City of La Crosse, Wisconsin

City Hall
400 La Crosse Street
La Crosse, WI 54601

Meeting Agenda

Climate Action Plan Steering Committee

Monday, October 9, 2023 | **4:30 PM** | **Grandad Room**

Note different meeting room

This meeting will also be conducted through video conferencing.

Join Zoom Meeting:
https://cityoflacrosse-org.zoom.us/j/83963386607?pwd=QlkvVG1EMm8vK2d6aXFrdWgyYXNaZz09

Meeting ID: 839 6338 6607 Passcode: 419317

Join by Phone: +1-305-224-1968

Call to Order

Roll Call

Approval of Minutes

Notices and Discussion

Agenda Items:

1 23-1181 Request to Submit Surface Water Grant Application for ReNew the Block Project

Attachments: Surface Water Grant Webpage

2 23-1183 Report on Johnson Controls' Energy Saving Performance Contract, Year 2 Measurement & Verification

Attachments: Report

3 23-1184 Discussion and Updates from Working Groups.

Next Meeting / Agenda Items

Adjournment

Notice is further given that members of other governmental bodies may be present at the above scheduled meeting to gather information about a subject over which they have decision-making responsibility.

NOTICE TO PERSONS WITH A DISABILITY
Requests from persons with a disability who need assistance to participate in this meeting should call the City Clerk's office at (608) 789-7510 or send an email to ADAcityclerk@cityoflacrosse.org, with as much advance notice as possible.

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Text File

File Number: 23-1181

Agenda Date: 10/9/2023 **Version:** 1 **Status:** Agenda Ready

In Control: Climate Action Plan Steering Committee **File Type:** Request

Agenda Number: 1

City of La Crosse, Wisconsin

City Hall
400 La Crosse Street
La Crosse, WI 54601

Text File

File Number: 23-1183

Agenda Date: 10/9/2023 **Version:** 1 **Status:** Agenda Ready

In Control: Climate Action Plan Steering Committee **File Type:** Status Update

Agenda Number: 2

City of La Crosse

Facility Improvements Through Performance Contract

Measurement & Verification Report – Year Two

Submitted by:
Jeff Van Ess
Jim Wolf

July 14, 2023

Presented to:
Lewis Kuhlman

The power behind **your mission**

Johnson Controls

July 14, 2023

Lewis Kuhlman, AICP
Environmental Planner
400 La Crosse St.
La Crosse, WI 56401

Dear Mr. Kuhlman:

On April 22, 2019, the City of La Crosse partnered with Johnson Controls to complete a Performance Contract designed to reduce the City's energy consumption and associated operational cost. This report has been prepared to detail the economic benefits realized by the City of La Crosse during implementation of the energy conservation and facility improvement measures through the end of Year Two (May 1, 2022 through April 30, 2023) of the three-year Guarantee Term.

Please know that Johnson Controls values our relationship with the City of La Crosse, and we look forward to working in partnership with the City's personnel to continue to provide programs, services, and support to enhance a comfortable, safe, and sustainable City.

Sincerely,

Jeff Van Ess
Senior Account Executive
Sustainable Infrastructure
262-505-0842
jeff.vaness@jci.com

Jim Wolf
Performance Specialist
Sustainable Infrastructure
630-917-4225
james.g.wolf@jci.com

Acceptance

Following review and acceptance of this report, please return a signed copy of this letter to:

Johnson Controls
Attn: Jim Wolf
20 Laurel Court
Yorkville, IL 60560

The Year Two report for the Performance Contract is accepted by the undersigned.

Signature: _____ Date: _____

Title: _____

Table of Contents

Executive Summary

The City of La Crosse's leadership team wished to deploy innovation to reduce the city's environmental footprint. In doing so, they would remain on track to reach their 2050 environmental goals, including achieving carbon neutrality and transitioning to 100% renewable energy. To reach these targets, enrich the community for generations to come and remain fiscally responsible to constituents, the City of La Crosse partnered with Johnson Controls. Together, we have embarked on a multi-phase sustainability and modernization initiative under a performance contract.

Via our partnership, the City of La Crosse and Johnson Controls created a comprehensive infrastructure improvement program through a twenty-year Performance Contract, dated April 22, 2019. The program optimizes systems and equipment, improves building environments, saves energy, and has provided benefits totaling $1,672,822, with a performance guarantee based on both measured and non-measured savings.

The primary goals of this project were established as:

- Reduce utility usage in the buildings
- Implement City-owned Renewable Energy
- Reduce deferred capital improvements
- Reduce on-going maintenance costs within the buildings
- Improve environment for building occupants
- Create a positive impact on the environment

This report details the savings the City achieved during implementation of the energy conservation and facility improvement measures through Year Two (May 1, 2022 through April 30, 2023) of the Guarantee Term.

The combined energy savings, capital benefits, energy rebate benefits, and operational benefits, have resulted in $1,672,822 total savings through the end of Year Two. As can be noted below, the aggregate results indicate this project has exceeded guarantee expectations.

$600,000	$689,764	$262,937	$120,121
Capital Benefits	Energy Savings [Installation through Year 2]	Energy Rebate Benefits	Operational & Maintenance Benefits

$1,672,822
Actual Benefits to Date

$1,408,739
Year 2 Projected Total Benefits

$21,528	$264,083
Year 2 Excess Energy and O&M Savings	Year-to-Date Excess Savings

This savings generated an excess for Year Two of $21,528. When combined with the benefits realized during the installation period, the project has cumulative excess savings of $264,083.

Summary of Project Benefits and Results

The energy and operational savings are to be derived from the following energy conservation measures (ECM).

