



VCS Methodology Module

VMD0049

Activity Method for Determining Additionality of Electric Vehicle Charging Systems

Version 1.0

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Sectoral Scopes 1 & 7

This methodology was developed by the Climate Neutral Business Network, a project of Strategic Environmental Associates Inc, based upon generous support from the EV Charging Carbon Coalition (EVCCC).



The EVCCC seeks to open up access to the carbon capital markets for EV charging systems in order to strengthen their business case fundamentals and accelerate deployment. Beyond GM's business case development, founding members include:

- Electrify America LLC/Audi of America
- Exelon
- EVgo Services LLC
- Siemens
- Connecticut Green Bank
- Carbon Neutral Cities Alliance (including Portland, San Francisco, Seattle, Palo Alto, NYC, Minneapolis, Vancouver BC, Sydney, Adelaide, AU)



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1 SUMMARY DESCRIPTION OF THE MODULE

This activity method module is intended for use in conjunction with VCS methodology *VM0038 Methodology for Electric Vehicle Charging Systems*. This module identifies a positive list of activities that are deemed additional and do not require further demonstration or assessment of additionality.

To simplify the positive list included in this module, regions for which project activities are deemed automatically additional are presented only at the national level, as all sub-regions evaluated have also been deemed additional. Where future versions of the module have evaluated sub-regions to no longer be deemed additional, and thus a region is segmented into national, sub-national and/or local regions which are included on positive and negative lists¹, the status of the smallest region governs the determination of additionality for each project activity instance (i.e., for each project charger) located within that region².

Additional guidance on the process for evaluating new regions for inclusion in the positive list and periodic reassessment of this module can be found on the Verra website.

2 APPLICABILITY CONDITIONS

This module applies to project activities which install EV charging systems, including their associated infrastructure, 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.

For both light-duty vehicle (LDV) and heavy-duty vehicle (HDV) projects, this module is applicable under the following conditions:

- 1) The project is located in a region(s) listed in Tables 1 and 2 below. These are the regions for which activity penetration of EVs has been demonstrated to be less than five percent, as differentiated by LDVs (Table 1) and HDVs (Table 2).

¹ For example, there may be future instances where at a national level, percent activity penetration may be below five percent, but certain states may be above five percent activity penetration. Additionally, local regions within these states may at the same time be below five percent (e.g., rural areas). In these instances, each of these regional segmentations may be included in both positive and negative lists concurrently. Further guidance on the assessment of national, sub and local regions can be found in the assessment of the United States as discussed in Appendix A.

² For example, a national region can therefore be on the positive list, a sub-region on the negative list and local regions within that sub-region can be on the positive list. In such combined cases, all EV chargers in the national region outside of the sub-region listed negatively and those EV chargers in the local regions positively listed are deemed additional. Therefore, when regions are combined in this fashion, the listing of specific regions on a negative lists does not impact the additionality standing for project instances located in related regions on a positive list.

Light Duty Vehicles:

Table 1: List of Countries and Applicable LDV EV Classes

BEV Applicable Fleets (DCFC)	BEV/PHEV Applicable Fleets (L1/L2)
Australia	Australia ³
Austria	Austria
Belgium	Belgium
Bulgaria	Bulgaria
Canada	Canada
China	China
Croatia	Croatia
Cyprus	Cyprus
Czech Republic	Czech Republic
Denmark	Denmark
Estonia	Estonia
Finland	Finland
France	France
Germany	Germany
Greece	Greece
Hungary	Hungary
Iceland	Iceland
India	India
Ireland	Ireland
Italy	Italy
Japan	Japan
Korea	Korea
Latvia	Latvia
Lichtenstein	Lichtenstein
Lithuania	Lithuania
Luxembourg	Luxembourg
Malta	Malta

³ <https://reneweconomy.com.au/australias-ev-options-vs-the-worlds-why-are-we-waiting-82878/>

Netherlands	Netherlands ⁴
Poland	Poland
Portugal	Portugal
Romania	Romania
Slovak Republic	Slovak Republic
Slovenia	Slovenia
South Africa	South Africa
Spain	Spain
Sweden	Sweden
Switzerland	Switzerland
Turkey	Turkey
United Kingdom	United Kingdom
United States of America	United States of America

Heavy Duty Vehicles:

Table 2: List of Countries and Applicable HDV EV Fleets

E-bus	E-truck
United States of America	United States of America

- 2) The applicable fleets of HDV projects must be limited to e-buses and e-trucks.
- 3) Where projects contain a combination of EV charging systems serving different applicable fleets (e.g., including both L1/L2 and DCFC systems), project proponents must assess a region's inclusion in the positive list for each of the project charging system's applicable fleets independently. For example, for LDV projects, project proponents must assess whether a region is included on the positive list separately for a combined BEV and PHEV applicable fleet (i.e., for the L1s/L2s), and for the BEV applicable fleet (i.e., for the DCFCs). Additionally, for HDV projects, project proponents must assess whether a region is included for e-buses and for e-trucks separately.

