THIRD AMENDATORY ENERGY PERFORMANCE AGREEMENT

This **THIRD AMENDATORY ENERGY PERFORMANCE AGREEMENT** is made between the **CITY AND COUNTY OF DENVER**, a municipal corporation of the State of Colorado (the "City"), and **MCKINSTRY ESSENTION, LLC**, a Washington limited liability company with an address of 5005 3rd Ave South, Seattle, WA 98134 (the "Contractor"), jointly ("the Parties").

WHEREAS, the Parties entered into an Energy Performance Agreement dated December 9, 2021, an Amendatory Energy Performance Agreement dated June 24, 2022, and a Second Amendatory Agreement Performance Agreement dated August 22, 2024 (collectively, the "Agreement") to implement the energy performance measures provided in **Schedule B**, the Description of Work;

WHEREAS, although the Agreement contemplated that the Maximum Contract Price (MCP) included the Measurement and Verification Fee, the Measurement and Verification Fee was not actually included in the calculation of the MCP;

WHEREAS, the Parties wish to amend the Agreement to reduce the Term and the M&V Term, to realign the lease equipment schedule with work occurring in the field, increase the Maximum Contract Price to reflect inclusion of the Measurement and Verification Fee, and to make such other Amendments as are herein set forth herein.

NOW THEREFORE, in consideration of the mutual covenants and agreements hereinafter set forth and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the Parties incorporate the recitals set forth above and amend the Agreement as follows:

1. Section 6, entitled "**TERM**:", is hereby deleted in its entirety and replaced with the following:

> "**6**. **TERM**: The Agreement will commence on the date set forth on the City's signature page and will expire on May 31, 2026 (the "Term"). Contractor shall complete the Work and its other obligations described herein on or before May 31, 2026. The City shall not be liable to compensate Contractor for any Work performed prior to the Effective Date or after the expiration or earlier termination of this Agreement. The term of this Agreement ("Contract Term") shall be divided into three (3) separate components.
>
> "**a. Planning Term.** The "Planning Term" shall commence on the Effective Date, which shall be defined as the date as set forth on the City's signature page, and upon delivery by the Principal Representative to Contractor of a Notice to Proceed to Commence Design Phase under Article 8.i. and terminate upon delivery by the Principal Representative to Contractor of a Notice to Proceed to Commence

Construction Phase for the last improvement per the Construction and Installation Article 10.b.

"**b. Construction Term.** The "Construction Term" shall commence upon delivery by the Principal Representative to Contractor of a Notice to Proceed to Commence Construction Phase under Article 10.e. and terminate no more than 907 calendar days after the Construction Commencement Date, unless sooner terminated as provided in this Agreement.

"c. M&V Term. The "M&V Term" shall begin on the M&V Commencement Date and continue until no later than May 31, 2026. The M&V Term shall terminate pursuant to Schedule D unless sooner terminated as provided in this Agreement."

2. In Section 8, entitled "**COMPENSATION AND PAYMENT**:", Subsection a., entitled "**Budget.**", is hereby deleted in its entirety and replaced with the following:

"**8**. **COMPENSATION AND PAYMENT**:

"a. **Budget**. The City and the Third Party Lessor shall collectively pay, and the Contractor shall accept, as the sole compensation for the Work, through this Agreement, the Escrow Agreement, and the Purchase Order, the amounts set forth below:

"Cost of Services (MCP) *via this Agreement*:	$2,599,533
Cost of Equipment (MEP) *via the Escrow*	$13,472,685
Cost of Direct Purchase Equipment (MDPEP) v*ia the Purchase Order*: (MDPEP):	$735,094
Total Project Value to be Paid to Contractor:	$16,807,312"

3. In Section 8, entitled "**COMPENSATION AND PAYMENT:**", Subsection d., entitled "**Maximum Contract Price:**", is hereby deleted in its entirety and replaced with the following:

"**d**. **Maximum Contract Price**:

"**(1)** Notwithstanding any other provision of the Agreement, the City's maximum payment obligation will not exceed **Two Million Five Hundred Ninety-Nine Thousand Five Hundred Thirty-Three Dollars and Zero Cents ($2,599,533.00) (the "Maximum Contract Price")**. The City is not obligated to execute an Agreement or any amendments for any further services, including any services performed by

Contractor beyond that specifically described in **Schedule B-2**. Any services performed beyond those in **Schedule B-2** are performed at Contractor's risk and without authorization under the Agreement."

4. **Schedule D-2** is hereby deleted in its entirety and replaced with **Schedule D-3 Measurement and Verification Plan**, attached and incorporated by reference herein. All references in the Agreement to **Schedule D-2** are changed to **Schedule D-3**.

5. As herein amended, the Agreement is affirmed and ratified in each and every particular.

6. This Third Amendatory Energy Performance Agreement will not be effective or binding on the City until it has been fully executed by all required signatories of the City and County of Denver, and if required by Charter, approved by the City Council.

[THE REMAINDER OF THIS PAGE IS INTENTIONALLY LEFT BLANK;
SIGNATURE PAGES FOLLOW.]

