VCS Methodology

VM0038

ELECTRIC VEHICLE CHARGING SYSTEMS

Version 1.1

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Sectoral Scope 7: Transport

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CONTENTS

1 SUMMARY DESCRIPTION

Project Category	Transport
Project Activity Type	Transport systems and infrastructure improvement
Additionality	Project method or activity method
Crediting Baseline	Project method
Mitigation Outcome	Reductions

This methodology applies to project activities that install electric vehicle (EV) charging systems, including associated infrastructure. Greenhouse gas emission reductions (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 reductions, and establishes default factors for estimating certain parameters for projects located in the United States and Canada as an alternative to project-specific calculations.

This methodology is applicable globally and provides a positive list for determining additionality. The positive list is found in VCS module *VMD0049 Positive List for Electric Vehicle Charging Systems*. Additionality may also be determined using a project method.

2 SOURCES

This methodology is based on the following CDM methodology:

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

This methodology uses the following VCS module and tools:

- *VMD0049 Positive List for 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 fleet
Class of electric vehicle (EV) eligible and technically able to charge at EV chargers associated with the project.

For light-duty vehicle (LDV) projects, applicable fleets comprise battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs) for alternating current (AC) chargers (Level 1 and Level 2), and BEVs for direct current fast chargers (DCFCs).[1]

For heavy-duty vehicle (HDV) projects, applicable fleets comprise the medium-duty and heavy-duty (MDV/HDV) electric vehicles eligible to charge at the project's EV chargers.

Associated infrastructure
Stationary battery storage devices[2] 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 electric vehicle (EV) charging systems and managed by the EV charging system control unit. Associated infrastructure includes on-site battery storage systems that can store and dispatch electricity to and/or from any on-site renewable power systems, the grid, and/or EV batteries. It also includes EV batteries themselves and thus includes battery swapping, EV-to-grid (V2G), and EV to on-site battery exchanges of electricity.

Associated infrastructure metering system
System used to track electricity flows between associated infrastructure 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 project 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)
An electric vehicle (EV) which relies exclusively upon electricity delivered from an external EV charging system for power to propel EV motion

[1] There are very few PHEVs that can also charge at DCFCs (e.g., Mitsubishi Outlander); these are considered de minimis. The BMW i3 REX (with range extender) is technically a PHEV, but only 5% of i3s use the range extender in practice. Argonne National Laboratory and the state of California classify the REX as a BEV, and therefore it is included in the BEV category for the purposes of default factor calculation in this methodology.

[2] For larger powered systems (e.g., 150 kW, 320 kW), 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 EV charging system's control unit and are located close to the site within the EV charging system's metering to the utility.

Charging network
A collection of charging systems which service any given applicable fleet

Closed charging network
A collection of electric vehicle (EV) charging systems used to charge only a specific identified subset of EVs (e.g., a transit agency's e-bus charging network to charge new e-buses, a logistic company's charging network dedicated to a fleet of new e-trucks)

Comparable fleet
Fossil fuel vehicles whose travel characteristics have been defined to be comparable to the EVs in an applicable fleet

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

Direct current fast charger (DCFC)
A charger which provides direct current charging (typically at 200–1000 V) from an off-board charger with a power rating above 11 kW

Electric vehicle (EV)
Vehicles, including battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs), spanning passenger cars, other light-duty vehicles, two and three-wheelers, and heavy-duty vehicles, including e-buses and e-truck categories, that are powered by the external electricity sources of charging systems. EVs do not include hybrid-only vehicles since these do not consume electricity from externally generated sources.

Electric vehicle charger
Charging dispenser and its metering system including alternating current (AC) (Level 1 (L1) and Level 2 (L2)) and direct current fast charging (DCFC) units that provide electricity to electric vehicles (EVs) within an applicable fleet and which may form part of an EV charging system

Electric vehicle charging system
A set of electric vehicle (EV) chargers including alternating current (AC) (Level 1 and Level 2) and direct current fast charging (DCFC) units 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

Electric vehicle stock 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 light-duty vehicle and heavy-duty vehicle sectors

Heavy-duty vehicle (HDV)

Vehicle consistent with definition provided by the governing national regulatory system(s) for the project location. HDVs may include some medium-duty vehicles (MDVs) where the characteristics of the MDVs are consistent with those of the vehicles assessed in the data sources used in the standardized tests and default factors applied, if any.[3]

Level 1 charger (L1)

A charger which provides 120 V alternating current charging services to a vehicle's onboard charger with a power rating up to 1.8 kW

Level 2 charger (L2)[4]

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

Light-duty vehicle (LDV)

Vehicle consistent with definitions provided by the governing national regulatory system(s) for the project location. LDVs include cars and two and three-wheelers, and may include some medium-duty vehicles (MDVs) where the characteristics of the MDVs are consistent with those of the vehicles assessed in the data sources used in the standardized tests and default factors applied, if any.[5]

Open charging network

A collection of electric vehicle charging systems used to charge an applicable fleet that is not restricted to a specific subset of identified EVs

Plug-in hybrid electric vehicle (PHEV)

A vehicle combining an internal combustion engine and one or more electric motors, which can receive electricity by plugging into an external electric vehicle charging system for power to propel its motion

[3] For example, in the United States, HDVs are specified as including both HDVs and any MDVs with gross vehicle weight ratings (GVWR) of more than 14 000 lbs (typically from class 4 and above). This is consistent with the IHS Markit data sources applied in the development of default factors for this methodology. HDV vehicles include both e-buses and e-trucks.

[4] In London, United Kingdom, L2 chargers are referred to as fast chargers and DCFCs are referred to as rapid chargers.

[5] For example, in the United States, LDVs are specified as including vehicles with GVWR up to and including 14 000 lbs, (classes 1, 2, and 3) and must therefore include any medium-duty vehicles (MDVs) up to this same weight limit. This is consistent with the IHS Markit data sources applied in the development of default factors for this methodology. The 14 000 lbs GVWR value is based on definitions used by IHS Markit data for light-duty vehicles. Their data forms the basis for most US EV market analysis publications. Commercial applications in the 8500–14 000 lb classes 2b and 3 are a de minimis proportion of total LDVs. See also: http://changingears.com/rv-sec-tow-vehicles-classes.shtml and https://www.afdc.energy.gov/data/10380. Lighter MDVs include the types of vehicles which also use the main LDV charging networks (e.g., retirement home vans).

Private charging network[6]
Electric vehicle charging system where charger access is limited to a defined applicable fleet (e.g., residential chargers since access is restricted, city chargers where their use is limited to charging the city's own electric vehicle fleet). 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 associated infrastructure, in order to charge EV applicable fleets. 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 or region is included in the positive list of *VMD0049* for the relevant charger type (i.e., alternating current (AC) charger or direct current fast charger, DCFC) implemented as part of the project activity.
    b) For open charging networks,[7] the EV market penetration is below both the stock share and sales share thresholds specified below, or, where data on only one threshold are available, below that threshold:
        i) For AC chargers: 5% EV stock share and 20% three-year average EV sales share at the state, provincial, or city level, or nationally where state/province/city information is not available, based on the most recent available data from official sources at the time of validation
        ii) For DCFC: 7.5% EV stock share and 30% three-year average EV sales share nationally, based on the most recent available data from official sources at the time of validation

    Note – Registered projects, and instances that have already been included in registered grouped projects, using VM0038, v1.0 *do not need to meet this applicability condition at crediting period renewal. However, if this applicability condition is no*

[6] Private refers to the limited degree of access to the chargers, not the status of the EV charging system's owner (since public city chargers can use private charging networks).

[7] In open charging networks, the specific EVs using the project chargers cannot be identified. As a result, the project chargers may serve both new and existing EVs. The applicability condition therefore restricts use of the methodology to countries where EV penetration remains low, based on both EV stock share and EV sales share.

longer met at the time of crediting period renewal, no new project activity instances may be included in the grouped project.

