

### Technical Appendix: K-State Engineering Extension Emission Reduction Projects

This technical appendix is provided to demonstrate the reasonableness of GHG reduction estimates introduced in the Workplan of this proposal. It explains the methodology and assumptions used in developing the estimated GHG emission reductions associated with each measure.

**Table 1a: Project Financial Summary**

Project Information		Financial Overview Total CPRG Funds Requested: \$48,180,934		
Project No.	Operational Start Date	Requested CPRG Funding	Total Funding to Implement	2025-2030 Cost Effectiveness
-	-	million \$	million \$	\$ / MTCO <sub>2</sub> e
1 <sup>*</sup>	Continuous	\$ 0.49	\$ 0.49	N/A
2A	June-27	\$ 2.67	\$ 5.22	\$ 130.24
2B	July-29	\$ 17.18	\$ 25.18	\$ 1,618.99
2C	January-27	\$ 7.84	\$ 9.84	\$ 116.54
2D <sup>**</sup>	Staggered	\$ 4.73	\$ 6.83	\$ 1,315.86
3 <sup>***</sup>	August-26	\$ 15.27	\$ 15.27	\$ 2,926.77

<sup>\*</sup> Project 1 not considered GHG reduction measure and not included in Quantified GHG reductions or Cost Effectiveness calculations.

<sup>\*\*</sup> Project 2D is based on staggered start dates with projects being implemented between 2026 to 2030. Additional details and calculation methodology are described in the 2D worksheet.

<sup>\*\*\*</sup> Project 3 Scenario 2 is preferred over Scenario 1 and is used for calculation purposes (e.g., Project 3 Scenario 1 is not included in this Table).

**Table 1b: Project Environmental Summary**

Project Information		GHG Reduction Overview			
Project No.	Operational Start Date	Annual Unquantified GHG Reduction	Annual Quantified GHG Reduction	2025-2030 Quantified GHG Reduction	2025-2050 Quantified GHG Reduction
-	-	kMTCO <sub>2</sub> e / yr	kMTCO <sub>2</sub> e / yr	kMTCO <sub>2</sub> e	kMTCO <sub>2</sub> e
1 <sup>*</sup>	Continuous	N/A	N/A	N/A	N/A
2A	June-27	15.5	7.9	20.5	178.9
2B	July-29	31.1	21.2	10.6	435.0
2C	January-27	28.2	22.4	67.3	516.0
2D <sup>**</sup>	Staggered	2.1	1.5	3.6	36.5
3 <sup>***</sup>	August-26	1.5	1.5	5.2	35.8

<sup>\*</sup> Project 1 not considered GHG reduction measure and not included in Quantified GHG reductions or Cost Effectiveness calculations.

*\*\* Project 2D is based on staggered start dates with projects being implemented between 2026 to 2030. Additional details and calculation methodology are described in the 2D worksheet. Annual values shown in this table are based on the average of 25 years of GHG reductions (2025 to 2050).*

*\*\*\* Project 3 Scenario 2 is preferred over Scenario 1 and is used for calculation purposes (e.g., Project 3 Scenario 1 is not included in this table).*

## PROJECT 1: INDUSTRY TRAINING AND COMMUNITY ENGAGEMENT

This project is not considered a GHG-reduction measure and is outside the scope of this section.

