

## IMPLEMENTATION GRANT APPLICATION TECHNICAL APPENDIX

This technical appendix explains the methodology and assumptions used for developing the estimated greenhouse gas (GHG) emissions reduced for each component of the proposal. The “GHG Emission Reduction Calculation Spreadsheet” included with this application provides the specific GHG emission reduction calculations for each measure.

### 1. Predevelopment Program (\$100 million)

#### a. Emission Reductions Estimate Method:

There are multiple components within the \$100 million pre-development phase, only one of which was analyzed for emissions reduction potential: the Predevelopment Assistance to Large Industrial Facilities. Our analysis identified the top 40 industrial sector, non-power plant emitters in each state. By partnering with state technical assistance providers, this program will offer up to 20 detailed audits per state to these facilities. While these audits will help identify transformative projects for which recipients may apply for competitive grant funding, they will also undoubtedly identify measures likely to be self-implemented by facilities due to their acceptable paybacks. It was assumed that the top 20% of emitters would have already implemented these measures and therefore they were not included in this savings analysis. Further, it was assumed that a set of facilities would self-fund their own energy audit or contract a third party to provide the analysis. Therefore, the technical assistance network in the Midwest is not expected to provide all analyses. However, since the completion of such a study is a requisite to participation in the competitive grant, the energy and GHG savings from implemented measures even from self-funded or third-party studies were included in this estimation analysis.

To calculate the amount of savings from implemented measures, we first identified the top 40 emitters in each state using the U.S. Environmental Protection Agency (EPA) Flight Tool. Each of these facilities was assigned a three-digit North American Industry Classification System (NAICS) code, if it was not provided through the Facility Level Information on Greenhouse gases Tool (FLIGHT).<sup>1</sup> For such facilities, NAICS codes were assigned individually based upon market sector characteristics of the facility. This analysis removed a number of market sectors as ineligible for program participation. See the table below for a list of removed sectors.

**Table 1: Eliminated Market Sectors**

Industrial Landfills	Underground Natural Gas Storage
LNG Storage	Natural Gas Pipelines - All
Municipal Landfills	Injection of Carbon Dioxide
Natural Gas Distribution	Natural Gas Processing
Natural Gas Liquids Fractionation	Solid Waste Combustion

---

<sup>1</sup> <https://ghgdata.epa.gov/ghgp>

Sometimes the listed sectors in FLIGHT differed from the chosen NAICS designation. One such example is the McKinley Paper Company in Combined Locks, Wisconsin. According to FLIGHT, this facility is designated an industrial landfill (NAICS 562); however, while there is a landfill present at the facility, its emissions and energy use characteristics more closely match a paper mill. Therefore, it was assigned NAICS code 322. See the tables below.

Individually Assigned Sectors	Identified NAICS Codes for Top State Emitters		
Other Combustion	212	324	331
Other Manufacturing	311	325	336
Industrial Landfills - Specific Sector	322	327	611

We then converted each facility's scope 1 GHG emissions into component parts (natural gas, petroleum, coal, etc.). This was accomplished by averaging the emissions breakdown into All Fuel Combustion components and Process Emissions categories for state level three-digit NAICS code. These averages were converted into percentages and then applied to each facility's scope 1 emissions to estimate input fuel emissions by type. This analysis then converted natural gas derived emissions into natural gas quantities in MMBtu at the rate of 14.43 kg CO<sub>2</sub>/MMBtu. See the table below for a list of NAICS codes and emissions breakdowns.