2) The applicable fleets of vehicles are:

   a) for projects targeting light-duty vehicles (LDVs), battery electric vehicles (BEVs) and plug-in hybrid vehicles (PHEVs)[8] for Level 1 (L1) and Level 2 (L2) chargers, and BEVs for DCFCs.

   b) for projects targeting heavy-duty vehicles (HDVs), BEV and PHEV MDV/HDV electric buses and trucks.

3) EV charging systems are used for applicable fleets and may include associated infrastructure to provide electricity to and from EVs, on-site batteries, and renewables.[9] Associated infrastructure metering systems must measure and accurately trace all electricity deliveries and receipts from all associated infrastructure sources. This includes electricity sourced from / returned to the grid, dedicated renewable energy generated on-site (including renewable energy sourced from direct transmission lines), on-site storage batteries, and an EV's on-board battery.

4) Project proponents demonstrate proof of ownership of reductions, for example with:

   a) EV charging system owners through contractual agreements, terms of service, utility program participation rules, or other means.

   b) 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).

5 GENERAL IMPLEMENTATION

5.1 Project Start Date

The project start date must be established in accordance with the applicable versions of the *VCS Standard* and *VCS Program Definitions*.

When determining the project start date, the following types of actions must be considered, as applicable:

1) Signing a contract to purchase charging equipment

2) Signing a contract for the installation or construction of charging infrastructure

[8] Hybrid-only vehicles are not eligible under this methodology.

[9] Associated infrastructure may store and dispatch electricity both to and from multiple sources, both on-site and regionally.

3) Obtaining or signing a license or agreement required for the implementation or operation of charging infrastructure with a government authority, regulator, utility, landowner, or other relevant entity, where such a license or agreement constitutes a binding commitment to implement the project activity.

5.2 Initial Crediting Period Start Date

The initial crediting period start date must be established in accordance with the applicable versions of the *VCS Standard* and *VCS Program Definitions*.

Under this methodology, the initial crediting period start date is the operational start date of the first EV charging system.

5.3 Crediting Period Renewal

Project proponents must renew the project crediting period in accordance with the VCS Program rules.

For baseline reassessment, project proponents must update the parameters related to the applicable fleet (*MPG* and *AFEC)* or demonstrate that the existing parameters remain valid.

Registered projects, and existing project activity instances that are already included in grouped projects, do not need to meet applicability condition (1) at crediting period renewal. However, where this applicability condition is no longer met by a grouped project at the time of crediting period renewal, no additional project activity instances may be included in the grouped project.

Registered projects and existing project activity instances that are already included in grouped projects are not required to reassess additionality at crediting period renewal. Such projects and project activity instances are not required to reapply *VMD0049*. However, any new project activity instances included from crediting period renewal onwards must either:

1) comply with the positive list in the version of *VMD0049* applied at crediting period renewal. Such version may be applied for the remainer of the crediting period; or

2) demonstrate additionality by applying the project method.

Where a project activity instance is not included in the applicable positive list, additionality may only be demonstrated by applying the project method.

5.4 Methodology Transition

Projects transitioning from *VM0038, v1.0* and using estimates to account for the electricity delivered ($ED_{i,y}$ in Equation (1)) or electricity consumed ($EC_{i,j,y}$ in Equation (4)) for a project's dumb network charge or non-metered project chargers may continue to use estimates where these are demonstrated to be conservative based on the possible ranges of uncertainty.

6 PROJECT BOUNDARY

The spatial extent of the project boundary encompasses:

1) the applicable fleets for the project EV chargers.
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_2	Yes	Main emission source
			CH_4	Optional	May be excluded for simplification (conservative)
			N_2O	Optional	May be excluded for simplification (conservative)
			Other	No	Not applicable
Project	Electricity consumption of project chargers and associated infrastructure	Source	CO_2	Yes	Main emission source
			CH_4	Optional	May be excluded for simplification. Where included in the baseline, source must be accounted for in project emissions.
			N_2O	Optional	May be excluded for simplification. Where included in the baseline, source must be accounted for in project emissions.
			Other	No	Not applicable
Leakage	None	Source	CO_2	No	No leakage
			CH_4	No	No leakage
			N_2O	No	No leakage
			Other	No	No leakage

7 BASELINE SCENARIO

The baseline scenario for projects on 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 8.3 below. Project proponents 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, whether applying the positive list or not, must demonstrate that the EV models comprising the applicable fleets of the project are comparable to conventional fossil fuel baseline vehicles using the following means:[10]

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

8 ADDITIONALITY

All projects must demonstrate regulatory surplus (Section 8.1) and either demonstrate that they meet the requirements of the positive list (Section 8.2) or the project method (Sections 8.3 and 8.4).

8.1 Regulatory Surplus

Project proponents must demonstrate regulatory surplus in accordance with the rules and requirements regarding regulatory surplus set out in the applicable version of the *VCS Standard*.

Where the project proponent demonstrates regulatory surplus, proceed to Section 8.2 or Section 8.3. Otherwise, the project activity is not additional.

[10] For open charging networks where project proponents apply the baseline emission default factors for miles per gallon (*MPG*) and applicable fleet electricity consumption (*AFEC*) determined for the United States and Canada, this requirement, which ensures comparability between applicable and comparable fleet models, has already been met.

8.2 Positive List

The applicability conditions of *VMD0049* 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 *VMD0049*, it is additional.

Where the project activity does not meet all applicability conditions of *VMD0049*, the project proponent must apply a project method (Section 8.3). Otherwise, the project activity is not additional.

8.3 Investment Analysis or Barrier Analysis

Project proponents applying a project method to demonstrate additionality must follow the procedures and requirements of Step 3 in *VT0008 Additionality Assessment* to conduct an investment analysis.

Projects with reductions equal to or below 60 kt CO_2e per year may apply a barrier analysis instead of an investment analysis, following the procedures and requirements of Step 2 in *VT0008*.[11] Such projects must not claim more than 60 kt CO_2e reductions per year. Where annual reductions exceed this threshold, the project proponent may apply the *VCS Methodology Change and Requantification Procedure* and re-demonstrate additionality by applying an investment analysis.

Where the project activity meets the conditions of the investment analysis or barrier analysis, proceed to Section 8.4. Otherwise, the project activity is not additional.

8.4 Common Practice Analysis

Project proponents applying the project method to demonstrate additionality must assess whether the project activity is common practice, following the procedures and requirements of Step 4 of *VT0008*. The common practice assessment must focus on the EV charging infrastructure in the project region and may also include an assessment of EV adoption in the region.

Where the project activity meets the requirements of Sections 8.1 and 8.3 and is not a common practice, it is deemed additional. Otherwise, it is not additional.

[11] When applying *VT0008*, 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, EV charging system network service providers, and EV manufacturers/retailers).

9 QUANTIFICATION OF REDUCTIONS AND REMOVALS

9.1 Baseline Emissions

Baseline emissions are calculated by converting the electricity used to charge project applicable fleet vehicles at EV chargers into distance traveled 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:

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

Where:

BE_y	=	Baseline emissions in year y (t CO_2e)
$ED_{i,y}$	=	Electricity delivered by project EV charging systems serving applicable fleet i in project year y (kWh)
$EF_{i,f,y}$	=	Emission factor for fossil fuel f used by vehicles in comparable fleet associated with applicable fleet i in year y (t CO_2e/US gallon)
IR_i	=	Technology improvement rate factor for applicable fleet i (unitless)
$AFEC_{i,y}$	=	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 vehicles in comparable fleet associated with applicable fleet i in project year y (miles/US gallon)

Default values for $MPG_{i,y}$, $AFEC_{i,y}$, $EF_{i,f,y}$, and IR_i across LDV and HDV applicable fleets in the United States and Canada are given in the parameter tables in Section 10. Further details on the calculation of default values for $MPG_{i,y}$ and $AFEC_{i,y}$ can be found in Appendix 1.