Contract Control Number: GENRL-202579566-03 [GENRL-202161179-03]
Contractor Name: MCKINSTRY ESSENTION, LLC

IN WITNESS WHEREOF, the parties have set their hands and affixed their seals at Denver, Colorado as of:

SEAL

CITY AND COUNTY OF DENVER:

ATTEST:

By: _____

_____

APPROVED AS TO FORM:

Attorney for the City and County of Denver

By: _____

REGISTERED AND COUNTERSIGNED:

By: _____

By: _____

Contract Control Number: GENRL-202579566-03 [GENRL-202161179-03]
Contractor Name: MCKINSTRY ESSENTION, LLC

By: DocuSigned by: Greg Spalding 4A9B3856B952412...

Name: Greg Spalding
(please print)

Title: Regional Director
(please print)

ATTEST: [if required]

By: _____

Name: _____
(please print)

Title: _____
(please print)

EPC Schedule D-3: Measurement and Verification Plan

Measurement and Verification Plan

"M&V Services" means Services or activities relating to the measurement and verification by the ESCO of the efficiency and effectiveness of the Project, pursuant to this EPC Contract and the CEO Measurement and Verification Policy as applied.

This schedule shall use the following documents as a standard for presentation and reporting purposes.

EPC M&V Policy: Should the City wish to extend M&V services beyond the Guarantee Period per the M&V Term definition, the future additional annual costs to the City are presented in the table below. If the extended M&V costs beyond the Guarantee Period are not included in the Maximum Contract Price, they will be funded separately by the City.

Year	Guaranteed Annual Cost Savings (2023 Utility Rates)	Annual Cost for M&V Services (Total)	M&V Cost Percent of Guaranteed Annual Savings
1	~~$726,107~~$567,804	$72,600	~~10.0%~~ 12.8%
2	~~$835,479$674,804~~	~~$41,837~~	~~5.0% 6.2%~~
3	~~$856,120$693,143~~	~~$42,835~~	~~5.0% 6.2%~~

1. INTRODUCTION TO M&V CONCEPTS

M&V is the process of quantifying the energy and cost savings resulting from improvements in energy-consuming systems. The effort required and rigor achieved should be commensurate with the project capital investment and savings risk. Energy and cost reductions are compared to a historical baseline. Savings are determined by comparing the energy use before and after the installation of ECMs.
The "before" case is called the baseline. The "after" case is referred to as the post-installation or performance period.

*Energy Savings = **Baseline** Model Energy Use - **Performance Period** Energy Use*

2. IPMVP M&V OPTIONS

The International Performance Measurement and Verification Protocol (IPMVP) is a guidance document that provides a conceptual framework for measuring, computing, and reporting savings achieved by energy or water efficiency projects at facilities. It defines key terms and outlines issues that must be considered in developing an M&V plan. Developed through a collaborative effort involving industry, government, financial, and other organizations, the IPMVP serves as the framework for M&V procedures. It provides four M&V options: Options A, B, C, and D. These categories are divided into two general types: retrofit isolation and whole facility. Retrofit isolation methods consider only the affected equipment or system independent of the rest of the facility. Whole facility methods consider the total energy use and de-emphasize specific equipment performance.

EPC Schedule D-3: Measurement and Verification Plan

M&V Option	Description	Considerations
Option A	Retrofit Isolation with **KEY** Parameter Measurement	• Focus on performance of individual energy saving measure • Short term measurements on one or two **KEY** parameters • Intent is validation of savings calculations
Option B	Retrofit Isolation with **ALL** Parameter Measurement OR Sub-metering of energy use	• Focus on performance of individual energy saving measure • Measure **ALL** key parameters to calculate annual energy use OR • Directly sub-meter and measure energy use of an individual system
Option C	Whole Facility / Utility Meter Comparison	• Focus on metered utility use associated with the whole facility • Extensive tracking of ALL factors pre & post impacting facility energy use • Calculations to adjust baseline for owner directed load, operational or equipment changes • Not appropriate for small utility savings (<20%)
Option D	Whole Facility Calibrated Simulation	• Focus on metered utility uses of the whole facility • Savings based on a detailed, calibrated, whole building energy model • Proposed savings highly dependent on energy model, inputs, calibration • Mostly appropriate for new buildings or major retrofits
Stipulated	Calculated Savings	• Measures having high certainty of savings • M&V cost would be a high percentage of savings • Savings is mostly contingent on owner's use or operation

Reference:

M&V Guidelines: Measurement and Verification for Federal Energy Projects Version 4.0
Prepared for the U.S. Department of Energy Federal Energy Management Program

OPTION A

Option A is a retrofit isolation approach designed for projects in which the potential to generate savings must be verified, but the actual savings can be determined from short-term data collection & measurement, engineering calculations, and stipulated factors. The approach is intended for retrofits where key performance factors (e.g. end-use capacity, demand, power) or operational factors (lighting operational hours, cooling ton-hours) can be spot or short term measured during the baseline and post installation periods. Any factor not measured is estimated based on assumptions, analysis of historical data, or manufacturer data. Post installation energy use, equipment performance and usage are generally not measured throughout the term of the contract.