## PROJECT 2: INDUSTRY EMISSION REDUCTION ASSISTANCE: ASSESSMENT & IMPLEMENTATION

### Project 2A: Installation of a Heat Exchanger (Hex) System to Recover and Recycle Wasted Heat to Preheat Process Air

- GHG Reduction Estimate Method: Project data was provided by Birla engineers using engineering estimates and internal records and models to estimate project costs and outcomes.
- Models/Tools Used: Birla engineers estimated GHG emission reductions based on known feedstock usage and carbon emissions per unit feedstock consumed. The facility directly monitors and reports its emissions to EPA under the GHG reporting program.
- Measure Implementation GHG Reduction Estimate Assumptions: Project is assumed to be implemented by June 1, 2027. This project involves the installation of a heat exchanger in the facility's Unit 3 reactor system; the requested CPRG funds will be used to cover the high initial cost to modify the reactor system and are not meant to cover costs associated with future heat exchanger replacements. Birla will cover the cost of maintaining and replacing the Unit 3 heat exchanger, meaning the cost to replace equipment is assumed zero for this proposal's purposes. Birla already operates at least one reactor line with a heat exchanger; this project modernizes Unit 3. Impacts to all GHGs except CO<sub>2</sub> are assumed negligible; data and estimates provided by Birla engineers are accurate (such as impacts to product yield as a consequence of project implementation); GHG emissions from changes in maintenance activities are negligible, including replacement of heat exchangers; estimated facility production and emissions reductions are at steady state over the life of the proposal's estimated timespan (2025-2050), specifically:
  - The facility currently produces 17,000 MT carbon black per year and will continue to do so through 2050.
  - The facility currently consumes 19,867 MT of feedstock oil per year and will continue to do so until project implementation.
  - The facility will consume 29,310 MT of feedstock oil per year from the time of project implementation through 2050.
- Reference Case Scenario: Activity level based on Birla engineering production data and material estimates. Projections are not impacted by non-CPRG federal incentives.
- Measure-Specific Activity Data: GHG emission estimates are based on Unit 3's consumption of feedstock oil, which can be assessed based on the yield of carbon black produced. Additionally, Birla Carbon directly measures its GHG emissions rates under EPA's greenhouse Gas Reporting Program.
- GHG Emissions Reduced: See [Table 1b](#) for measure-specific estimated annual GHG emission reductions and cumulative GHG emission reductions for the periods 2025-2030 and 2025-2050.

**Table 2: Project 2A CAPEX and Process Information**

Hickok Unit 3 - CAPEX Estimate for HEX Project		CAPEX (\$ Million)		
Heat Exchanger (90 tube)		\$1.1		
HEX Installation (foundation, structure, etc.) and Controls		\$2.4		
Reactor Connection		\$0.7		
Hot Air Piping w/ Structure		\$0.9		
<b>Total</b>		<b>\$5.1</b>		
Hickok Unit 3 - Process Info for HEX Project		Current	If APH is installed	Delta
Carbon Black Annual Production	MT/yr	17,000	17,000	
Yield	kg CB/kg oil	0.50	0.58	16%
Feedstock Oil Consumed	MT/yr	34,000	29,310	-4,690
CO <sub>2</sub> Emissions	MT/yr	49,867	34,391	-15,476
CO <sub>2</sub> Footprint	kg CO <sub>2</sub> /kg CB	2.93	2.02	
Water Consumption	gal/min	35	22	-13
Water Consumption - Annual	million gal/yr	16.8	10.6	-6.2
Feedstock Oil Cost	million \$/yr	\$18.7	\$16.1	(\$2.6)
Operations and Maintenance Cost	million \$/yr	\$0.0	\$0.2	\$0.2
Net Annual Benefit	million \$/yr			\$2.4

