



VCS Methodology

VM0038

---

# Electric Vehicle Charging Systems

M0222 Draft - Version 1.1

18 March 2026

Sectoral Scopes 1 and 7: Energy supply and Transport

Version 1.0 of this methodology was developed by the Climate Neutral Business Network, a project of Strategic Environmental Associates Inc, with support from the EV Charging Carbon Coalition (EVCCC).

The draft of version 1.1 of this methodology was developed by Verra with support from Climate Neutral Business Network.



All intellectual property rights in this document and any related materials for its interpretation and application constitute “Website Materials” as defined in the [Verra Website Terms and Conditions of Use](#). All applicable terms and conditions set out therein apply to this document. Website Materials are owned by Verra or by third parties who have licensed their materials to Verra and are protected by applicable intellectual property laws. Use of this Website Material in the establishment or operation of a project or development of a methodology under a Verra certification program is permitted (“Authorized Use”). Any other use, including copying, modifying, distributing, or creating derivative works, whether in whole or in part, is prohibited unless expressly authorized by Verra or the relevant rights holder. All proprietary notices must be retained in any copies made under the Authorized Use. Verra trademarks, logos, and brand names may not be used without Verra’s prior written consent. All rights not expressly granted herein are reserved.

# CONTENTS

---

<b>1</b>	<b>SUMMARY DESCRIPTION.....</b>	<b>5</b>
<b>2</b>	<b>SOURCES.....</b>	<b>5</b>
<b>3</b>	<b>DEFINITIONS.....</b>	<b>6</b>
<b>4</b>	<b>APPLICABILITY CONDITIONS .....</b>	<b>10</b>
<b>5</b>	<b>PROJECT BOUNDARY .....</b>	<b>11</b>
<b>6</b>	<b>BASELINE SCENARIO .....</b>	<b>12</b>
<b>7</b>	<b>ADDITIONALITY .....</b>	<b>13</b>
7.1	Regulatory Surplus .....	13
7.2	Positive List .....	13
7.3	Investment Analysis .....	14
7.4	Common Practice Analysis .....	14
<b>8</b>	<b>QUANTIFICATION OF REDUCTIONS AND REMOVALS .....</b>	<b>15</b>
8.1	Baseline Emissions .....	15
8.2	Project Emissions .....	16
8.3	Leakage Emissions.....	19
8.4	Net Reductions and Removals .....	19
<b>9</b>	<b>MONITORING .....</b>	<b>21</b>
9.1	Data and Parameters Available at Validation .....	21
9.2	Data and Parameters Monitored.....	22
9.3	Description of the Monitoring Plan.....	37
<b>10</b>	<b>REFERENCES.....</b>	<b>40</b>
	<b>APPENDIX 1: CALCULATION OF BASELINE DEFAULT VALUES FOR THE US AND CANADA.....</b>	<b>41</b>
	<b>APPENDIX 2: GUIDANCE FOR DESIGN OF ADEQUATE METERING SYSTEMS FOR AI PROJECTS.....</b>	<b>44</b>
	<b>APPENDIX 3: JUSTIFICATION OF COMPATIBILITY WITH TRANSITION TO NET ZERO ...</b>	<b>48</b>

**APPENDIX 4: UNCERTAINTY ASSESSMENT..... 49**

**DOCUMENT HISTORY ..... 50**

# 1 SUMMARY DESCRIPTION

Additionality, Crediting Method, and Mitigation Outcome	
Additionality	Project and Activity Method
Crediting Baseline	Project Method
Mitigation Outcome	Reductions

This methodology applies to project activities that install EV charging systems, including their associated infrastructure. GHG emission reductions are achieved through the displacement of emissions from conventional fossil fuel vehicles used for passenger and freight transportation as a result of the availability of project charging infrastructure which delivers electricity to EVs.

This methodology provides easy-to-use monitoring parameters to quantify emission reductions and also establishes default factors for the estimation of certain parameters for projects located in the United States and Canada as an alternative to project-specific calculations.

Finally, this methodology is applicable globally and provides a positive list for determining additionality. The positive list is found in VCS module *VMD0049 Activity Method for Determining Additionality of Electric Vehicle Charging Systems*.

# 2 SOURCES

This methodology is based on the following documents:

- *CDM methodology AMS-III.C. Emission Reductions by Electric and Hybrid Vehicles*

This methodology uses the following tools and modules:

- *VMD0049 Activity Method for Determining Additionality of Electric Vehicle Charging Systems*
- *VT0008 Additionality Assessment*
- *VT0011 Electricity System Emission Factors*

## 3 DEFINITIONS

In addition to the definitions set out in the *VCS Program Definitions*, the following definitions apply to this methodology.

### **Applicable Fleets**

The class of EVs eligible and technically able to charge at EV chargers associated with the project. For Light-Duty Vehicles (LDV) projects, these applicable fleets comprise<sup>1</sup> Battery Electric Vehicle (BEVs) and Plug-in Hybrid Electric Vehicle (PHEVs) for AC chargers (Level 1 and Level 2), and BEVs for Direct Current Fast Chargers (DCFCs). For Heavy-Duty Vehicles (HDV) projects, these applicable fleets comprise the Medium-Duty and Heavy-Duty (MDV/HDV) electric vehicles eligible to charge at the project's set of EV chargers.

### **Associated Infrastructure (AI)**

Stationary battery storage devices<sup>2</sup> and dedicated renewable energy systems (e.g., solar or biofuel from on-site or other locations which use dedicated direct transmission lines) integrated as part of EV charging systems and managed by their control units. Associated infrastructure includes on-site battery storage systems which can store and dispatch electricity to and/or from any on-site renewable power systems, the grid, and/or the EV batteries. Associated infrastructure also includes the EV batteries themselves and thus includes EV vehicle-to-grid (V2G) and EV to on-site battery exchanges of electricity.

### **Associated Infrastructure Metering Systems**

Systems used to track electricity flows between AI devices, whether using meters and/or associated measurement systems within or external to the EV charger. These may include upstream metering on the grid-side of the adequate metering system (e.g., where meters are installed grid-side of an on-site battery) and/or downstream metering (e.g., where metering takes place within the charger unit itself, downstream of the on-site battery).

### **Battery Electric Vehicle (BEV)**

---

<sup>1</sup> There may be a very few PHEVs which also have the plug capability to charge at DCFCs (e.g., Mitsubishi Outlander); these are considered de minimis. Similarly, the BMW i3 REX (with range extender) is technically a PHEV, but only 5% of i3s use the range extender in practice. Moreover, Argonne National Laboratory and California classify the REX as a BEV, and therefore it is included in the BEV category for default factor calculation purposes in this methodology.

<sup>2</sup> For larger powered systems (e.g., 150kW, 320kW), stationary battery systems may become a more typical integrated part of the EV charging system infrastructure over time (e.g., to mitigate demand peak charges from utilities); they are controlled by the charging system's control unit and are located close to the site within the charging system's metering to the utility.

An EV which relies exclusively upon electricity delivered from an external EV charging system for its power to propel its motion.

### **Charging Networks**

A collection of charging systems which service any given applicable fleet.

### **Closed Charging Networks**

A collection of charging systems for which composition of the applicable fleet is constrained to a particular sub-set of EVs whose composition and operating characteristics of both the applicable and comparable fleets can be specifically identified and documented (e.g., a transit agency's e-bus charging network to charge new e-buses, or a logistic company's charging network dedicated to a fleet of new e-trucks).

### **Comparable Fleets**

Those fossil-fuel vehicles whose travel characteristics have been defined to be comparable to the EVs in each applicable fleet.

### **DC Fast Charger (DCFC)**

A charger which provides direct current charging (typically at 200-1000V) from an off-board<sup>3</sup> charger with a power rating above 11kW. Typical DCFC ratings are 50kW, with the newest systems for passenger vehicles in the 150kW and 320 kW ranges. DCFC classifications are defined as:

- DCFC 50kW: capable of delivering maximum power from 11kW to 62.5kW
- DCFC 100kW: capable of delivering maximum power from 63kW to 110kW (i.e., 200A)
- DCFC 150kW: capable of delivering maximum power from 111kW to 160kW (i.e., 200A@800V or 350A@400V, some with cooled connectors)
- DCFC 320kW: capable of delivering maximum power from 161kW and 360kW (i.e., cooled connectors)
- DCFC 500kW: capable delivering maximum power from 361kW and above (i.e., different connectors)

Where no kW classification is specified in this methodology, DCFC includes all classes defined above.

---

<sup>3</sup>See SAE standards:  
[http://grouper.ieee.org/groups/earthobservationsSCC/IEEE\\_SAE\\_J1772\\_Update\\_10\\_02\\_08\\_Gery\\_Kissel.pdf](http://grouper.ieee.org/groups/earthobservationsSCC/IEEE_SAE_J1772_Update_10_02_08_Gery_Kissel.pdf)

**Dedicated Renewable Energy**

Renewable power (e.g., solar, wind, and biofuel) supplied either from sources on-site within the associated infrastructure of the project or received from a dedicated supply source via a direct transmission line. These renewable sources represent a distinct segment, differentiated from the renewable electricity supplied via the broader grid. These dedicated renewables may also be delivered in part for use on the main grid.

**Electric Vehicle (EV)**

Vehicles, including BEVs and PHEVs, spanning both passenger cars, LDVs and HDVs, powered by the external electricity sources of charging systems. EVs do not include hybrid-only vehicles since they do not consume electricity from externally generated sources.

**EV Chargers**

Charging dispensers and their metering systems including AC (L1 and L2) and/or DCFC units which provide electricity to EVs within an applicable fleet and which may form part of an EV charging system

**EV Charging Systems**

A set of EV chargers including AC (L1 and L2) and/or DCFC and their associated infrastructure (if any) which, when located at a given charging site, provide electricity to EVs within a given applicable fleet, and which may form part of a charging network

**EV Market Share**

The number of EVs on the road within a geographic region, expressed as a percentage of total vehicles on the road within a geographic region, segmented for applicable fleets across LDV and HDV sectors

**Heavy Duty Vehicles (HDV)**

Vehicles consistent with definitions provided by the governing national regulatory system(s) of the project location. HDVs may also include medium-duty vehicles (MDVs). These must be consistent with the data sources used in the standardized tests and default factors applied, if any<sup>4</sup>.

**Level 1 Charger (L1)**

A charger which provides 120V alternating current charging services to the vehicle's on-board charger with a power rating up to 1.8kW.

---

<sup>4</sup> For example, in the United States, HDVs are specified as including both HDVs and those MDVs with Gross Vehicle Weight Ratings (GVWR) of more than 14,000lbs (typically from class 4 and above), consistent with the IHS Markit data sources applied in the development of the default factors. HDV vehicles include both e-buses and e-trucks.

**Level 2 Charger (L2)<sup>5</sup>**

A charger which provides 240V alternating current charging services to the vehicle's on-board charger with a power rating up to 20kW (typically from 3.3kW to 6.6 kW)

**Light Duty Vehicles (LDV)**

Cars and trucks consistent with definitions provided by the governing national regulatory system(s) of the project location. These must be consistent with the data sources used in the standardized tests and default ER factors applied, if any<sup>6</sup>.

