

Project Information		Financial Overview			
		Total CPRG Funds Requested: \$48,180,934			
Project No.	Operational Start Date	Net Annual Savings	Requested CPRG Funding	Total Funding to Implement	2025-2030 Cost Effectiveness
-	-	<i>million \$ / yr</i>	<i>million \$</i>	<i>million \$</i>	<i>\$ / MTCO2e</i>
1*	Continuous	N/A	\$ 0.49	\$ 0.49	N/A
2A	Jun-27	\$2.4	\$ 2.67	\$ 5.22	\$ 130.24
2B	Jul-29	\$2.0	\$ 17.18	\$ 25.18	\$ 1,618.99

Project In
Project No.
-
1*
2A
2B

K-State Engineering Extension (EEX) - Project 2A: Installation of a Heat Exchanger (Hex) System to Recover and Recycle Wasted Heat to Preheat Process Air

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
Total	\$5.1

Feedstock price is \$550 per metric ton  
Air preheat increases yield by ~2.4% per 100 C  
Assumption 1: Impacts to all GHGs except CO2 are considered negligible  
Assumption 2: Birla's data is accurate  
Assumption 3: GHG emissions from changes in maintenance activities are negligible  
Assumption 4: steady state from data provided  
Does not consider lifespan of heat exchanger

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
CO2 Emissions	[MT/yr]	49,867	34,391	-15,476
CO2 Footprint	[kg CO2 / 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

K-State Engineering Extension (EEX) - Project 2B: Capture of Wasted Heat to Make Electricity at Carbon Black Plant

Estimated Hickok Co-gen Capital Investment for Full Cogen	CAPEX (\$ million)
Boiler	\$9.5
Steam turbine/generator	\$9.0
Air cooled condensor	\$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 CO2 at 992 lb/MWh (eGrid for 2021 SPNO)	[kMT CO2/yr]	31.1

Hickok Co-gen Project - Financial Benefits	Annual Benefit (million \$ / yr)
Financial Benefit from supplying internal 2.5 MW	\$1.3
Financial Benefit from exporting 6 MW to grid	\$1.0
Operating Cost	(\$0.3)
Total annual Benefit	\$2.0

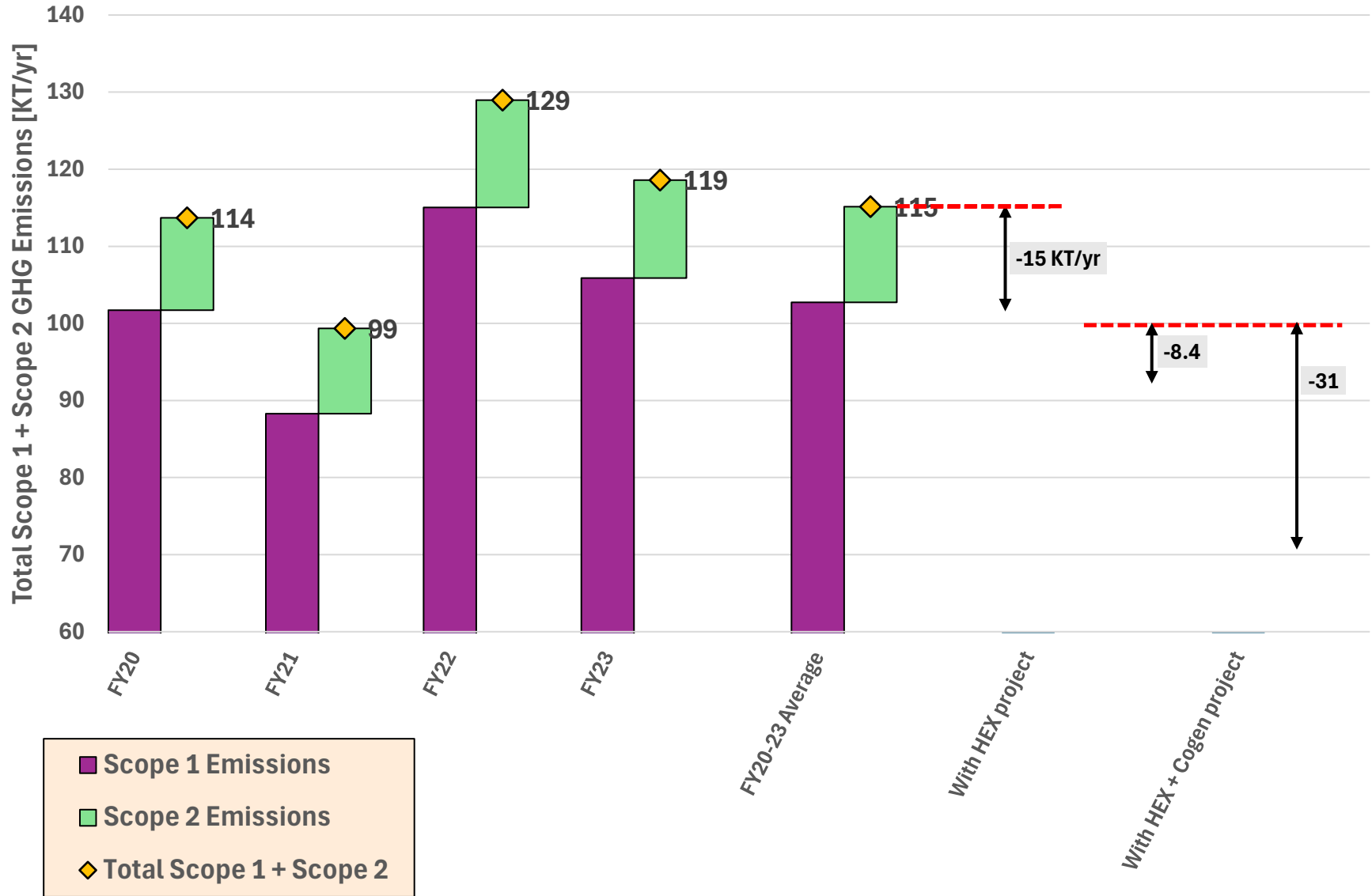
Electricity price for purchase from grid: \$65/MWh  
Electricity price for selling to grid: \$20/MWh

