

Middle Georgia Emissions Reduction Program

Technical Appendix: Climate Pollution Reduction Grants General Competition

Magnitude of GHG Reductions from 2025 through 2030

Zero-Emission Buses

As a greenhouse gas emission reduction action, the Middle Georgia Regional Commission and sub-awardee Macon-Bibb Transit Authority (MTA) prioritized the purchasing of 4 Zero-Emission Buses to replace current diesel vehicles. This activity aligns with those efforts of the State of Georgia in the Peach State Voluntary Emission Reduction Plan (PSVERP), under priority Strategy and Measure 1.1.

In support of the State of Georgia Emission reduction goals, the Middle Georgia Regional Commission application follows the guidance of the PSVERP two scenario method of estimating emission reductions. Impacts from weatherization of residential buildings are compared by Scenario 1, Business-as-usual (BAU), and Scenario 2, Policy Scenario. Scenarios were calculated utilizing the Rocky Mountain Institute's Energy Policy Simulator for both the near-term (2025-2030) and long-term (2025-2050).

BAU projections were modeled through the following assumptions from the State of Georgia. There were 874 commuter buses reported to the National Transit Database in Georgia in 2022.100 MARTA (the Metropolitan Atlanta Rapid Transit Authority) plans to add 63 fully electric buses starting in 2025, 101 which equates to 8% of the total statewide fleet; it is assumed that those buses will be added by 2030 and that an 8% replacement rate per decade follows. Additionally, it is assumed that the total number of buses will remain stagnant (instead of continuing its recent trend of decline) due to uncertainty on future projections of demand for bus transit. Given the above assumptions, the business-as-usual trend for electric buses is shown in the table below (PSVERP).

Year	% of buses that are electric	Total buses	Electric buses
2022	<1%	874	~9
2030	8%	874	70
2040	16%	874	140
2050	24%	874	210

As stated in Georgia's PSVERP, the policy scenario attempts to replace 50% of commuter and school buses with electric buses by the year 2050. The policy scenario assumes a yearly replacement of 2% of Georgia commuter buses with electric buses (PSVERP).

Year	% of buses that are electric	Total Buses	Electric Buses
2022	<1%	874	~9
2030	10%	874	88
2040	30%	874	262
2050	50%	874	437

As a priority reduction measure, the estimated cumulative emission reductions (MMTCO_{2e}) in the near-term of 2025 – 2030 by the State of Georgia in the PSVERP is -0.001 MMTCO_{2e} per bus. The total cumulative emission reduction in the near-term for the replacement of 4 buses was determined by multiplying -0.001 MMTCO_{2e} by 4. Based on the guidance of the policy scenario total cumulative emission reduction for the weatherization of all residential structures is -0.004 MMTCO_{2e}.



Georgia Emission Reduction Priority Strategy and Measure 1.1 (MMTCO_{2e})

Cumulative emission reduction (MMTCO _{2e}) near term (2025-2030) of replacement of transit buses		
Georgia Policy Scenario near-term (2025-2030) reduction	Number of Zero-emission buses	Cumulative emission reduction near-term (2025-2030) reduction (MMTCO _{2e})
-0.001	4	-0.004

Individual greenhouse gas emissions reductions for those commonly associated with buses in million metric tons (Mmt) were also calculated for the carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O) utilizing the Global Warming Potential (GWP) of the IPCC AR5 Fifth Assessment Report (NOFO). In the near term, the total greenhouse gas reductions were calculated as –0.001 Mmt.

Georgia GHG Emission Reduction Priority Strategy and Measure 1.1

CPRG - Global Warming Potential (GWP) for Greenhouse Gases		PSVERP cumulative near-term (2025-2030) emission reduction (MMTCO _{2e})	
Greenhouse Gas	100-Year Global Warming Potential	Georgia Policy Scenario near-term (2025-2030) reduction	Cumulative near-term reduction of greenhouse gas (million metric ton)
Carbon dioxide (CO ₂)	1	-0.001	-0.001
Methane (CH ₄)	28	-0.001	0.000
Nitrous oxide (N ₂ O)	265	-0.001	0.000
<i>Total GHG Reduction (million metric ton)</i>	<i>-0.001</i>		

Status	Current LFG collected (mmscf/y)	Current direct methane reduced (MMTCO _{2e} / year)	Policy add. direct methane reduced (MMTCO _{2e} / year)	Policy annual direct methane reduced (MMTCO _{2e} / year)
Operational	13,781.31	3.701961	0	3.701961
Planned	3,095.93	0.831635	0.301082	1.132717
Candidate	7,720.12	2.073792	0.846926	2.920718
Future Potential	0	0	0.098537	0.098537
Low Potential	2,580.04	0.693055	0	0.693055
Total	27,177.40	7.300443	1.246545	8.546988