For both light-duty vehicle (LDV) and heavy-duty vehicle (HDV) projects, this module is not applicable under the following conditions:

⁴ In 2016, IEA projected Netherlands' EV Market Share as 4% by 2020, as seen in Table 3 of the report, which is still under the 5% threshold. https://www.iea.org/publications/freepublications/publication/Global_EV_Outlook_2016.pdf

- 1) The project is located in a region(s) listed in Tables 3 and 4 below. These are the regions for which activity penetration of EVs has been demonstrated to be over five percent, as differentiated by LDVs (Table 3) and HDVs (Table 4).

Light Duty Vehicles:

Table 3: List of Countries and Applicable LDV EV Classes

BEV Applicable Fleets (DCFC)	BEV/PHEV Applicable Fleets (L1/L2)
Norway ⁵	Norway ⁶

Heavy Duty Vehicles:

Table 4: List of Countries and Applicable HDV EV Classes

E-bus	E-truck
None	None

3 PROCEDURES

This module uses an activity method for the demonstration of additionality. Projects that comply with the following steps are deemed automatically additional:

Step 1: Regulatory Surplus

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

Step 2: Positive List

The applicability conditions of this module represent the positive list. The project proponent must demonstrate using appropriate documentation that the project activity meets all of the applicability conditions, and in so doing, the project activity is deemed as compliant with the positive list.

4 REFERENCES

American Public Transportation Association (APTA), emailed communications with data from its US database

International Energy Agency (2016), *Global EV Outlook 2016*

Statistics Norway, *Registered vehicles, 2015 and 2017*

IHS Markit for US LDV and HDV on the road statistics by region

ZEVFACTS.com, <http://www.zevfacts.com/sales-dashboard.html>

⁵ <https://www.ssb.no/en/transport-og-reiseliv/statistikker/bilreg/aar/2016-03-30> gives the 2015 BEV results; updated for 2017, please see: <https://www.ssb.no/en/transport-og-reiseliv/statistikker/bilreg>

⁶ <https://www.ssb.no/en/transport-og-reiseliv/statistikker/bilreg> Given that BEVs are over 5% BEV and PHEV combined applicable fleets will also be over 5%

APPENDIX A: JUSTIFICATION OF THE ACTIVITY PENETRATION OPTION

Definitions

In addition to the definitions set out in VCS document *Program Definitions* and the latest version of VCS methodology *VM0038 Methodology for Electric Vehicle Charging Systems*, the following definitions apply to this Appendix A. These definitions are provided to add clarity to the discussion regarding justification of the activity penetration option further below.

Core-based Statistical Area (CBSA)

Regions in the U.S. classified in this module as a local region, which represents major metropolitan and economic regions, as defined by the U.S. federal government⁷. IHS Markit analyzes data from 935 such CBSA regions in the U.S. which represent the regions across which LDV EVs would typically be driving given their current ranges⁸.

Electric HDV bus (e-bus)

HDV vehicles with bus classifications (BEV and PHEV) powered by electricity energy delivered by external charging systems and reliant upon e-buses' on-board batteries to sustain propulsion. E-buses exclude catenary/third rail vehicles. E-buses are defined as HDV vehicles in this module, consistent with VCS methodology *VM0038 Methodology for Electric Vehicle Charging Systems*.

Electric HDV trucks (e-trucks)

HDV vehicles with truck classifications (BEV and PHEV) powered by electricity energy delivered by external charging systems reliant upon e-trucks' on-board batteries to sustain propulsion. E-trucks are defined as HDV vehicles in this module, consistent with *VM0038 Methodology for Electric Vehicle Charging Systems*

EV Market Share Proxy

Number of annual sales of an applicable fleet's EVs as a percentage of total EV applicable fleet sales during that same time period within a geographic region, segmented across LDV and HDV sectors.

HDV EV Market Share

The number of HDV EVs (e-bus, e-truck) in the applicable fleet on the road as a percentage of the total HDV vehicles in this category (buses, trucks respectively) on the road

Local Region

A region applicable to the project boundary and contained within the sub-regional boundary, which forms a widely accepted regional delineation and upon which positive lists have been developed (e.g., for the U.S.: CBSAs)

⁷ https://www.census.gov/geo/reference/gtc/gtc_cbsa.html

⁸ IHS Markit defines CBSA as a geographical area consisting of a county or counties associated with at least one core, plus adjacent counties. CBSAs have five-digit numeric codes, assigned to the 935 metropolitan and micropolitan statistical areas defined by the Office of Management and Budget (OMB).