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

$$AFEC_{i,y} = \sum_{a} (EV_{a,i,y} \times EVR_{a,i,y}) / \sum_{a} EVR_{a,i,y} \quad (2)$$

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)

$EV_{a,i,y}$ = Electricity consumption per 100 miles rating for EV model *a* in applicable fleet *i* in project year *y* (kWh/100 miles)

$EVR_{a,i,y}$ = Total number of EVs of model *a* in applicable fleet *i* on the road by project year *y* (cumulative number of EVs)

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

$$MPG_{i,y} = \sum_{a}(MPG_{a,i,y} \times EVR_{a,i,y}) / \sum_{a} EVR_{a,i,y} \tag{3}$$

Where:

$MPG_{i,y}$ = Weighted average miles per gallon rating for vehicles in comparable fleet associated with applicable fleet *i* in project year *y* (miles per US gallon)

$MPG_{a,i,y}$ = Miles per gallon for fossil fuel vehicle model in comparable fleet associated with EV model *a* from applicable fleet *i* in project year *y* (miles/US gallon)

$EVR_{a,i,y}$ = Total number of EVs of model *a* in applicable fleet *i* on the road by project year *y* (cumulative number of EVs)

9.2 Project Emissions

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

$$PE_y = \sum_{i,j} EC_{i,j,y} \times EFel_{i,j,y} \tag{4}$$

Where:

PE_y = Project emissions in year *y* (t CO_2e)

$EC_{i,j,y}$ = Electricity sourced from region *j* consumed by EV chargers serving applicable fleet *i* in project year *y* (kWh)

$EFel_{i,j,y}$ = Emission factor for the electricity sourced from region *j* consumed by project EV charging systems serving applicable fleet *i* in year *y* (t CO_2e/kWh)

Where project proponents determine the emission factor on an hourly basis, electricity consumption must also be determined for each hour and there must be no time periods in which electricity is provided but not accounted for within PE_y.

Where project proponents include associated infrastructure within their EV charging systems, project emissions must be quantified for all such sources *s* using Equation (5). This replaces Equation (4) and the following applies:

1) The electricity emission 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).
2) The associated infrastructure metering system must accurately measure and trace net electricity provided to the EV charging system (i.e., deliveries minus receipts) from all electricity sourced from / returned to the grid and dedicated renewables. This includes, for example, electricity sourced from the grid or 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 associated infrastructure metering systems.
3) PE_y cannot be negative (i.e., supplying excess renewable energy to the grid is not credited).

$$PE_y = \sum_{i,j,s} NEC_{i,j,s,y} \times EFAI_{i,j,s,y} - \sum_{i,j} LEC_{i,j,y} \times EFonsitebatt_{i,j,y} \quad (5)$$

Where:

PE_y	=	Project emissions in year y (t CO_2e)
$NEC_{i,j,s,y}$	=	Electricity consumed by EV charging systems supplied from associated infrastructure source s net of any electricity returned to this same source within region j serving applicable fleet i in project year y (kWh/year)
$EFAI_{i,j,s,y}$	=	Emission factor for electricity from associated infrastructure source s within region j consumed by EV chargers serving applicable fleet i in year y (t CO_2e/kWh)
$LEC_{i,j,y}$	=	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 $NEC_{i,j,s,y}$[12] (kWh/year)
$EFonsitebatt_{i,j,y}$	=	Emission factor for electricity from the on-site battery associated infrastructure within region j consumed by project EV charging systems serving applicable fleet i in year y (t CO_2e/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:

$$EFonsitebatt_{i,j,y} = \sum_{s} (ECB_{i,j,s,y} \times EFAI_{i,j,s,y}) \,/ \sum_{s} ECB_{i,j,s,y} \quad (6)$$

[12] Where $NEC_{i,j,s,y}$ includes all the electricity consumed by the charger and the battery (measured upstream of the battery) but does not account for any electricity lost from the battery to a building or back to the grid. See Appendix 2 for further guidance.

Where:

$EFonsitebatt_{i,j,y}$	=	Emission factor for electricity from the on-site battery associated infrastructure within region *j* consumed by project EV charging systems serving applicable fleet *i* in year *y* (t CO_2e/kWh)
$ECB_{i,j,s,y}$	=	Electricity consumed by on-site battery from associated infrastructure source *s*, where *s* is grid-connected or dedicated renewable, within region *j* serving applicable fleet *i* in project year *y* (kWh/year)
$EFAI_{i,j,s,y}$	=	Emission factor for electricity from associated infrastructure source *s*, where *s* is grid-connected or dedicated renewable, within region *j* consumed by on-site batteries serving applicable fleet *i* in year *y* (t CO_2e/kWh)

Guidance for sourcing the emission factors for other associated infrastructure sources *s* is provided in Section 10. Guidance regarding associated infrastructure metering systems is found in Appendix 2.

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

a) There must be 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).

b) The electricity emission factor for the on-site battery must be calculated using the net, time-weighted average of the grid and dedicated renewable emission factors given in Equation (6). The 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 period of the day when electricity is delivered to the on-site battery (i.e., not when delivered from the on-site battery to the EV charger).[13]

c) Provisions regarding the associated infrastructure 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.

[13] The GHG impacts for these kWh arise on the grid system when the units are first delivered into the associated infrastructure system (i.e., when the units are delivered to the on-site battery).

9.3 Leakage Emissions

Leakage is considered de minimis and is therefore set at zero.[14]

9.4 Net Reductions and Removals

Net 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:

$$ER_y = (BE_y - PE_y) \times D_y \tag{7}$$

Where:

ER_y	=	GHG emission reductions in year *y* (t CO_2e)
BE_y	=	Baseline emissions in year *y* (t CO_2e)
PE_y	=	Project emissions in year *y* (t CO_2e)
D_y	=	Discount factor to be applied in year *y* (%)

The discount factor is calculated as follows:

$$\mathrm{D_y} = \mathrm{ERC_y}/(\mathrm{ERF_y} + \mathrm{ERC_y}) \tag{8}$$

Where:

D_y	=	Discount factor to be applied in year *y* (%)
ERC_y	=	Sum of GHG credits[15] issued by all projects under this methodology (or other methodologies that support the introduction of EV charging systems) across the project's applicable fleets *i* within the project region in project year *y* – 1 (t CO_2e)
ERF_y	=	Sum of GHG credits issued by all projects under methodologies that support the introduction of EV fleets[16] located within the project region, where those projects have the same applicable fleet *i* categories as this project, in project year *y* – 1 (t CO_2e)

[14] 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 various factors. These include large distances between public DCFCs and unlikely substitution of public DCFC by public L2 charging; a very low portion of L2s are simultaneously public, accessible (e.g., not restricted to workplaces), and excluded from the project crediting period under VCS Program 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.

[15] Credits for GHG emission reductions issued under GHG programs such as the American Carbon Registry (ACR), Climate Action Reserve (CAR), the UNFCCC's Clean Development Mechanism (CDM), and the VCS Program.

[16] For example, CDM *AMS-III.C.* and VCS methodology revision *VMR0014 Electric and Hybrid Vehicles and Mobile Machinery (AMS-III.C. Revision)*

To determine ERF_y, project proponents must assess projects that introduce EV fleets based on both their location and applicable fleet category to address any potential double counting of GHG credits issued for other projects that introduce fleets of EVs and the GHG credits issued for this EV charging system project.

Project regions for this assessment are defined at a city, state, provincial, or national level for AC chargers and national level for DCFCs.

Where no GHG credits have been issued for projects that introduce EV fleets in the project region, D_y is equal to one (i.e., no discount is applied).

Where project proponents 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 agency where chargers are reserved exclusively for its own public agency fleet), and that relative to this closed or private charging network, no GHG credits have been issued for the introduction of EVs using the network, D_y is equal to one (i.e., no discount is applied).[17]

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 US-wide, while the proposed project is confined to one state), a sensible pro-rata share of the GHG credits issued for the introduction of EV fleets should be estimated for the project region (e.g., using the pro-rata number of EVs on the road in the project's state compared to the total in the US, using sources such as ZEVFacts.com).

