis for a total of 20 years. The benefits to this financial arrangement include: a) the price of electricity will be well below the current price of electricity bought from the utility, b) the annual price of electricity sold through the PPA will be fixed in advance for the full term of the agreement and, c) the PPA provider is able to take advantage of several tax credits and incentives unavailable to the City of Stamford as a non-profit entity, which help reduce the cost of electricity to the City.

## ECM Summary Table

The ECM Summary Table provided in the RFP document has been filled out for each facility included under RFP No. 649. The Tables, per facility, are included within the proposal section called *ECM Scope of Work*. The “Total” Summary Table has also been provided. This table can be found on page 9 of this *Executive Summary*.

Table 5 ECM Summary Table

ECM No.	ECM Description	Implementation Expense	Annual Demand Savings (kW)	Annual Electric Savings (kWh)	Annual Gas Savings (Therms)	Annual Water Savings (gal)	Annual Utility Cost Savings	Annual O&M Cost Savings	Total Cost Savings	Simple Payback (yrs)
1	Government Center Microgrid	\$3,065,137	3,240	2,654,829	-250,548	0	\$131,309	-\$70,210	\$61,099	50.2
2	High Efficiency Lighting Upgrades	\$3,961,654	7,421	2,430,859	0	0	\$359,465	\$124,222	\$483,687	8.2
3	Energy Management System Upgrades and Optimization	\$5,147,060	1,011	772,057	116,441	0	\$212,221	\$0	\$212,221	24.3
4	High Efficiency Boiler Replacement	\$1,386,761	0	0	6,750	0	\$6,750	\$0	\$6,750	205.4
5	HVAC Upgrades	\$792,435	0	0	0	0	\$0	\$0	\$0	-
6	Combined Heat and Power System (CHP) for Schools	\$2,113,160	3,800	1,868,460	-113,138	0	\$164,010	-\$60,000	\$104,010	20.3
7	Water Efficiency Upgrades	\$376,320	0	0	0	3,938	\$35,545	\$3,011	\$38,556	9.8
8	Resiliency at Schools	\$1,175,444	0	0	0	0	\$0	\$0	\$0	-
9	Kitchen Hood Controls	\$19,810	0	5,625	852	0	\$1,434	\$0	\$1,434	13.8
10	Kitchen Conversion at SGC from Electric to Gas	\$92,451	0	77,220	-3,252	0	\$5,059	\$0	\$5,059	18.3
11	Vending Machine Controls	\$10,965	0	28,713	0	0	\$2,974	\$0	\$2,974	3.7
12	Walk-in Cooler Controls	\$16,290	0	28,735	0	0	\$3,036	\$0	\$3,036	5.4
13	Weatherization	\$148,520	0	13,346	10,414	0	\$12,018	\$0	\$12,018	12.4
14	Indoor Pool Cover	\$135,746	0	19,679	9,881	49	\$12,355	\$0	\$12,355	11.0
15	Solar Photovoltaics Power Purchase Agreement	\$0	0	0	0	0	\$0	\$0	\$0	-
16	Asbestos Handling/Abatement	\$99,055	0	0	0	0	\$0	\$0	\$0	-
17	SGC-DX Units retrofit at SGC	\$349,992	0	0	0	0	\$0	\$0	\$0	-
18	City of Stamford Street Lighting	\$1,981,087	0	1,343,457	0	0	\$138,947	\$0	\$138,947	14.3
19	Operationalize AITE Ice Storage System	\$316,974	0	0	0	0	\$0	\$20,000	\$20,000	15.8
<b>Project Totals</b>		<b>\$21,188,859</b>	<b>15,472</b>	<b>9,242,980</b>	<b>-222,600</b>	<b>3,987</b>	<b>\$1,085,123</b>	<b>\$17,023</b>	<b>\$1,102,146</b>	<b>19.2</b>