Scope 1&2 Emissions Breakdown by NAICS and State - Using EPA PILOT & DOE EEIO									
NAICS Code	State Code	Natural Gas	Coal	Petroleum	Biofuels	Non Energy Emissions	Scope 1 Emissions % of Whole	Scope 2 Emissions % of Whole	Scope 2 Biogenic Portion %
212	212WI	9.16%	0.64%	15.59%	0.00%	74.60%	0%	0%	0.0%
311	311WI	35.16%	58.65%	0.20%	0.15%	5.84%	8%	7%	2.8%
322	322WI	82.02%	13.44%	0.13%	0.36%	4.04%	74%	11%	2.8%
324	324WI	81.58%	0.00%	17.82%	0.00%	0.60%	52%	6%	3.0%
325	325WI	99.99%	0.00%	0.01%	0.00%	0.00%	62%	17%	2.7%
327	327WI	20.12%	27.97%	1.53%	0.00%	50.37%	69%	12%	2.8%
331	331WI	38.67%	51.96%	0.19%	0.00%	9.18%	52%	26%	2.7%
336	336WI	97.50%	0.00%	1.25%	1.25%	0.00%	4%	12%	2.9%
212	212OH	9.16%	0.64%	15.59%	0.00%	74.60%	0%	0%	0.0%
311	311OH	30.45%	0.00%	0.01%	27.09%	42.45%	8%	7%	2.8%
322	322OH	91.44%	0.00%	0.99%	3.27%	4.30%	74%	11%	2.8%
324	324OH	7.85%	0.00%	0.03%	41.25%	50.87%	52%	6%	3.0%
325	325OH	53.26%	0.00%	0.54%	1.17%	45.02%	62%	17%	2.7%
327	327OH	21.79%	12.10%	8.93%	0.00%	57.18%	69%	12%	2.8%
331	331OH	28.73%	0.69%	0.01%	31.28%	39.30%	52%	26%	2.7%
336	336OH	97.50%	0.00%	1.25%	1.25%	0.00%	4%	12%	2.9%
611	611OH	99.47%	0.00%	0.53%	0.00%	0.00%	50%	50%	10.0%
212	212MI	9.16%	0.64%	15.59%	0.00%	74.60%	0%	0%	0.0%
311	311MI	32.90%	48.74%	0.16%	3.62%	14.57%	8%	7%	2.8%
322	322MI	76.90%	8.50%	0.00%	0.83%	13.77%	74%	11%	2.8%
324	324MI	5.72%	0.00%	0.00%	55.54%	38.74%	52%	6%	3.0%
325	325MI	63.35%	0.00%	0.21%	0.00%	36.44%	62%	17%	2.7%
327	327MI	7.90%	6.38%	0.50%	0.00%	85.22%	69%	12%	2.8%
331	331MI	23.95%	6.01%	0.13%	46.56%	23.37%	52%	26%	2.7%
336	336MI	97.50%	0.00%	1.25%	1.25%	0.00%	4%	12%	2.9%
611	611MI	99.95%	0.00%	0.04%	0.01%	0.00%	50%	50%	10.0%
212	212IL	9.16%	0.64%	15.59%	0.00%	74.60%	0%	0%	0.0%
311	311IL	20.65%	53.63%	0.13%	8.53%	17.06%	8%	7%	2.8%
322	322IL	99.97%	0.00%	0.03%	0.00%	0.00%	74%	11%	2.8%
324	324IL	2.62%	0.00%	0.46%	52.05%	44.88%	52%	6%	3.0%
325	325IL	63.01%	0.00%	0.03%	5.01%	31.95%	62%	17%	2.7%
327	327IL	24.18%	0.00%	0.00%	0.00%	75.82%	69%	12%	2.8%
331	331IL	26.62%	1.10%	0.02%	36.16%	36.11%	52%	26%	2.7%
336	336IL	97.50%	0.00%	1.25%	1.25%	0.00%	4%	12%	2.9%
611	611IL	86.79%	12.51%	0.13%	0.01%	0.56%	50%	50%	10.0%
212	212MN	9.16%	0.64%	15.59%	0.00%	74.60%	0%	0%	0.0%
311	311MN	43.04%	42.29%	0.94%	0.00%	13.73%	8%	7%	2.8%
322	322MN	77.29%	0.00%	0.52%	1.37%	20.82%	74%	11%	2.8%
324	324MN	12.98%	0.00%	0.02%	33.68%	53.36%	52%	6%	3.0%
325	325MN	99.58%	0.00%	0.32%	0.00%	0.11%	62%	17%	2.7%
327	327MN	68.96%	16.63%	0.00%	0.00%	14.41%	69%	12%	2.8%
331	331MN	19.53%	3.41%	0.12%	0.00%	76.94%	52%	26%	2.7%
336	336MN	97.50%	0.00%	1.25%	1.25%	0.00%	4%	12%	2.9%
611	611MN	99.89%	0.00%	0.11%	0.00%	0.00%	50%	50%	10.0%