**Project 2B: Capture of Wasted Heat to Make Electricity at Carbon Black Plant**

- **GHG Reduction Estimate Method:** Project data was provided by Birla engineers using engineering estimates and internal records and models to estimate project costs and outcomes.
- **Models/Tools Used:** Birla engineers estimated GHG emission reductions based on known tail gas flow rates, tail gas energy content and use of 2021 eGrid GHG emission estimates for SPNO region.
- **Measure Implementation and GHG Reduction Estimate Assumptions:** Project is assumed to be implemented by July 1, 2029. This project involves the installation of a co-gen energy system on the facility's tail gas incineration system; the requested CPRG funds will be used to help cover the cost to install the co-gen system, including the boiler, steam turbine, condenser and power systems. Excess energy is assumed to be used by the regional power system, lowering local power plant operation levels. The co-gen system will be 26% efficient at converting the tail gas' energy content to electrical energy. Impacts to all GHGs except CO<sub>2</sub> are assumed negligible except as considered within the eGrid tool; data and estimates provided by Birla engineers are accurate (such as energy content of tail gas); GHG emissions from changes in maintenance activities are negligible; estimated facility production and emissions reductions are at steady state over the life of the proposal's estimated timespan (2025-2050), specifically:
  - The facility currently produces 44 kNm<sup>3</sup> of tail gas per hour for 8,000 hours per year.
  - The chemical makeup of the facility's tail gas is such that its energy content is 710 kcal per Nm<sup>3</sup>.
  - The facility will consume 2.5 MW and supply the remainder to the electrical grid.
- **Reference Case Scenario:** Activity level based on Birla engineering production data and material estimates. Projections are not impacted by non-CPRG federal incentives.

- Measure-Specific Activity Data: GHG emission estimates are based on the facility's production of tail gas, its energy content and the amount of power supplied internally and externally.
- GHG Emissions Reduced: See [Table 1b](#) for measure-specific estimated annual GHG emission reductions and cumulative GHG emission reductions for the periods 2025-2030 and 2025-2050.

**Table 3: Project 2B CAPEX, Process and Financial Benefit Information**

Estimated Hickok Co-gen Capital Investment for Full Cogen		CAPEX (\$ Million)	
Boiler		\$9.5	
Steam Turbine/Generator		\$9.0	
Air Cooled Condenser		\$4.0	
Power Systems for Export		\$2.5	
Total		\$25.0	
Hickok Co-gen Project - Energy Flows			
Tail Gas Flow Rate		kNm3/hr	44
LHV of Wet TG		kcal/Nm3	710
Total TG Energy		MW_t	36.3
Electrical Power at 26% Efficiency		MW_e	9.4
Power Equipment Consumption (BFW pump, ACC)		MW_e	0.8
Net Electrical Energy Per Year at 8000 hr Per Year		MWh	69,048
Avoided CO <sub>2</sub> at 992 lb/MWh (eGrid for 2021 SPNO)		kMT CO <sub>2</sub> /yr	31.1

#### Project 2C: Emission Reduction Assistance: Bridging the Gap for Disadvantaged Industries

- GHG Reduction Estimate Method: Project estimates are based on a summation of, and average of, data generated by EEX interns over the past five years under various EPA grant programs (e.g., P2, SRA and SMM) for intern projects that had not been implemented. Data was calculated by interns using engineering estimations and publicly available tools and models under EPA-approved QAPPs and evaluated by intern mentors.
- Models/Tools Used: EPA P2 GHG calculator, EPA WARM Calculator, ultrasonic leak detector model.
- Measure Implementation and GHG Reduction Estimate Assumptions: All subprojects, both identified and unidentified, are assumed to be implemented by January 1, 2027. Averages of estimated subproject outcomes are indicative of unidentified projects. All assumptions used by EEX interns are valid. Data and estimates provided by EEX interns are accurate; GHG emissions from changes in maintenance activities are negligible, including replacement of equipment purchased to reduce GHGs; estimated emissions reductions and the measures they are based on are at steady state over the life of the proposal's estimated timespan (2025-2050).
- Reference Case Scenario: Activity level based on facility operations during intern recording.
- Measure-Specific Activity Data: GHG emission estimates from the list of projects are based on various metrics, including utility rates, waste generation and disposal activities, compressed air leak estimates from ultrasonic frequency measurements and equipment ratings and run hours.
- GHG Emissions Reduced: See [Table 1b](#) for measure-specific estimated annual GHG emission reductions and cumulative GHG emission reductions for the periods 2025-2030 and 2025-2050.