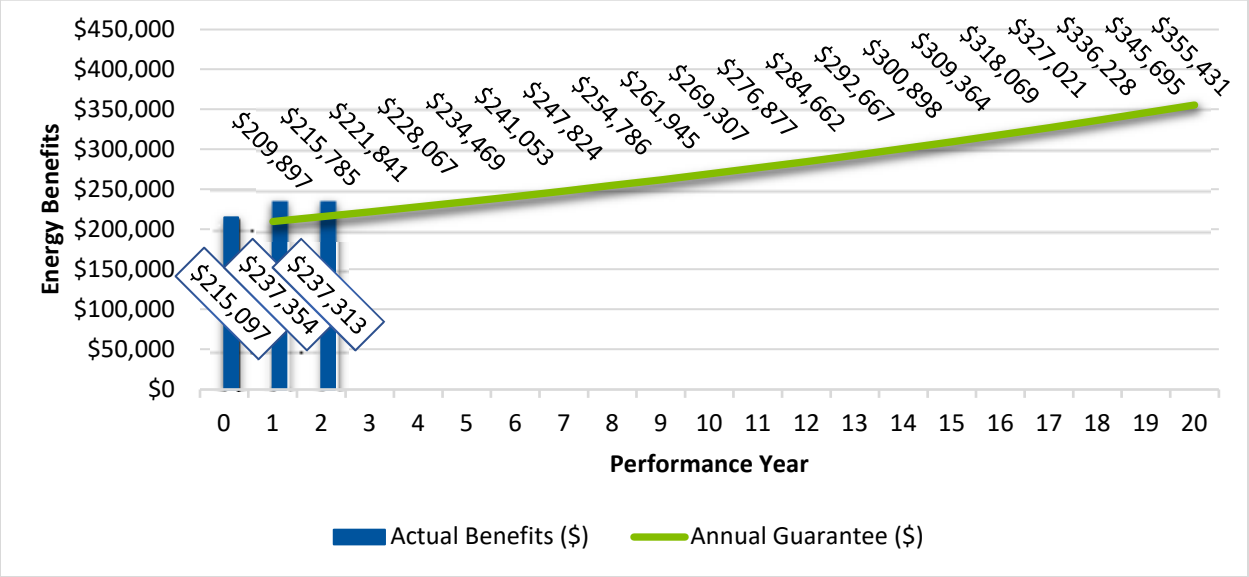
ECM Number	Energy Conservation Measure
ECM-1-LCCH	Replace Existing City Hall Heating Plant
ECM-2-LCCH	Replace Existing City Hall Chiller and Reconfigure Existing Chilled Water Plant
ECM-4-LCCH	Retrofit City Hall Lighting to LED
ECM-1-LCC	Retrofit La Crosse Center Lighting to LED
ECM-1-LCC-ALT	Retrofit La Crosse Center Parking Ramp Lighting to LED
ECM-2-LCC	Replace La Crosse Center VAV Terminals
ECM-3-LCC	Repair La Crosse Center Arena AHUs
ECM-1-LCML	Replace and Reconfigure Main Library Cooling Plant
ECM-2-LCML	Retrofit Main Library Lighting to LED
ECM-3-LCML	Implement Demand Control Ventilation for Main Library AH-1
ECM-2-LCMSC	Retrofit Service Center Lighting to LED
ECM-5-LCCH	City Hall PV Array
ECM-4-LCC	La Crosse Center PV Array
ECM-5-LCC	La Crosse Center Roof Replacement
ECM-4-LCML	Main Library PV Array
ECM-3-LCMSC	Service Center PV Array

Upon receipt of the Performance Contract, dated April 22, 2019, Johnson Controls mobilized to complete the scope of work. As can be noted in Appendix 2 – Completion Dates, the individual projects were completed at varying times during the Installation Period. Upon completion of each measure, the City of La Crosse began to realize economic benefits.

The following are highlights through the end of Year Two:

- Based upon the individual project completion dates, the City of La Crosse realized $215,097 in energy savings during the Installation Period
- Utility incentive (energy rebate) benefits totaled $238,635 achieving nearly 91% of the projected rebates [$262,936]
- Year Two benefits exceeded expectations by $21,528
- Avoided future capital expenditure of $600,000
- Environmental stewardship through reduced carbon emissions by 5,350 metric tons of CO_2

The following chart shows a comparison of the guaranteed measured and non-measured energy savings versus the actual achieved savings to date.



Decarbonization Impact

This project has benefits to the City outside of reducing your expenditure on utilities and maintenance. The reduction in energy consumption by the City of La Crosse also has a positive impact on your carbon dioxide (CO_2), nitrogen oxide (NOx), sulfur dioxide (SO_2), and other environmentally harmful emissions. Through Year Two, CO_2 emissions were reduced by 5,350 metric tons.

The following graphic depicts the emission reduction equivalencies achieved by the City as a result of the improvements made during the Installation Period through the end of Year Two of the Guarantee Term.

5,350

Metric Tons of CO_2 Emissions equates to:

GHG emissions from:	**CO_2 emissions from:**	**Carbon sequestered by:**
		
1,190	**601,884**	**88,445**
Passenger vehicles driven for one year	Gallons of gasoline consumed	Tree seedlings grown for 10 years

Additional Partnership Benefits to City of La Crosse

During the Installation Period, Johnson Controls partnered with Lewis Kuhlman, Environmental Planner to ensure the scope of work met City of La Crosse's expectations. This collaborative effort resulted in the retrofit of several additional light fixtures which served to enhance the projects energy and operational savings.

Scheduled Main Library Solar PV installation around a planned roof installation.

Assisted the City by providing documents for Energy Rebates and Grants resulting in $238,635.

Coordinated La Crosse Center improvements around the expansion project.

During the COVID-19 pandemic, the team also identified and implemented healthy facility technology at City Hall and the Main Library.

The team also identified and recently completed the implementation of an additional Performance Contract phase that includes street lighting retrofits to LED technology, lighting and HVAC upgrades at various park facilities and fire stations, and three additional City-owned Solar PV arrays.

New Opportunities for Improvement

Johnson Controls is fully committed to continuing our long-standing partnership with the City of La Crosse. As part of our services, we recommend continued collaboration to identify additional projects to maximize the benefits of your current systems, as well as support your future goals and long-term planning. To that end, we are currently in joint development of the next Performance Contracting phase (Phase IV) in which we are further investigating the following technology and services:

- Improvements at the Green Island Ice Arena
- Improvements at Public Pools
- La Crosse Center and Fire Stations #2 and #4 solar arrays
- Electric Vehicle charging stations

Year Two Results

The City of La Crosse began to realize economic benefit as the individual projects were completed during the Installation Period and throughout Year Two of the Guarantee Term (see Appendix 2 – Completion Dates). Based upon the individual project completion dates, the Year Two energy savings have exceeded guarantee expectations. The table below details the energy unit performance of each Energy Conservation Measure (ECM) during the Year Two period.

ECM Number	ECM Name	Electric Savings				Natural Gas Savings		Steam	
		Energy (kWh)		Demand (kW)		(MMBtu)*		(Mlb)**	
		Guaranteed	Actual	Guaranteed	Actual	Guaranteed	Actual	Guaranteed	Actual
ECM-1-LCCH	Replace Existing City Hall Heating Plant					1,271	1,706		
ECM-2-LCCH	Replace Existing City Hall Chiller and Reconfigure Existing Chilled Water Plant	87,311	202,395	258	258				
ECM-4-LCCH	Retrofit City Hall Lighting to LED	109,997	119,975	74	56				
ECM-1-LCC	Retrofit La Crosse Center Lighting to LED	850,682	845,673	251	260				
ECM-1-LCC-ALT	Retrofit La Crosse Center Parking Ramp Lighting to LED	230,420	219,847	37	44				
ECM-2-LCC	Replace La Crosse Center VAV Terminals	38,763	38,763					269	269
ECM-3-LCC	Repair La Crosse Center Arena AHUs								
ECM-1-LCML	Replace and Reconfigure Main Library Cooling Plant	66,745	144,313	288	288				
ECM-2-LCML	Retrofit Main Library Lighting to LED	244,207	256,567	68	80				
ECM-3-LCML	Implement Demand Control Ventilation for Main Library AH-1	534	534			22	22		
ECM-2-LCMSC	Retrofit Service Center Lighting to LED	94,990	101,224	14	35				
ECM-5-LCCH	City Hall PV Array	113,901	115,619	80	80				
ECM-4-LCC	La Crosse Center PV 100 kW Array	131,196	130,875	85	85				
ECM-5-LCC	La Crosse Center Roof Replacement								
ECM-4-LCML	Main Library PV Array	123,198	124,930	82	82				
ECM-3-LCMSC	Service Center PV Array	124,292	141,391	82	82				
	Total	*2,216,236*	*2,442,107*	*1,319*	*1,351*	*1,293*	*1,728*	*269*	*269*
	Excess (+) v. Shortfall (-)	225,871		32		435		0	

The table below details the **energy cost performance** of each Energy Conservation Measure (ECM) during the Year Two period.

