Climate Pollution Reduction Grants Program: Implementation Grants

Reducing Emissions in Maine's Buildings & Transportation Systems: Accelerating Climate Progress Equitably throughout a Rural State

TECHNICAL APPENDIX

This technical appendix explains the methodology and assumptions used for developing the estimated greenhouse gas (GHG) emissions reduced for each measure and co-pollutants for measures 2 and 3 included in the proposal. The "GHG Emission Reduction Calculation Spreadsheet" included with this application provides the specific GHG emission reduction calculations for each measure and co-pollutant reductions for measures 2 and 3.

Measure 1: <u>Clean Energy, Energy Efficiency, and HVAC Improvements in Maine Public Schools and Municipal Buildings</u>

Emission Reductions Estimate Method:

For Measure 1, emission reductions of municipal buildings implementing eligible energy saving efforts were estimated using program data from the Community Resilience Partnership and Efficiency Maine Trust to create a typical building scenario to determine heat load in the baseline and energy savings from the project measure and generate emission reductions by applying the EPA emission factors from 40 CFR Part 98. More specifically:

- To estimate the GHG emissions reductions in municipal and school facilities (such as heat pumps, variant refrigerator flow system (VRFs), and energy management systems), a case study from a rural high school in Maine provided their square footage served, their annual heat load in MMBTU, their baseline fuel type, and annual electricity consumption (kWh/year) once the project was installed.
    - Additional factors from previously implemented programs in Maine include:
        - Average cost per square foot to purchase and install a VRF system: $15.25
        - Average cost to purchase and install a mini-split heat pump: $4,200
        - Baseline fuel in municipal buildings is Fuel Oil No. 6, and baseline fuel in school buildings in Fuel Oil No. 2.
        - EPA emission factors from 40 CRF Part 98 were used to calculate the baseline and project emissions and then subtracting project emissions from baseline emissions based on estimated count of measures installed.
- To estimate how electrical vehicle charging infrastructure will reduce GHG within communities, we calculated replacing miles driven powered by gasoline with miles driven powered by the electric grid in the northeast.
- To estimate how clean energy and distributed energy systems for the purpose of increasing municipal/school energy efficiency and energy resiliency (e.g. solar PV, battery storage) will reduce emissions, emission reductions were determined for the estimated number of kW PV installations at $100,000 for 45,000 kWh annual production supplanting grid electricity. The price and size of the PV installation was based on the most recent round of applications by municipalities to the Community Resilience Partnership. Secondly, emission reductions were

calculated for replacing a diesel-powered generator for a school with a solar PV battery. All programs implemented 25% of projected measures each year for four years.

Models/Tools Used:

Emission reduction calculations for measure 1 were determined using Maine program data for installed measures, baseline heat load or kWh production and fuel source, and EPA emission factors from 40 CFR Part 98 for the baseline and project scenario.

Measure Implementation Assumptions:

The following key assumptions about measure implementation were used to quantify emissions reductions for this measure:

- The following implementation measure uptakes were used based on requested funding:
    - For municipal building projects: 9 VRF projects; 24 heat pump mini-split projects; 20 Level 2 Charging Infrastructure Projects; 8 solar PV 45,000 kWh projects, 50 battery storage 1,000 kWh projects.
    - For school projects: Approximately 11 VRF projects; 20 heat pump mini-split projects; 50 Level 2 Charging Infrastructure Projects; 20 solar PV 45,000 kWh projects, 50 battery storage 1,000 kWh projects. Funding will be distributed over 4 years, so uptake of projects was 25% per year for four years to calculate cumulative emission reductions between 2025-2030.
- Implementation milestones: Funding will be distributed over 4 years, so uptake of project technologies for municipal buildings and schools was 25% per year for four years (FY 2025- FY2028) to calculate cumulative emission reductions between 2025-2030.
- Measure lifetime: The following measure lifetimes were assumed:
    - The assumed lifetime of a VRF is 25 years.
    - The assumed lifetime of a heat pump minisplit is 15 years.
    - The assumed lifetime of an EV level 2 charger is 50 years. We assume one Level 2 Charger can provide 219,000 miles of charge in a year (based on the estimation chargers were used 8 hours a day and that 8 hours of charge provides 200 miles).
    - The assumed lifetime of a solar PV array is 25 years.
    - The assumed lifetime of battery storage is 10 years.
- Capital cost assumptions: We estimated the cost per square foot for a VRF project is $15.25. We estimate the cost per unit for a heat pump minisplit is $4,200. We estimate the cost per L2 Charging infrastructure is $10,000. We estimate the cost per 45,000 kWh solar PV project is $100,000. We estimate the cost per 1,000 kWh battery storage project is $10,000.
- Operation and maintenance cost assumptions: We anticipate communities will capture the energy cost savings AND applicable tax credits (via IRS “direct pay”) as seed funds for future energy efficiency projects in public facilities or schools to further benefit disadvantaged community members, however, to be conservative these secondary emission reductions were not included in cumulative emission calculations.