National

A region applicable to the project boundary delineated by a country's national boundaries

Region

Any region applicable to the project boundary, including national, sub-regional and local regional areas

Sub-Region

A region applicable to the project boundary and contained within the national boundary, which forms a widely accepted regional delineation and upon which positive lists have been developed (e.g., for the US: states)

Background and Analysis Approach

As California's ambitious GHG reduction plans attests, the shift in transportation from conventional fossil fuel vehicles to electric vehicles is essential for the state's goals to be reached. Leading experts such as the U.S. Department of Energy have also recognized the essential role which EV charging infrastructure plays, citing a six-fold increase in EV deployment when workplace chargers were installed.⁹

Nonetheless, the level of EV market share penetration across all countries analyzed for the development of this activity method was found to be extremely low and still well under five percent. Consistent with Verra precedents, where activity method positive lists have been developed at the country level, underlying drivers (socio-economic, climate change, etc.) were not found to have significant variances in the countries listed. However, incentives to motivate EV purchases were found to vary on a regional basis in the U.S. by state. As a result, extensive analysis was undertaken to determine whether the resulting EV market shares in U.S. sub-regions (states) and local regions (CBSAs) varied substantially, or were over five percent. At the conclusion of that analysis, all U.S. EV market shares by sub- and local regions were found to be well under five percent and to not exhibit significant variance. Similar results were also found for Canada. As a result of such consistent findings, we concluded that a sub-regional assessment was not required for other countries and so positive lists were therefore put forward at the country level¹⁰. The U.S. sub-regional analysis included in this module can, nonetheless, be used as a test case for analyzing other regions in the future.

Regional Assessments

For both LDV and HDV applicable fleets, the following regions have been evaluated to determine inclusion in the positive list:

- 1) Countries included in Table 11 of the *EIA EV Global Outlook* (see Figure A1 below) whose EV market share proxy statistics for LDVs, as listed in the 2016 edition, from which VCS methodology *VM0038 Methodology for Electric Vehicle Charging Systems* positive list has been derived, rendered them eligible.

⁹ DoE/INL EV Project reports, <https://avt.inl.gov/project-type/ev-project>

¹⁰ Similar variance analysis would be undertaken as the positive list is updated each 5 years under current VCS rules.

- 2) Australia and European countries whose EV market share statistics for LDVs rendered them eligible for the positive list, but were not listed Table 11 of the *EIA EV Global Outlook*.
- 3) Within the U.S., states or selected local regions whose EV market share and/or EV market share proxy statistics of LDVs rendered them eligible for the positive list.
- 4) Within the U.S., states whose HDV EV market share statistics rendered them eligible for the positive list.

Market Share Tests

The regions discussed above were assessed by considering the following:

Step 1: The EV market share proxy test (an annual sales based penetration rate for which data is typically more readily available) was applied and assessed for the region.

Step 2: If the region was not qualified using the proxy metric, the region was assessed with the EV market share test, which was the final determinative test in order to qualify for the positive list.

Market share penetration was determined based on the EV market share results for the applicable fleets in a given region as the governing, determinative metric (based upon vehicles on the road). In some regions, information is more readily accessed using the EV market share proxy determined by sales (i.e., EVs sold in a given year as a percentage of total vehicle sales). The EV market share proxy determined by sales is a conservative alternative test for the EV market share penetration test, which is the determinative applicability condition for a region to pass the activity penetration positive list. Therefore, this testing approach overall is conservative.

For all regions analyzed to date, EV market share proxy metrics are higher than EV market share metrics since a) proxy rates have gradually been rising over time so EV market share rates will average to be lower as a cumulative metric over time; b) total vehicles on the road (the denominator in the EV market share metric) includes all vehicles on the road, not just those sold since EV sales began, and thus a smaller market penetration figure results.

U.S. Case Study Analysis

In the U.S. case study analysis, due to the variance in socio-economic incentives by state, eligibility of chargers serving LDVs was also considered on a national, sub-regional (state) and local regional (CBSA¹¹) basis. For chargers serving U.S. HDV vehicle charging, eligibility was considered on a national and sub-regional (state) basis. The smallest regions examined were consistent with the typical range for LDV and HDV EVs.

The U.S. analysis covered a series of in-depth regional cases in order to examine whether significant variances in EV market share results might arise. This includes the following scenarios:

¹¹ The CBSA metro area is consistent with typical EV driving ranges

- A larger region's market share was above five percent (and so would not be included in this module's positive list), but smaller regions' EV market share penetration rates were still below five percent, and thus such smaller regions would still be included on the positive list. Projects would then earn credits within the smaller region's domain.
- A smaller region's market share penetration rate was over five percent but the larger region's market share was still below five percent, whereupon the larger region would be listed on the positive list and the smaller region would be cited on the module's negative list. Projects would then earn credits for areas it covers except for those within the smaller region's domain.

The analysis included cases where smaller regions' EV market share penetration could at some point reasonably be expected to exceed five percent, whereupon during periodic five-year updates it would be demonstrated that such regions were still below five percent in order to be referenced in the positive list¹².