The intent of Option A is to verify performance through pre- and post-retrofit measurements. Usage factors can be measured or stipulated based upon engineering estimates, operating schedules, operator logs, typical weather data, or other documented information sources. More extensive measurements are generally only made once post-retrofit. Thereafter, inspections and short term measurements are conducted to verify that the 'potential to perform' exists. As long as the 'potential to perform' is verified, the savings are as originally claimed and should not vary over the contract term.

Option A methods are appropriate for less complex measures for which performance and operational characteristics are well understood and are unlikely to change. An Option A approach can also be suitable when the value of the measure's cost savings is low. Examples of projects where Option A may be appropriate include one-for-one lighting replacement measures, high efficiency motors with constant loads, or measures with a small percentage of overall cost savings.

OPTION B

Option B is a retrofit isolation or system-level approach similar to Option A but involves the measurement of all relevant parameters. Measurements of performance and operational factors provide long-term persistence data on the energy use of the equipment or system. Measurements may be short-term, periodic, or continuous.

This method is intended for retrofits with performance factors and operational factors that can be measured at the component or system level. Short-term periodic measurements can be used when variations in the measured factor are small, and may be sufficient to characterize the baseline. Continuous monitoring information can be used to improve or optimize the operation of the equipment over time, thereby improving the performance of the retrofit. This approach provides the greatest accuracy in the calculation of savings.

The intent of Option B is to verify performance periodically or continuously with long-term measurements.

3. GENERAL APPROACH TO M&V

All guaranteed savings calculations and assumptions for this project were reviewed and agreed to by City staff and/ or a third party expert reviewer during the Investment Grade Audit. At that time, McKinstry had provided all calculations and supporting information including all trend data used to develop the basis of these calculations. The general approach to verifying savings is to ensure that the proposed changes to Key Performance Indicators (KPIs), the levers which drive savings, have been implemented or to update these calculations based on as-measured data during the annual M&V process. McKinstry will take a tiered approach to M&V execution. **Tier I** will be used for those measures for which a utility bill calibrated full building energy simulation was developed. **Tier II** will be used for savings derived by modelling individual systems.

The level of effort for each tier is informed by balancing the confidence in the persistence of savings and the cost effectiveness of activities.

EPC Schedule D-3: Measurement and Verification Plan

	Tier I	Tier II
Definition	Annual Verification	One-time Measurement and Annual Verification
Intent	Verify that changes to KPIs persist to demonstrate that proposed savings are achieved. In the event that KPIs deviate from those prescribed, the energy model can be updated with performance period operation to reflect actual performance period savings.	Evaluate performance by measuring KPIs pre and post retrofit. Update models with measured values to reflect actual performance period savings.
Post-Install Activities	Record the final constructed and commissioned conditions of KPIs, as observed via the BAS and Functional Performance Testing (FPT); update models as necessary.	Measure KPIs pre and post retrofit. Review as-built documentation for KPIs of all installed systems and update savings according to as-built/commissioned conditions.
Post-Acceptance Activities	Review trends of KPIs to ensure that savings persist; update models as necessary.	City staff will be interviewed to verify operation, such that savings persist.
Frequency and Duration	While data will be collected continuously from the BAS, actual review of trends for M&V purposes will take place once during the performance period. KPIs will be trended for a minimum of four weeks to sufficiently demonstrate consistent operation.	One time pre/post measurements during the Post-Install Process. One time, on-site inspection during Performance Year One, only. For subsequent years, City staff will be interviewed to confirm functionality.
Sampling Plan	KPIs will be observed at a directed sample of units, in a directed sample of facilities, selected to represent a substantive proportion of the total ECM savings. A sample to include the largest units at the facilities with the greater apportionment of ECM savings will be selected to demonstrate that ECM savings are achieved. Additional samples will be collected should an unsatisfactory variation be found in the original sample	KPIs will be measured on a sample of the most common population types. For less common population types, KPIs measurements will be based on a table of manufacturers' data. The measured population types will represent more than 75% of ECM savings. For each population, the number of samples measured will be sufficient to achieve 20% precision at an 80% confidence; the assumed coefficient of variation ($C_{v)}$ is 0.5. Additional samples will be collected if the C_v of the original sample exceeds 0.5.