To calculate the estimated electric consumption per facility, this analysis used the U.S. Department of Energy's (DOE) Environmentally Extended Input Output for Industrial Decarbonization Analysis (EEIO-IDA) subsector emissions summaries.<sup>2</sup> This document provides average facility emissions breakdown for the above NAICS codes with one exception; NAICS code 611 covering universities is not present in this dataset. This analysis assumed that scope 1 GHG emissions comprise 50% of total GHG emissions, and scope GHG 2 emissions comprise the other 50%. It was assumed that universities have minimal scope 3 GHG emissions. Using the breakdowns, we could make an estimation for annual electric emissions consumption at each facility. This analysis omitted biogenic electric emissions from these calculations.

<sup>2</sup><https://www.energy.gov/sites/default/files/2023-09/EEIO-IDA%20Overview%20and%20All%20Subsector%20Emissions%20Summary.pdf>

To convert these electric emissions into electricity consumed (MWh) this analysis used the average state emissions rate from the EPA's eGrid 2024 dataset. See table below.

It should be noted that state average emission rates are incredibly coarse, especially in states, like Illinois, that span two regional transmission operators (MISO and PJM) with widely differing average emissions rates. However, using the more accurate eGrid subregion geography proved too difficult, as many facilities exist in the gray area between region, requiring the model operator to individually select each facility's eGrid region.

To calculate savings from implemented measures, this analysis used the DOE's Office of Manufacturing and Energy Supply Chain's (MESC) Industrial Assessment Center (IAC) database.<sup>3</sup> This database contains

EPA eGrid 2024 (2022 data)	
State	eGrid 2024 Avg Emissions Rate CO2e (lbs/MWh)
IL	592.394
MI	1,015.727
MN	773.811
OH	1,162.128
WI	1,178.408

NAICS	Electric Savings (%)	Gas Savings (%)
212	1.3%	14.9%
311	3.4%	2.3%
322	1.6%	2.2%
324	1.1%	2.6%
325	2.8%	2.5%
327	2.5%	0.6%
331	2.3%	1.6%
336	4.1%	2.1%
611	7.0%	2.1%

statistics from all of the IAC energy audits nationwide on identified and implemented measures for natural gas and electricity. Using the three-digit NAICS codes, we can see the average implemented savings as a percentage of gas and electric consumption. While IAC assessments are provided for small- to medium-size industrial clients, we felt that this dataset is applicable to larger clients as well. However, we omitted the largest 20% of emitters in the five-state region under the assumption that these largest facilities would have already implemented most of these measures on their

own.

Multiplying each facility's estimated annual natural gas and electric consumption by the IAC average implemented savings by NAICS yielded an amount of MMBtu and MWh savings achieved through facilities' self-implementation. Due to the heterogenous nature of these industrial sites and their consumption of energy, it is not possible to provide a list of specific measures that we expect to be implemented.

