

Technical Appendix

1. GHG Reduction Estimate Assumptions

Carbon emissions calculations for all proposed measures rely on the assumptions described in this section. Therefore, these assumptions need not be reiterated for each proposed GHG Reduction Measure.

1.1 Avoided Electricity Emissions Calculations

Electricity emissions calculations are based on the EPA 2021 base year reporting requirements for WE Energies¹ and WPS.² The Department then applied the WEC Energy Group (parent company for both utilities) 2021 Corporate Social Responsibility Report³ carbon reduction goals to each utility's 2021 baseline emissions, which is described in the Tribe's PCAP in Appendix D, pages 146 – 148. The Corporate Social Responsibility Report aims to reach carbon neutrality by 2050. The Department models the incremental relative reductions by base year for each utility. For example, between 2021 and 2025, WEC states it will reduce 2025 emissions from 45% to 60%, representing a 15% absolute difference of 2005 emissions. With a 2021 base of 55% of 2005 emissions, this equates to a 27.3% relative reduction from 2021 emissions in 4 years. The net emissions factors for electricity are shown in Table 1.

Table 1: WPS and WE Energies Emissions Factors by Year According to WEC Energy Group 2021 Corporate Social Responsibility Report⁴

Year	WPS Emissions (kg CO ₂ e / MWh)	WE Energies Emissions (kg CO ₂ e / MWh)	Reduction Relative to 2005 Base Year
2021	620	445	45%
2022	578	415	49%
2023	535	384	53%
2024	493	354	56%
2025	451	324	60%
2026	406	291	64%
2027	361	259	68%
2028	316	227	72%
2029	271	194	76%
2030	225	162	80%
2031	214	154	81%
2032	203	146	82%
2033	192	138	83%
2034	180	129	84%
2035	169	121	85%

¹ <https://www.we-energies.com/environment/epa-greenhouse-gas-reporting>

² <https://www.wisconsinpublicservice.com/company/epa-greenhouse>

³ <https://www.wecenergygroup.com/csr/cr2021/wec-corporate-responsibility-report-2021.pdf>

⁴ <https://www.wecenergygroup.com/csr/cr2021/wec-corporate-responsibility-report-2021.pdf>

2036	158	113	86%
2037	147	105	87%
2038	135	97	88%
2039	124	89	89%
2040	113	81	90%
2041	101	73	91%
2042	90	65	92%
2043	79	57	93%
2044	68	49	94%
2045	56	40	95%
2046	45	32	96%
2047	34	24	97%
2048	23	16	98%
2049	11	8	99%
2050	0	0	100%

1.2 Avoided Natural Gas Emissions

Reduced natural gas consumption is based on the U.S. Energy Information Administration (EIA)⁵ value of 52.9 kg CO₂e / MMBtu or 5.29 kg CO₂e / therm. EIA formulates this value based on EPA's *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021*⁶ and EPA's *GHG Emission Factors Hub*⁷. The emissions factor is stated on page 39 of the Tribe's PCAP. Natural gas emissions are assumed to be constant until 2050. On page 12, section 2.2.3 of its PCAP, the Tribe discusses the potential for carbon-neutral natural gas from its utility by capturing dairy cow methane and supplying the gas system with it. The Department concluded that less than 4% of the natural gas supply (GWP of 28) could allow the utility to claim carbon-neutral gas. In comparison, a marginal reduction of any amount of natural gas would still result in the full decarbonization benefit of 100% fossil fuel-based natural gas. Therefore, the Tribe concluded that natural gas emissions reductions still result in the full avoided gas decarbonization benefit.

Until additional details are released from WEC Energy Group about its carbon-neutral natural gas plan, baseline natural gas emissions are assumed to be 100% fossil fuel-based.

2. Potawatomi Milwaukee Bingo Casino-Hotel (PBC) GHG Reduction Measures

GHG Reduction measures at PBC were all generated by the PBC Level 3 Energy Audit, which was paid for by the Tribe's CPRG PCAP Planning Grant award. On page 39 of the Tribe's PCAP, the Tribe stated, "*The Department has ongoing efforts to reduce greenhouse gases on Tribal lands, not all of which can be discussed in the PCAP. Most notably, the Department has ongoing Level 3 energy audits at PBC, PCCH, the Executive Building, and Health & Wellness.*" The most recent version of the PBC Level 3 energy audit was attached to the Tribe's PCAP in Appendix E. However, several changes have been made since then to

⁵ https://www.eia.gov/environment/emissions/co2_vol_mass.php

⁶ [Inventory of U.S. Greenhouse Gas Emissions and Sinks | US EPA](#)

⁷ [GHG Emission Factors Hub | US EPA](#)

assist in methodological clarification for the Technical Appendix that is not included in Appendix E. Therefore, the full technical descriptions are included only in the Technical Appendix.