Weatherization for Residential Buildings

As a greenhouse gas emission reduction action, the Middle Georgia Regional Commission has selected residential structure weatherization as a priority activity. This activity aligns with those efforts of the State of Georgia in the Peach State Voluntary Emission Reduction Plan (PSVERP), under priority Strategy and Measure 2.1 (PSVERP). Priority measure 2.1 is for the improved energy efficiency and promoting of electrification through weatherization of residential buildings, as the residential sector alone was responsible for 6% of Georgia's emissions in 2021. Priority measures reduce energy costs for homeowners by increasing the energy efficiency of their homes through sealing gaps and cracks, improving heating, and cooling systems, adding insulation and other interventions. The goal established for this program is the weatherization of 300 residential buildings.

In support of the State of Georgia Emission reduction goals, the Middle Georgia Regional Commission application follows the guidance of the PSVERP two-scenario method of estimating emission reductions. Impacts from weatherization of residential buildings are compared by Scenario 1, Business-as-usual (BAU), and Scenario 2, Policy Scenario. The BAU Calculated emissions were calculated using the U.S. EPA Global Change Analysis Model Long-term Interactive Multi-Pollutant Scenario Evaluator (GLIMPSE). This data was then summed and converted to million metric tons of carbon dioxide equivalent for a baseline (MMTCO_{2e}). Since the GLIMPSE tool does not specifically separate the weatherization of building envelopes from other more general residential energy efficiency improvements, baseline values were multiplied by estimated annual utility savings from the ENERGY STAR website (PSVERP). Policy scenario estimated savings from Residential Weatherization in Georgia was estimated as 8% Annual Utility Bill savings for Climate Zone 3 (South), total house.

As a priority reduction measure, the PSVERP estimated cumulative emission reductions (MMTCO_{2e}) in the near term of 2025 – 2030 at -2.508 MMTCO_{2e} per residential structure. The total cumulative emission reduction in the near term for the weatherization of 300 residential structures was determined by multiplying -2.508 MMTCO_{2e}. Based on the guidance of the policy scenario total cumulative emission reduction for the weatherization of all residential structures is -752.4 MMTCO_{2e}.

Georgia Emission Reduction Priority Strategy and Measure 2.1 (MMTCO_{2e})

Cumulative emission reduction (MMTCO_{2e}) near term (2025-2030) from weatherization of residential structures		
Georgia Policy Scenario near-term (2025-2030) reduction	Estimated number of weatherization residential structures	Cumulative emission reduction near-term (2025-2030) reduction (MMTCO_{2e})
-2.508	300	-752.4

Individual greenhouse gas emissions in million metric tons (Mmt) were also calculated for carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), and Fluorinated gases utilizing the Global Warming Potential (GWP) of the IPCC AR5 Fifth Assessment Report (NOFO). It is important to note that these values vary based on the individual heating, air conditioning, and appliances used. In the near term the total greenhouse gas reductions were calculated as -839.919 Mmt.



CPRG - Global Warming Potential (GWP) for Greenhouse Gases)		PSVERP cumulative near-term (2025-2030) emission reduction (MMTCO _{2e})	
Greenhouse Gas	100-Year Global Warming Potential	Georgia Policy Scenario near-term (2025-2030) reduction	Cumulative near-term reduction of greenhouse gas (million metric ton)
Carbon dioxide (CO ₂)	1	-2.508	-2.508
Methane (CH ₄)	28	-2.508	-0.090
Nitrous oxide (N ₂ O)	265	-2.508	-0.009
HFC-23	12400	-2.508	0.000
HFC-32	677	-2.508	-0.004
HFC-41	116	-2.508	-0.022
HFC-125	3170	-2.508	-0.001
HFC-134	1300	-2.508	-0.002
HFC-143	4800	-2.508	-0.001
HFC-152	138	-2.508	-0.018
HFC-227	3350	-2.508	-0.001
HFC-236f	8060	-2.508	0.000
HFC-43-10mee	1650	-2.508	-0.002
Total			-2.657
<i>Total GHG Reduction (million metric ton)</i>	-839.919		