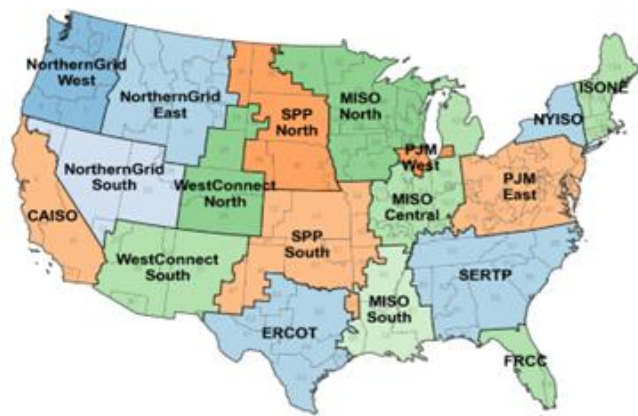
However, the underlying assumption that these site audits will identify cost-effective measures able to be self-funded is

rooted in the experience of the IAC program, the UIC, and the Coalition's experience working in the industrial sector. To calculate cumulative scope 1 emissions from natural gas saving measures, this analysis multiplied year 1 savings by 5 to arrive at 2030 cumulative savings and by 25 to arrive at 2050 cumulative savings for each facility.

This process is decidedly more complicated when calculating scope 2 emissions savings due to the evolving nature of the electric grid.

<sup>3</sup> <https://iac.university/statistics>

To calculate scope 2 emissions savings from measures identified in the audits and self-implemented by facilities it was necessary to model the emission rates of the grid. To calculate the emissions savings from these measures, this analysis used National Renewable Energy Laboratory's (NREL) Cambium model, specifically the Short Run Marginal Emissions Rate (SRMER) and the Long Run Marginal Emissions Rate (LRMER). When assessing the emissions savings from an efficiency measure it is appropriate to use the grid's marginal emissions rate instead of the average grid emissions rate. While the EPA's Avoided Emissions and Generation Tool (AVERT) provides marginal emissions rates for energy efficiency measures, its geographies are too large and timeframes too short for use in this analysis.



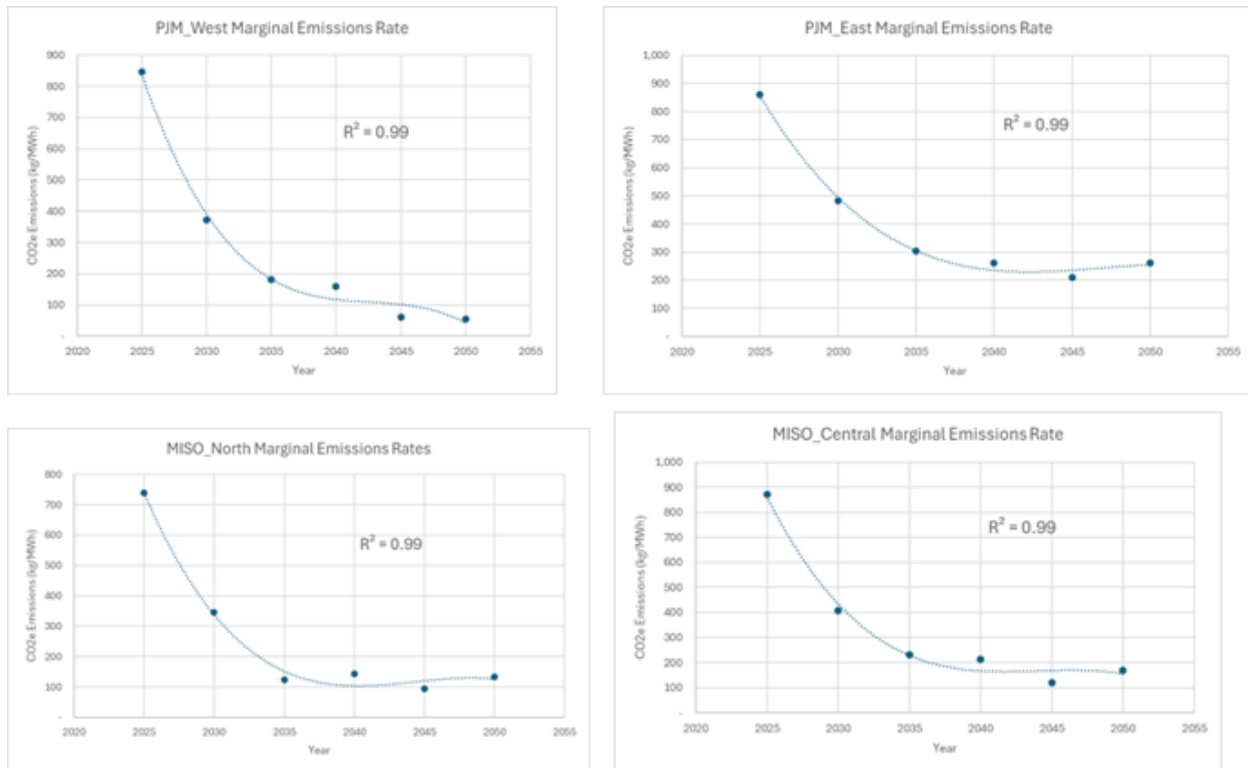
Therefore, this analysis used NREL's Cambium model to calculate the SRMER and LRMER by Generation and Emission Assessment (GEA) regions.<sup>4</sup> See the map for GEA Regions used in Cambium. Cambium lists GEA regions by zip code, thereby making it possible to search for each facility's specific region.