**Medium and Heavy Duty Electric Vehicle (HDV EV)**

Medium duty and heavy duty vehicles (collectively defined as *HDV*) comprising both BEV and PHEV, including e-buses and e-truck categories, which rely upon electricity delivered from external EV charging systems for their power.

**Open Charging Networks**

A charging network where the applicable fleet is not constrained to a particular sub-set of EVs whose composition and operating characteristics of both the applicable and comparable fleets can be identified and documented, as with a closed charging network.

**Plug-in Hybrid Electric Vehicle (PHEV)**

A vehicle combining an internal combustion engine and one or more electric motors, which must also be capable of receiving electricity by plugging into an external EV charging system for its power to propel its motion.

**Private Charging Networks**

Charging systems where charger access is limited to a defined applicable fleet. For example, residential chargers would be considered private since access is restricted, as would a city's chargers if their use was limited to the charging of the city's own EV fleet vehicles. Private refers to the limited degree of access to the chargers, not the charging system's owner's status (since public city chargers can use private charging networks). The composition of those EVs

---

<sup>5</sup> Note that, in London UK, L2 chargers have been referenced as fast chargers. And, DCFCs are referenced as rapid chargers. Regardless of nomenclature, the chargers will be defined against the technical criteria provided in this methodology.

<sup>6</sup> For example, in the United States, LDVs are specified as including vehicles with GVWR up to and including 14,000lbs, (classes 1, 2, and 3) and must therefore include those Medium Duty Vehicles (MDVs) up to this same weight limit, consistent with the IHS Markit data sources applied in the development of the default factors. This 14,000lbs GVWR values is based upon definitions used and supplied by IHS Markit data for light duty vehicles, whose data forms the basis for most US EV market analysis publications. Commercial applications in the 8500-14000 lb Class 2b and 3 are a de minimis proportion of total LDV's. See also: <http://changingears.com/rv-sec-tow-vehicles-classes.shtml>, and <https://www.afdc.energy.gov/data/10380> Lighter MDV's include the types of vehicles which also use the main LDV charging networks (e.g., retirement home vans).

accessing the network need not be known (that is, both open (e.g., residential) and closed (e.g., e-bus transit agency charging) networks can be private if access is limited).

## 4 APPLICABILITY CONDITIONS

This methodology applies to project activities that install EV charging systems, including their associated infrastructure (AI), in order to charge EV applicable fleets whose GHG emission reductions are achieved through the displacement of conventional fossil fuel vehicles used for passenger and freight transportation as a result of the electricity delivered by project chargers.

This methodology is applicable under the following conditions:

- 1) The project installs EV charging systems in a country or region where one of the following conditions is met:
  - a) The country is included in the positive list of *VMD0048* for the relevant charger type (i.e., AC charger or DCFC) implemented as part of the project activity.
  - b) The EV market penetration is below both the market share and EV sales share thresholds specified below:
    - i) AC chargers: 5% EV market share and 20% three-year average EV sales share, at state/province level, or, only where the information is not available, at country level, based on the most recent available data at the time of validation.
    - ii) DCFC: 7.5% EV market share and 30% three-year average EV sales share, at country level, based on the most recent available data at the time of validation.
- 2) The applicable fleets of vehicles in projects applying this methodology are limited to all LDV BEVs and PHEVs<sup>7</sup>, and HDV EVs.
  - a) For LDV projects, these applicable fleets comprise<sup>8</sup> BEVs and PHEVs for L1 and L2 chargers, and BEVs for DCFCs.

---

<sup>7</sup> Hybrid-only vehicles, which do not have batteries capable of receiving electricity to propel their motion, are not eligible under this methodology

<sup>8</sup> There may be a very few PHEVs which also have the plug capability to charge at DCFCs (e.g., Mitsubishi Outlander); these are considered de minimis. Similarly, the BMW i3 REX (with range extender) is technically a PHEV, but only 5% of i3s use the range extender in practice. Moreover, Argonne National Laboratory and California classify the REX as a BEV, and therefore it is included in the BEV category for default factor calculation purposes in this methodology.

- b) For HDV projects, these applicable fleets comprise MDV/HDV electric buses and trucks, both BEV and PHEV.
- 3) This methodology is applicable to EV charging systems used on applicable fleets utilizing AI to provide electricity to and from EVs, on-site batteries and renewables<sup>9</sup> under the condition that the AI must include adequate metering systems (e.g., meters/sub-meters and/or associated measurement systems). These metering systems must measure and accurately trace all electricity deliveries and receipts from all such interrelated AI sources. This includes electricity sourced from/returned to the grid, dedicated renewable energy generated on-site (including RE sourced from direct transmission lines), on-site storage batteries, and/or the EV's on-board battery.
- 4) Project proponents must demonstrate proof of ownership of emission reductions which may be achieved through the following:
- With the charging system owners through contractual agreements, terms of service, utility program participation rules, or other means, and/or
  - With EV drivers directly in closed charging networks and through disclosure of credit ownership in open charging networks (e.g., through dispenser notices, screen displays, terms of service, etc.).

## 5 PROJECT BOUNDARY

The spatial extent of the project boundary encompasses:

- 1) The applicable fleets for the project EV chargers;

---

<sup>9</sup> AI may store and dispatch electricity both to and from multiple sources, both on site and regionally.

- 2) The geographic boundaries where the EV charging systems are located;
- 3) The EV charging systems of the project activity including their electricity supply sources and associated infrastructure.

The greenhouse gas (GHG) sources and sinks accounted for, including leakage, are shown in Table 1 below.

**Table 1. GHG sources and sinks accounted for as baseline, project, and leakage emissions**

Source/Sink	Type	Gas	Included?	Justification/Explanation	
Baseline	Fossil fuel combustion of vehicles displaced by project activities	Source	CO <sub>2</sub>	Yes	Main emission source
			CH <sub>4</sub>	Optional	May be excluded for simplification (conservative)
			N <sub>2</sub> O	Optional	May be excluded for simplification (conservative)
			Other	No	Not Applicable
Project	Electricity consumption of project chargers and associated infrastructure	Source	CO <sub>2</sub>	Yes	Main emission source
			CH <sub>4</sub>	Optional	May be excluded for simplification. Where included in the baseline, source must also be accounted for in project emissions.
			N <sub>2</sub> O	Optional	May be excluded for simplification. Where included in the baseline, source must also be accounted for in project emissions.
			Other	No	Not Applicable.
Leakage	None	Source	CO <sub>2</sub>	No	No leakage
			CH <sub>4</sub>	No	No leakage
			N <sub>2</sub> O	No	No leakage
			Other	No	No leakage

## 6 BASELINE SCENARIO

The baseline scenario for projects under the positive list is the operation of comparable fleets that would have been used to provide the same transportation service in the absence of the project.

For projects that do not apply the positive list, the baseline scenario must be demonstrated based on investment analysis or barrier analysis as per section 7.3 below. Projects must demonstrate

that the EV charging infrastructure is not part of the baseline and the transportation sector would follow the historical mix of vehicles in the country.

Project proponents must demonstrate that the EV models comprising the applicable fleet of the project are comparable to their conventional fossil fuel baseline vehicles using the following means:

- a) Project and baseline vehicles belong to the same vehicle category (e.g., car, motorcycle, bus, truck, LDV, MDV, HDV);
- b) Project and baseline vehicles have comparable passenger/load capacity (comparing the baseline vehicle with the respective project vehicle).
- c) For closed charging networks the new EVs and the baseline vehicles must be identified. The operating characteristics of both the applicable and comparable fleets must be known and documented.

Note that for open charging networks, where project proponents apply the baseline emission default factors for MPG and AFEC determined for the US and Canada, this comparability requirement between applicable and comparable fleet models has already been completed and satisfied.

## 7 ADDITIONALITY

All projects must demonstrate regulatory surplus (Section 7.1) and either demonstrate that they meet the requirement of the positive list (Section 7.2) or the project method (Sections 7.3 and 7.4).

### 7.1 Regulatory Surplus

The project proponent must demonstrate regulatory surplus in accordance with the rules and requirements regarding regulatory surplus set out in the most recent versions of the *VCS Standard*.

Where the project proponent demonstrates regulatory surplus, proceed to Section 7.2 (positive list) or Section 7.3 (investment analysis). Otherwise, the project activity is not additional.

### 7.2 Positive List

The applicability conditions of *VMD0049 Activity Method for Determining Additionality of Electric Vehicle Charging Systems* represent the positive list. The positive list was established using the activity penetration option (Option A in the *VCS Standard*).

Where the project meets all applicability conditions of this methodology and VM0049, it is additional.

Where the project activity does not meet all applicability conditions of this methodology and VM0049, the project proponent must apply a project method (Section 7.3). Otherwise, the project activity is not additional.

### 7.3 Investment Analysis

The project proponent must follow the procedures and requirement of Step 3 in VT0008 *Additionality Assessment* to conduct an investment analysis.

Projects with emission reductions below 60 ktCO<sub>2</sub> per year may apply a barrier analysis instead of an investment analysis, following the procedures and requirements of Step 3 in VT0008. Such projects must not claim more than 60 ktCO<sub>2</sub> per year. Where annual emission reductions exceed this threshold, the project may apply the re-quantification procedures and re-demonstrate additionality by applying the investment analysis.<sup>10</sup>

Where the project proponent meets the conditions of the investment analysis or barrier analysis, proceed to Section 7.4. Otherwise, the project activity is not additional.

### 7.4 Common Practice Analysis

The project proponent must assess whether the project activity is common practice, following the procedures and requirements of Step 4 of the most recent version of VT0008.

Where the project activity meets all previous steps and is not a common practice, it is deemed additional. Otherwise, it is not additional.

---

<sup>10</sup> When applying the tool, regardless of which entity is implementing the project, project proponents may demonstrate that barriers apply for charging service providers and/or their associated partners (e.g., installation customers, utilities, end-users, charging system network service providers, and EV manufacturer/retailer).

# 8 QUANTIFICATION OF REDUCTIONS AND REMOVALS

## 8.1 Baseline Emissions

Baseline emissions are calculated by converting the electricity used to charge project applicable fleet vehicles at the EV chargers into distance travelled and multiplying this by the emission factor for fossil fuels used by baseline comparable fleet vehicles to travel the same distance.