K-State Engineering Extension (EEX): Project 2A & 2B

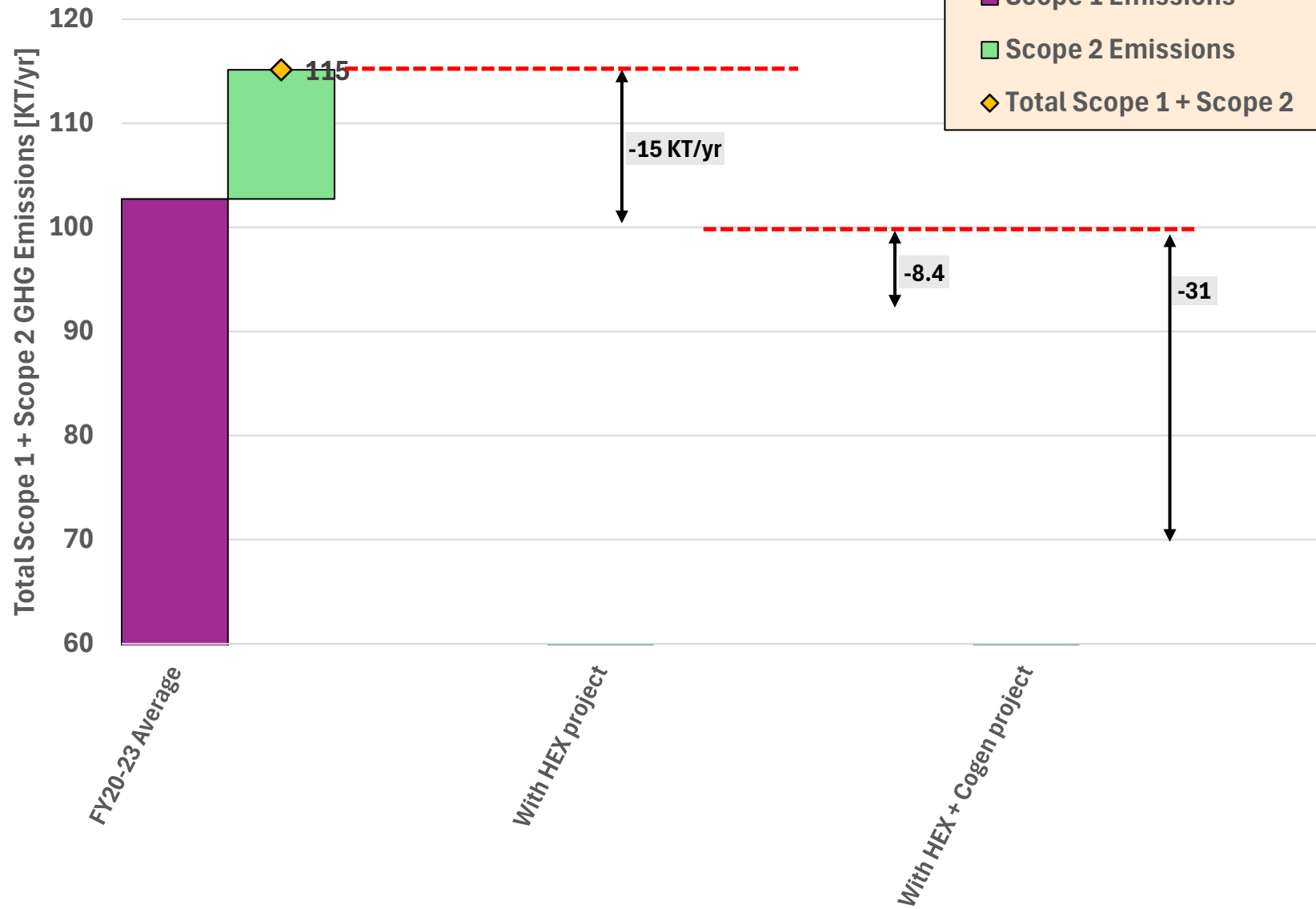
Reporting period		FY20	FY21	FY22	FY23		FY20-23 Average		With HEX project (2A)	With HEX and Cogen project (2A&2B)
Total Scope-1 Emissions	[kMT_CO2]	101.7	88.3	115.1	105.9		102.7		#REF!	#REF!
Total Scope-2 Emissions	[kMT_CO2]	12.0	11.1	13.9	12.7		12.4		12.4	#REF!
Total Scope 1 and 2	[kMT_CO2]	113.7	99.3	129.0	118.6		115.1		#REF!	#REF!
Scope 1 and 2 Intensity	[kg GHG / kg CB]	2.86	3.17	2.96	2.97		2.98		#REF!	#REF!