## Features and Benefits

Table 6 Features and Benefits

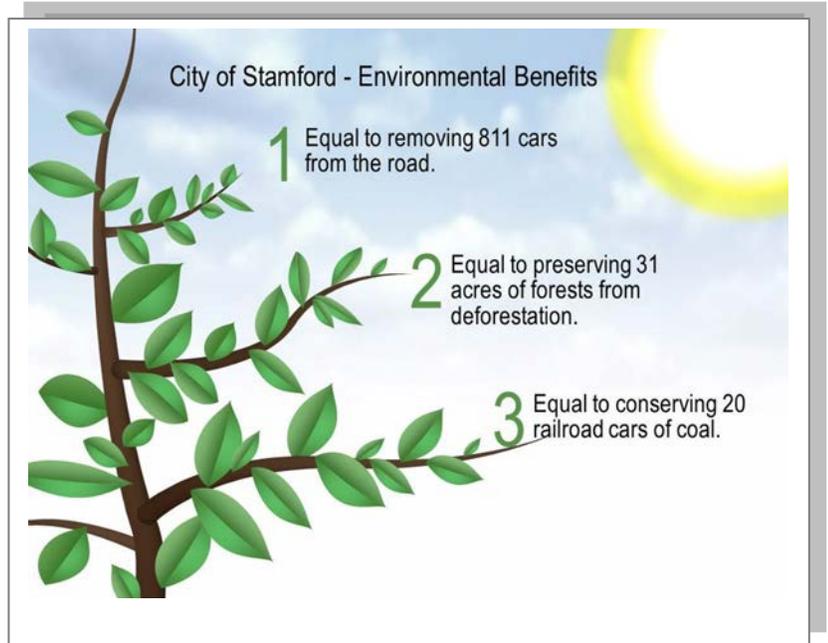
ECM No.	Description	Feature	Benefit
1	Generator Bus Paralleling Switchgear	<i>Full redundancy</i>	<i>It allows future electric loads to seamlessly integrate</i>
1	Government Center Chilled Water production from the Trigenation system	<i>Chilled water production integrated with Tri-Generation Plant for optimal performance, system includes a 100 R-Ton Absorption Chiller</i>	<i>Chilled water loop sourced from low-cost Tri-Gen plant using existing infrastructure;</i>
1	CHP generator configuration for Government Center	<i>Self-Generate electricity with Black Start Capability</i>	<i>Continuous power even during blackouts to supply critical loads</i>
6	CHP for Westhill and Stamford High Schools	<i>Self-Generate electricity with Black Start Capability</i>	<i>Continuous power even during blackouts to supply critical loads</i>
1	Heating & Cooling Disaster plan for government center, high schools and middle schools.	<i>Temporary heating plan and provisions</i>	<i>Assured heating during blackouts and public emergency situations.</i>
15	Solar Power Purchase Agreement	<i>Fixed cost for a portion of electricity consumption</i>	<i>Lower cost electricity, budget certainty, lower carbon footprint and green power</i>
3	Full Open Protocol Building Automation	<i>Simple architecture</i>	<i>Lower repair costs, allows competitive bidding, and eliminates monopoly around building automation.</i>
N/A	"Tel-ALL" Behavioral Change Program & ConEdison Learning Center	<i>Behavioral Change Program: FIRST (For Inspiration and Recognition of Science and Technology) Educational Dashboard for Tri-Gen System featuring real-time energy performance and environmental benefits</i>	<i>The objective of ConEdison Solutions' Tel-all training program is for students to develop a comprehensive understanding of how energy is created, how it is used, and how it can be used in more efficient and sustainable ways. Students will learn about renewable technologies, energy consumption, auditing and monitoring energy use, and sustainability through research, professional instruction, and hands-on activities.</i>

## Environmental Benefits

Energy performance contracting is good for business and for the environment. By taking action to implement an Energy Savings Performance Contract and Microgrid, the City is actively supporting its environmental responsibility to reduce carbon emissions. Environmentally-sensitive, smart energy decisions contribute to saving and renewing the vital ecosystem that is essential to us all.

The proposed energy savings have the potential effect of eliminating 4,225 tons of CO<sub>2</sub> emissions into the atmosphere every year.

The graphic to the right shows the environmental benefits, in various equivalent terms; of implementing the ConEdison Solutions' proposed efficiency project.



## Partnering with ConEdison Solutions

### Customized Energy Solutions

ConEdison Solutions is able to successfully manage and implement the City’s Energy Savings Performance Contract and Microgrid. ConEdison Solutions’ project implementation team comprised of experienced project management staff will manage the project implementation and technical compliance associated with the project.

The technical aspects of this project have been carefully evaluated and analyzed by our seasoned energy efficiency engineers. ConEdison Solutions’ energy experts have established an energy baseline based on thorough analysis of utility bills, site visits, and staff interviews. Our proposed energy conservation measures are customized for the City and are the result of careful analysis of collected data and the City’s energy efficiency objectives. The team visited each of the site locations, has met with facilities staff to discuss areas of concern, and reviewed available plans and drawings.

This hands-on approach provides the City with a custom-made solution to improve its energy efficiency. ConEdison Solutions offers various ongoing services in order to measure and verify savings, as well as ensure efficient operation and maintenance of City’s building systems. These on-going services are customized to meet City’s technical and financial needs.

### Summary

We are pleased to present this preliminary Investment Grade Audit (60% submittal) describing the cost and savings of our proposed Energy Conservation Measures. As this is a preliminary submittal, additional effort is needed on some of the energy conservation measures to confirm final costing and/or energy savings. We look forward to receiving feedback from the City and Celtic Energy so that we are able to deliver a final Investment Grade Audit report and a firm cost and savings proposal that meets the City’s needs and expectations, and delivers all of the value that the City expects from this effort.