Baseline emissions are calculated as follows:

$$BE_y = \sum_{i,f} ED_{iy} * EF_{if,y} * 100 * IR_i^{y-1} / (AFEC_{iy} * MPG_{iy}) \quad (1)$$

Where:

- $BE_y$  = Baseline emissions in year y (t CO<sub>2</sub>e)
- $ED_{i,y}$  = Electricity delivered by project charging systems serving applicable fleet i in project year y (kWh)
- $EF_{i,f,y}$  = Emission factor for the fossil fuel f used by comparable fleet vehicles i in year y (tCO<sub>2</sub>e/gallon)
- $IR_i$  = Technology improvement rate factor for applicable fleet i
- $AFEC_{i,y}$  = Weighted average electricity consumption per 100 miles rating for EVs in applicable fleet i in project year y (kWh/100 miles)
- $MPG_{i,y}$  = Weighted average miles per gallon rating for the fossil fuel vehicles comparable to each EV in applicable fleet i, in project year y (miles per gallon)

Default values for  $MPG_{i,y}$ ,  $AFEC_{i,y}$ ,  $EF_{i,f,y}$ , and  $IR_i$ , across both LDV and HDV applicable fleets can be found in the parameter tables in Section 9 below for the United States and Canada.

The weighted average electricity consumption per 100 miles rating for EVs in applicable fleet i, is calculated as follows:

$$AFEC_{iy} = \sum_a (EV_{aiy} * EVR_{aiy}) / \sum_a EVR_{aiy} \quad (2)$$

Where:

- $AFEC_{i,y}$  = Weighted average electricity consumption per 100 miles rating for EVs in applicable fleet  $i$  in project year  $y$  (kwh/100 miles)
- $EV_{a,j,y}$  = Electricity consumption per 100 miles rating for model  $a$  EV in applicable fleet  $i$  in project year  $y$  (kWh/100 miles)
- $EVR_{a,j,y}$  = Total number of model  $a$  EV in applicable fleet  $i$  on the road by project year  $y$  (cumulative number of EVs)

The weighted average miles per gallon rating for the comparable fleet associated with each applicable fleet  $i$ , is calculated as follows:

$$MPG_{i,y} = \frac{\sum_a (MPG_{aiy} * EVR_{aiy})}{\sum_a EVR_{aiy}} \quad (3)$$

Where:

- $MPG_{i,y}$  = Weighted average miles per gallon rating for fossil fuel vehicles comparable to each EV in applicable fleet  $i$  in project year  $y$  (miles per gallon)
- $MPG_{a,j,y}$  = Mile per gallon rating for the fossil fuel vehicle model deemed comparable to each EV model  $a$  from applicable fleet  $i$  in project year  $y$  (miles/gallon)
- $EVR_{a,j,y}$  = Total number of model  $a$  EV in applicable fleet  $i$  on the road by project year  $y$  (cumulative number of EVs)

Guidance regarding the calculation procedures for  $AFEC_{i,y}$  and  $MPG_{i,y}$  and their associated parameters is given in the parameter tables in Section 9.2.

Further details for the calculation of the default values for  $MPG_{i,y}$ ,  $AFEC_{i,y}$ , can be found in Appendix 1.

## 8.2 Project Emissions

Project emissions include the electricity consumption associated with the operation of the applicable fleet and must be calculated as follows:

$$PE_y = \sum_{ij} EC_{ijy} * EFel_{ijy} \quad (4)$$

Where:

- $PE_y$  = Project emissions in year  $y$  (t CO<sub>2</sub>e)
- $EC_{i,j,y}$  = Electricity consumed by project chargers sourced from region  $j$  serving applicable fleet  $i$  in project year  $y$  (kWh/year)

$EF_{e|i,j,y}$  = Emission factor for the electricity sourced from region j consumed by project charging systems serving applicable fleet i in year y following *VT0011 Electricity System Emission Factors* (tCO<sub>2e</sub>/kWh)

Where projects include associated infrastructure within their charging systems, project emissions must be quantified for all such sources s following Equation (5), which must replace Equation 4, where the following applies:

- 1) The electricity emissions factor for the on-site battery must be calculated using the net weighted average of the grid and on-site renewable emission factors as provided in Equation (6) below.
- 2) The charging system’s metering system must adequately and accurately measure and trace such net electricity provided to the charging system (i.e., deliveries minus receipts) from all electricity sourced from/returned to the grid and the dedicated renewables. This includes, for example, electricity sourced from the grid, dedicated renewables (e.g., on site) and delivered to the EV directly and/or via on-site batteries, net of electricity returned to such sources from the EV batteries. See Appendix 2 for guidance on adequate metering systems.
- 3) *PE cannot be negative (i.e. supplying excess RE to the grid is not credited)*

$$PE_y = \sum_{ijs} NEC_{ijsy} * EFkwAl_{ijsy} - \sum_{ij} LEC_{ijy} * EFkwonsitebatt_{ijy} \quad (5)$$

Where:

- $PE_y$  = Project emissions in year y (t CO<sub>2e</sub>)
- $NEC_{i,j,s,y}$  = Electricity consumed by EV charging systems supplied from associated infrastructure source s net of any electricity EV/charger returned to this same source within region j serving applicable fleet i in project year y (kWh/year)
- $EFkwAl_{i,j,s,y}$  = Emission factor for the electricity from each associated infrastructure source s within region j consumed by project chargers serving applicable fleet i in year y (tCO<sub>2e</sub>/kWh). For the grid, apply *VT0011 Electricity System Emission Factors*
- $LEC_{i,j,y}$  = Electricity provided to the grid and/or building from on-site storage battery within region j serving applicable fleet i in project year y, when also accounted for under NEC<sup>11</sup> (kWh/year)

---

<sup>11</sup> When NEC includes electricity consumed by the battery (measured upstream the battery). See Appendix 2 for further guidance.

$EF_{k\text{Wonsitebatt},i,j,y}$  = Emission factor for the electricity from the on-site battery associated infrastructure within region  $j$  consumed by project charging systems serving applicable fleet  $i$  in year  $y$  (tCO<sub>2e</sub>/kWh)

Where projects include associated infrastructure, the emission factor for electricity from on-site battery associated infrastructure must be calculated using the net weighted average of the grid and on-site renewable emission factors as follows:

$$EF_{k\text{wonsitebatt},i,j,y} = \frac{\sum_z (ECB_{i,j,s,y} * EF_{k\text{wAl},i,j,s,y})}{\sum_z ECB_{i,j,s,y}} \quad (6)$$

Where:

$EF_{k\text{wonsitebatt},i,j,y}$  = Emission factor for the electricity from the on-site battery associated infrastructure source  $s$  within region  $j$  consumed by project charging systems serving applicable fleet  $i$  in year  $y$  (tCO<sub>2e</sub>/kWh)

$ECB_{i,j,s,y}$  = Electricity consumed by on-site battery from associated infrastructure sources  $s$ , which comprise only the grid-connected and dedicated renewable sources, within region  $j$  serving applicable fleet  $i$  in project year  $y$  (kWh/year)

$EF_{k\text{wAl},i,j,s,y}$  = Emission factor for the electricity from the associated infrastructure sources  $s$ , which comprise only the grid-connected (according to *VT0011 Electricity System Emission Factors*) and dedicated renewable sources, within region  $j$  consumed by on-site batteries serving applicable fleet  $i$  in year  $y$  (tCO<sub>2e</sub>/kWh)

Guidance for sourcing the emission factors for the other associated infrastructure sources  $s$  is provided in the monitoring parameter boxes found in Section 9; guidance regarding adequate metering systems is found in Appendix 2.

Where projects include associated infrastructure and determine the emission factor on an hourly basis, the following applies:

- There are no time periods in which electricity is provided but not accounted for within  $PE_y$  (i.e., the sum of all such time-of-day time periods,  $t$ , equals 24 in any given full day within the project)
- The electricity emissions factor for the on-site battery must be calculated using the net and time weighted average of the grid and on-site renewable emission factors given in Equation (6).
- The provisions regarding the charging system’s adequate metering systems as given for Equation (5) and (6) (including guidance offered in Appendix 2) apply during each time-of-day period. The consumption of the on-site battery must be measured “upstream”, on the grid-side of the on-site battery. That is, emission factor of the on-site battery is the weighted average of the emission factor from the grid and/or dedicated renewable

sources during the time of day period taking into account *when* the electricity is actually delivered *to the on-site battery* (i.e., not when delivered from this battery to the EV charger), since the GHG impacts for these kwh arise on the grid system when they are first delivered into this associated infrastructure system (that is, are delivered to the on-site battery)

### 8.3 Leakage Emissions

Leakage is not considered an issue under this methodology and is therefore set at zero.<sup>12</sup>

### 8.4 Net Reductions and Removals

Net GHG emission reductions must be calculated as follows, including application of a discount factor,  $D_y$ , to adjust pro-rata where EV fleet credits have been issued within the project region:

$$ER_y = (BE_y - PE_y) \times D_y \quad (7)$$

Where:

- $ER_y$  = GHG emission reductions in year  $y$  (t CO<sub>2</sub>e)
- $BE_y$  = Baseline emissions in year  $y$  (t CO<sub>2</sub>e)
- $PE_y$  = Project emissions in year  $y$  (t CO<sub>2</sub>e)
- $D_y$  = Discount factor to be applied in year  $y$  (%)

The discount factor is calculated as follows:

$$D_y = ERC_y / (ERF_y + ERC_y) \quad (8)$$

Where:

- $D_y$  = Discount factor to be applied in year  $y$  (%)

---

<sup>12</sup> This is consistent with CDM methodology AMS-III.C, which sets leakage at zero. Further analysis of crediting substitution risks between ineligible and eligible EV chargers confirmed substitution risks to be de minimis in the US due to a number of factors. These include: the large distances between public DCFC's and unlikely substitution of public DCFC by public L2 charging; a very low portion of L2s are simultaneously public, accessible (e.g. not restricted workplaces) and excluded from project crediting period under VCS grandfathering rules (when 80-90% of L2 charging takes place in homes). Furthermore, L2 to L2 substitution between eligible and ineligible chargers in this de minimis segment can also be reciprocal reducing leakage still further.

- $ERC_y$  = Sum of GHG credits<sup>13</sup> issued by all projects under this methodology (or others which support the introduction of EV charging systems) across this project’s applicable fleet  $i$  categories within this total project region in project year  $y-1$  (tCO<sub>2</sub>e)
- $ERF_y$  = Sum of GHG credits issued by all projects under methodologies which support the introduction of EV fleets (e.g., CDM AMS.III.C or VMR00014) located within this project’s total region where the applicable fleet  $i$  categories are the same for both this EV charging system project and projects introducing EV fleets<sup>14</sup>, in project year  $y-1$  (tCO<sub>2</sub>e)

Where no GHG credits have been issued for projects that introduce EV fleets in the EV charging system project’s region,  $D_y$  will be 1 (i.e., there is no discount applied).

Where project proponents can demonstrate that the EV charging systems included in the project are comprised of a private or closed charging network (e.g., a private charging network that is in secure garages, or a closed charging network for e-buses owned by a transit agencies where chargers are reserved exclusively for its own public agency fleet), and can demonstrate that relative to this closed or private charging network, no GHG credits have been issued for the introduction of EVs using the network, then  $D_y$  will be 1 (i.e., there is no discount applied)<sup>15</sup>.