In addition, due to the suite of energy efficiency measures (EEMs) and heat decarbonization measures (HDMs) that were all studied under the PBC Level 3 Energy Audit Project, common methodologies are grouped for the entire audit to avoid repetition.

2.1 GHG Reduction Estimate Method

The PBC Level 3 Energy Audit relied on standards the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) required for Level 3 Energy Audits. The audits included several on-site visits, interviews with staff, and a systematic review of all available building plans, building schedules, and the inventory of major capital equipment and their estimated lifespans. The audit built upon a 2023 ASHRAE Level 2 energy audit that resulted in a \$2,006,844 funded U.S. Department of Energy (DOE) grant application to install 8 EEMs. The contractor calculated emissions savings after taking into account the installation of the 8 EEMs, which are not scheduled to be installed until 2025.

The carbon dioxide emissions for natural gas and electricity have been calculated based on current equipment usage and estimated energy savings. Yearly emissions factors are applied to the annual energy savings to determine pounds of carbon dioxide equivalent emissions each year. Emission reductions are provided yearly, on a cumulative basis, from 2025-2030, and from 2025-2050.

Annual carbon dioxide emissions values for PBC are collected from information and forecasts provided by WE Energies and the methodology outlined in the plan (FCPC PCAP) from February 2024. Natural gas emissions are assumed to be constant per therm consumed, using factors provided by the U.S. Energy Information Administration.

The methodology assumes that WE Energies will achieve their carbon neutral goals stated in the WEC Energy Group parent company Corporate Sustainability Report. It's assumed WE Energies will reach net zero emissions by 2050; thus, carbon emissions will decline each year until they reach 0 kg CO₂e/MWh in 2050. 2023 baseline emission reductions are modeled based on relative reduction goals from 2021 to 2050.

In 2021, WEC stated electricity emissions of WE Energies as 982 lbs CO₂e/MWh (WE Energies, 2023), or 445kg CO₂e/MWh. In the 4 years between 2021 and 2025, emissions are set to reduce from 445 kg to a 2025 emission level of 324 kg CO₂e/MWh to a 2030 emission level of 162 kg CO₂e/MWh. In the 20 years between 2030 and 2050, emissions are scheduled to reduce from 162 kg CO₂e/MWh to a 2050 emission level of 0 kg CO₂e/MWh.

Emissions factors for electricity data and avoided electricity costs are mapped from the Electric Tariffs & Emissions Factors file. This file contains a list of electric tariffs and electric costs by year for each active tariff. Emissions factors are published on the WE Energies website⁸ directly.

2.2 Models/Tools Used

⁸ [EPA Greenhouse Gas Reporting And Emission Rates | We Energies \(we-energies.com\)](https://www.we-energies.com/en/energy-environment/ghg-reporting)

Energy savings were calculated by using the OpenStudio energy model, as well as spreadsheet calculations that employ industry standard practices that are grounded in established engineering principles. Solar P.V. energy production was modeled using HelioScope. All calculations account for local weather data, hourly variation in equipment energy use, and building operations. The energy model additionally assumes interactions between EEMs and, therefore, underestimates the marginal value for adding only 1 EEM compared to the suite of all EEMs, where the EEMs interact.

2.3 Reference Case Scenario

The Reference Case Scenario assumes Business As Usual at PBC after installing the 8 EEMs described in Section 2.1. All energy use, net of the proposed 8 EEMs, is assumed to be fixed until 2050. The reference case also assumes that all electricity will be fully decarbonized by 2050 without any action by FCPC, but it does assume full emissions from 100% fossil fuel-based natural gas. As a base, the contractor used the 2023 energy use data for PBC, which states an energy consumption of 36,906,943 kWh and 1,589,092 therms. The estimated energy reduction of 2.6% for electricity and 15.7% for natural gas from the 2023 Level 2 Energy Audit Project were subtracted from the 2023 baseline data to estimate net energy savings for each EEM in the Level 3 Energy Audit Project.

2.4 Measure Implementation

2.4.1 Measure-Specific Implementation Assumptions

Measure-specific implementation assumptions are fully described in Attachment E of the PCAP, pages 175 – 193 and 211 – 220. Due to the length of the descriptions, this section has no room to properly outline the implementation assumptions made as part of this study.

There are no specific limitations for the projects proposed because none of the measures require significant disturbance of air or water resources to install. The main implementation activities include contracting, final design/engineering, equipment procurement, installation, and commissioning. The estimated implementation timeline for each EEM is for completion by the end of 2026. This would allow for 2 years for construction, and energy savings would begin to accrue in 2027.