In the detailed U.S. case study, spanning different applicable fleets, the analysis evaluated such smaller regions as follows:

- For LDV projects, the smallest region for which the EV market share penetration rate was assessed in the U.S. (if sub-national regions such as states' market shares are approaching five percent) was a CBSA since these are the areas where EV market penetrations are rising more rapidly and these regions reflect the typical BEV/PHEV driving ranges. This analysis was conducted in states to assess whether the state-wide market share was approaching five percent.
 - CBSAs are U.S. federally defined regions (935 of them) which represent major metro regions across which EVs would typically be driving given their current range. The CBSA is therefore considered the more applicable region upon which to assess BEV and PHEV market share penetration rates than the city or other smaller regions, since typical EV driving takes place outside these smaller local regions (e.g., during the typical 30-40 mile US commuter journey). CBSA are therefore the smallest local region under which, in the U.S., the positive list would be applied.
- For HDV projects, the smallest region for which the HDV EV market share penetration rate was assessed is the sub-regional level. In the U.S., this was the U.S. states. This level was selected for the following reasons:
 - Transit bus agencies typically operate across multiple U.S. cities, so such local regions would be overly constrained as an indicator of market penetration as such a "market" would be a subset of a transit agency's own fleet which is not an indicator of market-wide penetration rates.

¹² Detailed guidance on how to apply project regions (national, sub-regional and local) is given in section 4. Guidance on how to assess new regions for inclusion on the positive list can be found in a guidance document published on the Verra website.

- U.S. penetration rates for e-trucks are still extremely low (0.006% of total HDV on the road), thus state level rates are also going to be far below five percent. HDV e-trucks also operate across regions far broader than cities.

U.S. Case Study Findings

As can be seen with the regional and sub-regional analysis of the U.S., charging systems located in any ineligible regions (whose market share penetration rate exceeded five percent) would then have been excluded from a project's eligible charging system inventory, without adversely impacting the additionality standing of the project's remaining charging systems. As a result, on the national basis the U.S. still had an EV market share below five percent. However, if a state such as California had been found to have an EV market share over five percent whilst CBSA regions in California still had EV market share below five percent, the U.S. and the qualifying California CBSA regions would have been designated on the positive list, while the state of California included on the negative list in the module. In such cases, a new project (when applying such a combined set of positive and negative listed regions) would still have been considered additional for chargers located in the U.S. outside California, and within the positive California CBSA regions. Only chargers located in California outside of the positive CBSAs would be excluded. Thus, the additionality standing of an excluded region does not affect the additionality standing of other larger or smaller related regions provided they have an EV market share under five percent. Any such project charging systems excluded under the positive list test because their EV market share was above five percent in this way would nonetheless have been able to seek inclusion in the project using the Step 3 project testing (see Section 7 of VCS methodology *VM0038 Methodology for Electric Vehicle Charging Systems*).

Therefore, based upon the findings of the U.S. case study, in cases where a larger region's market share is above five percent (and so will not be included in the positive list), smaller regions' EV/HDV EV market share penetration rates, when remaining below five percent, can still be put forward for inclusion on the positive list. For example, a sub-regional state could still be included on the positive list even when the national EV/HDV EV market share penetration rate is above five percent and precluded the national region's positive listing.

Similarly, based upon the U.S. case study findings, positive list assessments are subject to some minimum specifications for the applicability of sub-regional and local region definitions. For LDVs in the U.S., the smallest local region subject to such testing is CBSA, which can reasonably be assumed to be the metro area consistent with typical EV driving ranges. For HDV e-buses and e-trucks in the U.S., the smallest region subject to such testing will be the state, and therefore local region positive lists are not required under the positive list for HDVs. HDV projects' applicable fleets are limited to e-buses and e-trucks in these regions for the current version of the activity method, but other categories of HDV's could be included in future module extensions. This provides minimum geographic regions under which positive list can be applied in order to be consistent with the typical range under which the applicable fleet's EVs are driving.

Lastly, the equations presented below are therefore presented for both EV market share and EV market share proxy tests for LDV projects, alongside EV HDV market share tests for HDV projects. The results

for the positive lists already generated are also shared below, with commentary regarding the data consistency within defined regions.

Quantification of Activity Penetration

For the purposes of this module, the positive lists were established following the requirements of Option A in the *VCS Standard* following $AP = X/MAP$ which has been applied to the below equations, with updated parameters reflecting the EV market share assessment. The below equations were applied in 2016 satisfying the requirement that they be applied on a timely basis using data from year w which would be taken from within 36 months of the publication date of this module.

Light Duty Electric Vehicles

For any region to be included in the module's positive list, Equation 1 must be satisfied, applying the EV market share metric. Given that the EV market share proxy is more conservative than the EV market share rate as discussed above, if Equation 2 is satisfied for a given country or region, using the EV market share proxy metric, Equation 1 will be deemed to have been satisfied for that country or region. Equation 1, EV Market Share, thus governs and is determinative.

Equations 1 or 2 were applied to all regions of the positive list to calculate the EV market share or market share proxy for each LDV applicable fleet.