Reporting period		FY20		FY21		FY22		FY23		FY20-23 Average		With HEX project		With HEX + Cogen project
Total Scope-1 Emissions	[kMT]	101.7		88.3		115.1		105.9		102.7		#REF!		#REF!
Total Scope-2 Emissions	[kMT]	12.0		11.1		13.9		12.7		12.4		12.4		#REF!
Total Scope 1 and 2	[kMT]	113.7		99.3		129.0		118.6		115.1		#REF!		#REF!
		FY20		FY21		FY22		FY23		FY20-23 Average		With HEX project		With HEX + Cogen project
Scope 1 Emissions		101.7		88.3		115.1		105.9		102.7		#REF!		#REF!
Column 2 White		101.7		88.3		115.1		105.9		102.7		#REF!		#REF!
Scope 2 Emissions		12.0		11.1		13.9		12.7		12.4		12.4		#REF!

## Hickok GHG Emissions



## Hickok Annual GHG Emissions



K-State Engineering Extension (EEEX) - Project 2C: Emission Reduction Assistance: Bridging the Gap for Disadvantaged Industries

Project Descriptor	Annual GHG Emissions Reductions (MTCO2e/yr)	Project Implementation Cost	Annual Cost Saving (\$/yr)	County	Facility No.
Oven efficiencies	4,437	\$ 5,315	\$ 25,661	Saline	7
Solar	2,336	\$ 2,489,957	\$ 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	\$ 73,000	\$ 38,089	Nevado	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	\$ 7,881	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	\$ 9,184	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	\$ 1,790	\$ 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
SUM:	17,965	\$ 4,586,962	\$ 1,476,713		
AVG:	408	\$ 104,249	\$ 33,562		

For identified projects:

CPRG Funding Percentage:	75%
CPRG Funding Requested:	\$ 3,440,222
Quantified GHG emissions reduction:	13,466 MTCO2e/yr

For unidentified projects:

Number of unidentified business projects:	25
CPRG Funding Percentage:	75%
CPRG Funding Requested:	\$ 2,558,778
Quantified GHG emissions reduction:	7,651 MTCO2e/yr