10 MONITORING

10.1 Data and Parameters Available at Validation

Data/Parameter	IR_i
Data unit	unitless
Description	Technology improvement rate factor for applicable fleet *i*
Equations	(1)
Source of data	CDM *AMS-III.C.*
Value applied	Where baselines are calculated using annually updated parameters in Equation (1), IR_i = 1

[17] 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 the charging network, and the EV fleets that do use the network have not issued separate GHG credits of their own. It would not normally be possible to demonstrate such lack of access for public charging systems operating as open networks and therefore in this case project proponents must determine whether a discount factor must be applied.

	Where default values are used for parameters in Equation (1): • for LDV applicable fleets, IR_i = 1 • for HDV applicable fleets, IR_i = 0.99
Justification of choice of data or description of measurement methods and procedures applied	Where the baseline is calculated annually using the applicable fleet and comparable fleet statistics in each project year *y*, no technology improvement rates need to be applied since annual accurate data is used each year. IR_i is therefore set equal to one. IR_i for LDV projects using default values is equal to one 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 redesigned or updated by manufacturers. This typically takes place on a 7–10 year cycle. IR_i for HDV projects using default values is 0.99 because the default 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). The 0.99 improvement rate is applied to each calendar year. For project year 1, IR_i is equal to one.
Purpose of data	Calculation of baseline emissions
Comments	For LDV projects, default equivalent MPG values are taken from specific comparable vehicles (rather than classes of vehicles) whose MPG values are only likely to change with major model upgrades (and thus remain steady for many years).

10.2 Data and Parameters Monitored

Data/Parameter	$EF_{i,f,y}$
Data unit	t CO_2e/US gallon
Description	Emission factor for fossil fuel *f* used by vehicles in comparable fleet associated with applicable fleet *i* in year *y*
Equations	(1)
Source of data	Use values from credible international (e.g., IPCC) or national government sources (e.g., US EPA). For LDV projects located in the US or Canada: • L1/L2 (BEV and PHEV average) = 0.0088 t CO_2e per US gallon • DCFC (BEV average) = 0.0088 t CO_2e per US gallon For HDV projects located in the US: • e-buses = 0.0102 t CO_2e per US gallon • e-trucks = 0.0102 t CO_2e per US gallon Project proponents must apply the default value using units (CO_2 or CO_2e) consistent with their project boundary choices and consistent across all project activity sources.

Description of measurement methods and procedures to be applied	International and national government transportation fuel emission factors have been widely established and peer-reviewed. Calculation of US and Canada default values is shown in Appendix 1.
Frequency of monitoring/recording	Annual
QA/QC procedures to be applied	Crosscheck with default values from the *2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories*. Any difference outside the default uncertainty range must be explained and justified.
Purpose of data	Calculation of baseline emissions
Calculation method	N/A
Comments	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

Data/Parameter	$ED_{i,y}$
Data unit	kWh
Description	Electricity delivered by project EV charging systems serving applicable fleet *i* in project year *y*
Equations	(1)
Source of data	EV charger meter or telematic systems from EVs
Description of measurement methods and procedures to be applied	Measured value based on the electricity delivered by EV charging systems in year *y* Use calibrated electricity meters or smart EV charging system measurement systems. Calibration must be conducted according to the equipment manufacturer's specifications.
Frequency of monitoring/recording	Measured actual data must be monitored and recorded for each charging event. Monitoring periods for metered data may be consistent with utility reports.
QA/QC procedures to be applied	The consistency of metered electricity consumption must be cross-checked with receipts from electricity purchases where applicable.
Purpose of data	Calculation of baseline emissions
Calculation method	N/A
Comments	For L2 chargers, the electricity delivered is considered the same as electricity consumed by the chargers because L2s are highly efficient chargers with de minimis losses from their own power consumption (i.e., $ED_{i,y} = EC_{i,j,y}$).

Data/Parameter	$AFEC_{i,y}$
Data unit	kWh/100 miles
Description	Weighted average electricity consumption per 100 miles rating for EVs in applicable fleet *i* in project year *y*
Equations	(1), (2)
Source of data	Calculated using Equation (2), or use the following default values. 1) Default values for LDV projects located in the US: a) L1/L2 (BEV and PHEV average) = 33.32 b) DCFC (BEV average) = 31.88 2) Default values for HDV projects located in the US: a) e-buses = 300 b) e-trucks = 140 3) Default values for LDV projects located in Canada: a) L1/L2 (BEV and PHEV average) = 35.44 b) DCFC (BEV average) = 33.00
Description of measurement methods and procedures to be applied	Calculation of default values is shown in Appendix 1.
Frequency of monitoring/recording	Calculated annually or once per crediting period, applying the corresponding IR_i
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of baseline emissions
Calculation method	N/A
Comments	Calculations for open networks (where the exact models of EVs charging are not known) must be established using data sources compiled on a national basis (e.g., number of BEVs of each model on the road in the US for open DCFC networks). Calculations for closed networks (i.e., 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) must use the specific composition of these fleets (e.g., *EVR* is the number of e-buses on the road for that particular transit agency fleet). For both open and closed networks, the individual EV model's consumption (kWh/100 miles) must be used as applicable to the government rating agencies from which it has been sourced (e.g., nationally for the US; supranationally for the EU), including in the periodic update of default values.

	Where this parameter is calculated using Equation (2), project proponents should not include this parameter table in the project description or monitoring reports.

Data/Parameter	$MPG_{i,y}$
Data unit	miles/US gallon
Description	Weighted average miles per gallon rating for vehicles in comparable fleet associated with applicable fleet *i* in project year *y*
Equations	(1), (3)
Source of data	Calculated using Equation (3) or use the following default values. 1) Default values for LDV projects located in the US: a) L1/L2 (BEV and PHEV average) = 29.18 b) DCFC (BEV average) = 29.10 2) Default values for HDV projects located in the US: a) e-buses = 4.34 b) e-trucks = 8.60 3) Default values for LDV projects located in Canada: a) L1/L2 (BEV and PHEV average) = 29.65 b) DCFC (BEV average) = 27.71
Description of measurement methods and procedures to be applied	Calculations of US and Canada default values are shown in Appendix 1.
Frequency of monitoring/recording	Calculated annually or once per crediting period, applying the corresponding IR_i
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of baseline emissions
Calculation method	N/A
Comments	Calculations for open networks (where the exact EV models charging are not known) must be established using data sources compiled on a national basis (e.g., number of BEVs of each model on the road in the US for open DCFC networks). Calculations for closed networks (i.e., 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) must use the specific composition of these fleets (e.g., *EVR* is the number of e-buses on the road for that particular transit agency fleet). For HDV closed networks, where 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 *MPG* for the agency's own baseline bus operations can be established as the agency's comparable fleet of fossil fuel buses), project proponents may use any of the approaches in CDM *AMS-III.C.* Approach 1, Options 1–5, paragraphs 32–39. For both open and closed networks, the individual fossil fuel model's MPG rating must be used as applicable to the government rating agencies from which it has been sourced (e.g., nationally for the US; supranationally for the EU), including in the periodic update of default values. Where this parameter is calculated using Equation (3), project proponents should not include this parameter table in the project description or monitoring reports.