Where GHG credits have been issued for projects that introduce EV fleets for a region larger than the proposed EV charging system project (e.g., a GHG project introducing a fleet of EVs U.S.-wide, while the EV charging system project is confined to one state), then a sensible pro-rata share of the GHG credits issued for the introduction of EV fleets can be estimated for the EV charging system project’s region (e.g., using the pro-rata number of EVs on the road in the EV charging system project state compared to the total in the US, using sources such as ZEVFacts.com).

---

<sup>13</sup> Credits for GHG emission reductions issued under GHG programs such as the American Carbon Registry (ACR) Climate Action Reserve (CAR), Verified Carbon Standard (VCS), or the UNFCCC’s Clean Development Mechanism (CDM).

<sup>14</sup> Therefore, to determine  $ERF_y$ , project proponents must assess projects that introduce EV fleets both based on their location and applicable fleet category to address any potential double counting between GHG credits issued for such projects which introduce fleets of EVs and the GHG credits issued for this EV charging system project.

<sup>15</sup> This is allowed as private and closed charging networks, even if publicly owned, are not subject to the risk that EV fleets with issued certified GHG credits would have access to its charging network, and the EV fleets that do use the network have not issued separate GHG credits of their own. Public charging system operating as open networks would not normally be able to demonstrate such lack of access and therefore must determine if a discount factor must be applied.

## 9 MONITORING

### 9.1 Data and Parameters Available at Validation

<b>Data/Parameter</b>	<i>IR<sub>i</sub></i>
<b>Data unit</b>	<i>Rate</i>
<b>Description</b>	<i>Technology improvement factor for applicable fleet i in year y for default value BE calculations.</i>
<b>Equations</b>	<i>(1)</i>
<b>Source of data</b>	<i>CDM AMS-III.C.</i>
<b>Value applied</b>	<p><i>If baselines are calculated using updated BE<sub>y</sub> parameters for each project year y, IR<sub>i</sub> = 1</i></p> <p><i>If default values are used for these BE<sub>y</sub> parameter calculations,</i></p> <p><i>For LDV applicable fleets, IR<sub>i</sub> = 1</i></p> <p><i>For HDV applicable fleets, IR<sub>i</sub> = 0.99</i></p>
<b>Justification of choice of data or description of measurement methods and procedures applied</b>	<p><i>If the baseline is calculated each year using the applicable fleet and conventional fleet statistics in each project year y, then no technology improvement rates need to be applied (since annual accurate data is used each year) IR<sub>i,y</sub> is therefore set to be 1.</i></p> <p><i>IR<sub>i</sub> when applied to LDV projects using default values is 1 because default values for MPG factors use individual, specific MPG figures for each fossil fuel vehicle comparable to each EV model in the applicable fleet (see Appendix 1). These MPG figures only change substantially when a fossil fuel model is re-designed/updated by manufacturers which takes place on a 7-10 year cycle: this timeframe is longer than the Verra five year update cycle for parameter updates.</i></p> <p><i>IR<sub>i</sub> when applied to HDV projects using default values is 0.99 because the defaults values use market-wide, class based comparable MPG factors for default calculations rather than individual, specific MPG figures for the fossil fuel vehicles comparable to each EV model (see Appendix 1) provided that:</i></p> <ul style="list-style-type: none"> <li><i>• This 0.99 improvement rate is applied to each calendar year.</i></li> <li><i>• This rate is taken to be 0.99 consistent with the IR default in CDM-III.C.</i></li> <li><i>• For project year 1, IR<sup>(y-1)</sup> must be 1 (since any number to power 0 is 1).</i></li> </ul> <p><i>See justification in MPG below.</i></p>
<b>Purpose of data</b>	<i>Calculation of baseline emissions</i>

<b>Comments</b>	<i>For LDV projects, the default equivalent MPG are taken from specific comparable vehicles (rather than classes of vehicles) whose MPG are only likely to change with major model upgrades (and thus remain steady for many years).</i>
-----------------	--

## 9.2 Data and Parameters Monitored

<b>Data/Parameter</b>	$EF_{i,f,y}$
<b>Data unit</b>	tCO <sub>2</sub> e/gallon
<b>Description</b>	<i>Emission factor for the fossil fuel f used by comparable fleet vehicles i in year y</i>
<b>Equations</b>	(1)
<b>Source of data</b>	<p><i>Use values from credible international (e.g. IPCC) or national government sources (e.g. US EPA).</i></p> <p><u><i>For LDV projects located in the US and Canada:</i></u></p> <p><i>L1/L2 (BEV and PHEV average) = 0.0088 tCO<sub>2</sub>e per gallon</i></p> <p><i>DCFC (BEV average) = 0.0088 tCO<sub>2</sub>e per gallon</i></p> <p><u><i>For HDV projects located in the US:</i></u></p> <p><i>e-buses = 0.0102 tCO<sub>2</sub>e per gallon</i></p> <p><i>e-trucks = 0.0102 tCO<sub>2</sub>e per gallon</i></p> <p><i>Projects must apply the default value using units (CO<sub>2</sub> or CO<sub>2</sub>e) consistent with their project boundary choices, consistent across all project activity sources.</i></p>
<b>Description of measurement methods and procedures to be applied</b>	<p><i>International and national government transportation fuel emission rates have been widely established and peer reviewed.</i></p> <p><i>US &amp; Canada default values calculated in Appendix 1.</i></p> <p><i>Note that if countries provide EF fuel emission factors using slightly different units such as CO<sub>2</sub> per liter simple conversions must be made during validation. One common conversion from CO<sub>2</sub> per liter to CO<sub>2</sub> per gallon is given below:</i></p> <p><i>CO<sub>2</sub> per gallon = CO<sub>2</sub> per liter * 3.785</i></p> <p><i>Based upon conversion factors of:</i></p> <p><i>1 gall = 3.785 liters</i></p>
<b>Frequency of monitoring/recording</b>	<i>Annual</i>

QA/QC procedures to be applied	<i>Crosscheck with 2019 refinement to 2006 IPCC default values.</i>
Purpose of data	<i>Calculation of baseline emissions</i>
Calculation method	NA
Comments	<i>Based on the fuels consumed by the fossil fuel vehicles deemed comparable to the EV models on the road each year in the applicable fleet, unless default values for baseline calculations for LDVs and/or HDVs are used.</i>

Data/Parameter	$AFEC_{iy}$
Data unit	<i>kWh/100 miles</i>
Description	<i>Weighted average electricity consumption per 100 miles rating for EVs in applicable fleet <math>i</math> in project year <math>y</math></i>
Equations	<i>(1) and (2)</i>
Source of data	<p><i>Calculated in Equation 2 if not default values.</i></p> <p><u><i>Default values for LDV projects located in the US:</i></u></p> <p><i>L1/L2 (BEV and PHEV average) = 33.32</i></p> <p><i>DCFC (BEV average) = 31.88</i></p> <p><u><i>Default values for HDV projects located in the US:</i></u></p> <p><i>e-buses = 300</i></p> <p><i>e-trucks = 140</i></p> <p><u><i>Default values for LDV projects located in Canada:</i></u></p> <p><i>L1/L2 (BEV and PHEV average) = 35.44</i></p> <p><i>DCFC (BEV average) = 33.00</i></p>
Description of measurement methods and procedures to be applied	<i>Analysis calculations can be found in Appendix 1.</i>
Frequency of monitoring/recording	<i>Calculated and default values for <math>AFEC_{iy}</math> must be updated at least each 5 years</i>
QA/QC procedures to be applied	
Purpose of data	<i>Calculation of baseline emissions</i>

<b>Calculation method</b>	
<b>Comments</b>	<p><i>Calculations for AFEC for open networks (where the exact EV models charging are not known) must be established using such data sources which must be compiled on a national basis (that is, for example, the number of BEV's of each model on the road in the US for open DCFC networks). Calculations for AFEC for closed networks (e.g. where the composition and operating characteristics of both the applicable and comparable fleets are known and documented, such as with transit agency e-bus fleets) may be made using the specific composition of these fleets (that is, for example, EVR must be the number of e-buses on the road for that particular transit agency fleet).</i></p> <p><i>For both open and closed networks, the individual EV model's EV ratings (kwh/100 miles) must be used as applicable to the government rating agencies from which they have been sourced, (e.g. nationally for US; supra-nationally for EU), including in the periodic update of default values.</i></p> <p><i>Note again that if EVs are rated using slightly different variables such as kWh/100 km in Europe simple conversions must be made during validation. One common conversion from kWh/100km to kWh/100 miles is given below:</i></p> <p><i>kWh per 100 miles = kWh per 100km * 1.609</i></p> <p><i>Based upon conversion factors of:</i></p> <p><i>1609 km = 1 mile</i></p>

<b>Data/Parameter</b>	$MPG_{iy}$
<b>Data unit</b>	<i>miles per gallon</i>
<b>Description</b>	<i>Weighted average miles per gallon rating for fossil fuel vehicles deemed comparable to each EV in applicable fleet i in project year y</i>
<b>Equations</b>	<b>(1) and (3)</b>
<b>Source of data</b>	<p><i>Derived in Equation (3) if not default values.</i></p> <p><u><i>Default values for LDV projects located in the US:</i></u></p> <p><i>L1/L2 (BEV and PHEV average) = 29.18</i></p> <p><i>DCFC (BEV average) = 29.10</i></p> <p><u><i>Default values for HDV projects located in the US:</i></u></p> <p><i>e-buses = 4.34</i></p> <p><i>e-trucks = 8.60</i></p> <p><u><i>Default values for LDV projects located in Canada:</i></u></p> <p><i>L1/L2 (BEV and PHEV average) = 29.65</i></p>

	<i>DCFC (BEV average) = 27.71</i>
<b>Description of measurement methods and procedures to be applied</b>	<i>US &amp; Canada default values calculated in Appendix 1</i>
<b>Frequency of monitoring/recording</b>	<i>Calculated and default values for <math>MPG_{i,y}</math> must be updated at least each 5 years</i>
<b>QA/QC procedures to be applied</b>	
<b>Purpose of data</b>	<i>Calculation of baseline emissions</i>
<b>Calculation method</b>	
<b>Comments</b>	<p><i>Consistent with guidance provided in AFEC above, weighted average is calculated for project year y based upon the number of EVs of each EV model type a in applicable fleet i on the road in project year y (<math>EVR_{a,i,y}</math>) combined with the mile per gallon ratings for each of these EV model's comparable fossil fuel vehicle (<math>MPG_{a,l,y}</math>).</i></p> <p><i>Calculations for comparable fleet's average MPG for open networks (where the exact EV models charging are not known) must be established using such data sources which must be compiled on a national basis (that is, for example, the number of BEV's of each model on the road in the US for open DCFC networks).</i></p> <p><i>Calculations for these fleet's MPG for closed networks (e.g. where the composition and operating characteristics of both the applicable and comparable fleets are known and documented, such as with transit agency e-bus fleets) may be made using the specific composition of these fleets (that is, for example, EVR must be the number of e-buses on the road for that particular transit agency fleet).</i></p> <p><i>For HDV closed networks, if the composition and operating characteristics of both the applicable and comparable fleets are known and documented (e.g. for transit agency EV charging infrastructure where the MPG's for the agency's own baseline bus operations can be established as the agency's comparable fleet of fossil fuel buses) using any of the CDM AMS-III.C Approach 1, Options 1 – 5, paragraphs 32 - 37.</i></p> <p><i>For both open and closed networks, the individual fossil fuel model's MPG ratings must be used as applicable to the government rating agencies from which they have been sourced (e.g., nationally for US; supra-nationally for EU), including in the periodic update of default values.</i></p>