Houston County

Houston County has shown a dedication to reducing GHG as a member of the Middle Georgia Clean Air Coalition, as so is seeking to be a subaward recipient of the CPRG. Houston County Georgia Board of Commissioners, operates the State Route 247 Municipal Solid Waste Landfill (SR247 MSW Landfill, ID# 457), located at 2080 Ga. State Route 247, Kathleen, Ga. The MSW Landfill has operated since 1987 and the projected closure date is the year 2227. In 2003 Houston County installed a gas collection system and flare station to serve Phase I Landfill. The second gas collection system to serve Phase II was added in 2009. By 2011 Houston County, Flint Energies and Power Secure started the landfill gas to power generation plant to serve Phase III, while phase IV came on operation. Phase V opened in 2014 and is reaching capacity. The Landfill Methane Outreach Program (LMOP) of EPA reports that in 2021 there was a total of 3,907,519 tons of waste in place. The Houston County MSW reduces methane emissions using a Reciprocation Engine system for capture. A total of 1.05 million standard cubic feet per day (MMSCFD) is captured at the site. The current operation has a direct emission reduction of 0.0921-Million Metric Tons Carbon Emission Equivalency per year (MMTCO_{2e}/yr.), and emission reduction avoided of 0.0088 MMTCO_{2e}/yr. (<https://www.epa.gov/lmop/lmop-landfill-and-project-database#about>).

As Houston County plans forward to Phase VI of its landfill expansion, additional gas collection infrastructure is needed to maintain methane emission reductions and limit GHG escaping to the atmosphere. Though landfill expansion is necessary, Houston County shares with the State of Georgia a mission for climate pollution reduction and prevention and seeks to bolster the state's efforts through further methane capture.



The State of Georgia's Peach State Voluntary Emission Reduction Plan listed Improved Waste Diversion and Landfill Management as its Priority Strategy and Measure 4. Strategy 4 addresses emissions from various waste streams in Georgia that end up in municipal landfills and contribute to the state's methane and CO₂ emissions. In 2021, municipal landfills accounted for 5.3% of the state's net emission. Priority strategy and measure 4.1 from the PSVERP is for the reduction of emissions through landfill gas management and utilization.

Engineering estimates have a potential 60,000,000 Standard Cubic Feet (scf) of greenhouse gas capture in 2026 from additional landfill methane capture system installation. Capturing the additional landfill gas would result in an estimated capture of 575.618 Metric Tons of Methane, which would equal a total of 0.016 MMTCO_{2e} of methane in 2026. In the near-term, by 2030, this additional capture would be an equivalent total of 0.064 MMTCO_{2e} of methane.

MMT calculation was based upon the following formula and an estimate of 60,000,000 scf of additional capture of landfill gas.

Methane Conversions	
0.0423	pounds methane/standard cubic foot methane
0.5	standard cubic feet methane/standard cubic foot landfill gas
2,000	pounds/short ton
0.9072	metric tons/short ton
28	GWP for methane

standard cubic feet methane/standard cubic foot landfill gas = 0.5 * 60,000,000 standard cubic foot of LFG/yr.
pounds methane/standard cubic foot methane = 0.0423 * 30,000,000 standard cubic foot of LFG/yr.
short tons of methane=126900 pounds of methane (2000 pounds per short ton)

$$MMTCO_{2e}/yr. = (((tons\ CH_4/yr.)) / ((1E+06\ metric\ tons/million\ metric\ tons) / (0.9072\ metric\ tons/short\ ton) / 28\ [GWP\ of\ methane])))$$

Magnitude of GHG Reductions from 2025 through 2050

Zero-Emission Buses

As a greenhouse gas emission reduction action, the Middle Georgia Regional Commission and sub-awardee Macon-Bibb Transit Authority prioritized the purchasing of 4 Zero-Emission Buses to replace current diesel vehicles. This activity aligns with those efforts of the State of Georgia in the Peach State Voluntary Emission Reduction Plan (PSVERP), under priority Strategy and Measure 1.1 (PSVERP). Priority measure 1.1 is for the electrified transportation sector and adapts to consumer mode shifts through Zero-emission buses.

In support of the State of Georgia Emission reduction goals, the Middle Georgia Regional Commission application follows the guidance of the PSVERP two scenario method of estimating emission reductions. Impacts from weatherization of residential buildings are compared by Scenario 1, Business-as-usual (BAU), and Scenario 2, Policy Scenario. Scenarios were calculated utilizing the Rocky Mountain Institute's Energy Policy Simulator for both the near-term (2025-2030) and long-term (2025-2050).