Emission Reduction Estimate Assumptions:

The following key assumptions about emission reductions were used to quantify emission reductions for this measure:

- Emission rates were determined by square footage and heat load for space heating, average of 200 miles provided by 8 hours of charging on a level 2 charger from Federal Highways Charging Speeds (link: https://www.transportation.gov/rural/ev/toolkit/ev-basics/charging-speeds), and the size of average solar PV installations capable of producing 45,000 kWh annually were based on recent applications by municipalities to the Community Resilience Partnership.
- Emission factors: EPA emission factors 40 CFR Part 98
- Model/Tool Input Assumptions
    - Conditioned Space Baseline: 15,000 square feet of conditioned space, 680 MMBTU heat load annually, 80% efficiency of heating system, fuel is Heating Fuel Oil No. 6
    - Conditioned Space Project technology VRF: 5,000 square feet of conditioned space, 680 MMBTU heat load annually, energy is grid tied electricity, cost per conditioned square foot is $15.25, annual electricity consumed from project is 30,000 kWh, annual fuel savings 850 MMBTU.
    - Conditioned Space Project technology Heat Pump: 5,000 square feet of conditioned space, 680 MMBTU heat load annually, energy is grid tied electricity, cost per unit is $4,200, annual electricity consumed from project is 30,000 kWh, annual fuel savings 850 MMBTU.
    - Level 2 Charging: Used 8 hours a day, charges 200 miles in those 8 hours, charges 219,000 annually and replaces baseline gasoline miles with electricity powered miles that are grid tied in Maine.
    - Solar PV and Battery storage: 45,000 kWh annual production replacing grid tied electricity with solar powered electricity. Battery storage replaces a diesel generator that consumes 71 gallons/hour and has an estimated 144 hours of operation a year and estimated consumption of 10,224 gallons of diesel a year in the baseline that is replaced with zero-emission solar PV.

Reference Case Scenario:

Absent this program, we assume 100% of the baseline GHG emissions from municipal buildings and schools would continue unabated. This is the reference case scenario. “A disproportionate share of fossil fuel burning takes place at schools with colder climates. More than 90 percent of schools in New England and the mid-Atlantic burn fossil fuels for HVAC systems.” – RMI Report (2023). There are more than 600 school buildings in the State of Maine, the majority of which are in small rural towns. Of those, only 11 are ENERGY STAR certified schools and 8 are LEED-certified schools. The Maine Department of Education's School Revolving Renovation Fund (SRRF) provides funding assistance to school administrative units (SAUs) to ensure that students have a safe, healthy and appropriate learning environment. The SRRF offers funding for identified needs in the areas of health and safety (Priority 1), building systems (Priority 2), energy and water conservation (Priority 3), and learning space upgrades (Priority 4). While $15 million was allocated by this fund in 2023, funding projects at 33 schools, all funding went to Priority 1 and 2 project types, as is required by statute. The state has, outside of a single

one-time legislative appropriation, never been able to fund Priority 3 projects through this long-standing funding source. In 2022, Governor Mills invested $8 million in school energy efficiency projects through the Maine Jobs and Recovery Plan (using federal ARPA funds). So far, this funding has supported 27 heat pump and/or VRF projects, with an additional 5 in the pipeline (as of March 1, 2024).

The Community Resilience Partnership was established in 2021 to provide grants to municipal and tribal governments in Maine ("communities") for projects to increase energy efficiency, transition to clean energy, and improve community resilience to the impacts of climate change. In its first two years, the Partnership awarded $6.1 million dollars in grants to 103 communities and to 21 service provider organizations that assist small, rural, and disadvantaged communities. There are currently 150 communities in Maine that are eligible for the Partnership's grants and nearly 70 more are working to complete the eligibility requirements. More than half of these contain a federal CEJST disadvantaged community.