**Table 4: Project 2C Identified Project Information**

Project Descriptor	GHG Emissions Reductions (MTCO <sub>2</sub> e/yr)	Project Implementation Cost	Annual Cost Saving (\$/yr)	Kansas County	Facility No.
Oven Efficiencies	4,437	\$5,315	\$25,661	Saline	7
Solar	2,336	\$2,469,957	\$208,924	Sedgwick	16
Compressed Air Audit	1,614	\$2,700	\$78,359	Nemaha	11
System Installation	1,431	\$950,000	\$240,000	Johnson	1
Compressed Air Audit	1,410	\$130,000	\$56,405	Miami	13
Lighting	799	\$75,000	\$38,089	Neosho	8
Going Paperless	788	\$51,600	\$30,968	Sedgwick	16
Compressed Air Audit	759	\$73,000	\$65,151	Miami	13
Compressed Air Audit	423	\$43,000	\$60,419	Labette	6
Compressed Air Audit	407	\$38,000	\$27,080	Atchison	4
Lighting	400	\$116,123	\$41,264	Sedgwick	16
Air Vibrators	355	\$3,000	\$11,791	Pawnee	21
Lighting and Fan	307	\$32,000	\$27,900	Saline	18
Compressed Air Audit	289	\$29,000	\$40,638	Geary	22
Lighting	217	\$95,295	\$18,587	Sedgwick	16
Lighting	217	\$500	\$26,541	Franklin	20
Lighting	206	\$21,000	\$18,150	Riley	10
Compressed Air Audit	186	\$17,000	\$20,477	Atchison	14
Fans Upgrade	167	\$2,100	\$16,545	Barton	23
Lighting	148	\$44,005	\$6,738	Sedgwick	19
Lighting	138	\$6,663	\$15,770	Atchison	14
Lighting	114	\$10,000	\$13,759	Douglas	25
Compressed Air Audit	100	\$10,000	\$12,774	Franklin	20
Lighting	91	\$9,000	\$8,697	Sedgwick	5
Lighting	90	\$39,412	\$6,753	Sedgwick	2
Climate Control in Open Space	85	\$5,500	\$7,861	Sedgwick	16
Solvent Distillation	60	\$27,949	\$200,969	Nemaha	11
Compressed Air Audit	46	\$5,212	\$3,484	Sedgwick	2
Lighting	46	\$4,300	\$6,154	Miami	13
Cure Oven Heat Retention	44	\$6,500	\$10,000	Saline	18
Lighting	44	\$4,500	\$5,184	Leavenworth	15

Chem Mill Optimization	42	\$221,460	\$100,317	Sedgwick	16
Compressed Air Audit	40	\$2,260	\$2,262	Grant	17
Lighting	30	\$2,800	\$2,466	Labette	12
Occupancy Light Sensors	23	\$2,300	\$2,011	Johnson	3
Light Occupancy Sensor	17	\$3,000	\$1,490	Riley	10
TV Usage Reduction	16	\$1,799	\$2,020	Franklin	20
Waste Stream - Excess Powder Paint	13	\$12,630	\$1,191	Saline	9
AC Line Cracks Correction	6.5	\$1,000	\$606	Sedgwick	24
Lighting	6.0	\$330	\$314	Grant	17
Occupancy Light Sensors	3.2	\$1,000	\$407	Leavenworth	15
Light Occupancy Sensor	3.1	\$252	\$231	Sedgwick	2
Water Bottle Prevention	1.1	\$1,650	\$3,216	Sedgwick	16
Glass Waste	1.0	\$8,850	\$9,090	Geary	22