Using the EV market share metric, Equation 1 is given as:

$$\frac{EV_{i,x,w}}{LDV_{x,w}} \leq 0.05 \quad (1)$$

Where:

$EV_{i,x,w}$ = Number of LDV EVs on the road in the applicable fleet i in region x by year w (# vehicles)

$LDV_{x,w}$ = Total number of LDVs on the road in the same region x by year w (# vehicles)

Using the EV market share proxy determined by sales metric, Equation 2 is given as:

$$\frac{EVS_{i,x,w}}{LDVS_{x,w}} \leq 0.05 \quad (2)$$

Where:

$EVS_{i,x,w}$ = Number of LDV EVs in the applicable fleet i sold in region x during year w (# vehicles)

$LDVS_{x,w}$ = Total number of LDVs sold in the same region x during year w (# vehicles)

The applicability conditions require that projects must apply the positive list separately for its L1/L2 and DCFC systems' applicable fleets independently. As a result, a given region which will have applied Equations 1 or 2 for each applicable fleet, may be featured on the positive list for DCFC systems (based

on BEV EV market share penetration rates) even while it is not on the positive list for L1/L2 systems (based on total BEV and PHEV EV market share penetration rates)

Heavy Duty Vehicles

Equation 3 was applied to the U.S. to calculate the HDV EV market share for HDV applicable fleet. A proxy test for HDV EV market share was not applied.

For HDV vehicles, Equation 3 was applied to determine the HDV EV market share metric.

$$\frac{EVHDV_{i,z,x,w}}{VHDV_{x,z,w}} \leq 0.05 \quad (3)$$

Where:

$EVHDV_{i,z,x,w}$ = Number of HDV EVs in applicable fleet i of category z on the road in region x in year w (# vehicles)

$VHDV_{x,z,w}$ = Total number of HDV vehicles of category z on the road in the same region x in year w (# vehicles)

The applicability conditions require that projects must apply the positive list separately for its HDV e-buses and e-trucks applicable fleets independently. As a result, a given region which will have applied Equation 3 for each applicable fleet category may be featured on the positive list for one applicable fleet but not for the other.

Results, Data Sources, and Variability

Light Duty Electric Vehicles

National Assessment

Figure A1 lists countries that have an EV market share proxy penetration rates determined by sales as below five percent based on *IEA EV Global EV Outlook 2016* report for both BEVs and/or BEV/PHEV fleets. Australian EV market share proxy rates are also *de minimis*¹³ estimated as below 0.12%.

It is noticeable that national EV market share proxy penetration rates remain below one percent for many years until an inflexion point is reached and rates rise more dramatically (see IEA Figure A1). The national region's market penetration rates are therefore a reasonable basis of assessment during the EV market's early development.

Even in the U.S., where the detailed case study analysis was conducted, the national EV market share proxy averaged 0.7% in 2016 (per IEA and Union of Concerned Scientists). California, the state with the highest EV market sales penetration rate, averaged a three percent proxy penetration rate¹⁴, still under the five percent threshold (see more in-depth discussion of this below).

¹³<https://reneweconomy.com.au/australias-ev-options-vs-the-worlds-why-are-we-waiting-82878/> and https://en.wikipedia.org/wiki/Electric_car_use_by_country#Australia

¹⁴ <http://www.ucsusa.org/sites/default/files/attach/2016/08/Electrifying-Vehicle-Market-full-report.pdf>

This U.S. market proxy penetration rate is also corroborated by Argonne National Laboratory as 0.66% in 2016, from its monthly emails listing EV sales as percent total LDV sales.

For two countries whose EV market share proxy was over 5% in the IEA Figure A1, the EV market share was further evaluated. In 2016, the IEA projected Netherlands' EV market share (BEV+PHEV) as four percent by 2020¹⁵, still under the five percent threshold. In 2016, the government's Statistics Norway reported that, by the end of 2015, BEVs were 2.6% of total passenger cars on the road, below the five percent threshold.¹⁶ However, by early 2018, Statistic Norway reported that BEVs were 5.1% of total passenger cars on the road, breaching the 5 percent threshold¹⁷. Accordingly, Norway has been placed on the negative list for both BEV and BEV/PHEV applicable fleets.

Figure A1: EV Market Shares

Electric cars: Market share

Table 11 • Electric cars (battery electric and plug-in hybrid), market share by country, 2005-15

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Canada							0.0%	0.1%	0.2%	0.3%	0.4%
China						0.0%	0.0%	0.1%	0.1%	0.4%	1.0%
France							0.1%	0.3%	0.5%	0.7%	1.2%
Germany							0.1%	0.1%	0.2%	0.4%	0.7%
India						0.0%	0.0%	0.1%	0.0%	0.0%	0.1%
Italy								0.0%	0.1%	0.1%	0.1%
Japan					0.0%	0.1%	0.4%	0.5%	0.6%	0.7%	0.6%
Korea							0.0%	0.1%	0.1%	0.1%	0.2%
Netherlands						0.0%	0.2%	1.0%	2.5%	3.9%	9.7%
Norway				0.2%	0.1%	0.3%	1.5%	3.2%	5.8%	13.7%	23.3%
Portugal							0.1%	0.1%	0.2%	0.2%	0.7%
South Africa											0.1%
Spain							0.1%	0.1%	0.1%	0.2%	0.2%
Sweden							0.1%	0.3%	0.5%	1.4%	2.4%
United Kingdom							0.1%	0.1%	0.2%	0.6%	1.0%
United States						0.0%	0.1%	0.4%	0.6%	0.7%	0.7%
Others*							0.0%	0.1%	0.1%	0.3%	0.7%
Total**				0.0%	0.0%	0.0%	0.1%	0.2%	0.3%	0.5%	0.9%

* Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Greece, Hungary, Iceland, Ireland, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Poland, Romania, Slovak Republic, Slovenia, Switzerland, Turkey.