	<p><math>MPG_{iy}</math> is calculated annually unless the default values for baseline calculations for LDVs and/or HDVs is used following Equation 4, which employs the default value <math>DMPG_{iy}</math>.</p> <p>US &amp; Canada default values calculated in Appendix 1.</p> <p>If standard emission values are provided using different parameters (such as <math>CO_2/km</math> as fossil fuel vehicle emission factors in Europe) conversions to given variable units will be made. One common conversion from liters per 100 km to miles per gallon is given below:</p> <p><math>MPG = 235.24 / \text{liters per 100 km}</math></p> <p>Based upon conversion factors of:</p> <p>1 gall = 3.785 liters</p> <p>100 km = 62.15 miles (100 miles = 160.9 km)</p>
--	--

<b>Data/Parameter</b>	$EV_{aiy}$
<b>Data unit</b>	kWh/100 miles
<b>Description</b>	Electricity kWh consumption per 100 miles rating for EV model a within applicable fleet i in project year y
<b>Equations</b>	(2)
<b>Source of data</b>	Use values from credible national governmental sources such as the ratings for the US provided by US DoE Fuel Economy program <sup>16</sup> .
<b>Description of measurement methods and procedures to be applied</b>	National, governmental ratings provide independent third party public source. A conservative value (i.e. higher) must be selected in case of uncertainty.
<b>Frequency of monitoring/recording</b>	At least every five years
<b>QA/QC procedures to be applied</b>	
<b>Purpose of data</b>	Calculation of baseline emissions
<b>Calculation method</b>	

<sup>16</sup> <https://www.fueleconomy.gov/feg/evsbs.shtml>

<b>Comments</b>	<p>See guidance for AFEC above.</p> <p>For both open and closed networks, the <math>EV_{aiy}</math> ratings must be used as applicable to the government rating agencies from which they have been sourced, e.g. nationally for US; supra-nationally for EU.</p>
<b>Data/Parameter</b>	$EVR_{aiy}$
<b>Data unit</b>	Cumulative number of EVs
<b>Description</b>	Total number of EV model $a$ within applicable fleet $i$ on the road by project year $y$
<b>Equations</b>	(2) and (3)
<b>Source of data</b>	<p>Use values from credible national governmental sources such as the statistics provided for the US provided by the Argonne National Laboratory's monthly email updates<sup>17</sup></p> <p>Closed networks may also use the number of EV's on the road using their known composition and operating characteristics of the applicable fleets they serve.</p>
<b>Description of measurement methods and procedures to be applied</b>	Argonne National Laboratory is an independent, trusted government source of EV data for the US market.
<b>Frequency of monitoring/recording</b>	Updated at least every 5 years
<b>QA/QC procedures to be applied</b>	
<b>Purpose of data</b>	Calculation of baseline emissions
<b>Calculation method</b>	

<sup>17</sup> Such as the *U.S. E-Drive vehicle monthly updates\_February 2017* provided via email by ANL. The main ANL web link is found here including the email address for the database manager: <https://www.anl.gov/energy-systems/project/light-duty-electric-drive-vehicles-monthly-sales-updates>

<sup>17</sup> <https://www.fueleconomy.gov/feg/pdfs/guides/FEG2016.pdf>

<b>Comments</b>	<p><i>This value is calculated for project year y based upon the cumulative number of EVs of each EV model type a in applicable fleet i on the road by project year y, consistent with AFEC guidance above.</i></p> <p><i>In the USA, statistics for the number of EVs on the road by model type is available from several sources including Argonne National Laboratory, in their monthly emails<sup>18</sup>, which draws upon data from hybridcars.com<sup>19</sup>.</i></p>
-----------------	---

<b>Data/Parameter</b>	$MPG_{a,i,y}$
<b>Data unit</b>	<i>miles/gallon</i>
<b>Description</b>	<i>Mile per gallon rating for fossil fuel vehicle model(s) deemed comparable to EV model a from applicable fleet i in project year y</i>
<b>Equations</b>	(3)
<b>Source of data</b>	<p><i>See guidance for <math>MPG_{i,y}</math> above.</i></p> <p><i>Use values from credible national government sources such as the US rating found in the 2016 Fuel Economy Guide<sup>20</sup></i></p> <p><i>For both open and closed networks, the <math>MPG_{a,i,y}</math> ratings must be used as applicable to the government rating agencies from which they have been sourced (e.g., nationally for US; supra-nationally for EU.)</i></p>
<b>Description of measurement methods and procedures to be applied</b>	<p><i>National governmental ratings such as those found in the US Fuel Economy Guides for the US market are independent, trusted government sources of fuel consumption ratings.</i></p> <p><i>A conservative value (i.e. higher) must be selected in case of uncertainty.</i></p>
<b>Frequency of monitoring/recording</b>	<i>Updated at least every 5 years</i>

<sup>18</sup> See U.S. E-Drive vehicle monthly updates\_February 2017 provided via email by ANL.

<https://www.anl.gov/energy-systems/project/light-duty-electric-drive-vehicles-monthly-sales-updates>

<sup>19</sup> Argonne National Lab's (ANL) monthly emails uses data sourced from the hybridcars.com web site:

<http://www.hybridcars.com/december-2016-dashboard/> The main ANL web link is found here including the email address for the database manager: <https://www.anl.gov/energy-systems/project/light-duty-electric-drive-vehicles-monthly-sales-updates>

<sup>20</sup> <https://www.fueleconomy.gov/feg/pdfs/guides/FEG2016.pdf>

QA/QC procedures to be applied	
Purpose of data	<i>Calculation of baseline emissions</i>
Calculation method	
Comments	<p><i>If standard emission values are provided using parameters which already incorporate fuel emission factors such as CO<sub>2</sub>/km ratings for fossil fuel vehicle emission factors in Europe then conversions to the appropriate combination of variables must be made to establish equivalence to the parameters in these equations.</i></p> <p><i>For example, in Europe, fossil fuel vehicle are rated in terms of CO<sub>2</sub> per km (given here as EFEU). Therefore, if the EV ratings are still given as kWh per 100 miles, then such a conversion would be: CO<sub>2</sub> per mile = <math>EF_{j,f,y} / MPG_{a,l,y} = EFEU / 0.62</math>.</i></p>

Data/Parameter	$ED_{i,y}$
Data unit	<i>kWh/year</i>
Description	<i>Quantity of electricity delivered to EV's by project chargers serving applicable fleet i in project year y</i>
Equations	<b>(1)</b>
Source of data	<p><i>EV charger meter</i></p> <p><i>Note that for L2 chargers, the electricity delivered, ED, will be considered the same as electricity consumed by the chargers EC since L2's are highly efficient chargers with de minimis losses due to their own power consumption. (i.e. ED = EC)</i></p>
Description of measurement methods and procedures to be applied	<p><i>Measured value based on the electricity delivered by charging systems in year y</i></p> <p><i>Use calibrated electricity meters/smart charging system measurement systems. Calibration must be conducted according to the equipment manufacturer's specifications.</i></p>
Frequency of monitoring/recording	<i>Measured actual data must be monitored and recorded for each charging event. Monitoring periods for metered data can be consistent with utility reports</i>
QA/QC procedures to be applied	<i>The consistency of metered electricity consumption must be cross-checked with receipts from electricity purchases where applicable</i>

Purpose of data	Calculation of baseline emissions
Calculation method	
Comments	
Data/Parameter	$EC_{i,y}$
Data unit	KWh/year
Description	Quantity of electricity consumed by project chargers serving applicable fleet $i$ in project year $y$
Equations	(4)
Source of data	<p>Electricity meter.</p> <p>Note that for L2 chargers, the electricity consumed <math>EC</math> will be considered the same as electricity delivered to the EV's by the chargers(<math>ED_{i,y}</math>), since L2's are highly efficient chargers with de minimis losses due to their own power consumption. (i.e. <math>ED = EC</math>)</p> <p>For DCFC, <math>EC</math> must be based upon the kwh consumed by the charging system (since efficiency losses can be more material for DCFC's). DCFC <math>EC</math> data can therefore either be sourced via: A) meters which are on the grid-side of the DCFC units/AI or, in case the data for A is not available, B) the chargers' own internal smart DCFC's meter data, provided that <math>ED_{i,y}</math> is increased to account for a DCFC efficiency factor of 92.3%</p> <p>If a project can demonstrate to validators a more accurate efficiency factor for their particular DCFC systems (for example due to improvements in DCFC technology efficiencies over time) this updated accurate efficiency factor may be substituted for the 92.3% default efficiency value.</p>
Description of measurement methods and procedures to be applied	<p>Measured value based on electricity consumed by charging systems in year <math>y</math></p> <p>For DCFC, using approach B, <math>EC_{i,y} = ED_{i,y}/0.923</math></p>
Frequency of monitoring/recording	Measured actual data must be monitored and recorded on at least an annual basis; monitoring periods for metered data can be consistent with utility reports. Estimated consumption can be made on annual basis from sources which monitoring using measured/actual or metered sources
QA/QC procedures to be applied	<p>Use calibrated electricity meters/smart charging system measurement systems. Calibration must be conducted according to the equipment manufacturer's specifications.</p> <p>The consistency of metered electricity consumption must be cross-checked with receipts from electricity purchases where applicable</p>

Purpose of data	<i>Calculation of project emissions</i>
Calculation method	
Comments	

Data/Parameter	$EF_{e_{i,j,y}}$
Data unit	<i>tCO<sub>2</sub>e/kWh</i>
Description	<i>Emission factor for the electricity sourced from region j consumed by project chargers serving applicable fleet i in year y</i>
Equations	(4)
Source of data	<i>Use credible government data sources such as, for the US, the regional eGRID emission factors published by EPA<sup>21</sup></i>
Description of measurement methods and procedures to be applied	<p><i>Following VT0011 Electricity System Emission Factors</i></p> <p><i>The emission factor must be consistent with the region j from which electricity is sourced</i></p> <p><i>Dedicated renewable electricity is treated as having zero tCO<sub>2</sub>e/kWh. Biogenic sources used on-site to generate electricity are considered dedicated renewables. Other on-site biofuels used to generate electricity must apply and justify their own emission factors for the biofuel used, such as those referenced in the same EPA source from which the other fuel emission default factors (EF) were derived.</i></p>
Frequency of monitoring/recording	<i>Annual</i>
QA/QC procedures to be applied	
Purpose of data	<i>Calculation of project emissions</i>
Calculation method	
Comments	<i>Region j represents any region from which electricity is sourced, each of which must have a well-documented emissions factor for the electricity provided.</i>