#### Project 2D: Energy efficiency and renewable energy technical and financial assistance

- **GHG Reduction Estimate Method:** Project estimates are based on a summation and average of data generated from KEP's energy assessments submitted for USDA REAP grant reimbursements between 2016-2023. Data was calculated by qualified energy assessors using historical energy use data, specific project quotes, and engineering estimations.
- **Models/Tools Used:** EPA P2 GHG calculator, eGRID
- **Measure Implementation and GHG Reduction Estimate Assumptions:** Subprojects are assumed to be implemented based on a staggered timeline as described in the methodology table below. For example, assessments completed in year 1 of period of performance will lead to projects implemented in year 2. Estimated emission reductions are based on steady state operation over the life of the GHG reduction measure and maintenance activity impacts are negligible. A weighted average life of implemented projects was used to determine longevity of emission reductions.
- **Reference Case Scenario:** GHG emissions reference scenario using a minimum of one year of historical energy use data from the industry.
- **Measure-Specific Activity Data:** A minimum of one year of historical energy data will be collected for each subproject/measure. EEX anticipates energy savings primarily of electricity and natural gas. EEX will use engineering estimations, manufacturer-specific data, and documented assumptions to determine measure-specific results.
- **GHG Emissions Reduced:** See [Table 1b](#) for measure-specific estimated annual GHG emission reductions and cumulative GHG emission reductions for the periods 2025-2030 and 2025-2050.

**Table 5a: Methodology to Estimate GHG-Emission Reductions and Project Cost**

Description	Value	Variable	Notes/Calculation
<b>Project Summary and Cost Estimate</b>			
Number of energy assessments completed by EEX's KEP	188	A	Based on historical data from 2016 to 2023 (8 years) including energy efficiency and renewable energy assessments

Number of assessments resulting in a USDA REAP grant application	114	B	
% of applications resulting in REAP submission	61%	C	$C = B / A \times 100$
Estimated % of businesses which will apply for financial assistance under Project 2D	75%	D	With increased funding from the Inflation Reduction Act, USDA increased potential reimbursement from 25% to 40% and then to 50%, resulting in increased REAP application submissions. When evaluating assessments completed since this increase, 41 out of 50 assessments resulted in a REAP grant application (82%).
Average total project cost of assessments resulting in REAP application, excluding those over \$200,000	\$70,000	E	Based on historical data from 2016 to 2023 (8 years); rounded to nearest thousand
Average financial assistance amount based on 50% reimbursement	\$35,000	F	$F = E \times 50\%$
Total number of proposed assessments	80	G	Based on 20 assessments/year in Years 2, 3, 4, and 10/year in Years 1 and 5 of period of performance (allows for promotion, data analysis, and project ramp-up/down).
Number of assessments resulting in funding and implementation	60	H	$H = G \times D$
Total proposed financial assistance from CPRG / total funds expended by businesses (each supply 50% of funding for project)	\$2,100,000	I	$I = F \times H$ (based on 50% funding)
Total proposed CPRG funding	\$4,734,317	J	Includes \$2.1 million financial assistance (I) + technical assistance + all other costs
<b>GHG Emission Reduction Estimate</b>			
Average annual electricity savings per assessment (kWh)	42,593	K	Based on historical data from 2016 to 2023 (8 years) for REAP submissions under \$200,000. Other fuel types not included.
Average annual natural gas savings per assessment (Btu)	24,246,039	L	
Annual MTCO <sub>2</sub> e reduction per assessment (electricity)	41.3	M	$M = K \times 0.0009692488512 \text{ MTCO}_2\text{e/kWh}$ (EPA P2 GHG Calculator - Kansas)
Annual MTCO <sub>2</sub> e reduction per assessment (nat. gas)	1.3	N	$N = L \times 5.31667 \times 10^{-5} \text{ kg/Btu} \times 1 \text{ ton/1,000 kg}$ (EPA P2 GHG Calculator)



Total estimated annual MTCO <sub>2</sub> e reduction per assessment	42.5722	O	O = M + N
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**Table 5b: Duration/Longevity of Projects by Type (for projects submitted for REAP and under \$200,000)**