EPC Schedule D-3: Measurement and Verification Plan

4. KPI MATRIX

ECM Name	Facilities	M&V Option	Key Performance Indicators	Baseline Values	Proposed Values	M&V Approach
01.02-FS21 Boiler Replacement	Fire Station #21	N/A	Boiler efficiency	0.77	0.85	stipulated
01.01-FS24 Boiler Replacement	Fire Station #24	N/A	Boiler efficiency	0.77	0.91	stipulated
01.06-CCB Steam Condensate Heat Recovery	City and County Building	Stipulated	Condensate heat recovery addition	Condensate drains to sewage	Condensate is recovered through heat exchanger	Stipulated
01.06-DCL Steam Condensate Heat Recovery	Denver Crime Lab	Stipulated	Condensate heat recovery addition	Condensate drains to sewage	Condensate is recovered through heat exchanger	Stipulated
01.06-PAB Steam Condensate Heat Recovery	Police Administration Building PAB	Stipulated	Condensate heat recovery addition	Condensate drains to sewage	Condensate is recovered through heat exchanger	Stipulated
02.01-CCB Chilled Water Pump Replacement	City and County Building	N/A	Pump efficiency	0.83	0.84	stipulated
		N/A	Motor efficiency	0.85	0.95	stipulated
02.12-RAC Chiller Replacement	Rose Andom Center	N/A	chiller efficiency	9.0 EER	15.6 EER	stipulated
03.04-POA VVT to VAV Unit Replacement	Denver Police Academy	N/A	Damper Control	fixed position	based on occ sensor	Stipulated
		N/A	RTU 1 only: SAT reset	No Reset	SAT resets at 75F	
03.07-PAB MZU to VAV Unit	Police Administration Building PAB	Stipulated	Hot deck/Cold deck control	Hot deck and cold deck linked, constant volume of supply air	Hot deck and cold deck operate independently, variable volume of supply air	Stipulated
		Stipulated	VFD	Constant speed	Fan speed modulates	
03.13 All Upgrade Air Cooled Chiller	Police District 1, #3	Stipulated	Tons of Cooling	140	130	Stipulated
		Stipulated	EER	10.2 BTU/Watt	16.3 BTU/Watt	
04.01-CCB BAS Controls Upgrade/ Replacement	City and County Building	A	Economizing	Economize when OAT is between 68F-60F	Economize when OAT is between 70F-50F	Tier I
		A	unoccupied setback hours	6 hours/night on weekdays	9 hours/night on weekdays	
04.01-PAB BAS Controls Upgrade/ Replacement	Police Administration Building PAB	A	Economizing	AHU economizing not operating	Economize when OAT is between 70F-50F	Tier I
		A	AHU fan speed control	AHU minimum fan speed = 80%	AHU minimum fan speed = 60%	
04.01-POA BAS Controls Upgrade/ Replacement	Denver Police Academy	stipulated	Air supply	Constant volume	Variable volume	Stipulated

EPC Schedule D-3: Measurement and Verification Plan

ECM Name	Facilities	M&V Option	Key Performance Indicators	Baseline Values	Proposed Values	M&V Approach
04.02-PTO Occupancy Based HVAC Control	Police Traffic Operations Bureau	A	Unoccupied Temperature Setpoint	Occ Cool: 75F, Occ Heat: 72F Unocc Cool: 80F Unocc Heat: 70	Occ Cool: 75F ~~Unocc Cool 80F~~ Occ Heat 72F ~~Unocc Heat 70 F~~ Unocc Cool setback: 77F ~~Unocc Heat setback: 68F~~	Tier I
04.02-PAB Occupancy Based HVAC Control	Police Administration Building PAB	A	Unoccupied Temperature Setpoint	Occ/Unocc Cool: 74F Occ/Unocc Heat: 72F	Occ Cool: 74F Occ Heat: 72F Unocc Cool: 78F Unocc Cool Setback: 76F Unocc Heat: 68F Unocc Heat Setback: 70F	Tier I
04.02-PMB Occupancy Based HVAC Controls	Permit Building	A	Unoccupied Temperature Setpoint	Occ Heat: 72F Occ Cool:74F Unocc Cool: 80F Unocc Heat: 65F	Occ Cool: 74F Unocc Cool: 80F Occ Heat: 72F Unocc Heat: 65F Unocc Cool setback: 76F Unocc Heat setback: 70F	Tier I
04.02-CMP Occupancy Based HVAC Controls	The Commons on Champa	A	Unoccupied Temperature Setpoint	Occ Cool: 73F, Occ Heat: 69F Unocc Cool: 80F Unocc Heat: 60F	Occ Cool: 73F, Occ Heat: 69F Unocc Cool 80F Unocc Heat 60F Unocc Cool setback: 75F Unocc Heat setback: 67F	Tier I
04.07-RAC Ventilation Control	Rose Andom Center	A	RAC: ERV energy recovery wheel heat recovery	disabled	enabled	Tier II
		A	RAC: ERV fan speed control	Constant speed	Fan speed modulates	
08.05 All Add VFDS to Building Pumps	Police District 1, 3	Stipulate	VFD installation	Constant speed	Variable speed	Stipulated
08.05-PD1 Add VFDs to Building Pumps	Police District 1	Stipulated	VFD installation	Constant speed	Variable speed	Stipulated
08.05-PD3 Add VFDs to Building Pumps	Police District #3	Stipulated	VFD installation	Constant speed	Variable speed	Stipulated