Measure-Specific Activity Data and Implementation Tracking Metrics:

Activity data used to estimate GHG emissions reductions for measure 1 include tracking applications awarded for projects, collecting reports from all awardees on costs of measures installed, completion of installation of measure, and operation performance metrics as designed.

GHG Emissions Reduced:

Implementation of this measure is anticipated to reduce 31,206 cumulative $mtCO_2e$ for the period between 2025 – 2030, and 91,300 cumulative $mtCO_2e$ for the period between 2025 – 2050 in municipal buildings, and 57,804 cumulative $mtCO_2e$ for the period between 2025 – 2030, and 180,411 cumulative $mtCO_2e$ for the period between 2025 – 2050 in public schools.

In addition to the direct GHG reductions resulting from the capital investments above, this program design should result in an additional 30% investment from related tax credits, and if energy savings are captured and reinvested we estimate $28 million of investment over a 20-year investment horizon.

Measure 2: Expand incentives and consumer education support for light-duty electric vehicle (EV) purchase by low-moderate income households.

Emission Reductions Estimate Method:

For Measure 2, emission reductions of expanding the reach of existing EV rebate programs to elevate participation by low-and-moderate-income consumers, community fleets and small business fleets were estimated using an existing publicly available tool – AFLEET (link: https://afleet.es.anl.gov/afleet/).

Models/Tools Used:

The AFLEET tool was used to estimate GHG emission reductions for Measure 2. Specifically, we used the Payback-Onroad Tab, with a passenger car, grid emissions from Maine, and 11,895 miles driven annually.

Measure Implementation Assumptions:

The following key assumptions about measure implementation were used to quantify emissions reductions for this measure:

With $15,000,000 of total CPRG funding allocated for LDV rebates, Efficiency Maine budgeted the following:

$10 million for EV vehicle rebates for Low to Moderate Income consumers

- $2,000,000 Rebate program delivery cost (20%) (this includes all staff time, admin, and subcontracted services)
- $8,000,000 Available for incentives

$5 million for community fleets

- $1,000,000 rebate delivery cost (20%) (this includes all staff time, admin, and subcontracted services)
- $4,000,000 available for incentives

Based on the following incentive amount assumptions in the second column of the table below, and the vehicle mix that the program has experienced in FY2024, we can expect the following vehicle quantities to be funded by CPRG:

Rebate type	Incentive amount	Qty expected	Notes
LI BEV	$10,000	345	$10k incentive amount includes incentive for home EV charger
LI PHEV	$4,500	70	
MI BEV	$5,000	752	
MI PHEV	$3,000	153	
Community BEV	$10,000	400	Assumes 50% electric trucks, 50% electric passenger cars
TOTAL		**1,720**	

Abbreviations: Low Income (LI); Moderate Income (MI); Battery Electric Vehicle (BEV); Plug-In Hybrid Electric Vehicle (PHEV).

- Implementation measure uptake: 1,720 total Light Duty Vehicle EVs
- Implementation milestones: 20% in FY25; 30% in FY26; 50% in FY27
- Measure lifetime: 14 years
- Capital cost assumptions: $15 million for program delivery and rebates
- Operation and maintenance cost assumptions: N/A
- The inputs for GHG savings from a LDV – including the useful life, the VMT, the gasoline displaced (gallons), and the increased consumption of electricity (kWh) – are contained in the Efficiency Maine Trust's Technical Reference Manual (TRM) pages 107-108, available online at https://www.efficiencymaine.com/docs/EMT-TRM_Retail_Residential_v2024_3_.pdf. There are

diesel powered LDVs in Maine, but they comprise less than 1% of total registered passenger vehicles and the emissions were negligible, so only gasoline LDVs were included in the baseline.

Emission Reduction Estimate Assumptions:

The following key assumptions about emission reductions were used to quantify emission reductions for this measure:

Using the AFLEET tool, we input the following assumptions/values

- Useful life of a new EV = 14 years
- Average annual vehicle miles traveled in Maine = 11,895 miles
- Efficiency assumptions (miles/kWh, miles/gal, and percent of PHEV travel that runs on gasoline) taken from the US DOE's AFDC for LDV EVs
- Number of new EVs rebated in program = 1,720 LDVs, of which:
    - 20% are added in 2025
    - 30% are added in 2026
    - 50% are added in 2027

Reference Case Scenario:

Absent this program, we assume 100% of the baseline GHG emissions from the targeted customer segments would continue unabated. The customer segments that targeted through this program face elevated barriers to accessing EVs. They are less likely than average consumers to choose an EV during the 14-year useful life of the measures that will be purchased during the program. We therefore assume that, absent this program, approximately 1,986 vehicles would operate at the average annual rate of LDVs with internal combustion engines in Maine across a 14-year period. As important, if not more so, we assume that facilitating access to EV mobility for these harder-to-reach market segments will have a significant multiplier effect enhancing familiarity with, and acceptance of, EVs across friends, family, and neighbors as a preferred vehicle type for future purchases. Absent the CPRG funding requested here, the reference case scenario for those "spillover" vehicles will be to remain consistent with the use of ICE vehicles. In the reference case scenario, there is increased risk that the forecasted program participants, together with their friends, family and neighbors, will become more deeply entrenched in resisting a transition to electrified mobility.

Measure-Specific Activity Data and Implementation Tracking Metrics:

Activity data used to estimate GHG emissions reductions for measure 2 include:

- Useful life of new BEV or PHEV passenger car vehicles, averaging 14 years.
- Average annual vehicle miles - 11,895 miles - traveled by Maine drivers.
- Anticipated rebate amounts for low income, moderate income and community fleet vehicles.

GHG and CAPs and HAPs Emissions Reduced:

Implementation of this measure is anticipated to reduce 29,785 cumulative $mtCO_2e$ for the period between 2025 – 2030, and 103,005 cumulative $mtCO_2e$ for the period between 2025 – 2050.

CAP or HAP	CO	NOx	PM10	PM2.5	SOx
Annual pollutants 2030 (short tons)	31.58	0.74	0.086	2.95	0.086

Measure 3: <u>Pilot Medium- and Heavy-Vehicle Duty zero-emissions vehicle purchase and operation in key geographic hubs</u>

Based on the following incentive amount assumptions in the second column of the table below, we can expect the following vehicle quantities to be funded by CPRG:

Rebate type	Average incentive	Qty expected	Notes
Class 2, 3, 4	$50,000	46	Charger incentive included in average rebate
Class 5+	$200,000	11	Charger incentive included in average rebate
DC Fast Charger	Included in vehicle incentives	10	Publicly accessible for charging
TOTAL		**57**	

Emission Reductions Estimate Method and Tool used:

For Measure 3, emission reductions were estimated using the publicly available AFLEET tool (link: https://afleet.es.anl.gov/afleet/)

Measure Implementation Assumptions:

The following key assumptions about measure implementation were used to quantify emissions reductions for this measure:

- Implementation milestones
    - Number of new EVs rebated in program = 46 MHDVs (Class 2b, 3, 4), and 11 HDVs (Class 5 and above) on the following schedule:
        - 20% are added in 2025
        - 30% are added in 2026
        - 50% are added in 2027
- Measure lifetime – 10 years for MDV and 14 years for HDV
- Capital cost assumptions - $50,000 per MDV and $200,000 per HDV

Emission Reduction Estimate Assumptions:

The following key assumptions about emission reductions were used to quantify emission reductions for this measure:

- Emission factors: EPA emission factors
- To arrive at a value for vehicle miles traveled for MHDVs, we used the State of Maine Bureau of Moter Vehicles Data in Groups 50 and 60 (comprising medium and heavy-duty vehicles in Maine, excluding buses). We divided total VMT for those Groups of vehicles by the total number of vehicles registered in those classes, producing a VMT average of 12,130 miles/year for Medium Duty and 77,896 miles/year for Heavy Duty vehicles.
- Assumptions about vehicle efficiency and useful life (10 years for MD; 14 years for HD) were taken from a study by MJ Bradley, "Medium- & Heavy-Duty Vehicles Market structure, Environmental Impact, and EV Readiness", July, 2021, (www.edf.org/sites/default/files/documents/EDFMHDVEVFeasibilityReport22jul21.pdf)

Reference Case Scenario:

Absent this program, we assume 100% of the baseline GHG emissions from the targeted customer segments would continue unabated. The MHDV customer segments that targeted through this program face elevated barriers to accessing EVs. They are less likely than average consumers to choose an EV during the useful life of the measures that will be purchased during the program. We therefore assume that, absent this program, approximately 46 MDV and 11 HDV would operate at the average annual rate of those classes of vehicles having internal combustion engines in Maine across a period of 10 years for the medium duty vehicles and 14 years for the heavy-duty vehicles.