<sup>21</sup> <https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid>

<b>Data/Parameter</b>	<i>NEC<sub>i,j,s,y</sub></i>
<b>Data unit</b>	<i>kWh/year</i>
<b>Description</b>	<i>Electricity consumed by project chargers supplied from associated infrastructure source s net of any electricity EV/charger returned to this same source within region j serving applicable fleet i in project year y</i>
<b>Equations</b>	(5)
<b>Source of data</b>	<p><i>Net electricity consumption from project chargers must be secured for each associated infrastructure source (whether derived from the grid, dedicated renewables or the on-site battery) as actual net electricity values using chargers' adequate metering systems</i></p> <p><i>The same core guidance provided for EC<sub>i,y</sub> relative to the sources of data for L2 and DCFC apply here. So L2 data can be sourced from kwh measured as delivered to EV's by the charger meter or as the kwh consumed by the chargers from a grid-based source since losses are de minimis. And DCFC data may either be sourced via A) meters which are on the grid-side of the DCFC units/AI for each source s, or B) DCFC's own internal smart meter systems capable of differentiating the net kwh delivered to the EV's from each source s, provided that a DCFC efficiency factor of 92.3% is applied;</i></p> <p><i>Thus again for DCFC, using approach B, the value applied would be NEC<sub>i,j,s,y</sub> / 0.923</i></p> <p><i>If project can demonstrate to validators a more accurate efficiency factor for their particular DCFC systems (for example due to improvements in DCFC technology efficiencies over time) this updated accurate efficiency factor may be substituted for the 92.3% default efficiency value.</i></p>
<b>Description of measurement methods and procedures to be applied</b>	<p><i>Projects must track the net electricity consumption for charging systems from across all potential associated infrastructure sources, s, (whether grid, dedicated renewable sources, on-site battery), net of kwh supplied back from the EV battery to such sources, using the charger's metering system to track such net kwh calculations.</i></p> <p><i>Associated infrastructure sources, s, for which NEC is calculated include:</i></p> <ul style="list-style-type: none"> <li><i>• grid-connected electricity from region j</i></li> <li><i>• and/or dedicated renewable energy generated on-site (including RE sourced from direct transmission lines)</i></li> <li><i>• and/or the EV vehicle's on-board battery</i></li> </ul>

	<p>Each of the grid and renewables sources, <math>s</math>, must have a well-documented emissions factor for the electricity sourced and/or dispatched</p> <p>Project metering systems' calibration must be conducted according to the equipment manufacturer's specifications.</p> <p>Projects must incorporate adequate metering systems. Guidance for the design/application of such metering systems is provided in Appendix 2.</p>
Frequency of monitoring/recording	<p>Measured actual data must be monitored and recorded on at least an annual basis.</p> <p>Monitoring periods for metered net data can be consistent with reports which the charging systems' metering system provides.</p>
QA/QC procedures to be applied	<p>The consistency of net metered electricity generation should be cross-checked with receipts and invoices from electricity purchases and sales where applicable</p>
Purpose of data	<p>Calculation of project emissions</p>
Calculation method	
Comments	<p>The charging system's metering system must adequately and accurately measure and traces such electricity deliveries and receipts from these associated infrastructure sources, (including for example electricity sourced from/returned to the grid, on-site/dedicated renewables, on-site batteries, EV batteries).</p> <p>Applicable only if PE emissions are to be calculated on a net metered basis integrating multiple associated infrastructure sources, <math>s</math>.</p>

Data/Parameter	$EF_{kwAl_i,j,s,y}$
Data unit	(tCO <sub>2e</sub> /kWh)
Description	<p>Emission factor for the net electricity from each associated infrastructure source <math>s</math> within region <math>j</math> consumed by project chargers serving applicable fleet <math>i</math> in year <math>y</math></p>
Equations	(5)
Source of data	<p>Each of associated infrastructure source <math>s</math>, must have a well-documented emissions factor for the electricity it supplies and/or dispatches as follows:</p> <ul style="list-style-type: none"> <li>Grid-connected electricity from region <math>j</math> must follow the same procedures as for parameter <math>EF_{kwi,j,y}</math> in Equation 4 (see above)</li> </ul>

	<ul style="list-style-type: none"> <li>Dedicated renewable energy generated on-site, including renewable energy sourced via direct transmission lines, must set emission factors at zero</li> </ul> <p>On-site storage batteries must calculate the weighted average emission factor based upon the proportionate net consumption of grid and dedicated renewable energy at the charging system (see equation (6))</p>
Description of measurement methods and procedures to be applied	<p>For grid-connected electricity, see procedures for parameter <math>EF_{kwi,j,y}</math></p> <p>For dedicated renewables, emission factors are set at zero.</p> <p>For on-site storage batteries, the calculations are given in equation (6).</p> <p>Guidance for the design/application of such metering systems is provided in Appendix 2.</p>
Frequency of monitoring/recording	Annual
QA/QC procedures to be applied	
Purpose of data	Calculation of project emissions
Calculation method	For the grid apply VT0011 Electricity System Emission Factors. For on-site batteries see equation (6)
Comments	<p>Applicable only if PE emissions are to be calculated on a net metered basis integrating multiple associated infrastructure sources, s.</p> <p>Note: hourly monitoring of EV charging/associated infrastructure deliveries and receipts may be applied to Equation (5) and (6).</p>
Data/Parameter	$LEC_{j,j,y}$
Data unit	kWh/year
Description	Electricity provided to the grid and/or building from on-site storage battery within region j serving applicable fleet i in project year y, when also accounted for under NEC
Equations	(5)
Source of data	From on-site battery/charging system's adequate measurement systems
Description of measurement methods	LEC arises if on-site batteries provide electricity back to the grid or local building (for example if used as back up generators/sources of power) and are accounted for as consumption under NEC but delivered outside

and procedures to be applied	<p>the battery through a different connection. This electricity is not supplied to the EV charging system and do not result in EV miles driven and so are deducted.</p> <p>Guidance for the design/application of such metering systems is provided in Appendix 2.</p> <p>Project metering systems' calibration must be conducted according to the equipment manufacturer's specifications.</p>
Frequency of monitoring/recording	Measured actual data must be monitored continuously and recorded hourly or on at least an annual basis.
QA/QC procedures to be applied	The consistency of such electricity must be cross-checked with other information sources where applicable
Purpose of data	Calculation of project emissions
Calculation method	
Comments	Applicable only if PE emissions are to be calculated on a net metered basis integrating multiple associated infrastructure sources, s.

Data/Parameter	$ECB_{i,j,s,y}$
Data unit	kWh/year
Description	Electricity consumed by on-site battery from associated infrastructure sources $s$ , which comprise only the grid-connected and dedicated renewable sources, within region $j$ serving applicable fleet $i$ in project year $y$
Equations	(6)
Source of data	As for $NEC_{i,j,s,y}$ in equation (5)
Description of measurement methods and procedures to be applied	<p>As for <math>NEC_{i,j,s,y}</math> in equation (5)</p> <p>Guidance for the design/application of such metering systems is provided in Appendix 2.</p> <p>Metering systems must measure the electricity delivered to the onsite battery from the grid and/or renewable sources as distinct from that delivered directly to the EV charger from the grid and/or dedicated renewable sources</p>
Frequency of monitoring/recording	As for $NEC_{i,j,s,y}$ in equation (5)
QA/QC procedures to be applied	

<b>Purpose of data</b>	<i>Calculation of project emissions</i>
<b>Calculation method</b>	<i>As for <math>NEC_{i,j,s,y}</math> in equation (5)</i>
<b>Comments</b>	<i>Applicable only if PE emissions are to be calculated on a metered basis integrating multiple associated infrastructure sources, <math>s</math>, when these sources are grid-connected electricity and dedicated renewable energy.</i>

<b>Data/Parameter</b>	<i>ERC<sub>y</sub></i>
<b>Data unit</b>	<i>tCO<sub>2e</sub></i>
<b>Description</b>	<i>Sum of GHG credits issued by all projects under this methodology (or others which support the introduction of EV charging systems) across this project's applicable fleet <math>i</math> categories within this total project region in project year <math>y-1</math></i>
<b>Equations</b>	<i>(8)</i>
<b>Source of data</b>	<i>VCS (and other voluntary and regulated credit registries if they develop similar EV charging system methodologies), with GHG credits issued from EV charging system projects within this same project's region (e.g. for complementary charging networks)</i>
<b>Description of measurement methods and procedures to be applied</b>	<p><i>Simple tallies of the total GHG credits issued from EV charging system project year 1 through year <math>y-1</math> within this project's region</i></p> <p><i>These GHG credits include those issued under this VCS charging system methodology (or similar ones developed by other certification groups) whose credits arise within the same region as this project but cover credits issued from complementary charging network systems (e.g. workplace chargers from a complementary project located in the same region as this project's residential chargers).</i></p>
<b>Frequency of monitoring/recording</b>	<i>Annual</i>
<b>QA/QC procedures to be applied</b>	
<b>Purpose of data</b>	<i>Calculation of emission reductions</i>
<b>Calculation method</b>	<i>NA</i>
<b>Comments</b>	<i>NA</i>

<b>Data/Parameter</b>	<i>ERF<sub>y</sub></i>
-----------------------	------------------------

<b>Data unit</b>	tCO <sub>2</sub> e
<b>Description</b>	<i>Sum of GHG credits issued by all projects under methodologies which support the introduction of EV fleets (e.g., CDM AMS.III.C) within this project's same total region where the applicable fleet i categories are the same for both this EV charging system project and projects introducing EV fleets, in project year y-1</i>
<b>Equations</b>	<b>(8)</b>
<b>Source of data</b>	<i>VCS and other voluntary and regulated credit registries, with GHG credits issued from projects that introduce EV fleets within the project region</i>
<b>Description of measurement methods and procedures to be applied</b>	<p><i>Simple tallies of the total GHG credits issued for projects that introduce EV fleets within this project's region from project year 1 through year y-1</i></p> <p><i>These GHG credits are those issued under EV fleet methodologies such as CDM AMS-III.C whose credit potentially double count with those issued through EV charging system projects where the applicable fleet of the EV charging system project include those that were introduced in the EV fleet project</i></p>
<b>Frequency of monitoring/recording</b>	<i>Annual</i>
<b>QA/QC procedures to be applied</b>	
<b>Purpose of data</b>	<i>Calculation of emission reductions</i>
<b>Calculation method</b>	NA
<b>Comments</b>	<i>If GHG credits have been issued projects introducing EV fleets for a region larger than the proposed EV charging system project (e.g. the project introducing EVs s US-wide while the EV charging system project is confined to one state), then a sensible pro-rata share of the GHG credits issued to the project that introduced EV fleets can be made (e.g. using the pro-rata number of EV's on the road in the EV charging system project state compared to the total in the US, using sources such as ZEVFacts.com).</i>

### 9.3 Description of the Monitoring Plan

The project proponent must establish, maintain and apply a monitoring plan and GHG information system that includes criteria and procedures for obtaining, recording, compiling and analyzing data, parameters and other information important for quantifying and reporting GHG emissions.