EPC Schedule D-3: Measurement and Verification Plan

ECM Name	Facilities	M&V Option	Key Performance Indicators	Baseline Values	Proposed Values	M&V Approach
09.01-All Interior LED Lighting Upgrades	All in scope	A	Wattage	Refer to Audit	Refer to Audit	Tier II
		N/A	Burn hours	Refer to Audit	Refer to Audit	Stipulated
		N/A	Quantity	Refer to Audit	Refer to Audit	Stipulated
09.02-All Exterior LED Lighting Upgrades	All in scope	A	Wattage	Refer to Audit	Refer to Audit	Tier II
		N/A	Burn hours	Refer to Audit	Refer to Audit	Stipulated
		N/A	Quantity	Refer to Audit	Refer to Audit	Stipulated
10.01-FS2 Solar Photovoltaic - Roof	Fire Station 2	B	Weather adjusted kWh production	0 kWh	133,360 kWh	N/A
10.01-POA Solar Photovoltaic-Canopy	Denver Police Academy	B	Weather adjusted kWh production	0 kWh	161,131 kWh	N/A
10.01-PD3 Solar Photovoltaic-Roof	Police District #3	B	Weather adjusted kWh production	0 kWh	~~249,338 kWh~~ ~~Size to be determined~~ 218,900 kWh	~~N/A~~
10.01-PTO Solar Photovoltaic-Roof	Police Traffic Operations Bureau	B	Weather adjusted kWh production	0 kWh	136,799 kWh	N/A
10.02-FM5 Solar Photovoltaic - Canopy	Fleet Maintenance Building #5	B	Weather adjusted kWh production	0 kWh	94,701 kWh	N/A
10.02-PD2 Solar Photovoltaic - Canopy	Police District 2	B	Weather adjusted kWh production	0 kWh	~~282,910 kWh~~ 169,016 kWh	N/A
13.01-PTO Air Sealing and Weather Stripping	Police Traffic Operations Bureau	Stipulated	Door parameter leakage sealed	0 ft	140 ft around doors sealed	Stipulated
		Stipulated	Roof/wall connection leakage sealed	0 ft	475 ft around roof/wall connection sealed	
13.01-RAC Air Sealing and Weather Stripping	Rose Andom Center	Stipulated	Doors' leakage sealed	0	27 exterior & interior doors	Stipulated
		Stipulated	Wall leakage sealed	0	Side wall of 2nd floor storage room sealed	
13.02-PTO Ceiling and Wall Insulation	Police Traffic Operations Bureau	Stipulated	Wall insulation R-Value	1.96 exposed concrete block	12.11 insulated wall	Stipulated
13.04-CMP Replace Single Pane Windows	The Commons on Champa	Stipulated	Window U-value	Single pane, 0.535	Double pane, 0.38	Stipulated
		Stipulated	SHGC	Single pane, 0.59	Double pane, 0.45	

EPC Schedule D-3: Measurement and Verification Plan

ECM Name	Facilities	M&V Option	Key Performance Indicators	Baseline Values	Proposed Values	M&V Approach
20.01-CCB Rate Analysis	City and County Building	A	CHW monthly demand reservation fee	400 tons/month contracted	360 tons/month contracted	Tier II
20.01-CMP Rate Analysis	The Commons on Champa	A	CHW monthly demand reservation fee	165 tons/month contracted	149 tons/month contracted	Tier II
20.01-LFC & VDC Rate Analysis	Lindsay-Flanigan Courthouse & Van Cise-Simonet Detention Center	A	CHW monthly demand reservation fee	2100 tons/month contracted (shared between Courthouse and Detention Center)	1890 tons/month contracted	Tier II
20.01-PAB Rate Analysis	Police Administration Building PAB	A	CHW monthly demand reservation fee	350 tons/month contracted	315 tons/month contracted	Tier II
20.01-PMB Rate Analysis	Permit Building	A	CHW monthly demand reservation fee	150 tons/month contracted	135 tons/month contracted	Tier II
22.01 Controls Optimization/RCx	CCD all	TBD	Operational changes	To be determined as measures are identified	To be determined as measures are identified	TBD

EPC Schedule D-3: Measurement and Verification Plan

5. powerED SUPPLEMENT

During construction and throughout the performance periods, the energy, water, and cost savings impact of each specific measure identified as an element of the powerED program will be documented. Savings potential will be quantified via industry accepted calculation methodology.

SAVINGS THRESHOLD

Measures that are implemented with an annual savings potential less than **$17,000** will be verified via one-time pre- and post-measurements of the identified KPIs. In coordination with the City, an M&V plan with a fully documented baseline, sufficient modelling, and periodic measurement of KPIs will be created and executed for implemented measures with a savings potential greater than **$17,000**.

The **$17,000** threshold has been established to provide the most valuable and cost effective M&V, with the understanding that a lower threshold adds increased cost for additional M&V activities while not necessarily providing additional value. Generally, measures with well understood savings and lower savings potential should require a one-time measurement of KPIs, while those with greater savings merit more detailed M&V efforts.

UTILITY RATES FOR POWERED SAVINGS

Natural gas, propane, water, and sewer savings will be calculated using the contractual utility rates for each facility. For measures with savings estimated below the threshold, a blended rate of **$0.11/kWh** will be used to quantify electricity and demand savings. For measures with savings equal to or above the threshold, the contractual electricity and demand rates will be applied.