ECM Number	ECM Name	Electric Savings				Natural Gas Savings		Steam	
		Energy (kWh [$])		Demand (kW [$])		(MMBtu [$])*		(Mlb [$])**	
		Guaranteed	Actual	Guaranteed	Actual	Guaranteed	Actual	Guaranteed	Actual
ECM-1-LCCH	Replace Existing City Hall Heating Plant					$7,887	$10,609		
ECM-2-LCCH	Replace Existing City Hall Chiller and Reconfigure Existing Chilled Water Plant	$5,704	$13,248	$4,171	$4,177				
ECM-4-LCCH	Retrofit City Hall Lighting to LED	$6,976	$7,853	$1,168	$911				
ECM-1-LCC	Retrofit La Crosse Center Lighting to LED	$53,957	$55,356	$3,916	$4,086				
ECM-1-LCC-ALT	Retrofit La Crosse Center Parking Ramp Lighting to LED	$14,615	$14,391	$567	$689				
ECM-2-LCC	Replace La Crosse Center VAV Terminals	$2,537	$2,537					$77	$77
ECM-3-LCC	Repair La Crosse Center Arena AHUs								
ECM-1-LCML	Replace and Reconfigure Main Library Cooling Plant	$4,552	$9,860	$4,573	$4,580				
ECM-2-LCML	Retrofit Main Library Lighting to LED	$16,160	$17,529	$1,054	$1,271				
ECM-3-LCML	Implement Demand Control Ventilation for Main Library AH-1	$36	$36			$142	$142		
ECM-2-LCMSC	Retrofit Service Center Lighting to LED	$6,233	$6,851	$178	$458				
ECM-5-LCCH	City Hall PV Array	$7,456	$7,568	$12,579	$12,579				
ECM-4-LCC	La Crosse Center PV 100 kW Array	$8,588	$8,567	$12,848	$12,848				
ECM-5-LCC	La Crosse Center Roof Replacement								
ECM-4-LCML	Main Library PV Array	$8,417	$8,535	$12,655	$12,655				
ECM-3-LCMSC	Service Center PV Array	$8,413	$9,570	$10,328	$10,328				
	Total	*$143,644*	*$161,902*	*$64,037*	*$64,582*	*$8,029*	*$10,751*	*$77*	*$77*
	Excess (+) v. Shortfall (-)	$18,258		$546		$2,722		$0	

*MMBtu is a common energy industry unit of measure that is equal to one million British thermal units (Btu). MMBtu is also equal to ten (10) therms. A therm is the unit of measure as typically billed by the natural gas utility.

**Mlb is a common energy industry unit of measure that is equal to one million British thermal units (Btu). Mlb is also equal to one thousand pounds of steam which is the typical unit of measure for steam systems.

Utility Rates for Calculations

The “Base Utility Cost(s)” were established after extensive review of the City of La Crosse’s actual energy usage during the time period January 2017 through December 2018. These “Base Utility Cost(s)” were set forth in the Contract as the basis for all savings calculations and are to be “escalated annually, beginning in Year One, by the actual utility cost escalation, but such escalation shall be no less than the mutually agree ‘floor’ escalation rate of three percent (3%).” The utility rates used to calculate the Installation Period and Year Two energy savings can be found in Appendix 1.

Measurement & Verification

Overview

The performance measurement and verification (M&V) methodologies applicable to the Energy Conservation Measure (ECM) set forth below are predicated upon the International Performance Measurement & Verification Protocol (IPMVP) for the transparent, reliable and consistent reporting of savings for this project. The table below details the IPMVP M&V Option associated with each listed energy conservation measure (ECM).

Summary of M&V Options

ECM Number	Energy Conservation Measure	M&V Option
ECM-1-LCCH	Replace Existing City Hall Heating Plant	Option A
ECM-2-LCCH	Replace Existing City Hall Chiller and Reconfigure Existing Chilled Water Plant	Option A
ECM-4-LCCH	Retrofit City Hall Lighting to LED	Option A
ECM-1-LCC	Retrofit La Crosse Center Lighting to LED	Option A
ECM-1-LCC-ALT	Retrofit La Crosse Center Parking Ramp Lighting to LED	Option A
ECM-2-LCC	Replace La Crosse Center VAV Terminals	Non-Measured
ECM-3-LCC	Repair La Crosse Center Arena AHUs	Non-Measured
ECM-1-LCML	Replace and Reconfigure Main Library Cooling Plant	Option A
ECM-2-LCML	Retrofit Main Library Lighting to LED	Option A
ECM-3-LCML	Implement Demand Control Ventilation for Main Library AH-1	Non-Measured
ECM-2-LCMSC	Retrofit Service Center Lighting to LED	Option A
ECM-5-LCCH	City Hall PV Array	Option A
ECM-4-LCC	La Crosse Center PV Array	Option A
ECM-5-LCC	La Crosse Center Roof Replacement	Non-Measured
ECM-4-LCML	Main Library PV Array	Option A
ECM-3-LCMSC	Service Center PV Array	Option A

ECM-1-LCCH Replace Existing City Hall Heating Plant

ECM Description

At City Hall, the two (2) existing hot water boilers and two (2) pumps were replaced with a condensing boiler plant containing two (2) new sealed combustion boilers and two (2) new primary pumps. Two (2) new secondary pumps were added to provide a primary-secondary variable flow system. Additionally, the plant has full digital controls installed.

M&V Activities

Contract Compliance

The savings associated with this energy conservation measure have been calculated in accordance with the provisions associated with the International Performance Measurement and Verification Protocol (IPMVP), Option A, Retrofit Isolation with Key Parameter Measurement. Measured Project Benefits have been determined by partial field measurement of the energy use of the system(s); separate from the energy use of the rest of the facility. Partial measurement means that some but not all parameters have been measured. Careful review of the design and installation of Improvement Measures is intended to demonstrate that the agreed-upon values fairly represent the probable actual values. Agreed-upon values are detailed, documented and agreed upon. Engineering calculations using measurements and agreed-upon values are used to calculate Measured Project Benefits for the duration of the Guarantee Term.

Savings Methodology

Equations for Calculating Savings

The savings for this ECM are generated through a gain in efficiency with the new equipment compared to the existing equipment.

The baseline efficiency is based on manufacturer's data, engineering judgment and the age of the equipment. It is agreed that the baseline efficiency is to be 75% and will not be measured. Boiler Radiant Jacket and Boiler Distribution Losses listed below are also estimated and will not

be measured. The calculation below has been updated with the post-retrofit measured boiler combustion efficiency and Year Two utility rates.