To capture the full effect of implemented measures on emissions, this analysis blended SRMER and LRMER rates in the near term. See table below for weighting of each emissions rate by year.

	LRMER and SRMER Weighted Averages					
	2025	2030	2035	2040	2045	2050
LRMER	0%	30%	80%	100%	100%	100%
SRMER	100%	70%	20%	0%	0%	0%
	Blended SRMER & LRMER Combined CO <sub>2</sub> e (kg/MWh)					
	2025	2030	2035	2040	2045	2050
MISO_Central	873.00	408.17	231.85	212.70	119.87	169.31
MISO_North	738.80	346.08	124.64	144.40	93.70	132.73
PJM_East	861.60	482.91	304.33	261.18	209.79	262.40
PJM_West	845.80	371.92	181.35	159.37	60.87	54.05

Once the blended emission rates were calculated using the weightings shared in the table above, this analysis used a regression analysis to estimate the year-by-year marginal emission rate for each GEA region. See graphs in the table below.

<sup>4</sup> <https://www.nrel.gov/analysis/cambium.html>



The implemented electric savings in MWh was multiplied by the marginal emission rate by year and corresponding GEA region to calculate the cumulative emissions savings.

Lastly, we should note that while most energy efficiency programs in the United States assume a maximum lifetime for each implemented measure, this analysis did not. This is for two primary reasons. The first is that it is our assumption that measures self-funded and implemented because of the CPRG-funded site audits will be replaced by a similar or more efficient measure at the end of its life. Therefore, the savings identified and implemented will persist even after the initial measure reaches the end of its lifetime. And since the initial measure was induced as a direct result of CPRG funding, it is proper to account for savings beyond its life. Second, measure lifetimes are necessary for energy efficiency programs in order to pass a cost/benefit analysis. All EE programs require a cost/benefit analysis to decide which measure they will fund. However, our assumption is that the savings identified in phase one are implemented by each facility with no additional CPRG funding since the measures are assumed to have an attractive payback. A cost/benefit approach is not relevant to this analysis.