Data/Parameter	$EV_{a,i,y}$
Data unit	kWh/100 miles
Description	Electricity consumption per 100 miles rating for EV model *a* in applicable fleet *i* in project year *y*
Equations	(2)
Source of data	Use values from credible national governmental sources (e.g., ratings for the US provided by the US Department of Energy Fuel Economy program).[18] International sources (e.g., IPCC, IEA) or manufacturer specifications, industry reports, peer-reviewed academic publications are also eligible.
Description of measurement methods and procedures to be applied	National governmental ratings provide independent third-party public source. A conservative (i.e., higher) value must be selected where there is uncertainty in the values.
Frequency of monitoring/recording	Every five years or more frequently
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of baseline emissions
Calculation method	N/A
Comments	See guidance in the "Comments" section of the table for $AFEC_{i,y}$ above. For both open and closed networks, the $EV_{a,i,y}$ ratings must be used as applicable to the government rating agencies from which they have been sourced (e.g., nationally for the US; supra-nationally for the EU).

[18] Available at: https://www.fueleconomy.gov/feg/evsbs.shtml

Data/Parameter	$EVR_{a,i,y}$
Data unit	Cumulative number of EVs
Description	Total number of EVs of model *a* in applicable fleet *i* on the road by project year *y*
Equations	(2), (3)
Source of data	Use values from credible national governmental sources (e.g., statistics provided for the US by the Argonne National Laboratory).[19] International sources (e.g., IPCC, IEA) or manufacturer specifications, industry reports, peer-reviewed academic publications are also eligible. Closed networks may set the number of EVs on the road using the known composition and operating characteristics of the applicable fleets they serve.
Description of measurement methods and procedures to be applied	Argonne National Laboratory is an independent, trusted government source of EV data for the US market.
Frequency of monitoring/recording	Updated every five years or more frequently
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of baseline emissions
Calculation method	N/A
Comments	This value is calculated for project year *y* based on the cumulative number of EVs of each EV model type *a* in applicable fleet *i* on the road by project year *y*, consistent with guidance in the “Comments” section of the table for $AFEC_{i,y}$ above.

Data/Parameter	$MPG_{a,i,y}$
Data unit	miles/US gallon
Description	Miles per gallon for fossil fuel vehicle model in comparable fleet associated with EV model *a* from applicable fleet *i* in project year *y*
Equations	(3)
Source of data	See guidance on “Source of data” for $MPG_{i,y}$ in the table above.

[19] Argonne National Laboratory data available at: https://www.anl.gov/esia/light-duty-electric-drive-vehicles-monthly-sales-updates.

	Use values from credible national government sources (e.g., the US rating found in the Fuel Economy Guide).[20] For both open and closed networks, the ratings must be used as applicable to the government rating agencies from which they have been sourced (e.g., nationally for the US, supranationally for the EU). International sources (e.g., IPCC, IEA) or manufacturer specifications, industry reports, peer-reviewed academic publications are also eligible.
Description of measurement methods and procedures to be applied	National governmental ratings are independent, trusted government sources of fuel consumption ratings. A conservative value (i.e., higher) must be selected where there is uncertainty in the values.
Frequency of monitoring/recording	Updated every five years or more frequently
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of baseline emissions
Calculation method	N/A
Comments	Where standard emission values are provided using parameters that already incorporate fuel emission factors, values must be converted to the appropriate combination of units to establish equivalence to the parameters in the equations in this methodology.

Data/Parameter	$EC_{i,j,y}$
Data unit	kWh
Description	Electricity sourced from region *j* consumed by EV chargers serving applicable fleet *i* in project year *y*
Equations	(4)
Source of data	Electricity meter or telematic systems from EVs. For DCFCs, values must be based on the kWh consumed by the EV charging system. Values must be sourced from data from meters on the grid-side of the DCFC units / associated infrastructure. Where such data are unavailable, the chargers' own internal smart DCFC meter data may be used, provided that $ED_{i,y}$ is increased to account for a DCFC efficiency factor of 92.3%. Where a project proponent demonstrates a more accurate efficiency factor for their specific DCFC systems (e.g., due to improvements in DCFC technology efficiencies over time), the updated accurate efficiency factor may substitute the 92.3% default efficiency value.
Description of measurement methods	Measured value based on electricity consumed by EV charging systems in year *y*.

[20] Available at: https://www.fueleconomy.gov/feg/printGuides.shtml

and procedures to be applied	For data from DCFCs' internal smart meter, $EC_{i,j,y} = ED_{i,y} / 0.923$.
Frequency of monitoring/recording	Measured actual data must be monitored continuously and recorded annually or more frequently. Monitoring periods for metered data may be consistent with utility reports.
QA/QC procedures to be applied	Use calibrated electricity meters or smart EV charging system measurement systems. Calibration must be conducted according to the equipment manufacturer's specifications. The consistency of metered electricity consumption must be cross-checked with receipts from electricity purchases where applicable.
Purpose of data	Calculation of project emissions
Calculation method	N/A
Comments	For L2 chargers, the electricity delivered is considered the same as electricity consumed by the chargers because L2s are highly efficient chargers with de minimis losses from their own power consumption (i.e.. $ED_{i,y} = EC_{i,j,y}$).

Data/Parameter	$EFel_{i,j,y}$
Data unit	t CO_2e/kWh
Description	Emission factor for the electricity sourced from region *j* consumed by project EV charging systems serving applicable fleet *i* in year *y*
Equations	(4)
Source of data	According to *VT0011 Electricity System Emission Factors*
Description of measurement methods and procedures to be applied	Use *VT0011 Electricity System Emission Factors* to calculate $EFel_{i,j,y}$. The emission factor must be consistent with the region *j* from which electricity is sourced.
Frequency of monitoring/recording	Annual
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of project emissions
Calculation method	N/A
Comments	Region *j* represents any region from which electricity is sourced. Each region must have a well-documented emission factor for the electricity provided.

Data/Parameter	$NEC_{i,j,s,y}$
Data unit	kWh/year
Description	Electricity consumed by EV charging systems supplied from associated infrastructure source *s* net of any electricity returned to this same source within region *j* serving applicable fleet *i* in project year *y*
Equations	(5)
Source of data	Net electricity consumption from project chargers must be obtained for each associated infrastructure source (whether derived from the grid, dedicated renewables, or the on-site battery) as actual net electricity values using the associated infrastructure monitoring system. L2 data may be sourced from measured kWh delivered to EVs by the charger meter or consumed by the chargers from a grid-based source, since losses are de minimis. DCFC data may either be sourced via grid-side meters for each source *s* or the DCFC's own internal smart meter system capable of differentiating net kWh delivered to EVs from each source *s*. Where the internal smart meter is used, a DCFC efficiency factor of 92.3% must be applied. Where a project proponent demonstrates a more accurate efficiency factor for their specific DCFC systems (e.g., due to improvements in DCFC technology efficiencies over time), this updated accurate efficiency factor may substitute the 92.3% default efficiency value.
Description of measurement methods and procedures to be applied	Project proponents must track net electricity consumption for EV charging systems across all potential associated infrastructure sources *s* (e.g., grid, dedicated renewable sources, on-site battery), net of kWh supplied back from the EV battery to such sources. The associated infrastructure monitoring system must be used to track net kWh calculations. Associated infrastructure sources *s* for which $NEC_{i,j,s,y}$ is calculated include: 1) grid-connected electricity from region *j*. 2) dedicated renewable energy generated on-site (including renewable energy sourced from direct transmission lines). 3) the EV's on-board battery. Each grid and renewable source *s* must have a well-documented emission factor for the electricity sourced and/or dispatched. Metering systems must be calibrated according to the equipment manufacturer's specifications. Projects must incorporate adequate metering systems. Guidance for their design and application is provided in Appendix 2.
Frequency of monitoring/recording	Measured actual data must be monitored and recorded annually or more frequently. Monitoring periods for metered net data may be consistent with reports provided by the associated infrastructure monitoring system.
QA/QC procedures to be applied	The consistency of net metered electricity generation should be cross-checked with receipts and invoices from electricity purchases and sales where applicable.

Purpose of data	Calculation of project emissions
Calculation method	N/A
Comments	The associated infrastructure monitoring system must accurately measure and trace electricity deliveries and receipts from associated infrastructure sources (e.g., electricity sourced from / returned to the grid, on-site/dedicated renewables, on-site batteries, EV batteries). Applicable only where project emissions are calculated integrating multiple associated infrastructure sources s.