Combined evaluation variables:

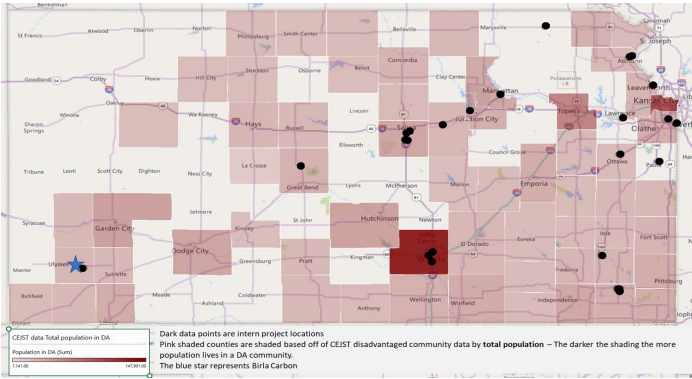
CPRG funding requested	\$ 6,000,000
Quantified GHG emissions reduction	21,118 MTCO2e/yr

Assumptions:

All projects implemented and operational starting 2027

For unidentified business projects, assume Implementation cost and GHG reductions are equal to average values for identified projects

Assume that the unidentified projects will be similar to the preidentified projects, so we're using the average of identified project variables to determine unidentified variables





**K-State Engineering Extension (EEX) - Project 2D: Energy efficiency and renewable energy technical and financial assistance**
**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	
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	
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.
Average annual natural gas savings per assessment (Btu)	24,246,039	L	Other fuel types not included.
Annual MTCO2e reduction per assessment (electricity)	41.3	M	$M = K \times 0.0009692488512$ MTCO2e/kWh (EPA P2 GHG Calculator - Kansas)
Annual MTCO2e reduction per assessment (nat. gas)	1.3	N	$N = L \times 5.31667 \times 10^{-5}$ kg/Btu $\times 1$ ton/1,000 kg (EPA P2 GHG Calculator)
Total estimated annual MTCO2e reduction per assessment	42.6	O	$O = M + N$

**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 $\times$ 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	

**K-State Engineering Extension (EEX) - Project 2D: Energy efficiency and renewable energy technical and financial assistance (continued)**
**Magnitude of GHG Reductions - MTCO2e**

Description	MTCO2e	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	$Q = 8 \times (2030 - 2026) \times O$ ; 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	$R = 15 \times (2030 - 2027) \times O$ ; 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	$S = 15 \times (2030 - 2028) \times O$ ; 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	$T = 15 \times (2030 - 2029) \times O$ ; 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 MTCO2e Reduction from 2025 through 2030	5,193.8	V	$V = \text{SUM}(Q:U)$
CPRG-Funded MTCO2e Reduction from 2025 through 2030	3,597.9	W	$W = V \times (J / (I + J))$
Total MTCO2e 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 MTCO2e Reduction from 2025 through 2050	36,451.1	Y	$Y = X \times (J / (I + J))$

**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.
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	$AC = J / (I + J)$

K-State Engineering Extension (EEK) - Project 3: Global Center for Grain and Food Innovation (GCGFI)

ECM	Absolute GHG [metric tons CO2e per year]	GHG Savings [metric tons CO2e per year]	First Cost	\$/ton CO2 per yr	ECM Description
Baseline	5715	--	-	-	Estimated lab consumption based on actual operation data from past lab building
ECM 1A	5505	210	\$ 1,310,000.00	\$ 6,238.10	Smaller HR Chiller for Simultaneous Load
ECM 1B	4512	1203	\$ 5,875,000.00	\$ 4,883.62	Ground-coupled heat recovery chiller
ECM 2	5430	285	\$ 1,365,000.00	\$ 4,789.47	Photovoltaic system @ 455 kW
ECM 3	5676	39	\$ 550,000.00	\$ 14,102.56	Wall to R-13+10ci (U-0.055) from R-13+7.5 ci (U-0.064) Fenestration assembly to U-0.30 from U-0.36

Start year:	Aug-26	Total Cost	GHG savings per year (MTCO2)	2025-2030 GHGs (MTCO2)	2025-2050 GHGs (MTCO2)	2025-2030 Cost effectiveness	2025-2050 Cost effectiveness
Scenario 1	ECM 1A, 2, 3	\$ 3,225,000.00	534.00	1824.5	12504.5	\$ 1,767.61	\$ 257.91
Scenario 2	ECM 1B, 2, 3	\$ 7,790,000.00	1527.00	5217.25	35757.25	\$ 1,493.12	\$ 217.86