** The total market share is calculated for all the countries covered above.

Sub-national Assessment

Figures A2, A3, and A4 list U.S. sub-regions, whose EV market share or EV market share proxy penetration rates have also been confirmed as below five percent for both BEV and BEV/PHEV fleets.

Sub-regional data has been collected to form a positive list for the U.S., where all states, including California, have an EV market share penetration rate of below five percent. This data was collected on a

¹⁵ https://www.iea.org/publications/freepublications/publication/Global_EV_Outlook_2016.pdf

¹⁶ <https://www.ssb.no/en/transport-og-reiseliv/statistikker/bilreg/aar/2016-03-30>

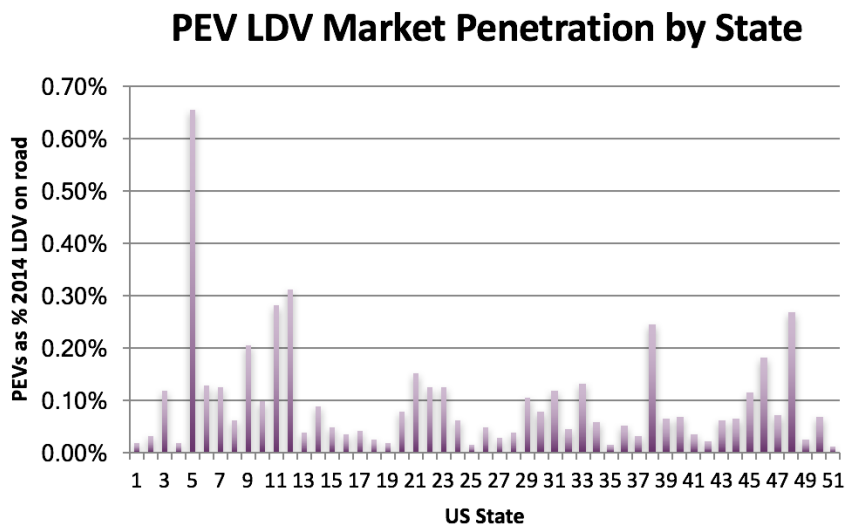
¹⁷ <https://www.ssb.no/en/transport-og-reiseliv/statistikker/bilreg>

precautionary basis, in part to confirm that sub-region’s penetration rates were not at substantial variance to the national average.

Data sources for these U.S. national state-based results were drawn from many sources (which yielded the same results since they drew upon the IHS Markit data), including¹⁸:

- ZEVFACTS.com – an auto industry alliance which gives BEV and PHEV sales and on-the-road data by state¹⁹
- U.S. Department of Transportation statistics for the LDVs on the road²⁰
- Argonne National Laboratory monthly emailed sales information

Figure A2: PHEV and BEV Combined 2016 EV Market Share Estimates for US States



Source: US Department of Transportation Statistics, ZEVFacts.com, CNBN

¹⁸ These data sources are credible since they rely upon government national and state agency data. Particularly, IHS Markit data systematically reviews Department of Motor Vehicle registration data from across all U.S. regions and upgrades it for consistency and reliability. It is considered the most credible source of vehicle sales/on the road information in the U.S. and forms the basis for all data used to build the positive lists here, including non-profit (UCS, ICCT), government agency (Argonne National Lab, NREL) and other publications (e.g., ZEVFACTS.com) sources

¹⁹ <http://www.zevfacts.com/sales-dashboard.html>

²⁰ <http://www.fhwa.dot.gov/policyinformation/statistics/2014/mv1.cfm>

Figure A3: BEV and PHEV Market Share Proxy Results and EV Market Share Analysis, California per ZEVFacts.com



Figure A4: 2016 California Market Share (by May 2016)

BEVs on the road	111k
PHEVs on the road	105k
Total PEVs ²¹	216k
Number of registered cars in CA (2014) ²²	14.7m
Number of total registered LDVs in CA (2014)	27m
Implied PEVs as a % of these vehicles:	
Registered cars:	1.46%
Registered LDVs	0.8%

Source: ZEVFACTS.com, US Transportation CNBN analysis

Data for Canadian national and sub-regional Provincial results were drawn from FleetCarma which also draws upon IHS Markit data²³.

Results are given for EV market share proxy results demonstrating that Canada's national sales-based market share is just over 1.2 percent by end 2016 and was also just over 1 percent for British Columbia

²¹ Based on ZEVFacts.com cumulative monthly sales 2011-16. See: <http://www.zevfacts.com/sales-dashboard.html>

²² Making the comparison to the most recent 2014 DoT data available at that same time for cars/LDV on the road. See; <http://www.fhwa.dot.gov/policyinformation/statistics/2014/mv1.cfm>

²³ <http://www.fleetcarma.com/ev-sales-canada-2016-final/> referencing the company which IHS Markit acquired, R. L. Polk & Company

and Quebec which were confirmed as the Provinces with the leading market share penetrations. Thus, all Canadian Provinces' EV market share proxy results are below five percent

Local Assessment

A detailed analysis of the U.S. CBSA EV market share penetrations was conducted (referenced as the CBSA Assessment Workbook). This analysis provides the local EV market share penetration rates for all U.S. CBSAs and demonstrated that all these local regions' EV market shares have been confirmed as below five percent for both BEV and BEV/PHEV fleets.