Data/Parameter	$EFAI_{i,j,s,y}$
Data unit	t CO_2e/kWh
Description	Emission factor for electricity from associated infrastructure source s within region *j* consumed by EV chargers serving applicable fleet *i* in year *y*
Equations	(5)
Source of data	Each associated infrastructure source s must have a well-documented emission factor for the electricity it supplies and/or dispatches as follows: 1) For grid-connected electricity from region *j*, project proponents must follow the same procedures as for parameter $EFel_{i,j,y}$. 2) Dedicated renewable energy generated on-site, including renewable energy sourced via direct transmission lines, has an emission factor of 0 t CO_2e/kWh. 3) For on-site storage batteries, project proponents must calculate the weighted average emission factor based on the proportionate net consumption of grid and dedicated renewable energy at the EV charging system (using Equation (6)).
Description of measurement methods and procedures to be applied	Guidance for the design and application of appropriate associated infrastructure metering systems is provided in Appendix 2.
Frequency of monitoring/recording	Annual
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of project emissions
Calculation method	For the grid, apply *VT0011 Electricity System Emission Factors*. For on-site batteries, use Equation (6).
Comments	Applicable only where project emissions are calculated integrating multiple associated infrastructure sources s.

	Hourly monitoring of EV charging / associated infrastructure deliveries and receipts may be applied to Equations (5) and (6).

Data/Parameter	$LEC_{i,j,y}$
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 $NEC_{i,j,s,y}$
Equations	(5)
Source of data	From on-site battery or associated infrastructure monitoring system
Description of measurement methods and procedures to be applied	$LEC_{i,j,y}$ must be measured where on-site batteries provide electricity back to the grid or local building (e.g., where used as back-up generators or sources of power) and are accounted for as consumption under $NEC_{i,j,s,y}$ but delivered outside the battery through a different connection. This electricity is not supplied to the EV charging system and does not result in EV miles driven and so is deducted from calculations. Guidance for the design and application of associated infrastructure metering systems is provided in Appendix 2. Metering systems must be calibrated according to the equipment manufacturer's specifications.
Frequency of monitoring/recording	Measured actual data must be monitored continuously and recorded hourly or at least annually.
QA/QC procedures to be applied	The provision of electricity must be cross-checked with other information sources where applicable.
Purpose of data	Calculation of project emissions
Calculation method	N/A
Comments	Applicable only where project emissions are calculated 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 source *s*, where *s* is grid-connected or dedicated renewable, within region *j* serving applicable fleet *i* in project year *y*
Equations	(6)
Source of data	Net electricity consumption from the battery must be obtained for each associated infrastructure source (whether derived from the grid or

	dedicated renewables) as actual net electricity values using the associated infrastructure monitoring system.
Description of measurement methods and procedures to be applied	Metering systems must be calibrated according to the equipment manufacturer's specifications. The associated infrastructure monitoring system must measure the electricity delivered to the on-site 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. $ECB_{i,j,s,y}$ may be equal to $NEC_{i,j,s,y}$ where measured upstream of the battery and there is a single connection between the grid and the battery or the renewable energy and the battery. Guidance for the design and application of associated infrastructure metering systems is provided in Appendix 2.
Frequency of monitoring/recording	Measured actual data must be monitored continuously and recorded annually or more frequently. Monitoring periods for metered net data may be consistent with reports provided by the associated infrastructure monitoring system.
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of project emissions
Calculation method	N/A
Comments	Applicable only where project emissions are calculated integrating multiple associated infrastructure sources s that include grid-connected electricity and/or dedicated renewable energy.

Data/Parameter	ERC_y
Data unit	t CO_2e
Description	Sum of GHG credits issued by all projects under this methodology (or other methodologies that support the introduction of EV charging systems) across the project's applicable fleet *i* within the total project region in project year $y - 1$
Equations	(8)
Source of data	Verra Registry (and other voluntary and regulated credit registries that develop similar EV charging system methodologies), with GHG credits issued from EV charging system projects within the project region (e.g., for complementary charging networks)
Description of measurement methods and procedures to be applied	Simple tallies of the total GHG credits issued from EV charging systems in project year 1 through year $y - 1$ within the project region. These GHG credits include those issued under this VCS methodology (and similar methodologies in other certification programs) whose credits arise within the same region as the project but where the credits are issued from complementary charging network systems (e.g.,

	workplace chargers from a complementary project located in the same region as the project's residential chargers).
Frequency of monitoring/recording	Annual
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of net reductions
Calculation method	N/A
Comments	None

Data/Parameter	ERF_y
Data unit	t CO_2e
Description	Sum of GHG credits issued by all projects under methodologies that support the introduction of EV fleets located within the project region, where those projects have the same applicable fleet *i* categories as this project, in project year *y* – 1
Equations	(8)
Source of data	Verra Registry (and other voluntary and regulated credit registries that develop similar EV fleet methodologies), with GHG credits issued from EV fleet projects within the project region
Description of measurement methods and procedures to be applied	Simple tallies of the total GHG credits issued for projects that introduce EV fleets within the project region from project year 1 through year *y* – 1. These GHG credits are those issued under EV fleet methodologies such as CDM *AMS-III.C.* whose credits potentially double count those issued through EV charging system projects where the applicable fleet of the EV charging system project includes fleets introduced in an EV fleet project.
Frequency of monitoring/recording	Annual
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of net reductions
Calculation method	N/A
Comments	Where GHG credits have been issued to projects introducing EV fleets for a region larger than the proposed project (e.g., the project introducing EVs is US-wide while the EV charging system project is confined to one state), a sensible pro-rata share of the GHG credits issued to the project that introduced EV fleets may be made (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).

10.3 Description of the Monitoring Plan

10.3.1 Monitoring

Project proponents 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 must be archived electronically and be kept for at least 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 reductions will not occur, project proponents must maintain an inventory of EV chargers included in the project. Project documentation must include the following for each EV charger:

1) Classification using the performance voltage, AC/DC basis, and kW power specifications given for L1, L2, and DCFC 50/100/150/320/500 definitions
2) Unique identifiers, including geospatial coordinates and one other unique reference such as National Electrical Manufacturers Association (NEMA) code, customer code, equipment serial number, charger ID code, or Alternative Fuels Data Center (AFDC) ID code

Other measures to avoid double counting 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 EV charging system's inventory.

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

a) For activities monitored once during project validation or as new project activity instances are admitted to a grouped project during verification:
    i) Inventory and geographic location for each EV charging system included in the project
    ii) Where an EV charging system's associated infrastructure is used to provide electricity to EVs 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 associated infrastructure's metering systems (e.g., meters/sub-meters and/or associated measurement systems). Guidance for metering is provided in Appendix 2.

iii) Review of any previously issued Verified Carbon Units (VCUs) for EV charging projects to check for no overlap of ownership with chargers included in the project description (e.g., using unique EV charging identifiers supplied in the project description's EV charging system inventory). For grouped projects, this applies 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).

iv) Review of any previously issued EV fleet credits to confirm the value established for the discount factor (D_y)

b) For activities monitored each year for verification for credit issuance:

i) Data on electricity consumption consistent with guidance provided in the parameter boxes in Section 10.2 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 both LDV and HDV applicable fleets, electricity consumption must be monitored separately.

ii) Supporting documentation used to determine parameters for use in quantification of annual baseline emissions where default factors (per Appendix 1) are not used.

Projects with reductions of 60 kt CO_2e per year or less that demonstrate additionality through a barrier analysis (see Section 8.3) must monitor and report whether annual reductions remain below this threshold during the crediting period. Where annual reductions exceed this threshold, reductions claimed must not exceed the 60 kt CO_2e per year threshold until the project proponent has applied the *VCS Methodology Change and Requantification Procedure* and re-demonstrated additionality by applying an investment analysis.

