

## TECHNICAL APPENDIX

The technical appendix outlines the approach and underlying assumptions employed in determining the estimated reduction of greenhouse gas (GHG) emissions and co-pollutant emissions for the REV Midwest Coalition proposal. The accompanying “GHG Emission Reduction Calculations Spreadsheet” within this submission provides detailed calculations specific to GHG emission reductions for this proposal.

### 1. Accelerating Vehicle Electrification for Emerging Applications

#### a. Emission Reductions Estimate Method

The first step in determining the reduction of greenhouse gas emissions from the REV Midwest Coalition was to estimate the annual fuel dispensed from each site. Since megawatt charging is a nascent technology, existing tools and models cannot be used to calculate average usage. Charger manufacturers, charging service providers, and operators who piloted megawatt charging programs were contacted to obtain estimates about charger costs, utilization, and average fuel dispensation per unit. The following assumptions were developed based on these conversations:

- Each charging port is utilized for 14 sessions per week
- 350 kW charging ports dispense 200 kWh per session on average. These chargers will primarily cater to medium-duty electric vehicles and light-duty electric vehicles that need to use pull-through chargers
- 1 MW charging ports dispense 400 kWh per session on average. These chargers will primarily cater to heavy-duty electric vehicles and medium-duty electric vehicles that are rated to use megawatt chargers
- Light-duty vehicle utilization at the multi-use charging hubs is assumed to be 25%
- Heavy-duty vehicle utilization at the multi-use charging hubs is assumed to be 75%

The annual fuel consumption per port is as follows:

- 145,600 kWh per port for 350 kW ports
- 291,200 kWh per port for 1 MW ports

Each site will consist of four 350 kW ports and four 1 MW ports, dispensing 1,747,200 kWh annually.

There will be two sites per state. The analysis considers two sites per state, totaling six sites.

The energy usage figures were inserted into the Charging and Fueling Infrastructure Emissions Calculator in the AFLEET 2023 to estimate reductions in GHG emissions and air pollutant emissions, as detailed below. The process was repeated for each state, and the results were combined to present cumulative GHG and air pollutant reductions.

#### b. Models/Tools Used

The Argonne Laboratory Alternative Fuel Life-Cycle Environmental and Economic Transportation (AFLEET) Tool was used to estimate reductions in GHG emissions and air pollutant emissions from the establishment of multi-use electric vehicle charging hubs.<sup>17</sup> The annual fuel consumption figures from each site, in kWhs, were put into the Charging and Fueling Infrastructure Emissions Calculator in AFLEET 2023 model Tool (Cell: K29; Annual Fuel Consumption - fuel unit/year) with the corresponding state to estimate each site's GHG and air pollutant emissions.

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<sup>17</sup> [AFLEET Tool \(anl.gov\)](https://afleet.anl.gov)

The Argonne National Laboratory (ANL) developed the tool, which incorporates data from Argonne's Research and Development Greenhouse Gases, Regulated Emissions, and Energy Use in Technologies (GREET) fuel-cycle model, as well as the United States Environmental Protection Agency's (EPA's) Motor Vehicle Emissions Simulator (MOVES) and certification data. The tool is available for download at <https://afleet.es.anl.gov/home/>.

### c. Measure Implementation Assumptions

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

- Measure Uptake:
  - The electric vehicle charging hubs competition is a one-time opportunity and is fully subscribed.
- Implementation Milestones:
  - The optimization study solicits proposals in mid-2025
  - The consultant prepares an optimization map and the safety and technical standards whitepaper by the end of 2026
  - The electric vehicle charging hubs solicit proposals for charging hub operators by the end of 2027
  - Charging hubs are installed by early 2029
- Measure lifetime:
  - Average lifetime for electric vehicle infrastructure is assumed to be 30 years according to the maximum vehicle lifetime consistent with AFLEET Tool 2023 background data
- Cost assumptions:
  - Contract for optimization study (competitive procurement) with embedded CBO and LIDAC support
    - \$3,500,000
    - This is based on estimates received from various firms that could complete the optimization study.
  - Multi-use electric vehicle charging hubs
    - The National Renewable Energy Lab's study *Estimating the Breakeven Cost of Delivered Electricity To Charge Class 8 Electric Tractors* was used to collect the following cost information per port <sup>18</sup>
      - 350 kW chargers
        - Unit cost: \$125,195
        - Installation cost: \$320,250
        - Utility upgrades cost: \$140,248
        - Total cost: \$585,693
      - 1 MW chargers
        - Unit cost: \$300,000
        - Installation cost: \$65,000
        - Utility upgrades cost: \$500,000
        - Total cost: \$865,000