Project Type	Total Cost	Estimated Life	Description
Appliances/equipment	\$398,808.68	15	The estimated life of equipment is based on historical data, warranties, conversations with contractors, etc. For example, HVAC life expectancy is based on ASHRAE Equipment Life Expectancy Chart. Solar photovoltaic systems often have warranties of a minimum of 20 to 25 years, so assumed to have a 25 year estimated life. These values are used to determine the weighted average estimated life of all equipment installed under Project 2D. Weighted average is calculated by determining the sum of the Total Cost × Estimated Life for each type of product and dividing that total by the Sum of the Total Cost.
Building Envelope	\$279,544.92	25	
Compressor	\$22,966.00	10	
Geothermal	\$70,311.00	25	
HVAC	\$388,497.02	15	
Lighting	\$382,761.96	20	
Refrigeration	\$2,094,437.27	15	
Solar	\$3,564,943.41	25	
Water Heater	\$3,970.22	10	

**Table 5c: Magnitude of GHG Reductions - MTCO<sub>2</sub>e**

Description	MTCO <sub>2</sub> e	Variable	Description
Duration/Life of Projects (Weighted Avg)	20.7	P	P = Weighted average as described above
Year 1 (2025): 10 assessments completed leading to 8 projects implemented in Year 2	1,362.3	Q	Q = 8 × (2030 - 2026) × O; assumes Year 1 Projects are implemented at beginning of 2026 (Year 2), so there would be 4 years of associated GHG reductions. Based on 75% of 10 completed assessments (rounded up)
Year 2 (2026): 20 assessments completed leading to 15 projects implemented in Year 3	1,915.8	R	R = 15 × (2030 - 2027) × O; assumes Year 2 Projects are implemented at beginning of 2027 (Year 3), so would have 3 years of associated GHG reductions. Based on 75% of 20 completed assessments.
Year 3 (2027): 20 assessments completed leading to 15 projects implemented in Year 4	1,277.2	S	S = 15 × (2030 - 2028) × O; assumes Year 3 Projects are implemented at beginning of 2028 (Year 4), so would have 2 years of associated GHG reductions. Based on 75% of 20 completed assessments.
Year 4 (2028): 20 assessments completed leading to 15 projects implemented in Year 5	638.6	T	T = 15 × (2030 - 2029) × O; assumes Year 4 Projects are implemented at beginning of 2029 (Year 5), so would have 1 year of associated GHG reductions. Based on 75% of 20 completed assessments.



Year 5 (2029): 10 assessments completed leading to 7 projects implemented at end of period of performance	0	U	$U = 7 \times (2030 - 2030) \times O$ ; assumes Year 5 Projects are implemented beginning of 2030 (end of performance period), so would have 0 years of associated GHG reductions. Based on 75% of 10 completed assessments (rounded down).
Total MTCO <sub>2</sub> e Reduction from 2025 through 2030	5,193.8	V	$V = \text{SUM}(Q:U)$
CPRG-Funded MTCO <sub>2</sub> e Reduction from 2025 through 2030	3,597.9	W	$W = V \times (J / (I + J))$
Total MTCO <sub>2</sub> e Reduction from 2025 through 2050	52,619.7	X	$X = ((8 + 15 + 15 + 15 \text{ projects}) \times O \times P) + (7 \times O \times 20 \text{ years})$ ; Year 1 through Year 4 projects assume GHG reductions throughout average project life (Variable P). Year 5 projects (implemented in 2030 assume 20 years of GHG reductions (2030 to 2050)).
CPRG-Funded MTCO <sub>2</sub> e Reduction from 2025 through 2050	36,451.1	Y	$Y = X \times (J / (I + J))$