Measure Savings	Electricity (kWh)	Natural Gas (Therms)	Steam (Mb)	Chilled Water (Ton/hr)
Below threshold	$0.11	$0.35	$17.29	0.14
Equal to or above threshold	See section 2.1 Baseline Energy Use in IGA			

All applicable utility rates will be escalated by the agreed upon escalation rates starting in Year 2.

6. SAMPLING PLAN

LIGHTING

Lighting follows 80/20 sampling plan where measurements are taken at a 20% precision level with 80% confidence level. The baseline and proposed wattage readings are based on total project savings percentage, combining for the top 75% of the savings contribution load. The following table shows the pre-construction and post-construction fixtures and their respective kW readings. The sample size is based on the fixture's population size.

EPC Schedule D-3: Measurement and Verification Plan

Pre Construction Fixture Type	Existing kW	Sample Size	Post Construction Fixture Type	Proposed kW	Sample Size
F T8 F32-32W-48" NLO- 2L	446.34	11	RET-2xLEDT4FT-DW	145.84	11
F T8 F32-28W-48" NLO- 2L	127.78	11	RET/1x100LEDSI/Mogul Base Bypass (PAR)_DET_CTR	13.80	11
F T8 F32-32W-48" NLO- 3L	134.39	11	RET-1X20_LEDT4FT_T5	15.72	10
F T8 F32-32W-48" NLO- 4L	88.82	11	IN/1x150LEDF_SB	7.50	10
F T8 F32-32W-48" NLO- 1L	121.38	11	Lamp/1x25LEDSI/A21	2.25	11
F T5 45.8" 54W- 1L	57.54	11	RET-2xLEDT4FT_T5-DRIVER	7.62	11
MH Mogul 150W- 1L	36.86	11	LAMP-1x9LEDSI-A19	4.17	11
MH Mogul 250W- 1L	32.75	11	RET-2XLEDT8FT-DW	6.50	11
MH Mogul 175W- 1L	25.80	11	LAMP/1x15LEDPLV_Omni	4.48	11
MH Mogul 400W- 1L	26.56	10			
F T5 45.8" 54W- 2L	42.01	11			
CFL SI MED 32W- 1L	21.92	11			
F T8 F32-32W-48" RLO- 4L	23.36	11			

7. CITY O&M REPORTING RESPONSIBILITIES

Refer to Section 21 of the Agreement – Material Changes -

8. SCHEDULE OF VERIFICATION REPORTING ACTIVITIES

Item	Submission Timeline	Customer Review and Acceptance Period
Post-Installation Report	60 to 90 days after Completion	30 days
Annual Report	60 to 90 days after conclusion of performance period	30 days

9. CALIBRATION SUPPLEMENT

The analysis of some KPIs will require data collected using the existing BAS systems. The calibration maintenance of measuring and metering devices that are elements of these systems are the responsibility of the City. McKinstry will provide details of equipment make, model, and calibration for all other devices used as an element of the M&V process.

10. REFERENCES

Item	Location

EPC Schedule D-3: Measurement and Verification Plan

ECM Scope and Description	IGA Appendix D/ EPC Schedule B
ECM Proposed Annual Savings	IGA Report Section 3/ EPC Schedule G
Schedule of Values	EPC Schedule F
Customer Maintenance Responsibilities	EPC Schedule S

EPC Schedule D-3: Measurement and Verification Plan

11. M&V REPORT CONTENT & FORMAT

(I) EXECUTIVE SUMMARY

1) Project Summary
2) Summary Of Guaranteed And Verified Utility Cost Savings
3) Comparison Of Guaranteed And Verified Savings By ECM By Utility Type
4) Summary Of Observations, Issues, And Recommendations
5) Brief ECM Descriptions
6) M&V Approach

(II) DETAILED M&V SECTIONS – BY INDIVIDUAL ECM

1) Brief ECM Descriptions
2) M&V Activities Overview
   A) M&V Plan Overview
   B) Summary Of Sampling Plan
   C) Table Of KPI Measurements
2) Observations, Issues, and Recommendations
3) Verified Savings Calculation And Methodology
   A) Calculation And Methodology Summary
   B) Guarantee Factor Details
   C) Summary Of Guaranteed And Verified Savings For Performance Year

(II) APPENDICES

1) Supporting Documentation
   A) Testing Data, Trend Charts, And Analysis
   B) Bas Screen Captures
   C) Site Visit Photos
2) Utility Rates