2.4.2 Cost Estimation

The implementation cost estimates are based on information gathered from available plans, observations during the on-site visit, and information provided by building operators and all other stakeholders. All costs were estimated by the contractor using appropriate methods. Opinions of probable construction costs were made based on the contractor's experience and qualifications. They represent their best judgment as experienced and qualified design professionals.

Material Costs are based on recent vendor quotes for similar products or values listed in standard estimating guides and product catalogs. The contractor worked with various vendors and consultants in the price estimating process. For example, the current Potawatomi Liebert sales representative, CDP, provided pricing for computer room and air conditioning equipment. The current Potawatomi kitchen consultant, Rippe Associates, provided kitchen equipment pricing.

Labor Costs are based on prevailing wage rates for local contractors. Wage rates for self-installed projects (if applicable) were provided by the owner, or the labor was a sunk cost and, therefore, not included.

All prices are Build America Buy America (BABA) Compliant.

2.5 Measure Specific Activity and Carbon Savings

Measure-specific activities and carbon savings are summarized in Table 2. This data is available in the GHG Emission Reduction Calculations “GHGcalcs_Forest County Potawatomi Community.xlsx” file. Measure 1 is estimated to save 1,646 MWh a year, which is a decrease from Measure 2, which is estimated to use an additional 761.2 MWh a year and save 517,019 therms yearly. Measure 3 is estimated to save 206 MWh a year and is estimated to save 28,000 therms a year. The 2025 – 2030 average carbon savings of Measure 1 is 1,385 MT CO₂e a year. The 2025 – 2030 average carbon savings of Measure 2 is 10,299.6 MT CO₂e a year, and Measure 3 is expected to save 973 a year.

Please note that the estimated PCAP electricity use was revised down from 1,212.9 MWh a year to 761.2 MWh a year, and the estimated natural gas savings were revised up from 221,249 therms a year to 517,019 therms a year. As noted previously, the energy audits were ongoing. FCPC can provide a full copy of the revised contractor’s estimate for the Heat Recovery Chillers upon request.

Table 2: Summary of All GHG Reduction Energy and Carbon Savings for Measures 1 and 2

GHG Reduction Measure	1	2	3	3	3	3
EEM / HDM	HDM3: Install Solar P.V. Canopy/ Solar Wall	HDM2: Install Heat Recovery Chillers and Replace Boilers	EEM1: Retrofit LED Fixtures	EEM2: Optimize DCV Controls	EEM3: Add Unoccupied Setbacks	EEMs 1,2,3
Cost (\$)	\$6,574,000	\$44,202,301	\$101,702	\$22,575	\$36,8230	\$160,100
Annual MWh Reduction	1,646.0	-761.2	39.0	31.0	136.0	206
Annual Therm Reduction	0	517,019	0	15,000	13,000	28,000
Lifespan	25	25	20	20	25	25
Start Year	2027	2027	2026	2026	2026	2026
End Year	2051	2051	2045	2045	2050	2050
Total MWh Reduction	41,150	-19,030	780	620	3,400	5,150
Total Therm Reduction	0	12,925,475	0	300,000	325,000	700,000
Utility	WE Energies	WE Energies	WE Energies	WE Energies	WE Energies	WE Energies

2025 - 2030 Carbon Savings (MT CO ₂ e)	1,385.0	10,299.6	44.2	431.9	497.9	973.9
2025 - 2050 Carbon Savings (MT CO ₂ e)	3,915.4	66,565.1	101.0	1,667.3	2,082.4	3,850.6
Cost Effectiveness (\$ / MT CO ₂ e 2025 - 2030)	\$4,611	\$4,292	\$2,280	\$52	\$74	\$164

3. Potawatomi Carter Casino-Hotel (PCCH) GHG Reduction Measures

GHG Reduction measures at PCCH were all generated by the PCCH Level 3 Energy Audit, which was paid for by a mix of Federal, State, and Tribal funding. On page 39 of the Tribe's PCAP, the Tribe stated, *"The Department has ongoing efforts to reduce greenhouse gases on Tribal lands, not all of which can be discussed in the PCAP. Most notably, the Department has ongoing Level 3 energy audits at PBC, PCCH, the Executive Building, and Health & Wellness."* The most recent version of the PBC Level 3 energy audit was attached to the Tribe's PCAP in Appendix E; however, several changes have been made since that time to assist in methodological clarification for the Technical Appendix that is not included in Appendix E. Therefore, the full technical descriptions are included only in the Technical Appendix.

In addition, due to the suite of energy EEMs and HDMs studied under the PCCH Level 3 Energy Audit Project, common methodologies are grouped for the entire audit to avoid repetition.