Heating System Efficiency	
Assumed Current Boiler Combustion Efficiency (%)	75.0%
Proposed Boiler Combustion Efficiency (%)	88.75%
Assumed Current Boiler Radiant Jacket Losses (%)	9.0%
Proposed Boiler Radiant Jacket Losses (%)	1.0%
Current Boiler Distribution Losses (%)	5.0%
Proposed Boiler Distribution Losses (%)	5.0%
Oil Usage Information	
Annual Fuel Consumption (MMBtu)	0.00
Proposed Oil Savings from other measures (MMBtu)	0.00
Estimated Non-Boiler Oil Consumption (MMBtu)	0.00
Gas Usage Information	
Annual Gas Consumption (Therms)	77,206
Proposed Gas Savings from other measures (Therms)	0.00
Estimated Non-Boiler Gas Consumption (Therms)	772
Calculation	
Net Applicable Fuel Usage (MMBtu)	7,643
Current Boiler Fuel-to-Heat Efficiency (%)	65%
Proposed Boiler Fuel-to-Heat Efficiency (%)	83%
Fuel Savings (MMBtu)	1,706

Formulae

1. Net Applicable Fuel Usage (MMBtu) = (Current Oil Consumption - Proposed Oil Savings from other measures - Non-Boiler Oil Consumption)+ (Current Gas Consumption - Proposed Gas Savings from other measures - Non-Boiler Gas Consumption)
2. Fuel-to-Heat Efficiency = Boiler Combustion Efficiency x (1-Boiler Radiant Jacket Losses) x (1-Boiler Distribution Losses)
3. Fuel Savings = Net Applicable Fuel Usage - (Net Applicable Fuel Usage x (Current Fuel-to-Heat Efficiency/Proposed Fuel-to-Heat Efficiency))

Annual Savings

The following table lists the Year Two economic benefits.

ECM Number	Energy Conservation Measure	(MMBtu/yr)	($)
ECM-1-LCCH	Replace Existing City Hall Heating Plant	1,706	$10,609
Totals		**1,706**	**$10,609**

Replace and Reconfigure Chilled Water Plant

- ECM-2-LCCH
- ECM-1-LCML

ECM Description

The City Hall existing chiller was replaced with a new water-cooled York YZ magnetic bearing, variable speed, centrifugal, chiller with a new primary pump. The existing well water connection was reused as cooling for the condenser.

The Main Library scope of work replaced the existing chilled water plant. This includes replacing one existing chiller, cooling towers, chilled water pump, and condenser water pumps. The new chiller was a York YZ magnetic bearing, variable speed, centrifugal chiller. The 225-ton chiller has been sized to accommodate the existing cooling load for the building (approximately 185 tons) as well as limited expansion within the footprint of the old museum space (approximately 35 tons). A single tower was installed to support the capacity of either the new 225-ton chiller or the existing 320-ton Trane chiller running as backup. The roof curb and steel structure were modified to accommodate the new tower. Additionally, this ECM included balancing of the outside air dampers in the seven (7) existing air handling units and reset of the control system outside air minimums.

New York Chiller	New Cooling Tower
	

M&V Activities

Contract Compliance

The savings associated with this energy conservation measure have been calculated in accordance with the provisions associated with the International Performance Measurement and Verification Protocol (IPMVP), Option A, Retrofit Isolation with Key Parameter Measurement. Measured Project Benefits have been determined by partial field measurement of the energy use of the system(s); separate from the energy use of the rest of the facility. Partial measurement means that some but not all parameters have been measured. Careful review of the design and installation of Improvement Measures is intended to demonstrate that the agreed-upon values fairly represent the probable actual values. Agreed-upon values are detailed, documented and agreed upon. Engineering calculations using measurements and agreed-upon values are used to calculate Measured Project Benefits for the duration of the Guarantee Term.

Savings Methodology

Equations for Calculating Savings

ECM-2-LCCH Replace Existing City Hall Chiller and Reconfigure Existing Chilled Water Plant

The savings for this ECM are generated through a gain in efficiency with the new equipment compared to the existing equipment.

The baseline efficiency is based on manufacturer's data, engineering judgment and the age of the equipment. It is agreed that the efficiency is to be 0.85 kW per Ton and will not be measured. The output from the calculation file below will be annually updated with the measured efficiency and/or actual energy usage and reported in the annual report. Chillers will be confirmed annually to meet the operation sequence used to calculate the savings.

The following table reflects the actual chiller energy usage (kWh) as compared to the previous chiller energy usage.

	Est. old Chiller kWh	Actual kWH	kWh Savings	Est. old kW Ton @ 0.85	Est new kW Ton @ 0.65	Est. kW Savings
May-2022	36,400	3,824	32,576	106	71	36
Jun-2022	50,400	12,196	38,204	129	85	43
Jul-2022	76,450	16,236	60,214	142	94	48
Aug-2022	60,800	16,740	44,060	155	103	52
Sep-2022	46,000	15,418	30,582	117	78	39
Oct-2022	0	2,798	-2,798	0	0	0
Nov-2022	0	0	0	0	0	0
Dec-2022	0	0	0	0	0	0
Jan-2023	0	0	0	0	0	0
Feb-2023	0	0	0	0	0	0
Mar-2023	0	0	0	0	0	0
Apr-2023	1,180	1624	-444	120	80	40
	271,230	68,836	202,395	769	511	

ECM-1-LCML Replace and Reconfigure Main Library Existing Chilled Water Plant

The savings for this ECM are generated through a gain in efficiency with the new equipment compared to the existing equipment.

The baseline efficiency is based on manufacturer's data, engineering judgment and the age of the equipment. It is agreed that the efficiency is to be 0.85 kW per Ton and will not be measured. The output from the calculation file below will be annually updated with the measured efficiency and/or actual energy usage and reported in the annual report. Chillers will be confirmed annually to meet the operation sequence used to calculate the savings.

The following table reflects the actual chiller energy usage (kWh) as compared to the previous chiller energy usage.

	Est. old Chiller kWH	Actual kWh	kWh Savings	Est. old kW Ton @ 0.85	Est new kW Ton @ 0.65	Est. kW Savings
May-2022	45,000	17,679	27,321	118	76	42
Jun-2022	64,400	27,529	36,871	132	85	47
Jul-2022	56,100	32,340	23,760	120	78	42
Aug-2022	56,100	30,902	25,198	120	78	42
Sep-2022	36,400	18,427	17,973	122	79	43
Oct-2022	17,200	5,725	11,475	101	65	36
Nov-2022	0	0	0	0	0	0
Dec-2022	0	0	0	0	0	0
Jan-2023	0	0	0	0	0	0
Feb-2023	0	0	0	0	0	0
Mar-2023	0	0	0	0	0	0
Apr-2023	4,400	2685	1,715	104	67	37
	279,600	135,287	144,313	816	528	288

Annual Savings

The following table lists the Year Two economic benefits.

ECM Number	Energy Conservation Measure	(kWh)	($)	(kW)	($)
ECM-2-LCCH	Replace Existing City Hall Chiller and Reconfigure Existing Chilled Water Plant	202,395	$13,248	258	$4,177
ECM-1-LCML	Replace and Reconfigure Main Library Cooling Plant	144,313	$9,860	288	$4,580
Totals		**346,708**	**$23,108**	**546**	**$8,757**

Retrofit Lighting to LED

- ECM-4-LCCH
- ECM-1-LCC
- ECM-1-LCC-ALT
- ECM-2-LCML
- ECM-2-LCMSC

ECM Description

Lighting retrofits were installed at City Hall, La Crosse Center and Parking structure, Main Library, and Municipal Service Center. The conversion to LED lighting and reengineering of the fixtures made it possible have consistent light levels and matching temperature colors to better illuminate the areas. Each was assessed to provide the most cost-effective solution. The final retrofit count across all facilities was 5,340 fixtures.