Measure-Specific Activity Data and Implementation Tracking Metrics:

Activity data used to estimate GHG emissions reductions for measure 3 include: Inputting average annual vehicle miles traveled, efficiency assumptions, and useful lives for both MDV and HDV in Maine to the AFLEET tool.

GHG and CAPs and HAPs Emissions Reduced:

Implementation of this measure is anticipated to reduce 24,895 cumulative $mtCO_2e$ for the period between 2025 – 2030, and 188,595 cumulative $mtCO_2e$ for the period between 2025 – 2050.

CAP or HAP	CO	NOx	PM10	PM2.5	SOx
Annual pollutants 2030 (short tons)	1.74	1.04	0.0085	0.20	0.013

Measure 4: <u>Extend the State's rural workforce commuting pilot program with electric vehicles.</u>

Emission Reductions Estimate Method:

For Measure 4, emission reductions of the rural workforce transportation pilot extension were estimated using Maine DOT's program design and the AFLEET tool to determine the per vehicle estimated emissions.

Models/Tools Used:

AFLEET was used to estimate GHG emission reductions for Measure 4 based on 45 light duty hybrid or electric passenger vans purchased with an average of 12,310 miles driven per year, and an assumed lifetime of 20 years. In addition, 9 Level 2 chargers were modeled at $50,000 per unit and being in use for 8 hours a day for 8760 hours per year, which equated to 219,000 miles provided by electricity rather than gasoline annually. This reduction was multiplied by EPA emission factors, and unit conversions to determine the cumulative $mtCO_2e$.

Measure Implementation Assumptions:

The following key assumptions about measure implementation were used to quantify emissions reductions for this measure:

- Implementation measure uptake: 45 Electric Vans
- Implementation milestones: 40% in FY 2026, 40% in in FY 2027, 20% in FY2028
- Measure lifetime: 20 years
- Capital cost assumptions: $100,000 per unit
- Operation and maintenance cost assumptions: N/A

Conservatively, this would support the purchase of 45-50 hybrid or electric transit vehicles (estimating approximately $100,000 per vehicle) and necessary charging infrastructure (estimated at approximately $50,000 per charger).

Emission Reduction Estimate Assumptions:

The following key assumptions about emission reductions were used to quantify emission reductions for this measure:

- Emission rates: Assumed an average of 12,130 miles per year, at 13 mpg
- Emission factors: EPA Emission Factors
- Model/Tool Input Assumptions: AFLEET tool for a commercial truck (light duty), 12,130 miles per year, 13 MPG baseline for vans; e-bikes estimated at 40 at $1,250 each with a lifetime of 7 years, 1 kWh per 3.2 miles ridden, estimated 1250 commute annually; 9 Level 2 chargers at $50,000 each to provide 219,000 miles of charge each year.

Reference Case Scenario:

It is expected that initiatives funded through the program will both provide additional, more environmentally friendly transportation options for current employees, and provide access to jobs for some individuals who were not employed due to transportation barriers. Absent this program, the reference case scenario is workforce commuters traveling in single occupancy gasoline powered vehicles, in most cases over an hour each way. In a 2020 American Community Survey through the United States Census Bureau, it was determined that 90.7% of commuters in Somerset County, Maine drive to work alone. A case study from one company seeking to support workforce carpooling and vehicle electrification stated “Our mill workforce does not have opportunities to work remotely, which would require some individuals to commute over an hour each way every day. Mainers are often willing to do that for good paying jobs with strong companies, but it would be ideal if commuters could be better supported.”

Measure-Specific Activity Data and Implementation Tracking Metrics:

Activity data used to estimate GHG emissions reductions for measure 4 include annual miles driven, type of light duty vehicle purchased, the type of electric vehicle charger and uptime spent charging, and the number of e-bikes purchased and annual miles traveled. Along with metrics on the number of workers impacted and jobs filled or created, grantees will be expected to report on the number of vehicle miles traveled by hybrid or electric vehicles, the number of vehicle miles traveled foregone as a result of the program, and any vehicle miles traveled added by creating transportation options for new employees who otherwise would not have been traveling to work.

GHG Emissions Reduced:

Implementation of this measure is anticipated to reduce 9,867 cumulative $mtCO_2e$ for the period between 2025 – 2030, and 53,268 cumulative $mtCO_2e$ for the period between 2025 – 2050.