The data, derived from IHS Markit data, confirms that as of 1 January 2017, both LDV BEVs and BEV+PHEVs combined have less than a five percent EV market share of LDV vehicles on the road in all 935 U.S. CBSA metro regions – below the additionality penetration threshold.

Data supplied by the City of Vancouver, sourced from the BC government-run auto insurance provider (ICBC), covering the Vancouver Metro Region also confirms that the EV market share results for both LDV BEVs and BEV+PHEVs combined are also less than five percent.

Vancouver Metro Region market share data is provided since the minimum local region analyzed in the U.S. was the metro CBSA region (see above). A similar logic applies in BC given comparable typical EV ranges and daily commuting average distances.

The Vancouver Metro area as of Q2 2016 had 2215 BEV and 710 PHEVs out of a total of 1.4m LDVs, giving an EV market share penetration of 0.21% for L2 applicable fleets (BEV+PHEV) and 0.16% for DCFC applicable fleets (BEV).

The City of Vancouver had 350 BEVs and 170 PHEVs out of a total of 305,707 LDVs, giving EV market share penetration rates of 0.16% for L2 applicable fleets and 0.11% for DCFC.

Heavy Duty Electric Vehicles

E-buses

An analysis of market penetration data to establish the EV HDV market share penetration metric (as a percentage all HDVs on the road) was conducted nationally for the U.S., and all U.S. states, using the comprehensive data base compiled by IHS Markit and supported by, on an ancillary basis for transit e-buses, the American Public Transport Association (APTA).

IHS Markit compiles data on a subscription basis for U.S. MDV/HDV buses and trucks. Since there are currently no PHEV MDV/HDV on the road, data was compiled for BEV MDV/HDV buses and trucks separately, noting that fuel cell electric vehicles (which IHS Markit includes in its BEV category) were excluded in this analysis. IHS Markit compiles its data from U.S. government/state sources and is considered the most credible of market-wide data. Its results are consistent with those published by other government sources such as California State reports.²⁴

²⁴ https://www.arb.ca.gov/msprog/tech/techreport/bev_tech_report.pdf

APTA is an association which collects this information from all the U.S./Canadian regions' transit agencies, updated annually. Transit agencies are typically public agencies whose data is therefore considered credible. Generally, very few buses operate commercially in the U.S. (e.g., Greyhound, Bolt Bus, etc.) so APTA considers these market penetration statistics representative for all e-buses operating in U.S./Canadian regions.

Since the IHS Markit data spans both e-bus and e-truck segments, its results have been used as the primary source. Since the APTA data focuses on the sub-set of transit e-bus information in the U.S.²⁵, its results have been used in a supporting role only.

IHS Markit data confirms that e-buses as of 1 January 2017 have a 0.03% market share of MDV/HDV buses on the road in the US – well below the five percent market share penetration threshold. Given the de-minimis levels of market penetration, U.S. states are also confirmed as below five percent market share penetration levels.

IHS Markit reported 306 e-buses (BEV) on the road as of 1 January 2017 of a total of 0.9m MDV/HDV buses on the road.

These IHS Markit findings are consistent with the analysis results from the APTA data, which confirmed that national U.S. penetration rates for transit e-buses are only 0.17%. Less than a dozen U.S. states have any e-buses operating currently, all of which are substantially below five percent EV HDV market share penetration rates.

Table A1: E-buses as % total in state (APTA sourced)

State	EB % total in state
CA	0.5%
CT	0.4%
FL	0.1%
IL	0.3%
KY	2.3%
NV	0.3%
PA	0.04%
TN	2.1%
TX	0.2%
VA	0.4%
WA	0.4%
NY	0.05%*
ALL OTHER STATES	0%
NATIONAL AVG USA	0.17%

²⁵ IHS Markit data includes other e-buses such as school buses

*Based on potential purchase of 10 EBs

E-trucks

IHS Markit data confirms that e-trucks as of 1 January 2017 have a 0.006% market share of MDV/HDV trucks on the road in the U.S. – well below the five percent market share penetration threshold. Given the de-minimis levels of market penetration, U.S. states are also confirmed as below five percent market share penetration levels.

IHS Markit reported 333 e-truck vehicles (BEV) on the road as of 1 January 2017 of a total of 5.7m MDV/HDV trucks on the road.

E-bus and e-truck market penetration rates are calculated separately due to the rather higher penetration rates for e-buses.