Quant	Unit cost	Expanded	
ECM-1A: Small HP Chiller for Simul. H/C			
200-ton 4-pj	200 \$	2,800.00 \$	560,000.00
Associated P	1 \$	550,000.00 \$	550,000.00
Baseline Chil	200 \$	(1,000.00) \$	(200,000.00)
Baseline Pun	1 \$	400,000.00 \$	400,000.00
Total		\$	1,310,000.00
ECM-1B: Large HP Chiller + Geo			
1250-ton 6-p	1250 \$	2,400.00 \$	3,000,000.00
Geothermal i	725 \$	5,000.00 \$	3,625,000.00
Associated P	1 \$	2,500,000.00 \$	2,500,000.00
Baseline Chil	1250 \$	(1,000.00) \$	(1,250,000.00)
Baseline Pun	1 \$	(2,000,000.00) \$	(2,000,000.00)
Total		\$	5,875,000.00
ECM-2: PV Arrays			
Array costs	1 \$	1,365,000.00 \$	1,365,000.00
ECM-3: Envelope Improvements			
Wall Insulati	1 \$	250,000.00 \$	250,000.00
Fenestration	1 \$	300,000.00 \$	300,000.00
Total		\$	550,000.00

Here's a revised schedule for just the GHG reduction portion

The expected timeline is as follows.

- Scope project- 3 months
- Design and engineering work- 6 months
- Construct project- 12 months
- Commission project- 1 month

Total time on project to completion- **22 months**

Defintion	<p>Notes</p> <p>Heating degree day/cooling degree day</p> <p>Recommended sources: ASHRAE Fundamentals or weather station data</p> <p><a href="http://www.degreeedays.net">www.degreeedays.net</a> for real-world data</p> <p>Alternate source: EnergyStar PortfolioManager: <a href="https://portfoliomanager.energystar.gov/pm/degreeDaysCalculator">https://portfoliomanager.energystar.gov/pm/degreeDaysCalculator</a></p>
HDD/CDD	<p>The numeral after the HDD or CDD denotes the temperature around which the HDD quantity are calculated. This should typically be the balance point of the building, where no mechanical heating is needed or where no mechanical cooling is needed</p> <p>Equivalent full load hour</p>
EFLH	<p>Good resources are the 90.1 User's Manual typical schedules</p> <p>Convert complex rates (demand, ratchet, seasonal, etc) to flat-rate equivalent</p> <p>Sources: DOE EIA electricity: select predefined report 5.6, change to annual, scroll to find state and use commercial (or other category if appropriate)</p> <p><a href="https://www.eia.gov/electricity/data/browser/">https://www.eia.gov/electricity/data/browser/</a></p> <p>DOE EIA natural gas: change to annual and select state; use same year data as electricity</p> <p><a href="https://www.eia.gov/dnav/ng/ng_pri_sum_dcu_nus_m.htm">https://www.eia.gov/dnav/ng/ng_pri_sum_dcu_nus_m.htm</a></p>
Utilty cost	

Project Number 629-040-23  
Project Name KSU GCGFI  
City Manhattan  
State Kansas  
Zip Code 66502

Energy Code 90.1-2016  
Climate zone 5A

HDD65 5053  
CDDxx 4175 CDD50  
HDD ideally selected at balance point of building; HDD65 is good starting point  
CDD ideally selected at balance point of building

Column1	Column2	Column3
Building floor area	281,594	sq ft
Typical floor to ceiling height	16	ft

Column1	\$/unit	Units	\$/kBtu	Source
Electricity	0.1151	\$/ kWh	#REF!	DOE EIA 2022 KS average
Natural gas	1.233	\$/ therm	#REF!	DOE EIA 2022 KS average
Chilled water	8.1721	\$/ MMBTU	#REF!	LEED DES Guidance v2009
Steam	#REF!	\$/ MMBTU	#REF!	LEED DES Guidance v2009