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<sup>18</sup> [Estimating the Breakeven Cost of Delivered Electricity To Charge Class 8 Electric Tractors \(nrel.gov\)](#)

## DRIVE Midwest

- The total cost per site, with four 350 kW ports and four 1 MW ports, is \$5,802,773.
- The cost for six sites is \$34,816,638
- Third-party administrator
  - \$862,611 based on estimates received
- Total cost
  - The total cost is \$3,500,000 (optimization study) + \$34,816,638 (charging hubs) + \$862,611 = \$39,179,249
- Tax credits:
  - Federal tax credit for qualified alternative fuel vehicle refueling depreciable property: 30% of the cost of the qualified property placed in service during the previous tax year, up to \$100,000 per item.<sup>19</sup>

### d. Emission Reduction Estimate Assumptions

The following assumptions were used as part of the method for estimating GHG emission reductions:

- Light-duty vehicle utilization at the multi-use charging hubs is assumed to be 25%
- Heavy-duty vehicle utilization at the multi-use charging hubs is assumed to be 75%
- The emission factors for petroleum displacement and the electricity consumed by the multi-use charging hubs were specific to the state in which the hubs are located. The emission factors for the fuel mix in each state can be found in the 'Background Data' tab in AFLEET 2023.
- The weighted fuel economy averages (MPGGE) for alternative fuel vehicles (light-duty passenger vehicles and heavy-duty combination long-haul trucks) can be found in the 'Background Data' and 'Inputs' tabs in AFLEET 2023.
- The averages for baseline fuel economy (MPGGE) for conventional vehicles (light-duty passenger vehicles and heavy-duty combination long-haul trucks) can also be found in the 'Background Data' and 'Inputs' tabs in AFLEET 2023.

### e. Reference Case Scenario

The annual amount of GHG emissions from medium- and heavy-duty vehicles from the REV Midwest Coalition states is 72,660,000 MTCO<sub>2</sub>e.<sup>20, 21</sup>

According to the AFLEET 2023 outputs, 10,078,835 vehicle miles will be electrified as a result of the charging hubs. These vehicle miles amount to 922,194 gallons of petroleum that would be used by conventional vehicle trips along key commercial corridors annually, emitting 11,103 MTCO<sub>2</sub>e.

This equals 23,977,044 gallons of petroleum being consumed and 288,678 MTCO<sub>2</sub>e being emitted in the baseline scenario with no charging hubs by 2050.

The mentioned trips will be covered by electric vehicles as a result of the charging hubs.

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<sup>19</sup> Alternative Fuel Infrastructure Tax Credit, installation assumed to meet U.S. Department of Labor prevailing wage and apprenticeship requirements.

<sup>20</sup> [GHG emissions data | Tableau Public](#)

<sup>21</sup> [ClimateDeck | Rhodium Group \(rhg.com\)](#)

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

This analysis assumes that ten multi-use electric vehicle charging sites will be funded and operational by March 2029. Each site will include:

- Four 350 kW DC fast-charging EVSEs
- Four 1 MW DC fast-charging EVSEs

The expected annual consumption is:

- 145,600 kWh per port for 350 kW ports
- 291,200 kWh per port for 1 MW ports
- Each site will consist of four 350 kW ports and four 1 MW ports, dispensing 1,747,200 kWh annually
- 6 sites will dispense 10,483,200 kWh (10,483 MWh) annually

Tracking metrics will include:

- The number of DC fast-charging EVSEs installed
- The number of charging sessions completed at each site

**g. GHG and Co-pollutant Emissions Reduced**

The REV Midwest Coalition multi-use charging hubs are anticipated to reduce 3,804 metric tons of carbon dioxide equivalent (MTCO<sub>2</sub>e) in 2029 and 5,072 MTCO<sub>2</sub>e each year thereafter. A cumulative 8,876 MTCO<sub>2</sub>e would be avoided for the period between 2025-2030 and 110,318 cumulative MTCO<sub>2</sub>e for the period between 2025-2050. These annual and cumulative GHG emission reduction values represent emission reductions achieved attributable to CPRG implementation dollars consistent with the following formula:

$$\text{Quantified GHG reductions from CPRG funding} = \left[ \frac{\text{Requested CPRG funding}}{\text{Total funding to implement measure}} \right] \times (\text{Total estimated GHG reductions of measure})$$

**Table 10** lists the annual co-pollutant benefits associated with the implementation of this measure..

**Table 10. Co-pollutant benefits**

Pollutant	Metric Tons Reduced
Carbon monoxide (CO)	14.81
Nitrogen oxides (NO)	17.72
Coarse particulate matter (PM10)	0.17
Fine particulate (PM2.5)	0.15
Volatile organic compounds (VOC)	0.74