BAU projections were modeled through the following assumptions from the State of Georgia. There were 874 commuter buses reported to the National Transit Database in Georgia in 2022.100 MARTA (the Metropolitan Atlanta Rapid Transit Authority) plans to add 63 fully electric buses starting in 2025, 101 which equates to 8% of the total statewide fleet; it is assumed that those buses will be added by 2030 and that an 8% replacement rate per decade follows. Additionally, it is assumed that the total number of buses will remain stagnant (instead of continuing its recent trend of decline) due to uncertainty on future projections of demand for bus transit. Given the above assumptions, the business-as-usual trend for electric buses is shown in the table below (PSVERP).

Year	% of buses that are electric	Total buses	Electric buses
2022	<1%	874	~9
2030	8%	874	70
2040	16%	874	140
2050	24%	874	210

As stated in Georgia's PSVERP, the policy scenario attempts to replace 50% of commuter and school buses with electric buses by the year 2050. The policy scenario assumes a yearly replacement of 2% of Georgia commuter buses with electric buses (PSVERP).

Year	% of buses that are electric	Total Buses	Electric Buses
2022	<1%	874	~9
2030	10%	874	88
2040	30%	874	262
2050	50%	874	437

As a priority reduction measure, the estimated cumulative emission reductions (MMTCO_{2e}) in the long term of 2025 – 2050 by the State of Georgia is –0.02 MMTCO_{2e} per bus. The total cumulative emission reduction in the long term for the replacement of 4 buses was determined by multiplying -0.02 MMTCO_{2e} by 4. Based on the guidance of the policy scenario total cumulative emission reduction for the replacement of four buses is -0.08 MMTCO_{2e}.

Georgia Emission Reduction Priority Strategy and Measure 1.1 (MMTCO_{2e})

Cumulative emission reduction (MMTCO _{2e}) near term (2025-2050) of replacement of transit buses		
Georgia Policy Scenario long-term (2025-2050) reduction	Number of Zero-emission buses	Cumulative emission reduction long-term (2025-2050) reduction (MMTCO _{2e})
-0.02	4	-0.08

Individual greenhouse gas emissions reductions for those commonly associated with buses in million metric tons (Mmt) were also calculated for the carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O) utilizing the Global Warming Potential (GWP) of the IPCC AR5 Fifth Assessment Report (NOFO). In the near-term, the total greenhouse gas reductions were calculated as –0.083 Mmt.



Georgia GHG Emission Reduction Priority Strategy and Measure 1.1

CPRG - Global Warming Potential (GWP) for Greenhouse Gases)		PSVERP cumulative long-term emission reduction million metric tons	
Greenhouse Gas	100-Year Global Warming Potential	Georgia Policy Scenario long-term (2025-2050) reduction	Cumulative long-term (2025-2050) reduction
Carbon dioxide (CO ₂)	1	-0.08	-0.08
Methane (CH ₄)	28	-0.08	-0.003
Nitrous oxide (N ₂ O)	265	-0.08	0.000
Total			-0.083
Total GHG Reduction (million metric ton)	-0.083		

Georgia GHG Emission Reduction Priority Strategy and Measure 1.1

CPRG - Global Warming Potential (GWP) for Greenhouse Gases)		PSVERP cumulative near-term (2025-2030) emission reduction (MMTCO ₂ e)	
Greenhouse Gas	100-Year Global Warming Potential	Georgia Policy Scenario near-term (2025-2030) reduction	Cumulative near-term reduction of greenhouse gas (million metric ton)
Carbon dioxide (CO ₂)	1	-0.001	-0.001
Methane (CH ₄)	28	-0.001	0.000
Nitrous oxide (N ₂ O)	265	-0.001	0.000
Total GHG Reduction (million metric ton)	-0.001		

Status	Current LFG collected (mmscf/y)	Current direct methane reduced (MMTCO ₂ e / year)	Policy add. direct methane reduced (MMTCO ₂ e / year)	Policy annual direct methane reduced (MMTCO ₂ e / year)
Operational	13,781.31	3.701961	0	3.701961
Planned	3,095.93	0.831635	0.301082	1.132717
Candidate	7,720.12	2.073792	0.846926	2.920718
Future Potential	0	0	0.098537	0.098537
Low Potential	2,580.04	0.693055	0	0.693055
Total	27,177.40	7.300443	1.246545	8.546988

Middle Georgia Regional Commission -Weatherization

In support of the State of Georgia Emission reduction goals, the Middle Georgia Regional Commission application follows the guidance of the PSVERP two-scenario method of estimating emission reductions. Impacts from weatherization of residential buildings are compared and contrasted by Scenario 1, the weatherization of building envelopes from other more general residential energy efficient improvements, baseline values were multiplied by estimated annual utility savings from the ENERGY STAR website.