All data collected as part of monitoring should be archived electronically and be kept at least for two years after the end of the last project crediting period. All data must be monitored unless indicated otherwise in the tables above.

To demonstrate that double counting of emission reduction will not occur, the project proponent must maintain an inventory of EV chargers included in the project, including their L1/L2/DCFC classifications and unique identifiers; other measures may include disclosure of credit ownership to EV drivers. Where associated infrastructure and/or renewable power (on-site and/or direct transmission) are included in an EV charging system, this must be referenced and described in the charging system's inventory. Project documentation must also include the following for each EV charger:

- Classification using the performance voltage, AC/DC basis and kW power specifications given for L1, L2 and DCFC 50/100/150/320/500 definitions
- Unique identifiers, including the geo-spatial coordinates and one other unique reference such as NEMA codes, customer codes, equipment serial numbers, charger ID codes, or AFDC ID codes

Project reporting must include the following information for EV charging systems included in a project:

For activities monitored once up-front during project validation or as new project activity instances are admitted to a grouped project during verification:

- 1) Inventory and geographic location for each EV charging system included in the project.
- 2) Where EV charging systems' AI is utilized to provide electricity to EVs, in order to store and dispatch electricity to and from multiple sources, both on site and regionally, the monitoring plan must include plans for how data will be processed from the AI's metering systems (e.g., meters/sub-meters and/or associated measurement systems). Guidance for such metering is provided in Appendix 2.
- 3) Review of any previously issued VCUs for EV charging projects to verify that there is no overlap of ownership with chargers included in the project description, for example, using the unique EV charging identifiers supplied in the project description's EV charging system inventory. For grouped projects, such verification must apply to any new project activity instances and for new chargers subsequently added to the grouped project (e.g., by referencing the unique EV charging identifiers for these new project activity instances in project monitoring reports).
- 4) Review of any previously issued EV fleet credits to confirm the value established for the discount factor,  $D_y$ .

For activities monitored each year during verification for credit issuance:

- 1) Data on electricity consumption consistent with guidance provided in the parameter boxes above for each EV charger, which must be reported in a consistent manner with supporting data, such as invoices or utility or on site meter records. Where projects include LDV and HDV applicable fleets, electricity consumption must be monitored separately.
- 2) Supporting documentation used to determine parameters for use in quantification of annual baseline emissions if default factors (per Appendix 1) are not used.

The project proponent must establish and apply quality management procedures to manage data and information. Written procedures must be established for each measurement task outlining responsibility, timing and record location requirements. Record keeping practices must include:

- Electronic recording of values of logged parameters for each monitoring period
- Offsite electronic back-up of all logged data
- Maintenance of all documents and records in a secure and retrievable manner for at least two years after the end of the project crediting period.

Quality assurance/quality control procedures must also be applied to add confidence that all measurements and calculations have been made correctly. These may include, but are not limited to:

- Protecting monitoring equipment (sealed meters and data loggers)
- Protecting records of monitored data (hard copy and electronic storage)
- Checking data integrity on a regular and periodic basis (manual assessment, comparing redundant metered data, and detection of outstanding data/records)
- Comparing current estimates with previous estimates to identify any abnormal readings
- Providing sufficient training to project participants to install and maintain project devices
- Establishing minimum experience and requirements for operators in charge of project and monitoring
- Performing recalculations to make sure no mathematical errors have been made

## 10 REFERENCES

US Environmental Protection Agency (2017). *eGRID2014v2 Summary Table*.

US Department of Energy (2018). *Model Year 2016 Fuel Economy Guide*.

Idaho National Laboratory. *The EV Project*. Retrieved from <https://avt.inl.gov/project-type/ev-project>

Zhou, Y. *Light Duty Electric Drive Vehicles Monthly Sales Updates*. Retrieved from Argonne National Laboratory: <https://www.anl.gov/energy-systems/project/light-duty-electric-drive-vehicles-monthly-sales-updates>

# APPENDIX 1: CALCULATION OF BASELINE DEFAULT VALUES FOR THE US AND CANADA

This appendix outlines the basis for the calculation of the optional default values used in the baseline emission calculations for U.S. LDV and HDV projects, and Canadian HDV projects. Values used to calculate the default value results were presented to the VVB via a separate Excel workbook during the approval process of the methodology.

Projects must apply the default value using units for EF (CO<sub>2</sub> or CO<sub>2e</sub>) consistent with their project boundary choices, consistent across all project activity sources.

## LDV Weighted Averages in the United States

Weighted averages for LDVs are based upon:

- The total number of each BEV and PHEV model on the road by end of 2015, based upon cumulative US sales data for 2010-2015 sourced from Argonne National Laboratories' monthly emails and web site<sup>22</sup>
- Kwh/100 mile and MPG ratings sourced from [www.fueleconomy.gov](http://www.fueleconomy.gov) or the 2016 Fuel Economy Guide, <https://www.fueleconomy.gov/feg/pdfs/guides/FEG2016.pdf>
- Gasoline was the fuel which the comparable fossil fuel cars consumed

The simple weighted average has been calculated for each applicable fleet (BEV+PHEV and BEV) based upon the number of EV models of each type on the road by end of 2015 multiplied by its corresponding kwh/100 mile value (AFEC) and equivalent fossil fuel vehicle's MPG value (MPG), which are listed in the table below.

**Table A1:** LDV Project Default Value Table

Applicable fleet	$AFEC_{ij}$	$MPG_{ij}$	$EF_{ij}$
L1/L2 (BEV and PHEV average)	33.32	29.18	19.56 lbs CO <sub>2</sub> /gal = 0.0088 tCO <sub>2</sub> /gal or 0.0088 tCO <sub>2e</sub> /gal

<sup>22</sup> Argonne National Lab's (ANL) monthly emails uses data sourced from the [hybridcars.com](http://www.hybridcars.com) web site: <http://www.hybridcars.com/december-2016-dashboard/> The main ANL web link is found here including the email address for the database manager: <https://www.anl.gov/energy-systems/project/light-duty-electric-drive-vehicles-monthly-sales-updates>

DCFC (BEV average)	31.88	29.10	19.56 lbs CO <sub>2</sub> /gal = 0.0088 tCO <sub>2</sub> e/gal or 0.0088 tCO <sub>2</sub> e/gal
--------------------	-------	-------	--

### HDV Weighted Averages in the United States

Each of these e-bus and e-truck weighted averages are based upon:

- The total number of each e-bus and e-truck models on the road in the US by beginning of 2017, based upon on data sourced from IHS Markit
- The corresponding GWV classification for each model of e-bus and e-truck on the road, based upon data sourced from IHS Markit
- Kwh/mile data sourced for e-buses from commercial sources (confidential) and for e-trucks from Smith Electric and NREL reports for e-delivery truck vehicles as follows:
  - <http://insideevs.com/smith-electric-vehicles-distance-energy-consumption/>
  - <http://www.nrel.gov/docs/fy17osti/66382.pdf>
- Average MPG ratings for the corresponding class of MDV/HDV, as sourced from independent academic sources, specifically: <https://www.nap.edu/read/12845/chapter/4#18>
- Diesel fuel was the dominant baseline bus and truck fuel

The simple weighted average is calculated for each applicable fleet (e-bus and e-truck) based upon the number of EV models of each type on the road by beginning of 2017 multiplied by its corresponding kwh/100 mile value (AFEC) and equivalent GWV class of fossil fuel vehicle’s average MPG value (MPG), which are listed in the table below.

**Table A2:** HDV Project Default Value Table

Applicable fleet	$AFEC_{jy}$	$MPG_{jy}$	$EF_{jy}$
e-buses	300	4.34	22.4 lbs CO <sub>2</sub> /gal = 0.0102 tCO <sub>2</sub> /gal or 0.0102 tCO <sub>2</sub> e/gal
e-trucks	140	8.60	22.4 lbs CO <sub>2</sub> /gal = 0.0102 tCO <sub>2</sub> e/gal or 0.0102 tCO <sub>2</sub> e/gal

### LDV Weighted Averages in Canada

These weighted averages are based upon:

- The total number of each BEV and PHEV model on the road by end of 2016, based upon cumulative Canada data; kwh/100 mile and MPG ratings, all sourced from Natural Resources Canada
- Gasoline was the fuel which the comparable fossil fuel cars consumed

The simple weighted average has been calculated for each applicable fleet (BEV+PHEV and BEV) based upon the number of EV models of each type on the road by beginning of 2017 multiplied by its corresponding kWh/100 mile value (AFEC) and equivalent fossil fuel vehicle’s MPG value (MPG), which are listed in the table below.

**Table A3:** LDV Project Default Value Table for Canada

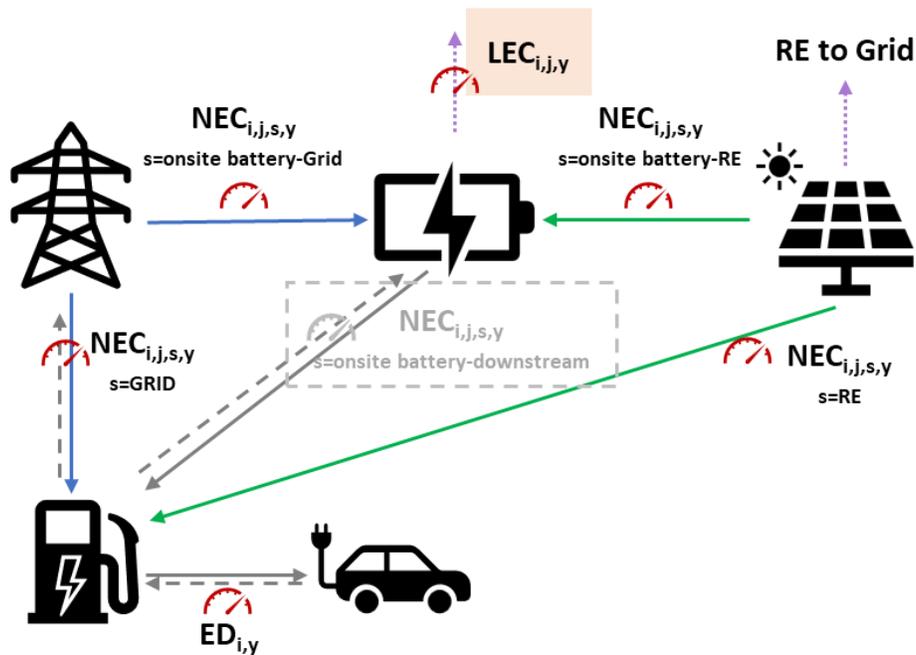
Applicable fleet	$AFEC_{ij}$	$MPG_{ij}$	$EF_{ij}$
L1/L2 (BEV and PHEV average)	35.44	29.65	19.56 lbs CO <sub>2</sub> /gal = 0.0088 tCO <sub>2</sub> /gal or 0.0088 tCO <sub>2e</sub> /gal
DCFC (BEV average)	33.00	27.71	19.56 lbs CO <sub>2</sub> /ga = 0.0088 tCO <sub>2</sub> /gall or 0.0088 tCO <sub>2e</sub> /gal

# APPENDIX 2: GUIDANCE FOR DESIGN OF ADEQUATE METERING SYSTEMS FOR AI PROJECTS

This appendix outlines guidance for the design and application of metering systems of charging systems to adequately measure electricity exchanges when associated infrastructure (AI) is incorporated into projects when they apply to the determination of project emissions, as shown in Figure A1. If associated infrastructure is incorporated into the project boundary, PE equations (5) and (6) are applicable.