**b. Models/Tools Used:**

- EPA Facility Level Information on Greenhouse Gases Tool
- National Renewable Energy Laboratory Cambium Model
- EPA 2024 eGrid Dataset
- DOE Environmentally Extended Input Output for Industrial Decarbonization Analysis
- Industrial Assessment Center Statistics

c. Measure Implementation Assumptions:

- 20 studies per state provided by the technical assistance network
- Additional studies provided or acquired by sites themselves
- Top 20% of emitters excluded on the assumption that they have already accomplished any identified measure

d. Emission Reduction Estimate Assumptions:

- Estimated scope 2 emissions using the DOE EEIO tool by three-digit NAICS code.
- Converted facility level scope 2 emissions to MWh using 2023 eGrid state average CO2e emissions rate.
- Estimated self-implemented electric and natural gas savings using the Industrial Assessment Center's national statistics by three-digit NAICS code.
- Did not analyze or estimate any other GHG source reduction.

e. Reference Case Scenario:

**BAU Cumulative Emissions by 2030 (Metric Tons)**

	Gas	Electric	Total
Illinois	122,964,927	1,501,971	124,466,897
Minnesota	59,669,600	301,795	59,971,394
Michigan	57,093,860	519,207	57,613,066
Ohio	104,526,854	681,115	105,207,969
Wisconsin	27,107,185	51,843	27,159,028
Total	371,362,425	3,055,930	<b>Grand Total 374,418,355</b>

**BAU Cumulative Emissions by 2050 (Metric Tons)**

	Gas	Electric	Total
Illinois	614,824,633	3,921,757	618,746,389
Minnesota	298,347,998	617,885	298,965,883
Michigan	285,469,298	1,341,641	286,810,939
Ohio	522,634,270	2,338,961	524,973,231
Wisconsin	135,535,925	106,141	135,642,066
Total	1,856,812,123	8,326,385	<b>Grand Total 1,865,138,507</b>

f. Measure-Specific Activity Data and Implementation Tracking Metrics:

Measure-specific activity data and implementation will be tracked and measured based on the metrics outlined in the "Performance Measures and Plan" in the workplan and other relevant data to be determined during the first year of the project and on a case-by-case basis as projects are awarded funding. The implementation tracking process will include at least one year of monitoring and verification for each project awarded funds.

g. GHG Emissions Reduced:

### Phase 1 Cumulative Savings by 2030 (Metric Tons)

	Gas	Electric	Total
Illinois	233,498	53,563	287,061
Minnesota	341,277	17,310	358,587
Michigan	255,250	43,605	298,855
Ohio	224,487	19,753	244,241
Wisconsin	361,469	3,111	364,580
Total	1,415,981	137,342	<b>Grand Total 1,553,323</b>

### Phase 1 Cumulative Savings by 2050 (Metric Tons)

	Gas	Electric	Total
Illinois	1,167,488	120,072	1,287,560
Minnesota	1,706,384	38,394	1,744,778
Michigan	1,276,249	103,190	1,379,439
Ohio	1,122,437	54,324	1,176,761
Wisconsin	1,807,345	6,900	1,814,245
Total	7,079,904	322,880	<b>Grand Total 7,402,783</b>

## 2. Challenge Grant Program (\$400 million)

### a. Emission Reductions Estimate Method:

Due to the nature of the phase 2 competitive grant, it is difficult to predict which projects or facilities will be funded. The only methodologically sound approach to estimating emissions savings from such a competitive grant program is to calculate the minimum achievable savings.

In order to access grant funded a project must meet two criteria. First, a project must provide a minimum 40% combined scope 1 & 2 GHG reduction in year 1; and second, a project must have a private/grant leverage of at least 4-1.

For the purposes of this analysis, it was assumed that this program would provide 40 grants and that these grants would be divided between states based on the weighted average facility emissions from sites in each state. Each grant would provide a minimum 40% emissions reduction to each state's average facility emissions. The attributable savings would be the 20% funded directly through the CPRG, and not inclusive of private leverage. It was estimated that phase 2 first-year savings to be 7,238,472 metric tons of CO<sub>2</sub>e, 1,447,694 metric tons of which is directly allocable to the CPRG funding. See the table below.