M&V Activities

Contract Compliance

The savings associated with this energy conservation measure have been calculated in accordance with the provisions associated with the International Performance Measurement and Verification Protocol (IPMVP), Option A, Retrofit Isolation with Key Parameter Measurement. Measured Project Benefits have been determined by partial field measurement of the energy use of the system(s); separate from the energy use of the rest of the facility. Partial measurement means that some but not all parameters have been measured. Careful review of the design and installation of Improvement Measures is intended to demonstrate that the agreed-upon values fairly represent the probable actual values. Agreed-upon values are detailed documented and agreed upon. Engineering calculations using measurements and agreed-upon values are used to calculate Measured Project Benefits for the duration of the Guarantee Term.

Savings Methodology

Equations for Calculating Savings

The savings for this ECM are generated through a reduction in energy used by the lighting system; therefore, the measurement boundary is the lighting system itself.

Equations for Calculating Lighting Retrofit Savings (Option A)

Demand (kW)

$$\text{Connected kW Saving} = \sum_u [\ (\text{kW/Fixture}_{baseline} \times \text{Quantity}_{baseline} - \text{kW/Fixture}_{post} \times \text{Quantity}_{post})]_{t,u}$$

where:

$\text{kW/fixture}_{baseline}$ = lighting baseline demand per fixture for usage group *u*

kW/fixture_{post} = lighting demand per fixture during post-installation period for usage group

$\text{Quantity}_{baseline}$ = quantity of affected fixtures before the lighting retrofit for usage group *u*

Quantity_{post} = quantity of affected fixtures after the lighting retrofit for usage group *u*

Examples of usage groups include hallways and offices.

Energy (kWh)

$$\text{kWh Savings}_{Lighting} = \Sigma_u [\text{Connected kW Savings}_u \times \text{Hours of Operation}]_{t,u}$$

where:

Hours of Operation= number of operating hours during the time period *t* for the usage group *u*

The lighting system annual run hours by space type are agreed to be as summarized in the table below. The run hours are based on building operating schedules and information provided by facility staff during walk-throughs. These values are considered non-measured and agreed upon by the City.

Building	Area	Existing Burn Hours Assigned	Proposed Burn Hours
City Hall	Elevators	8,760	8,760
	Police Station Common Areas	8,760	4,380
	Exterior Wallpacks	4,380	2,500
	Police Station, all other areas	2,500	2,500
	Main Lobby	2,500	2,500
	Grounds Department Basement Rooms	2,500	1,000
	Police Firing Range	1,000	2,000
	City Hall, all other areas	2,000	4,084
La Crosse Center	South Hall A, Metal Halide Lighting	4,084	4,000
	South Hall A, Halogen Incandescent Lighting	4,000	4,300
	South Hall B	4,300	4,400
	South Hall Lobby	4,400	3,800
	Arena, Metal Halide Lighting	3,800	2,500
	Arena, Halogen Incandescent Lighting	2,500	1,500

Building	Area	Existing Burn Hours Assigned	Proposed Burn Hours
	Common Areas	1,500	1,000
	Offices	1,000	8,760
La Crosse Center Parking Ramp	Elevator	8,760	8,760
	24/7 Canopy Lighting	8,760	8,760
	All other lighting	4,380	4,380
Main Library	Public Reading Rooms	3,850	3,850
	Exterior Lighting	4,300	4,300
	Elevators	8,760	8,760
	Basement Offices and Auditorium	2,000	2,000
	Basement Storage Spaces	1,000	1,000
	Basement Utility Rooms	500	500
	Winding Rivers Room	1,500	1,500
Municipal Services Center	Maintenance Shop	6,370	6,370
	Exterior Lighting	4,300	4,300
	Parts	3,000	3,000
	MTU Office, Streets Office	2,500	2,500
	Vehicle Storage	2,125	2,125
	Sign Shop	2,000	2,000
	Bus Parking	1,820	1,820
	Lunch Room	1,500	1,500

Annual Savings

The savings for this FIM were verified through actual pre- and post-wattage measurements conducted during the installation period. The savings were calculated for each building annually in energy units, applying the associated utility rates. The following table is the result of updating the lighting calculations to include the pre-retrofit and post-retrofit wattage measurements, final quantities, fixture types, and Year Two utility rates.

ECM Number	Energy Conservation Measure	(kWh)	($)	(kW)	($)
ECM-4-LCCH	Retrofit City Hall Lighting to LED	119,975	$7,853	56	$911
ECM-1-LCC	Retrofit La Crosse Center Lighting to LED	845,673	$55,356	260	$4,086
ECM-1-LCC-ALT	Retrofit La Crosse Center Parking Ramp Lighting to LED	219,847	$14,391	44	$689
ECM-2-LCML	Retrofit Main Library Lighting to LED	256,567	$17,529	80	$1,271
ECM-2-LCMSC	Retrofit Service Center Lighting to LED	101,224	$6,916	35	$458
Totals		**1,543,287**	**$102,045**	**476**	**$7,415**

Solar Photovoltaic (PV) Array

- ECM-5-LCCH
- ECM-4-LCC
- ECM-4-LCML
- ECM-3-LCMSC

ECM Description

Solar PV arrays were installed at City Hall, La Crosse Center, Main Library and Municipal Service Center. The design considered the roof layout, potential shading sources and architectural constraints. The Main Library installation was coordinated with the City's planned roof replacement. The combined energy expected first year production is 510,374 kWh, following years are expected to have an annual 0.5% degradation.

La Crosse Center

Main Library

Municipal Service Center

City Hall

Photos courtesy of Eagle Point Solar

M&V Activities

Contract Compliance

The electrical production for this ECM will be verified using IPMVP Option A, Retrofit Isolation with Key Parameter Measurement. The electrical production for this ECM is generated through a production of electricity through the solar photovoltaic arrays; therefore, the measurement boundary is the Solar PV system itself.

Parameter	Measurement Frequency	Measurement Description
Irradiance (kWh/m2)	ongoing	The irradiance will be measured using a pyranometer. The value will be totalized, and the totalized value will be recorded on an hourly basis using the system software. Two pyranometers will be installed at the same tilt and azimuth angle as the PV array. One of these pyranometers will be the primary and will have a rated accuracy of +/- 2%. The other pyranometer will be a backup, will have a rated accuracy of +/- 5%, and will be used to fill in any gaps in the irradiance data from the primary pyranometer. The primary pyranometer will be sent to a manufacturer-certified laboratory every two years for recalibration starting year 4.
AC Energy (kWh)	ongoing	The AC energy will be measured using revenue-grade AC meters located near the AC interconnection point of each PV system.