**Figure A1:** Examples of Associated Infrastructure and Electricity Flows

$$PE_y = \sum_{ijs} NEC_{ijsy} * EFkwAI_{ijsy} - \sum_{ij} LEC_{ijy} * EFkwonsitebatt_{ijy}$$



When incorporating associated infrastructure, the charging system’s metering system must adequately and accurately measure and trace the net electricity kWh provided to the charging system (i.e., deliveries minus receipts) from all electricity sourced from and returned to the grid, and the dedicated renewables. This may include dedicated renewable energy (e.g., on site) delivered to the EV directly and/or via on-site batteries, and net of kWh returned back to such sources from the EV batteries.

Note that metering systems for associated infrastructure can include “downstream” meters close to the EV, such as those provided by DCFC onboard meters (and referenced specifically in the ED parameter for kWh *delivered* by a charger to the EV which applies to the BE calculations), and “upstream” meters, located grid-side such as meters monitoring electricity (in kWh) delivered to the on-site batteries (which could be designed/applied to measure the kWh which a charger *consumes* in the EC parameter measurements which applies to the PE calculations).

Where the system’s meters are located further “upstream”, in order to not include any electricity lost to the EV charging system, any electricity sourced from associated infrastructure sources (notably from solar and the on-site battery) but delivered outside the EV charging system (e.g. delivered to the grid or the local building when the on-site battery is used as a back up generator source), must be sensibly taken into account for quantification. This includes the following examples:

- 1) Where the metered kWh to the on-site battery is located “upstream” on the grid side (rather than downstream of the on-site battery in the charger where electricity delivered to the EV is measured), any electricity that the on-site battery provides back to the grid, or its building in a given year must be measured and subtracted – as  $LEC_{ijy}$  – since these kWh represent losses to the overall charging system and do not result in EV miles driven.
- 2) Where the on-site battery is not connected to the grid or building (i.e., it does not serve as a power back up system), then the on-site battery does not need to be accounted for as a separate source, since it merely acts as a flow through for the grid and renewables sources. Any electricity received from the EV would also be returned to the EV. Therefore, the on-site battery would supply electricity consistent with the change in stored power between the year’s starting and end points which, compared to the kWh supplied by the grid and/or dedicated renewables, would be *de minimis*.
- 3) Any transfer of electricity from the EV to the onsite battery represent internal flows within the system and can be set aside since the electricity must either be returned downstream to the EV at a later date or tracked via LEC if subsequently delivered back to the grid via the on-site battery. Therefore, transfers of electricity from the EV to the onsite battery can be set aside.
- 4) Projects must be able to measure or sensibly estimate the electricity supplied from the grid and/or from dedicated renewable sources to the charger system and this may be a subset of the total electricity from this source. For example, the electricity delivered to the charging system may be less than the total electricity generated by the onsite renewables if these renewables also provide power back to the grid within a particular associated infrastructure

system<sup>23</sup>. Similarly, the total grid electricity delivered to the system may be shared across both the EV charger if delivered directly while also supplying in parallel electricity to the on-site battery – the former contributing to NEC from the grid source and latter to NEC for the on-site battery.

Where the systems meters are located “downstream”, in order to not include any electricity lost to the EV charging system, any electricity sourced from associated infrastructure sources must be sensibly taken into account for quantification. This includes the following examples:

- 1) Although upstream-metering, (the measurement of kWh consumed by the chargers for parameter EC), typically applies for the PE calculations, the calculation of PE values can be made using downstream meters located in the chargers’ internal systems provided appropriate efficiency factors are applied to take account of chargers’ own electricity consumption. Where downstream measurement of PE is applied:
  - For PE calculations using downstream metering, consistent with the guidance in the parameter boxes for EC and NEC, efficiency factors must be applied to account for potential efficiency losses due to the chargers’ own consumption. For L2s, such efficiency losses are de minimis<sup>24</sup> and so no efficiency factor is applied in the L2 EC, and NEC parameter applications (since “downstream” meters would have de minimis variances with upstream meters). For DCFCs, if electricity data is sourced from “downstream” meters located within their own DCFCs internal smart meter systems (assuming as needed across these parameters that these smart meters are capable of differentiating inter alia the net kWh delivered to the EV’s from each source s during time period t), then to establish the PE equation electricity *consumed* by the DCFC charger a DCFC default efficiency factor of 92.3% is applied to these internal smart DCFC metered kWh readings (i.e., using approach B in the parameter boxes)).
  - Alternatively, DCFCs can use approach A applying “upstream” meter kWh measurements which are on the grid-side of the DCFC units/AI (e.g., for each source s and time period t).
  - However, often relative to time-of-day periods it is a DCFC’s own “downstream” internal “smart” meters which have the most sophisticated metering capabilities for such time-of-day applications (whereupon approach B would be followed and the DCFC default efficiency factor applied).

---

<sup>23</sup> At a future date, projects may wish to consider issuing GHG credits for the subset of kWh delivered from the dedicated renewables to the grid (but not to the EV charger) using methodologies such as AMS-I.F

<https://cdm.unfccc.int/methodologies/DB/XKCRT4QQUUWXXZMQRXUGESOWON451M>

<sup>24</sup> Per INL: <https://avt.inl.gov/evse-type/ac-level-2>

- 2) Where meters are located downstream for the measurement of NEC pertaining to the on-site battery, then the electricity measured must already be net of any LEC losses from the on-site battery to the grid – **and thus LEC must be set at zero**. This basis for such on-site battery net electricity measurements would be consistent with DCFC’s measurement systems which track the electricity exchanges close the point of delivery to the EV. Additionally, for downstream metering, the electricity provided by the EV to the onsite battery must be measured for the calculation of NEC for the on-site battery (that is, it cannot be set aside for downstream metering).
- 3) Where the EV is delivering vehicle-to-grid (V2G) services where electricity from the car’s on-board battery is returned directly to the grid, these EV-sourced electricity are netted out in the grid-sourced net-kWh (that is, in the calculation of NEC for the grid source s).
- 4) Where charging systems include simple associated infrastructure settings, such as residences using L1/L2 systems where “upstream” metering systems apply and where the associated infrastructure system elements can be limited (e.g. no on-site battery).

Note that the quantification of emissions from project associated infrastructure systems can be simplified using sensible estimates. For example, where a household residence has a solar panel that is grid-connected – which, while its total solar kWh production and grid-sales are metered, does not have a separate sub-meter to establish the solar kWh supplied to the EV charging system specifically – it is acceptable to assume that the kWh delivered to the EV charger is the same weighted average as the solar/grid kWh mix the household itself consumed (i.e., sources whose electricity would have been separately metered). Utility-style modeling is also acceptable for settings where only the net electricity consumption/generation is measured for a household in order to establish the electricity delivered by both the grid and the on-site renewables and thus the required weighted average.

# APPENDIX 3: JUSTIFICATION OF COMPATIBILITY WITH TRANSITION TO NET ZERO

The development of electric vehicle charging infrastructure does not present a material risk of carbon lock-in, as it directly supports the long-term transition away from fossil-fuel-based transport. EV charging assets are specifically designed to enable a shift toward low- and zero-emission mobility. Their typical project lifetime of 10 to 20 years aligns with national and global decarbonization pathways in which the electrification of transport is a central mitigation measure, ensuring that such infrastructure remains fully compatible with increasingly cleaner electricity grids over time. Moreover, charging systems are inherently flexible: they can be upgraded, expanded, or integrated with renewable energy supply, smart-grid management, and storage solutions without locking in high-emission practices. As a result, rather than prolonging unabated fossil fuel consumption, EV charging infrastructure facilitates behavioral and market transitions that reduce greenhouse gas emissions across the transport sector.

## APPENDIX 4: UNCERTAINTY ASSESSMENT

There are two sources of uncertainty that are identified and discussed in this methodology: Uncertainty of the displacement of fossil fuel vehicles and uncertainty related to the baseline and project vehicles performance.

### Uncertainty of the displacement of fossil fuel vehicles:

This uncertainty is related to the expansion of EVs due to the expansion of the charging infrastructure. New EVs in the road incentivized by the project activity will charge electricity in the project chargers, displacing the use of fossil fuel vehicles. Also, those new EVs may be charged somewhere else, which would not be captured by the project as emission reductions. This situation is conservative.

However, the same can be argued in the opposite direction; project chargers delivering electricity to new EVs in the road may also be used by existing EVs, which does not replace the use of fossil fuels cars.

The balance between the two effects could be positive or negative, and it is not possible to determine to which extent this effect materializes in each direction in all cases. Therefore, the methodology addresses this uncertainty by limiting the applicability to countries where the penetration rate of EVs is low, both in the stock share and in the sales share. In those cases, the effect of existing EVs, if any, switching to a project charger is expected to be less relevant than the effect of new EVs charging outside the project chargers (e.g. home charging) as the market evolves. As such, countries where the EV penetration rate has reached a determined threshold are not eligible.

### Uncertainty of the baseline and project vehicles:

This uncertainty is related to the parameters used to calculate the emission reductions. Baseline emissions are determined based on the monitoring of the electricity supplied to EVs. This data is used to calculate the distance traveled, by applying the performance of the EV (kWh/100 miles), and transformed into fossil fuel consumption avoided with the miles per gallon rating associated to the baseline fossil fuel vehicle.

For closed charging networks, the EV fleets are known and identified, and the uncertainty related to the performance of the associated vehicles is very low.

For open charging networks, the specific EV fleet is not known. Therefore, the weighted average of the mix of EVs and baseline vehicles is used. The parameters for the comparable fleet and EV fleet are determined conservatively by requiring selecting a higher value when a range is identified, which reduces the emission reduction estimates.

# DOCUMENT HISTORY

Version	Date	Comment
v1.0	18 Sep 2018	Initial version
v1.1	18 Mar 2026 (draft)	Minor revision, including the following changes: <ul style="list-style-type: none"><li>• Added applicability condition with EV market share limit</li><li>• Corrections and clarifications</li><li>• Adoption of VCS tools VT0008 and VT0011</li><li>• Simplifications to the quantification approach</li><li>• New appendices</li><li>• Update to the latest VCS methodology template</li></ul>