4.1 GHG Reduction Estimate Method

The PCCH Level 3 Energy Audit relied on standards the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) required for Level 3 Energy Audits. The audits included several on-site visits, interviews with staff, and a systematic review of all available building plans, building schedules, and the inventory of major capital equipment and their estimated lifespans.

The carbon dioxide emissions for natural gas and electricity have been calculated based on current equipment usage and estimated energy savings. Yearly emissions factors are applied to the annual energy savings to determine pounds of carbon dioxide equivalent emissions each year. Emission reductions are provided yearly, on a cumulative basis, from 2025-2030, and from 2025-2050.

4.2 Models/Tools Used

Energy savings were calculated using an EQuest energy model, as well as datalogging and spreadsheet calculations that employ industry standard practices grounded in established engineering principles. The energy model additionally assumes interactions between EEMs and, therefore, underestimates the marginal value for adding only 1 EEM compared to the suite of all EEMs, where the EEMs interact.

4.3 Reference Case Scenario

The Reference Case Scenario assumes Business As Usual at PCCH. All energy use is assumed to be fixed until 2050. The reference case also assumes that all electricity will be fully decarbonized by 2050 without any action by FCPC. Still, it does assume full emissions from 100% fossil fuel-based natural gas. The contractor used the 2023 energy use data for PCCH as a base, which states an energy consumption of 4,715,013 kWh and 201,641 therms.

4.4 Measure Implementation

4.4.1 Measure-Specific Implementation Assumptions

Measure-specific implementation assumptions are fully described in Attachment E of the PCAP, pages 230 – 237. Due to the length of the descriptions, there is not room in this section to properly outline the implementation assumptions made as part of this study.

There are no specific limitations for the projects proposed, as none of the measures require significant disturbance of air or water resources to install. The main implementation activities include contracting, final design/engineering, equipment procurement, installation, and commissioning. None of the changes require significant modifications to existing infrastructure. The estimated implementation timeline for each EEM is for completion by the end of 2026. This would allow for 1 year for construction, and energy savings would begin to accrue in 2026.

4.4.2 Cost Estimation

The implementation cost estimates are based on information gathered from available plans, observations during the on-site visit, and information provided by building operators and all other stakeholders. All costs were estimated by the contractor using appropriate methods. Opinions of probable construction costs were made based on the contractor's experience and qualifications. They represent their best judgment as experienced and qualified design professionals.

Material Costs are based on recent vendor quotes for similar products or values listed in standard estimating guides and product catalogs. The contractor worked with FCPC vendors and consultants to obtain price quotations.

Costs for the geothermal system are conservative and could potentially be reduced depending on the productivity of wells.

Labor Costs are based on prevailing wage rates for local contractors. All prices are BABA compliant.

4.5 Measure Specific Activity and Carbon Savings

Measure-specific activities and carbon savings are summarized in Table 3. This data is available in the GHG Emission Reduction Calculations "GHGcalcs_Forest County Potawatomi Community.xlsx" file. The project is estimated to save 861.7 MWh a year of electricity and 83,079 therms. The 2025 – 2030 average carbon savings is 3,557.3 MT CO₂e a year.

Table 3: Summary of All GHG Reduction Energy and Carbon Savings for Measure 4

GHG Reduction Measure	4	4	4	4	4	4	4
EEM / HDM	EEM1: Rebuild RTU 1 & 2	EEM2: Modify RTU 3	EEM3: Schedule RTU 6 VAVs	EEM4: Flames Makeup Air	EEM5: RTU 7 Occupancy Sensors	EEM6: Ground-source Heat Pump System	EEMs 1 - 6
Cost (\$)	\$1,400,00	\$490,000	\$5,000	\$10,000	\$10,000	\$5,925,000	\$784,000
Annual MWh Reduction	525.0	32.6	8.6	10.7	12.9	271.9	861.7
Annual Therm Reduction	53,400	5,000	1,900	2,000	1,100	19,679	83,079
Lifespan	20	20	20	20	20	20	20
Start Year	2026	2026	2026	2026	2026	2026	2026
End Year	2045	2045	2045	2045	2045	2045	2045
Total MWh Reduction	10,500	652	172	214	258	5,437	17,233
Total Therm Reduction	1,068,000	100,000	38,000	40,000	22,000	393,580	1,268,000
Utility	WPS	WPS	WPS	WPS	WPS	WPS	WPS
2025 - 2030 Carbon Savings (MT CO2e)	2,241.0	183.7	63.8	69.8	49.5	949.6	3,557.3
2025 - 2050 Carbon Savings (MT CO2e)	7,543.5	646.6	232.0	250.2	162.9	3,062.7	11,898.0
Cost Effectiveness (\$ / MT CO2e 2025 - 2030)	625	\$2,667	\$78	\$143	\$202	\$7,152	\$2,204