Savings Methodology

Equations for Calculating Savings

The estimated energy production for this ECM is based on a computer simulation performed using the HelioScope software. Below is the baseline monthly and annual solar irradiance (plane of array) for La Crosse, based on the NSRDB TMY2 weather data for La Crosse Municipal Airport. Also shown in the table below is the Year One Energy production estimate for the combined output of the PV systems.

PV Array	Baseline Global Incident (Plane of Array) Irradiance (kWh/m2)	Baseline Year 1 AC Energy output (kWh)
Service Center PV Array	103	129,263
La Crosse Center PV 100 Kw Array	101	135,762
Main Library PV Array	95	127,485
City Hall PV Array	94	117,864
Annual Total	**NA**	**510,374**

Below is the Baseline AC Energy Output for the combined PV systems, by Project Year. These numbers include degradation of 3% during the first year then 0.5% per year thereafter from the 2nd until 20th year (only 10 years shown in the table) of the manufacturer's warranty period were accounted for in the savings model.

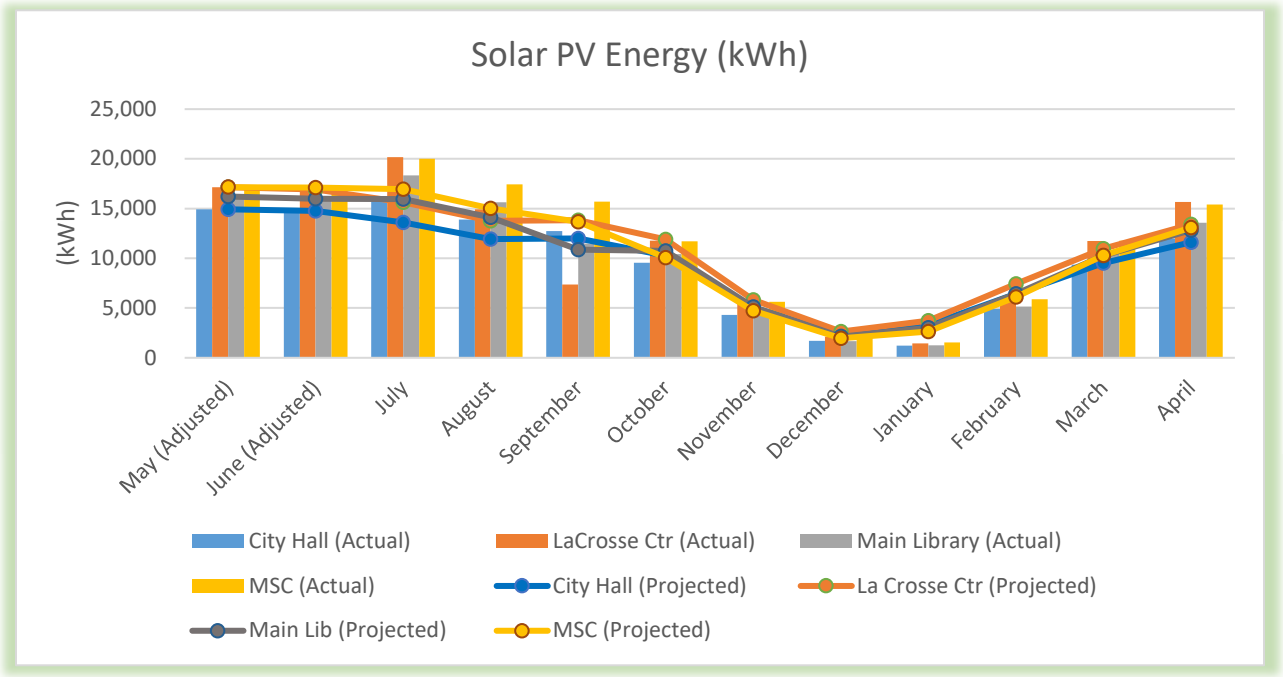
Project Year	Baseline AC Energy output(kWh)
1	510,374
2	507,822
3	505,283
4	502,756
5	500,242
6	497,741
7	495,253
8	492,776
9	490,312
10	487,861

The energy production guarantee shall assume the monthly baseline (reference) solar irradiance as shown above. On an annual basis (recorded monthly), the total measured AC Energy output of the PV systems will be adjusted based on the actual measured plane-of-array solar irradiance received compared to the baseline (reference) plane-of-array solar irradiance, as per the following formula:

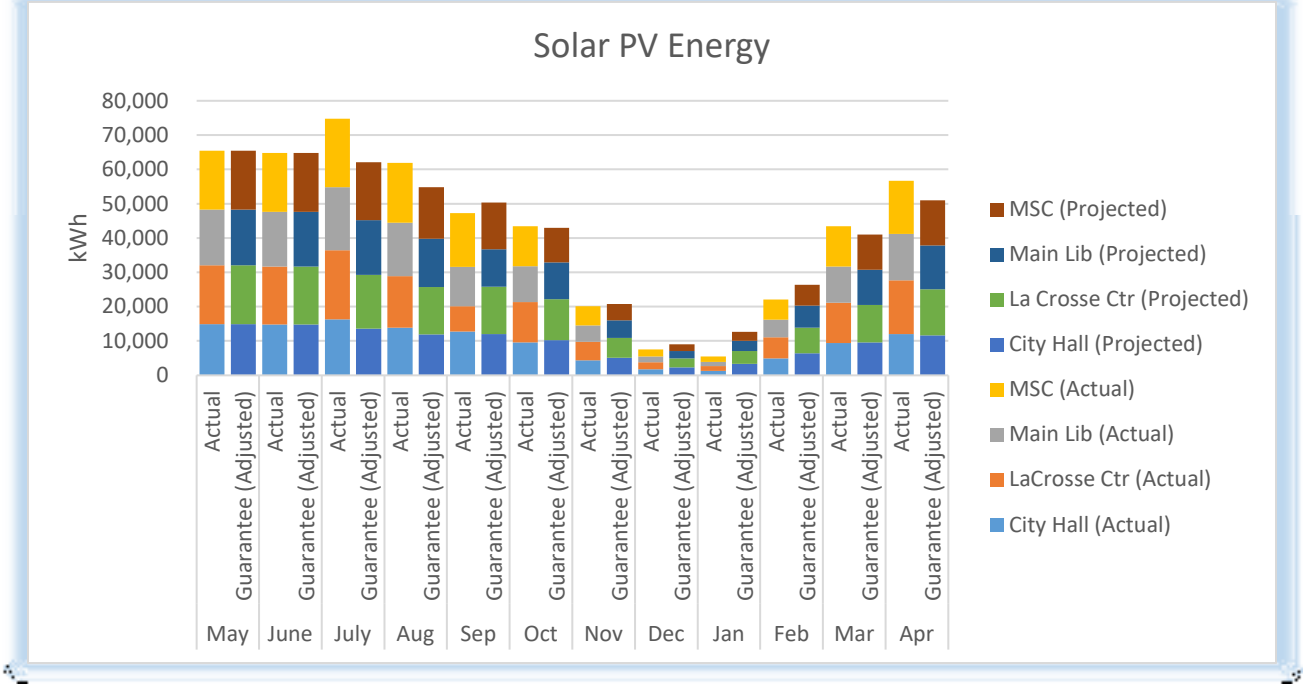
$$P_{Adjusted} = (P_{Measured})\left(\frac{Q_{reference}}{Q_{actual}}\right)$$

Where P is energy measured in kWh and Q is solar irradiance measured in kWh/m2, either the actual measured or the reference as shown. If the adjusted amount of measured energy produced is less than the baseline energy for a given Project Year, the amount of kWh shortfall will be multiplied by the applicable $/kWh electricity rate for the Student Community Center for that Project Year, and the result will be the PV ECM Project Benefit Shortfall for that year. If the adjusted amount of measured energy produced is greater than the baseline energy for a given Project Year, the amount of kWh surplus will be multiplied by the applicable $/kWh electricity rate for the site for that Project Year, and the result will be the PV ECM Project Benefit Surplus for that year.