As a priority reduction measure, the PSVERP estimated cumulative emission reductions (MMTCO_{2e}) in the long-term of 2025 – 2050 was estimated as -8.835 MMTCO_{2e} per residential structure. The total cumulative emission reduction in the near-term for the weatherization of 300 residential structures were determined by multiplying -8.835 MMTCO_{2e}. Based on the guidance of the policy scenario total cumulative emission reduction for the weatherization of all residential structures is -2650.500 MMTCO_{2e}.

Georgia Emission Reduction Priority Strategy and Measure 2.1 (MMTCO_{2e})

Cumulative emission reduction (MMTCO _{2e}) near term (2025-2050) from weatherization of residential structures		
Georgia Policy Scenario long-term (2025-2050) reduction	Estimated number of weatherization residential structures	Cumulative emission reduction long-term (2025-2050) reduction (MMTCO _{2e})
-8.835	300	-2650.500

Individual greenhouse gas emissions in million metric tons (Mmt) were also calculated for carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), and Fluorinated gases utilizing the Global Warming Potential (GWP) of the IPCC AR5 Fifth Assessment Report (NOFO). It is important to note that these values vary based upon the individual heating, air conditioning, and appliances used. In the near-term the total greenhouse gas reductions were calculated as -2958.805 Mmt.

CPRG - Global Warming Potential (GWP) for Greenhouse Gases)		PSVERP cumulative long-term emission reduction (MMTCO _{2e})	
Greenhouse Gas	100-Year Global Warming Potential	Georgia Policy Scenario long-term (2025-2050) reduction	Cumulative long-term (2025-2050) reduction
Carbon dioxide (CO ₂)	1	-8.835	-8.835
Methane (CH ₄)	28	-8.835	-0.316
Nitrous oxide (N ₂ O)	265	-8.835	-0.033
HFC-23	12400	-8.835	-0.001
HFC-32	677	-8.835	-0.013
HFC-41	116	-8.835	-0.076
HFC-125	3170	-8.835	-0.003
HFC-134	1300	-8.835	-0.007
HFC-143	4800	-8.835	-0.002
HFC-152	138	-8.835	-0.064
HFC-227	3350	-8.835	-0.003
HFC-236f	8060	-8.835	-0.001
HFC-43-10mee	1650	-8.835	-0.005
Total			-9.358



CPRG - Global Warming Potential (GWP) for Greenhouse Gases)		PSVERP cumulative near-term emission reduction Million metric tons (Mmt)	
Greenhouse Gas	100-Year Global Warming Potential	Georgia Policy Scenario long-term (2025-2050) reduction	Cumulative long-term (2025-2050) reduction
1 HFC-245	858	-8.835	-0.010297203
HFC-365mf	804	-8.835	-0.010988806
CF4	6630	-8.835	-0.001332579
C2F6	11100	-8.835	-0.000795946
C3F8	8900	-8.835	-0.000992697
C4F6	0.003	-8.835	-2945
c-C5F8 2	2	-8.835	-4.4175
C4F10	9,200	-8.835	-0.000960326
c-C4F8	9,540	-8.835	-0.000926101
C5F12	8,550	-8.835	-0.001033333
C6F14	7,910	-8.835	-0.001116941
SF6	23,500	-8.835	-0.000375957
NF3	16,100	-8.835	-0.000548758
			-2949.446869
Total Reduction GHG Reduction (million metric ton)	-2958.805		

In describing the durability of the GHG emission reductions, applicants should discuss the extent to which the measures will result in a permanent reduction in cumulative GHG emissions.

Houston County

As Houston County plans forward to Phase VI of its landfill expansion, additional gas collection infrastructure is needed to maintain methane emission reductions and limit GHG escaping to the atmosphere. Though landfill expansion is necessary, Houston County shares with the State of Georgia a mission to climate pollution reduction and prevention and is seeks to bolster the state's efforts through further methane capture. In support of the mission of the Middle Georgia Clean Air Coalition and the State of Georgia continued effort of GHG reduction, Houston County is following the guidance provided in the Peach State Voluntary Emission Reduction Plan (PSVERP).

Engineering estimates have a potential 60,000,000 Standard Cubic Feet (scf) of greenhouse gas capture in 2026 from additional landfill methane capture system installation. Capturing the additional landfill gas would result in an estimated capture of 575.618 Metric Tons of Methane, which would equal a total of 0.016 MMTCO_{2e} of methane in 2026. In the long-term of 2025 - 2050, this additional capture would be an equivalent total of 0.387 MMTCO_{2e} of methane. The calculation was multiplying 0.016 MMTCO_{2e} over 24 years.