### Phase 2 - Year 1 GHG Savings (Minimum)

States	Avg. Facility GHG Emissions	Weighted %	Grants per State	Avg. Savings by Site (Metric Tons CO2e)	Total State Savings (Metric Tons CO2e)	Attributable to CPRG (Metric Tons CO2e)
IL	614,825	33%	13	245,930	3,257,276	651,455
MN	298,348	16%	6	119,339	767,005	153,401
MI	285,469	15%	6	114,188	702,216	140,443
OH	522,634	28%	11	209,054	2,353,682	470,736
WI	135,536	7%	3	54,214	158,293	31,659
<b>Total</b>					<b>7,238,472</b>	<b>1,447,694</b>

**b. Models/Tools Used:**

Without knowing which projects or facilities will receive grant funding, it was largely impossible to model the emission reduction affects of implemented projects.

**c. Measure Implementation Assumptions:**

While we are not able to know which facilities or projects might be funded through this program, based on the identified NAICS codes of the top 40 emitters in each state, we understand the processes responsible for a significant portion of total emissions. Thermal energy plays a significant role in generating emissions from the industrial sector.

**d. Emission Reduction Estimate Assumptions:**

It was assumed that the average project will be implemented in 2026 and provide emissions savings through 2050.

**e. Reference Case Scenario:**

#### BAU Cumulative Emissions by 2030 (Metric Tons)

	Gas	Electric	Total
Illinois	122,964,927	1,501,971	124,466,897
Minnesota	59,669,600	301,795	59,971,394
Michigan	57,093,860	519,207	57,613,066
Ohio	104,526,854	681,115	105,207,969
Wisconsin	27,107,185	51,843	27,159,028
<b>Total</b>	<b>371,362,425</b>	<b>3,055,930</b>	<b>Grand Total 374,418,355</b>

#### BAU Cumulative Emissions by 2050 (Metric Tons)

	Gas	Electric	Total
Illinois	614,824,633	3,921,757	618,746,389
Minnesota	298,347,998	617,885	298,965,883
Michigan	285,469,298	1,341,641	286,810,939
Ohio	522,634,270	2,338,961	524,973,231
Wisconsin	135,535,925	106,141	135,642,066
<b>Total</b>	<b>1,856,812,123</b>	<b>8,326,385</b>	<b>Grand Total 1,865,138,507</b>

**f. Measure-Specific Activity Data and Implementation Tracking Metrics:**

Measure-specific activity data and implementation will be tracked and measured based on the metrics outlined in the “Performance Measures and Plan” in the workplan and other relevant data to be determined during the first year of the project and on a case-by-case basis as projects are awarded funding. The implementation tracking process will include at least one year of monitoring and verification for each project awarded funds.

**g. GHG <and Co-pollutant> Emissions Reduced:**

	<b>Cumulative Total Savings by 2030 (Metric Tons CO2e)</b>	<b>Cumulative CPRG Savings by 2030 (Metric Tons CO2e)</b>	<b>Cumulative Total Savings by 2050 (Metric Tons CO2e)</b>	<b>Cumulative CPRG Savings by 2050 (Metric Tons CO2e)</b>
IL	16,286,379	3,257,276	78,174,620.08	15,634,924.02
MN	3,835,026	767,005	18,408,123.36	3,681,624.67
MI	3,511,081	702,216	16,853,188.34	3,370,637.67
OH	11,768,410	2,353,682	56,488,368.16	11,297,673.63
WI	791,463	158,293	3,799,024.63	759,804.93
<b>Total</b>	<b>36,192,359</b>	<b>7,238,472</b>	<b>173,723,325</b>	<b>34,744,665</b>

	<b>Phase 1 Cumulative Savings (Metric Tons CO2e)</b>	<b>Phase 2 CPRG Responsible Cumulative Savings (Metric Tons)</b>	<b>Total CPRG Responsible GHG Savings (Metric Tons)</b>	<b>Cost of Emissions Reduction (\$/metric ton)</b>
<b>2030</b>	1,553,323	7,238,472	8,791,795	\$56.87
<b>2050</b>	7,402,783	34,744,665	42,147,448	\$11.86