The table below reflects the actual solar PV energy production (kWh) as compared to the projected production. Where the columns are greater than the lines, the systems produced more energy than expected.



The table below reflects the actual solar PV energy production (kWh) as compared to the guaranteed production when adjusted to align with the actual solar irradiance realized during this reporting period. Where the Actual columns are greater than the Guarantee (Adjusted) columns, the systems produced more energy than what would have been expected. In aggregate, the systems met performance expectations.



Annual Savings

The following table was updated using the Year Two kWh production and Year Two utility rates.

ECM Number	Energy Conservation Measure	(kWh)	($)	(kW)	($)
ECM-5-LCCH	Service Center PV Array	115,619	$7,568	80	$12,579
ECM-4-LCC	La Crosse Center PV 100 Kw Array	130,875	$8,567	85	$12,848
ECM-4-LCML	Main Library PV Array	124,930	$8,535	82	$12,655
ECM-3-LCMSC	City Hall PV Array	141,391	$9,570	82	$10,328
Totals		**512,815**	**$34,240**	**329**	**$48,410**

Non-Measured Agreed Upon Engineering Calculations

Non-Measured Utility Benefits

Where the cost to validate the projected savings is determined to be potentially greater than the value of the savings, the City of La Crosse and Johnson Controls have agreed upon the engineering calculations associated with the projected savings. With reasonable effort, the City of La Crosse should expect to realize the energy savings detailed below. These Non-Measured Project Benefits were derived using engineering calculations based upon industry standards and data provided by the City of La Crosse. Details can be found in the Performance Contract.

ECM-3-LCML Implement Demand Control Ventilation for Main Library AH-1

ECM Description

The Main Library retrofit installed new occupancy sensors and CO2 based demand control ventilation for specified high occupancy spaces. The new lighting occupancy sensors were also tied into air handler operation to provide better control of space. These improvements included reconditioning of the existing digital controls and actuators on the Air Handler Unit.

ECM-2-LCC Repair La Crosse Center VAV Terminals

ECM Description

Thirty-two (32) variable air volume (VAV) terminals were replaced with new VAV terminals and updated direct digital controls (DDC). Work included installing control valves for hot water reheat coils, any necessary ductwork changes, and insulation of all installed equipment. Each area had a temperature sensor added for full digital control.

ECM-3-LCC Repair La Crosse Center Arena AHUs

ECM Description

Air Handling Unit improvements repaired the fans and replaced the coils on the four (4) air handling units serving the La Crosse Center Arena. Installation included four (4) supply fan motors and four (4) relief fan motors with high efficiency motors, sized to match existing motors. The design included installing variable frequency drives (VFD) on each fan motor for “soft start.” This will protect the air handling units from excessive pressure build-up during start up and operation. Replacement of the associated fan pulleys, sheaves, and belts on four (4) supply fans and four (4) reliefs were performed with laser alignment of fan belts. The blower wheel, blower housing, and fan surfaces were cleaned and inspected. Heating and cooling coils were replaced and connected to the system via insulated pipes. The plant now has full digital controls installed.

New Variable Frequency Drive 	New High Efficiency Motor 
New Coil 	New Controls Actuator 

Annual Savings

The following table provides an overview of the Year Two non-measured utility benefits.

ECM Number	Non-Measured Utility Benefits	Year 2 Benefits	Escalation
ECM-3-LCML	Implement Demand Control Ventilation for Main Library AH-1	$179	3%
ECM-2-LCC	Replace La Crosse Center VAV Terminals	$2,614	3%
ECM-3-LCC	Repair La Crosse Center Arena AHUs	$0	3%
Total		**$2,793**	

Non-Measured Utility Rebate Benefits

Johnson Controls assisted the City in applying for rebates with Focus on Energy and Xcel Energy. Each rebate was submitted upon completion of the energy improvement with the required forms, inspections, and documentation. The following table lists the anticipated rebate amounts by energy improvement type. Upon completion of the project, the City was able to realize $238,635 in actual rebate reimbursement. These are one-time benefits and will not reoccur.

Non-Measured Rebate Benefits	Anticipated One-time Benefits	WI Focus on Energy (Actual)	Xcel Energy (Actual)
ECM-1-LCCH: Replace Existing City Hall Heating Plant	$0	$12,000	$4,000
ECM-2-LCCH: Replace Existing City Hall Chiller and Reconfigure Existing Chilled Water Plant	$0	$12,122	$0
ECM-4-LCCH: Retrofit City Hall Lighting to LED	$15,228	$10,372	$0
ECM-5-LCCH: City Hall PV Array	$28,044	$0	$0
ECM-1-LCC: Retrofit La Crosse Center Lighting to LED	$67,329	$70,330	$4,000
ECM-1-LCC-ALT: Retrofit La Crosse Center Parking Ramp Lighting to LED	$21,257	$15,437	$4,000
ECM-4-LCC: La Crosse Center PV Array	$29,286	$19,818	$0
ECM-1-LCML: Replace and Reconfigure Main Library Cooling Plant	$0	$7,256	$3,628
ECM-2-LCML: Retrofit Main Library Lighting to LED	$25,173	$21,798	$3,505
ECM-4-LCML: Main Library PV Array	$27,944	$17,478	$0
ECM-2-LCMSC: Retrofit Service Center Lighting to LED	$16,807	$9,447	$4,000
ECM-3-LCMSC: Service Center PV Array	$31,869	$19,444	$0
		$215,502	$23,133
Total Non-Measured Rebate Benefits:	**$262,937**	**$238,635**	

Operational and Capital Benefits

Non-Measured Operational and Capital Benefits are derived from avoided future costs. The City of La Crosse and Johnson Controls have agreed upon the engineering calculations associated with the projected savings. These Non-Measured Project Benefits were derived using engineering calculations based upon industry standards and data provided by the City of La Crosse.