10.3.2 Quality Assurance and Quality Control

Project proponents 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:

1) electronic recording of values of logged parameters for each monitoring period.
2) off-site electronic back-up of all logged data.
3) 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 be applied to add confidence that all measurements and calculations have been made correctly. Some examples are:

- 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 monitoring.
- performing recalculations to make sure no mathematical errors have been made.

11 REFERENCES

Argonne National Laboratory. "Light Duty Electric Drive Vehicles Monthly Sales Updates." Argonne National Laboratory. https://www.anl.gov/esia/light-duty-electric-drive-vehicles-monthly-sales-updates

Idaho National Laboratory. n.d. *The EV Project*. Idaho National Laboratory.

US Department of Energy. 2026. *Model Year 2016 Fuel Economy Guide.* Updated version.

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

This appendix outlines the basis for the calculation of optional default values used in baseline emission calculations for US LDV and HDV projects, and Canadian HDV projects.

Project proponents must apply the default value using units (CO_2 or CO_2e) consistent with their project boundary choices and across all project activity sources.

A1.1 LDV Weighted Averages in the United States

Weighted averages for LDVs are based on:

- the total number of each BEV and PHEV model on the road by end of 2015, based on cumulative US sales data for 2010–2015 sourced from Argonne National Laboratories' monthly emails and web site.[21]
- kWh/100 miles and MPG ratings sourced from www.fueleconomy.gov or the 2016 Fuel Economy Guide.[22]
- comparable fossil fuel cars consuming gasoline.

The simple weighted average has been calculated for each applicable fleet (BEV+PHEV and BEV) based on the number of EV models of each type on the road by end of 2015 multiplied by the fleet's corresponding kWh/100 miles value ($AFEC_{i,y}$) and comparable fossil fuel vehicle's miles per gallon ($MPG_{i,y}$), which are listed in the table below.

Table 2. LDV project default values

Applicable fleet	$AFEC_{i,y}$ (kWh/100 miles)	$MPG_{i,y}$ (miles/US gallon)	$EF_{i,f,y}$
L1/L2 (BEV and PHEV average)	33.32	29.18	19.56 lbs CO_2/gal = 0.0088 t CO_2/gal or 0.0088 t CO_2e/gal
DCFC (BEV average)	31.88	29.10	19.56 lbs CO_2/gal = 0.0088 t CO_2e/gal

[21] Uses data sourced from hybridcars.com.

[22] Available at: https://www.fueleconomy.gov/feg/pdfs/guides/FEG2016.pdf

			or 0.0088 t CO_2e/gal

A1.2 HDV Weighted Averages in the United States

The following e-bus and e-truck weighted averages are based on:

- the total number of each model of e-bus and e-truck on the road in the US by the beginning of 2017, based on data sourced from IHS Markit.
- the corresponding gross vehicle weight (GVW) classification for each model of e-bus and e-truck on the road, based on 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.[23]
- average MPG ratings for the corresponding class of MDV or HDV sourced from The National Research Council of the National Academies.[24]
- the dominant baseline bus and truck fuel being diesel.

The simple weighted average is calculated for each applicable fleet (e-bus and e-truck) based on the number of EV models of each type on the road by the beginning of 2017 multiplied by the fleet's corresponding kWh/100 miles rating ($AFEC_{i,y}$) and average miles per gallon ($MPG_{i,y}$) of the equivalent GVW class of fossil fuel vehicle, which are listed in the table below.

Table 3. HDV project default values

Applicable fleet	$AFEC_{i,y}$ (kWh/100 miles)	$MPG_{i,y}$ (miles/US gallon)	$EF_{i,f,y}$
e-buses	300	4.34	22.4 lbs CO_2/gal = 0.0102 t CO_2/gal or 0.0102 t CO_2e/gal
e-trucks	140	8.60	22.4 lbs CO_2/gal = 0.0102 t CO_2e/gal or 0.0102 t CO_2e/gal

A1.3 LDV Weighted Averages in Canada

The following weighted averages are based on:

- the total number of each BEV and PHEV model on the road by the end of 2016, based on cumulative data sourced from Natural Resources Canada.

[23] Data were retrieved from Inside EVs (https://insideevs.com).

[24] Available at: https://www.nap.edu/read/12845/chapter/4#18

- comparable fossil fuel vehicles consuming gasoline.

The simple weighted average has been calculated for each applicable fleet (BEV+PHEV and BEV) based on the number of EV models of each type on the road by the end of 2016 multiplied by the fleet's corresponding kWh/100 miles rating ($AFEC_{i,y}$) and equivalent fossil fuel vehicle's miles per gallon ($MPG_{i,y}$), which are listed in the table below.

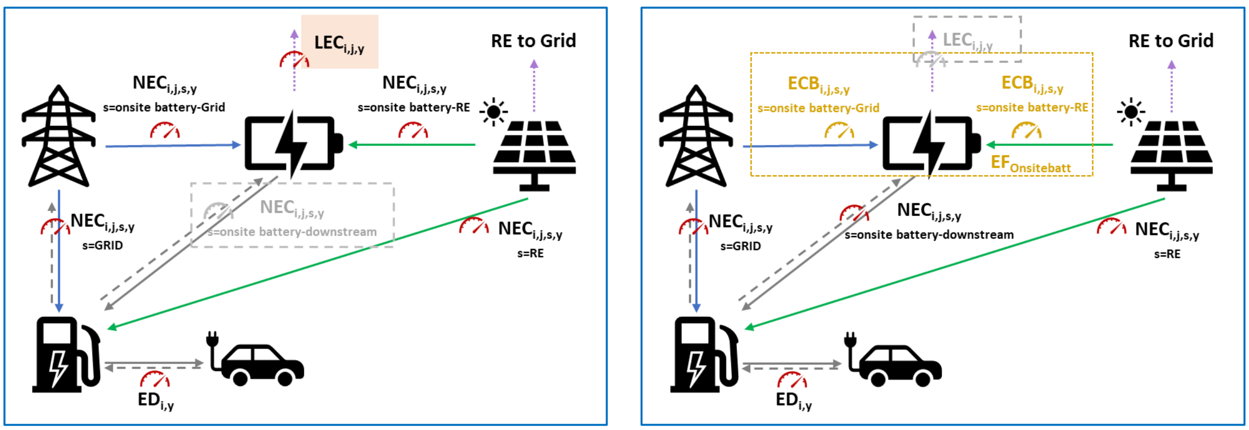
Table 4. LDV project default values for Canada

Applicable fleet	$AFEC_{i,y}$ (kWh/100 miles)	$MPG_{i,y}$ (miles/US gallon)	$EF_{i,f,y}$
L1/L2 (BEV and PHEV average)	35.44	29.65	19.56 lbs CO_2/gal = 0.0088 t CO_2/gal or 0.0088 t CO_2e/gal
DCFC (BEV average)	33.00	27.71	19.56 lbs CO_2/ga = 0.0088 t CO_2/gal or 0.0088 t CO_2e/gal

APPENDIX 2: GUIDANCE FOR DESIGN OF ASSOCIATED INFRASTRUCTURE METERING SYSTEMS

This appendix outlines guidance for the design and application of associated infrastructure metering systems in EV charging systems to adequately measure electricity exchanges when associated infrastructure is incorporated into projects and affects determination of project emissions, as shown in Figure 1. Where associated infrastructure is incorporated into the project boundary, Equations (5) and (6) are applicable.

Figure 1. Examples of associated infrastructure and electricity flows



Left: Metering systems upstream of the battery. Battery–charger flows are not needed (gray dotted box). $NEC_{i,j,s,y}$ onsite battery-grid = $ECB_{i,j,s,y}$ grid and $NEC_{i,j,s,y}$ onsite battery-renewable energy (RE) = $ECB_{i,j,s,y}$ renewable energy.