**Table 5d: Cost Savings and Payback**

Description	Value	Variable	Description
Average annual cost savings per assessment	\$5,566.83	Z	Based on historical data from 2016 to 2023 (8 years) for REAP submissions under \$200,000. $AA = E / Z$ (based on total project cost of single project)
Simple payback on per project basis (based only on project financial cost)	12.6	AA	
Net annual cost reduction (based on 2025 - 2050 timeline)	\$275,226	AB	$AB = ((8 + 15 + 15 + 15 \text{ projects}) \times Z \times P + (7 \text{ projects} \times Z \times 20)) / 25 \text{ years}$ ; similar to explanation of Variable X
CPRG Funding Contribution (including all project costs: financial assistance, technical assistance, supplies, travel, etc)	69.3%	AC	$AC = J / (I + J)$

### Project 3: Global Center for Grain and Food Innovation (GCGFI)

- **GHG Reduction Estimate Method:** Engineering calculations and modeling used in building design.
- **Models/Tools Used:** The DOE/EPA EnergyStar Target Finder (ENERGY STAR Portfolio Manager Target Finder) online tool was used to estimate the GHG emissions. Industry standard models and calculations were also used, such as impacts on heating and cooling load due to insulation values and seasonal temperature patterns.
- **Measure Implementation and GHG Reduction Estimate Assumptions:** Dollar costs can be found in the GHG calculation spreadsheet. Assumed start of GHG reductions is the first of August 2026.

Scenario 2 (ECM 1B, 2 and 3) is preferred over Scenario 1 (ECM 1A, 2 and 3) and used for calculation purposes. Additional assumptions are provided in the calculation spreadsheet where appropriate.

- *GCGFI rooftop array*: Estimated usable rooftop area: 19,000 ft<sup>2</sup>, determined from current floor plans deducting safety setbacks and clearances around rooftop equipment. Utilizes 430W modules, sized at 78 inches x 39 inches, estimating 884 modules on a space-efficient Ballasted Racking system for maximum efficiency with direct southern exposure. Predicted to produce 525,380 kWh/Year.
- *Weber Link rooftop array*: Estimated usable rooftop area: 1,650 ft<sup>2</sup>, determined from current floor plans deducting safety setbacks. Utilizes 430W modules, sized at 78 inches x 39 inches, estimating 70 modules on a space-efficient Ballasted Racking system for maximum efficiency with direct southern exposure. Predicted to produce 41,477 kWh/Year.
- *Dairy Bar patio canopy array*: Estimated canopy overhang area: 2,375 ft<sup>2</sup>, determined from current landscape/civil plans for Dairy Bar patio area. Utilizes 430W modules, sized at 78 inches x 39 inches, estimating 104 modules on a Semi Cantilevered Canopy Mounting System for optimal energy output with south-southeast exposure. Predicted to produce 63,833 kWh/Year.
- Reference Case Scenario: Activity level based on anticipated heating and cooling load of the building and yearly sunlight availability.
- Measure-Specific Activity Data: GHG reduction measures are based on the estimated energy consumption data derived from past lab buildings. The baseline emissions for the GCGFI and related buildings are estimated at 5,715 MTCO<sub>2</sub>e per year. The implementation of various energy efficiency measures is expected to significantly reduce greenhouse gas (GHG) emissions. Once the new Global Center for Grain and Food Innovation (GCGFI) building is in operation, EEX plans to use EPA's eGrid to convert electricity consumption to GHG emissions.
- GHG Emissions Reduced: See Table 1b for measure-specific estimated annual GHG emission reductions and cumulative GHG emission reductions for the periods 2025-2030 and 2025-2050.

**Table 6: Project 3 ECM Information**

ECM	Absolute GHG [MTCO <sub>2</sub> e/yr]	Difference from Baseline [MTCO <sub>2</sub> e/yr]	First Cost Estimate [\$]	Cost per Reduced GHG [\$/(MTCO <sub>2</sub> e/yr)]
Baseline	5,715	-	-	-
ECM 1A	5,505	210	\$1,310,000	\$6,238.10
ECM 1B	4,512	1,203	\$5,875,000	\$4,883.62
ECM 2	5,430	285	\$1,365,000	\$4,789.47
ECM 3	5,676	39	\$550,000	\$14,102.56