ECM Number	Non-Measured Operational Benefits	Year 2 Benefits	Escalation
ECM-2-LCCH	The Non-Measured Operational Benefits of ECM-2-LCCH are a result of Operational Subcontracted Maintenance and Repair Costs avoided due to the new chiller	$10,927	3.00%
ECM-4-LCCH	The Non-Measured Operational Benefits of ECM-4-LCCH are the result of Operational Material Savings due to Lighting Replacement	$4,995	3.00%
ECM-1-LCC	The Non-Measured Operational Benefits of ECM-1-LCC are the result of Operational Material Savings due to Lighting Replacement	$27,713	3.00%
ECM-1-LCC-ALT	The Non-Measured Operational Benefits of ECM-1-LCC-ALT are the result of Operational Material Savings due to Lighting Replacement	$6,119	3.00%
ECM-2-LCML	The Non-Measured Operational Benefits of ECM-2-LCML are the result of Operational Material Savings due to Lighting Replacement	$8,155	3.00%
ECM-2-LCMSC	The Non-Measured Operational Benefits of ECM-2-LCMSC are the result of Operational Material Savings due to Lighting Replacement	$4,867	3.00%
Total Non-Measured Operational Benefits =		**$62,777**	

Appendix 1 – Utility Rates

The unit utility costs for the Baseline period are set forth below as “Base Utility Cost” and shall be used for all calculations made under this Schedule. The Base Utility Cost shall be escalated annually, beginning in Year One, by the actual utility cost escalation but such escalation shall be no less than the mutually agreed “floor” escalation rate of three percent (3.0%).

Baseline Rates

The calculations for baseline utility costs are further explained below. Baseline energy usage data for all buildings was obtained from Xcel Energy and analyzed against billed utility rates included within the data tables.

Baseline Electric: January to December, 2018 Natural Gas: January to December, 2017		Energy			Total Annual Utility
		Electric Consumption	Annual Electric Demand	Natural Gas	
		kWh	kW	therm	MMBtu
La Crosse City Hall	Dollars	$89,495	$44,739	$47,189	$181,423
	Units	1,450,720	330	80,516	
La Crosse Center	Dollars	$187,309	$109,927	$76,737	$373,974
	Units	3,035,813	737	164,095	
La Crosse Main Library	Dollars	$70,911	$38,565	$29,252	$138,727
	Units	1,101,600	270	47,370	
La Crosse MSC	Dollars	$21,335	$11,439	$28,212	$60,986
	Units	334,240	90	46,521	
Sites Total	**Dollars**	**$369,050**	**$204,670**	**$181,390**	**$755,111**
	Units	**5,922,373**	**1,427**	**338,502**	

The unit utility costs for the Baseline period are set forth below as “Base Utility Cost” and shall be used for all calculations, prior to utility cost escalation. The Base Utility Cost for electric, natural gas, and fuel represents the 12 or 24 month average utility costs between January 2017 and December 2018 as described in detail in the following table.

Building	Address	Account	Rate Code	Tariff	Unit	Base Rate	Year One Rate
La Crosse Center	300 HARBORVIEW PLZ	4374326	207	Xcel	Gas Used (therm)	$0.4676	$0.48163
			B13		Blended Electric Usage (kWh)	$0.0617	$0.06355
					Blended Electric Demand (kW)	$14.80	$15.24
La Crosse Main Library	800 MAIN ST	4892112	202	Xcel	Gas Used (therm)	$0.6087	$0.62695
			B13		Blended Electric Usage (kWh)	$0.0644	$.06633
					Blended Electric Demand (kW)	$14.99	$15.4397
La Crosse City Hall	400 LA CROSSE ST	6834747	202	Xcel	Gas Used (therm)	$0.5861	$0.60368
			B13		Blended Electric Usage (kWh)	$0.0617	$0.06355

					Blended Electric Demand (kW)	$15.26	$15.7178
La Crosse MSC	2000 MARCO DR	5863027	207	Xcel	Gas Used (therm)	$0.6182	$0.63675
			B06		Blended Electric Usage (kWh)	$0.0638	$0.06571
					Blended Electric Demand (kW)	$12.22	$12.5866

Year Two Rates

Listed below are the unit utility rates applicable to this reporting period.

Building	Address	Account	Unit	Rate
La Crosse Center	300 HARBORVIEW PLZ	4374326	Gas Used (therm)	$0.4676
			Blended Electric Usage (kWh)	$0.0617
			Blended Electric Demand (kW)	$14.8000
La Crosse Main Library	800 MAIN ST	4892112	Gas Used (therm)	$0.6087
			Blended Electric Usage (kWh)	$0.0644
			Blended Electric Demand (kW)	$14.9900
La Crosse City Hall	400 LA CROSSE ST	6834747	Gas Used (therm)	$0.5861
			Blended Electric Usage (kWh)	$0.0617
			Blended Electric Demand (kW)	$15.2600
La Crosse MSC	2000 MARCO DR	5863027	Gas Used (therm)	$0.6182
			Blended Electric Usage (kWh)	$0.0638
			Blended Electric Demand (kW)	$12.2200

Appendix 2 – ECM Completion Dates & Installation Period Savings

ECM Number	Energy Conservation Measure	M&V Option	Guarantee Commencement Date: 5/1/2021 Completion Dates	Installation Period Savings				
				Natural Gas		Electric		
				Therms	$	kWh	kW	$
ECM-1-LCCH	Replace Existing City Hall Heating Plant	Option A	10/29/2019	2,566	$15,040	0	0	$0
ECM-2-LCCH	Replace Existing City Hall Chiller and Reconfigure Existing Chilled Water Plant	Option A	5/4/2020	0	$0	86,354	255	$9,222
ECM-4-LCCH	Retrofit City Hall Lighting to LED	Option A	10/24/2019	0	$0	182,100	85	$12,537
ECM-1-LCC	Retrofit La Crosse Center Lighting to LED	Option A	4/10/2020	0	$0	892,011	275	$59,099
ECM-1-LCC-ALT	Retrofit La Crosse Center Parking Ramp Lighting to LED	Option A	4/10/2020	0	$0	231,894	46	$14,992
ECM-2-LCC	Replace La Crosse Center VAV Terminals	Non-Measured	5/28/2020	0	$0	35,789	0	$2,275
ECM-3-LCC	Repair La Crosse Center Arena AHUs	Non-Measured	7/9/2020	0	$0	0	0	$0
ECM-1-LCML	Replace and Reconfigure Main Library Cooling Plant	Option A	7/22/2020	0	$0	123,162	223	$11,264
ECM-2-LCML	Retrofit Main Library Lighting to LED	Option A	6/19/2019	0	$0	478,691	149	$33,050
ECM-3-LCML	Implement Demand Control Ventilation for Main Library AH-1	Non-Measured	11/11/2019	0	$0	784	0	$46
ECM-2-LCMSC	Retrofit Service Center Lighting to LED	Option A	7/23/2020	0	$0	77,929	27	$5,307
ECM-5-LCCH	Service Center PV Array	Option A	7/23/2020	0	$0	66,759	79	$13,723
ECM-4-LCC	La Crosse Center PV 100 Kw Array	Option A	7/13/2020	0	$0	75,638	87	$14,915
ECM-5-LCC	La Crosse Center Roof Replacement	Non-Measured	5/5/2020	0	$0	0	0	$0
ECM-4-LCML	Main Library PV Array	Option A	7/15/2020	0	$0	67,870	75	$13,353
ECM-3-LCMSC	City Hall PV Array	Option A	6/26/2020	0	$0	411	87	$10,275
			Sub-totals:	**2,566**	**$15,040**	**2,319,392**	**87**	**$200,057**
			Total:					**$215,097**

City of La Crosse, Wisconsin

City Hall
400 La Crosse Street
La Crosse, WI 54601

Text File

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