Right: Metering systems downstream of the battery. Battery–charger flows are measured and the associated $EFAI_{i,j,s,y}$ must be determined for the $EFonsitebatt_{i,j,y}$. $LEC_{i,j,y}$ is not needed ($LEC_{i,j,y} = 0$).

$$PE_y = \sum_{i,j,s} NEC_{i,j,s,y} \times EFAI_{i,j,s,y} - \sum_{i,j} LEC_{i,j,y} \times EFonsitebatt_{i,j,y} \tag{5}$$

Where:

PE_y	=	Project emissions in year y (t CO_2e)
$NEC_{i,j,s,y}$	=	Electricity consumed by EV charging systems supplied from associated infrastructure source s net of any electricity returned to this same source within region j serving applicable fleet i in project year y (kWh/year)

$EFAI_{i,j,s,y}$	=	Emission factor for electricity from associated infrastructure source s within region j consumed by EV chargers serving applicable fleet i in year y (t CO_2e/kWh)
$LEC_{i,j,y}$	=	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 $NEC_{i,j,s,y}$[25] (kWh/year)
$EFonsitebatt_{i,j,y}$	=	Emission factor for electricity from the on-site battery associated infrastructure within region j consumed by project EV charging systems serving applicable fleet i in year y (t CO_2e/kWh)

$$EFonsitebatt_{i,j,y} = \sum_{s}(ECB_{i,j,s,y} \times EFAI_{i,j,s,y}) \,/\, \sum_{s} ECB_{i,j,s,y} \tag{6}$$

Where:

$EFonsitebatt_{i,j,y}$	=	Emission factor for electricity from the on-site battery associated infrastructure within region j consumed by project EV charging systems serving applicable fleet i in year y (t CO_2e/kWh)
$ECB_{i,j,s,y}$	=	Electricity consumed by on-site battery from associated infrastructure source s, where s is grid-connected or dedicated renewable, within region j serving applicable fleet i in project year y (kWh/year)
$EFAI_{i,j,s,y}$	=	Emission factor for electricity from associated infrastructure source s, where s is grid-connected or dedicated renewable, within region j consumed by on-site batteries serving applicable fleet i in year y (t CO_2e/kWh)

When incorporating associated infrastructure, the metering system must adequately and accurately measure and trace net electricity kWh provided to the EV 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 to such sources from the EV batteries.

Associated infrastructure metering systems may include:

- "downstream" meters close to the EV, such as those provided by DCFC onboard meters (and referenced specifically in the $ED_{i,y}$ parameter for kWh delivered by a charger to the EV which applies to baseline emissions calculations).
- "upstream" meters, located grid-side (e.g., meters monitoring electricity (in kWh) delivered to on-site batteries, which could be designed or applied to measure the kWh that a charger consumes for NEC parameter measurements for project emissions calculations).

Where a system's meters are located "upstream," any electricity sourced from associated infrastructure sources (notably from solar and on-site battery) and delivered outside the EV charging system (e.g.,

[25] Where $NEC_{i,j,s,y}$ includes all the electricity consumed by the charger and the battery (measured upstream of the battery) but does not account for any electricity lost from the battery to a building or back to the grid

delivered to the grid or local building when the on-site battery is used as a back-up generator source) must be taken into account for quantification, as follows:

1) Any electricity that the on-site battery provides back to the grid or to its building in a given year must be measured and subtracted (as $LEC_{i,j,y}$). These kWh represent losses to the overall EV 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), the on-site battery does not need to be accounted for as a separate source; it acts as a flow-through for the grid and renewable sources. Any electricity received from the EV would be returned to the EV. Therefore, the on-site battery supplies 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 on-site battery represents 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 $LEC_{i,j,y}$ if subsequently delivered back to the grid via the on-site battery. Therefore, transfers of electricity from the EV to the on-site battery can be set aside.
4) Project proponents must be able to measure or estimate the electricity supplied from the grid and/or from dedicated renewable sources to the EV charging system. This may be a subset of the total electricity from a source. For example, the electricity delivered to the EV charging system may be less than the total electricity generated by on-site renewables where the renewables also provide power back to the grid within a particular associated infrastructure system.[26] The total grid electricity delivered to the system may be shared across the EV charger and the on-site battery where electricity is provided to both in parallel – the former contributing to $NEC_{i,j,s,y}$ from the grid source and the latter to $NEC_{i,j,s,y}$ for the on-site battery.

Where the system's meters are located "downstream," any electricity sourced from associated infrastructure sources must be taken into account for quantification, as follows:

a) Downstream meters located in the chargers' internal systems may be used provided appropriate efficiency factors are applied to take account of a charger's own electricity consumption. Where downstream measurement of project emissions is applied:
    i) Efficiency factors must be applied to account for potential efficiency losses due to the chargers' own consumption.
    ii) For L2s, such efficiency losses are de minimis[27] and no efficiency factor is applied.
    iii) For DCFCs, where electricity data are sourced from "downstream" meters located within the DCFC's own internal smart meter systems, the electricity consumed by the DCFC

[26] At a future date, project proponents 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. Renewable Electricity Generation for Captive Use and Mini-Grid*.

[27] Per Idaho National Laboratory

charger is obtained by applying a DCFC default efficiency factor of 92.3% to metered kWh readings. This approach assumes that the DCFC smart meters can differentiate net kWh delivered to EVs from each source *s* during time period *t*.

iv) DCFCs may use measurements from "upstream" meters on the grid-side of the DCFC unit / associated infrastructure. However, DCFC internal smart meters often provide more sophisticated metering capabilities for time-of-day applications.

b) Where meters are located downstream for the measurement of $NEC_{i,j,s,y}$ pertaining to the on-site battery, the electricity measured must already be net of any $LEC_{i,j,y}$ losses from the on-site battery to the grid and thus $LEC_{i,j,y}$ must be set at zero. This is consistent with DCFC measurement systems which track electricity exchanges close to the point of delivery to the EV. The electricity provided by the EV to the on-site battery must also be measured.

c) Where the EV delivers vehicle-to-grid (V2G) services in which electricity from the car's on-board battery is returned directly to the grid, this EV-sourced electricity is netted out in the calculation of $NEC_{i,j,sy}$ for grid source s).

Where EV charging systems include simple associated infrastructure settings (e.g., residences using L1/L2 systems where "upstream" metering systems apply) and the associated infrastructure system elements are limited (e.g., no on-site battery), quantification of emissions from project associated infrastructure systems may be simplified using estimates. For example, where a household residence has a solar panel that is grid-connected and its total solar kWh production and grid sales are metered but there is no separate sub-meter to establish solar kWh supplied to the EV charging system, it may be assumed that the kWh delivered to the EV charger is the same weighted average as the solar/grid kWh mix consumed by the household (i.e., from sources whose electricity would have been separately metered). Utility-style modeling may be used for settings where only the net electricity consumption or generation is measured for a household in order to establish the electricity delivered by both the grid and 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, EV 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

Uncertainty of baseline and project vehicle performance is the main driver of the overall uncertainty of reductions. Baseline emissions are determined based on the monitoring of electricity supplied to EVs. This data is used to calculate the distance traveled, by applying the performance of the EV ($AFEC_{i,y}$ in kWh/100 miles), and transforming this into fossil fuel consumption avoided using the miles per gallon rating (MPG) associated with the baseline fossil fuel vehicles.

For closed charging networks, 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 applicable fleet are determined conservatively by requiring the selection of the highest value when a range is identified, which reduces estimated reductions and thus is conservative.

DOCUMENT HISTORY

Version	Date	Comment
v1.0	18 Sep 2018	Initial version
v1.1	19 August 2026	Minor revision, including the following updates: • Addition of applicability condition with EV stock and sales share limit • Incorporation of corrections and clarifications issued on 20 September 2023 • Adoption of VCS tools *VT0008* and *VT0011* • Simplification of quantification approach • Enhanced monitoring requirements • New appendices • Adoption of the latest VCS methodology template