EPC Schedule D-3: Measurement and Verification Plan

12. RISK, RESPONSIBILITY AND PERFORMANCE MATRIX

RESPONSIBILITY/DESCRIPTION	CONTRACTOR PROPOSED APPROACH
1. Financial	
M&V confidence: The City assumes the responsibility to determine the confidence that it desires to have in the M&V program and energy savings determinations. The desired confidence will be reflected in the resources required for the M&V program, and the ESCO must consider the requirement prior to submittal of the final proposal. **Clarify how project savings are being verified (e.g., equipment performance, operational factors, energy use) and the impact on M&V costs.**	McKinstry's approach to the application of M&V will be to verify the performance of the installed ECMs. The M&V Plan details the steps taken in the verification process. The approach to M&V on each ECM is matched with the level of savings and the implementation complexity of the ECM. As applicable, equipment performance is measured and operational factors are tracked through the BAS data for buildings that are applicable.
Energy Related Cost Savings: The City and the contractor may agree that the project will include savings from *recurring* and/or *one-time* costs. This may include one-time savings from avoided expenditures for projects that were appropriated but will no longer be necessary. Including one-time cost savings before the money has been appropriated may involve some risk to the Institution. Recurring savings generally result from reduced O&M expenses or reduced water consumption. These O&M and water savings must be based on actual spending reductions. **Clarify sources of non-energy cost savings and how they will be verified.**	No one-time cost avoidances are included in the project financials. Non-energy cost savings include a 10% reduction in the monthly contracted chilled water capacity at facilities subscribed to district chilled water. O&M expense savings have not been included in the project per the request of the City.
Delays: Both the contractor and the City can cause delays. Failure to implement a viable project in a timely manner costs the Institution in the form of lost savings, and can add cost to the project (e.g., construction interest, re-mobilization). **Clarify schedule and how delays will be handled.**	McKinstry has mitigated this risk by providing ample schedule contingency within the construction schedule. This risk is further mitigated by not taking construction-period savings into account in the pro forma. Construction-period savings will be a reality and will provide a buffer for any potential schedule extensions.
Major changes in facility: The City controls major changes in facility use, including closure. **Clarify responsibilities in the event of a premature facility closure, loss of funding, or other major change.**	In the case of facility closure, loss of funding, or other major changes, McKinstry and the City will have open discussions of ECM reduction, modification, or removal. In the event of major changes in facility use, the energy savings will be calculated based on the baseline and proposed conditions as contained in M&V Plan.

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<table>
<tr><th>RESPONSIBILITY/DESCRIPTION</th><th>CONTRACTOR PROPOSED APPROACH</th></tr>
<tr><td>2. Operational</td><td></td></tr>
<tr><td><u>Operating hours</u>: The City generally has control over operating hours. Increases and decreases in operating hours can show up as increases or decreases in “savings” depending on the M&V method (e.g., operating hours multiplied by improved efficiency of equipment vs. whole-building/utility bill analysis). Clarify whether operating hours are to be measured or stipulated and what the impact will be if they change. If the operating hours are stipulated, the baseline should be carefully documented and agreed to by both parties.</td><td>Detailed operating hour baselines have been developed; the values were presented to the City in the IGA to identify the acceptable values to be used in the savings calculations.
Savings will be verified at the originally proposed hours regardless of future changes. If operating hours do change, McKinstry may recalculate savings at its discretion to demonstrate the impact of the change.
The application of the operating hours varies by type of measures proposed, magnitude of savings, and potential for impact on the overall savings. Operating hours are applied as follows:
<table>
<tr><th>Measure Category</th><th>Baseline</th><th>Post-Install</th></tr>
<tr><td>Lighting</td><td>Measured kW, stipulated hours</td><td>Measured</td></tr>
<tr><td>Schedule Changes</td><td>On-site observations, staff interviews</td><td>Measured</td></tr>
<tr><td>Equipment Replacement</td><td>On-site observations, Utility Data</td><td>Agreed Upon</td></tr>
<tr><td>General Facility Operating Hours</td><td>Staff Interviews, Published Schedules</td><td>Agreed Upon</td></tr>
</table>
If equipment loads do change, McKinstry may recalculate savings at its discretion to demonstrate the impact of the change.</td></tr>
<tr><td><u>Load:</u> Equipment loads can change over time. The City generally has control over hours of operation, conditioned floor area, intensity of use (e.g., changes in occupancy or level of automation). Changes in load can show up as increases or decreases in “savings” depending on the M&V method. Clarify whether equipment loads are to be measured or stipulated and what the impact will be if they change. If the equipment loads are stipulated, the baseline should be carefully documented and agreed to by both parties.</td><td>All savings calculations assume that the equipment loads are constant for the duration of the project's performance period. The City assumes all risk and responsibility to manage the equipment loads at or below the baseline conditions documented in individual savings calculations. If actual equipment loads, as defined in the M&V plan, are higher than baseline values, all savings will be capped at the baseline load conditions. If equipment load is lower than baseline, all savings will be capped at baseline load conditions, as the facility now has the potential to increase the loads to the baseline values without impact on the actual savings. As such, demand savings associated with FIM 10.XX Solar Photovoltaic will be stipulated.</td></tr>
<tr><td><u>Weather:</u> A number of energy efficiency measures are affected by weather. Neither the contractor nor the Institution has control over the weather. Should the Institution agree to accept risk for weather fluctuations, it shall be contingent upon aggregate payments not exceeding aggregate savings. Clearly specify how weather corrections will be performed.</td><td>Savings calculations for ECM 04.0X HVAC Controls are based on Typical Meteorological Year (TMY) weather files for the weather station closest to the site or the local airport. All post-install calculations will continue to use the TMY weather files as applicable. Interactive heating and cooling effects for ECM 09.01-Lighting Upgrades and ECM 09.02 are based on published ASHRAE “Fraction of Annual Lighting Heat to Cooling and Heating” values. McKinstry will not perform a facility level weather regression of the utility bills.