\$/ton-hr = elec \* 0.85  
\$/MMBtu = NG\*1.81 + elec\*3  
\$/MMBTU = elec \* 71

Assumptions: DES Heating plant 0.7 COP LEEDv4 reference guide  
DES cooling plant 4.4 COP LEEDv4 reference guide  
CHW losses 5% LEEDv4 reference guide  
HW losses 10% LEEDv4 reference guide  
Steam losses 15% closed loop system; LEEDv4 reference guide

Surface ID	Net Area [sf]	Assembly U-value	SHGC
AG Wall	111301	0.055 --	
BG Wall	0	0.064 --	
Wall type 3	0	0.064 --	
Spandrel	0	0.1 --	
Roof	12486.8	0.03 --	
Total	123787.8		5

Surface ID	Net Area [sf]	Assembly U-value	SHGC
Fenestration	27677	0.3	0.36
Basement windows	0	1.25	0.82
Window Type 3	0	0.4	0.5
Exterior glass door	0	0.6	0.3
Total	27677		1.98

Surface ID	Net Area [sf]	Assembly U-value	SHGC
Opaque door	0	0.6	0.36
Opaque door (swinging)	0	0.37 --	
Overhead door (nonswinging)	0	0.31 --	
Total	0		3

Fenestration SHGC      [Sustainable By Design :: window heat gain \(susdesign.com\)](#)

Fenestration Orientation	Area	Btu/ft2
North (within 45-deg of N)		
East		
South		
West		

Checksums	Area	Weighted Average U-value	Average SHGC
Opaque wall aggregate	123787.8	0.0525 --	
Fenestration aggregate	27677	0.3000	0.3600
Exterior door aggregate	0	#DIV/0!	--

Future improvement: break out cooling, heating, shoulder seasons

Infiltration rate	CFM/sf façade	CFM	0	0.4 typical value
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Column1	Peak Load (W/sf)	EFLH
Building average Interior LPD	0.7	2288
Building average process load	0.75	2920
Other area based electrical load		

Column1	Peak Load (kW)	EFLH
Elevator	30	1526
Unique process load 2		
Unique process load 3		
Unique process load 4		

Column1	Peak Load (kW)	EFLH
Exterior lighting		3800

Unique process loads could be elevators, data center load, etc

	Cooling	Heating
Envelope gains	Y	Y
Fenestration SHGC	Y	N
Infiltration	Y	Y
Internal gains	Y	N
Ventilation Load	Y	Y
Fan Power	N	N

Future  
Slab-on-grade heat gain  
Roof heat gain

ENVELOPE LOADS

Heating envelope	Column2	Column1
Opaque envelope	787,802	kBtu
Window conduction	1,006,934	kBtu
Ventilation	0	kBtu
Infiltration	0	kBtu
Total	1,794,736	4

Area x #HDD x 24 hrs x U-value / 1000  
Area x #HDD x 24 hrs x U-value / 1000  
CFM x 0.0182 x #HDD x 24 / 1000  
CFM x 0.0182 x #HDD x 24 / 1000

Cooling envelope	Area x #HDD x 24 hrs x U-value	Column1
Opaque	650,915	kBtu
Window conduction	831,971	kBtu
Ventilation	0	kBtu
Infiltration	0	kBtu
Total	1,482,886	4

Area x #CDD x 24 hrs x U-value / 1000  
Area x #CDD x 24 hrs x U-value / 1000  
CFM x 0.0182 x #CDD x 24 / 1000  
CFM x 0.0182 x #CDD x 24 / 1000

Heating energy consumption 2,063,946 kBtu  
Cooling energy consumption 1,557,030 kBtu

EUI  
7.33 kBtu/sf-yr  
5.53 kBtu/sf-yr

Heating energy cost #REF! \$  
Cooling energy cost #REF! \$

SYSTEM FANS

Fan Power  
  
0 kW  
0 kWh  
0 kBtu 0.00  
\$ - \$

Historical Utility Data: October bills provided by owner				
Natural Gas		Note: gas meter serves whole building		
	Therms	kBtu	Est cost	\$/therm
Total annual	9454	945400	#####	\$1.2330
Less SHW base	9238	923800	#####	\$1.2330
Electricity				
Three electric meters; assumed to represent electric base load given October timeframe				
	kWh	Cost	\$/kWh	
EL	7000	651.21	0.0930	
SE	29854	1339.13	0.0449	
WA	29854	1364.65	0.0457	
total	66708	3354.99	0.0503	