Solar M&V and Weather Normalization
The production of solar arrays is highly dependent upon the available solar irradiance and other weather factors of which neither McKinstry nor the City has control. Savings calculations for ECM 10.XX are based on Typical Meteorological Year (TMY) weather files that are the best statistical fit for a specific project site. The guaranteed solar production in kWh/kW and the associated dollar savings represent the estimated performance from a TMY based energy production model with a guarantee factor applied. Utilizing project site integrated data acquisition systems that include weather station components, McKinstry will monitor the relevant weather parameters in order to normalize the verified solar production for <u>estimated</u> generation, adjusting for other non-routine procedures as necessary; i.e. system down time events caused by non-weather-related issues. The verified savings for a performance period will be reported as the actual solar production adjusted to reflect the typical weather conditions for the year. Neither McKinstry nor the City shall be penalized or credited for weather conditions that deviate from the estimated TMY conditions that result in excess or insufficient availability of solar irradiance, weather parameters, or other non-weather-related issues.</td></tr>
</table>

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User participation: Many facility improvement measures require user participation to generate savings (e.g., control settings). The savings can be variable and the contractor may be unwilling to invest in these measures. **Clarify what degree of user participation is needed and utilize monitoring and training to mitigate risk.** If performance is stipulated, document and review assumptions carefully and consider M&V to confirm the capacity to save (e.g., confirm that the controls are functioning properly).	City maintenance of proper time schedules, set-points, and programming of controls is required. For ECMs proposed, routine maintenance requirements for any new systems will be identified and documented. To ensure the City understands the risk, McKinstry will provide training, videotaping, and operating guides. McKinstry may review operating logs on a periodic basis during the performance period. City maintenance of trends, trend export, and access to automation systems is required for execution of the M&V Plan.

3. Performance	
Equipment performance: The contractor has control over the selection of equipment and is responsible for its proper installation, commissioning, and performance. The contractor has responsibility to demonstrate that the new improvements meet expected performance levels including specified equipment capacity, standards of service, and efficiency. **Clarify who is responsible for initial and long-term performance, how it will be verified, and what will be done if performance does not meet expectations.**	McKinstry will select major equipment that will have life expectancy that meets or exceeds the contract term, is based on the requirements of the City, facility needs, and provides enhancement of the operation and savings of the ECMs. McKinstry will perform periodic checks to ensure that performance does not degrade impacting savings, and verify routine preventive maintenance (PM) is performed by the City in accordance with industry and OEM specifications and per subsection C below. If in a case of equipment non-performance, McKinstry may contact the OEM for required repairs to return equipment to OEM performance standards or replace to remedy performance deficiencies. McKinstry will secure long-term warranties from equipment manufacturers if warranted, and will also ensure these warranties are transferrable to the City at project acceptance.
Operations: Performance of the day-to-day operations activities is negotiable and can impact performance. However, the contractor bears the ultimate risk regardless of which party performs the activity. **Clarify which party will perform equipment operations, the implications of equipment control, how changes in operating procedures will be handled, and how proper operations will be assured.**	McKinstry has assumed the City will maintain operation of all ECMs. McKinstry will be responsible for equipment performance regardless of who performs the O&M tasks. McKinstry will provide operating and PM guidelines and initial training to ensure that the systems are operated and maintained per OEM required guidelines that will ensure savings are retained.
Preventive Maintenance: Performance of day-to-day maintenance activities is negotiable and can impact performance. However, the contractor bears the ultimate risk regardless of which party performs the activity. **Clarify how long-term preventive maintenance will be assured, especially if the party responsible for long-term performance is not responsible for maintenance (e.g., contractor provides maintenance checklist and reporting frequency). Clarify who is responsible for performing long-term preventive maintenance to maintain operational performance throughout the contract term. Clarify what will be done if inadequate preventive maintenance impacts performance.**	McKinstry will provide all necessary training on the maintenance requirements of the equipment for operation by the City. Should the maintenance requirements be inadequate, McKinstry will notify the City immediately and will work with the City to determine the best approach to ensure proper maintenance practices are adhered to in accordance with prescribed practices by McKinstry and/or OEM specifications.
Equipment Repair and Replacement: Performance of day-to-day repair and replacement of contractor-installed equipment is negotiable; however, it is often tied to project performance. The contractor bears the ultimate risk regardless of which party performs the activity. **Clarify who is responsible for performing replacement of failed components or equipment replacement throughout the term of the contract.** Specifically address potential impacts on performance due to equipment failure. Specify expected equipment life and warranties for all installed equipment. Discuss replacement responsibility when equipment life is shorter than the term of the contract.	Refer to Maintenance & Warranty Coordination Matrix in Schedule W.