Parameters

The following parameters were applied for the determination of the EV market share for the regions assessed:

Data / Parameter	$EV_{i,x,w}$
Data unit	Number of vehicles
Description	Number of EVs on the road in applicable fleet i in region x by year w
Equations	1
Source of data	Use values from credible governmental or quasi-governmental sources, including credible non-governmental sources (such as IHS Markit which upgrades US DMV information).
Value applied:	N/A
Justification of choice of data or description of measurement methods and procedures applied	See Appendix A for justification To include region x in this EV Market Share positive list, the on the road data for year w will have been published on a timely basis, e.g. within 36 months of the module version's publication date. Year w will precede project year 1.
Purpose of Data	Calculation of EV Market Share Additionality
Comments	In the US, several such sources can be used including: IHS Markit subscriptions; ZEVFACTS.com; Argonne National Laboratory monthly publications based on hybridcars.com; DMV state data

Data / Parameter	$LDV_{x,w}$
Data unit	Number of vehicles
Description	Number of LDVs on the road in region x by year w
Equations	1
Source of data	Use values from credible governmental or quasi-governmental sources, including private subscription sources which upgrade such information to be more reliable.
Value applied:	N/A
Justification of choice of data or description of measurement methods and procedures applied	See Appendix A for justification To include region x in this EV Market Share positive list, the on the road data for year w will have been published on a timely basis, e.g. within 36 months of the module version's publication date. Year w will precede project year 1.
Purpose of Data	Calculation of EV Market Share Additionality
Comments	In the US, several such sources can be used including: IHS Markit subscriptions; ZEVFACTS.com; Argonne National Laboratory monthly publications based on hybridcars.com; DMV state data

Data / Parameter	$EVS_{i,x,w}$
Data unit	Number of vehicles
Description	Number of EVs in Applicable Fleet i sold in region x during year w
Equations	2
Source of data	Use values from credible governmental or quasi-governmental sources, including private subscription sources which upgrade such information to be more reliable.
Value applied:	N/A
Justification of choice of data or description of measurement methods and procedures applied	See Appendix A for justification To include region x in this EV Market Share Proxy positive list, the sales data for year w will have been published on a timely basis, e.g. within 36 months of the module version's publication date. Year w will precede project year 1
Purpose of Data	Calculation of EV Market Share Proxy Additionality
Comments	In the US, several such sources can be used including: IHS Markit subscriptions; ZEVFACTS.com; Argonne National Laboratory monthly publications based on hybridcars.com; DMV state data. Also reports from credible non profits, such as Union of Concerned Scientists, ICCT, which rely upon the IHS Markit data source.

	Internationally, the EIA EV Global Outlook, table 11.
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Data / Parameter	$LDVS_{x,w}$
Data unit	Number of vehicles
Description	Total number of LDVs sold in the same region x during year w
Equations	2
Source of data	Use values from credible governmental or quasi-governmental sources, including private subscription sources which upgrade such information to be more reliable.
Value applied:	N/A
Justification of choice of data or description of measurement methods and procedures applied	See Appendix A for justification To include region x in this EV Market Share Proxy positive list, the sales data for year w will have been published on a timely basis, e.g. within 36 months of the module version's publication date. Year w will precede project year 1
Purpose of Data	Calculation of EV Market Share Proxy in Additionality
Comments	In the US, several such sources can be used including: IHS Markit subscriptions; ZEVFACTS.com; Argonne National Laboratory monthly publications based on hybridcars.com; DMV state data Also reports from credible non profits, such as Union of Concerned Scientists, ICCT, which rely upon the IHS Markit data source. Internationally, the EIA EV Global Outlook, table 11.

Data / Parameter	$EVHDV_{x,z,w}$
Data unit	Number of vehicles
Description	Number of HDV EVs in Applicable fleet i of category z on the road in region x by year w
Equations	3
Source of data	Use values from credible governmental or quasi-governmental sources, including private subscription sources which upgrade such information to be more reliable.
Value applied:	N/A
Justification of choice of data or description of	See Appendix A for justification To include region x in this HDV EV Market Share positive list, the on the road data for year w will have been published on a timely

measurement methods and procedures applied	basis, e.g. within 36 months of the module version's publication date. Year w will precede project year 1. HDV vehicles of category z are limited to buses and trucks. For project regions to be admitted to the positive list, Equation 3 must be satisfied independently for each category z of such vehicles (that is separately for e-buses and e-trucks)
Purpose of Data	Calculation of HDV EV Market Share in Additionality
Comments	In the US, several such sources can be used including: IHS Markit subscriptions; American Public Transport Association (APTA) for transit bus databases. See Guidance document found separately on the VERRA website for further details and links

Data / Parameter	$VHDV_{x,z,w}$
Data unit	Number of vehicles
Description	Total number of HDV vehicles of category z on the road in the same region x by year w
Equations	3
Source of data	Use values from credible governmental or quasi-governmental sources, including private subscription sources which upgrade such information to be more reliable.
Value applied:	N/A
Justification of choice of data or description of measurement methods and procedures applied	See Appendix A for justification To include region x in this HDV EV Market Share positive list, the on the road data for year w will have been published on a timely basis, e.g. within 36 months of the module version's publication date. Year w will precede project year 1. HDVs of category z are limited to buses and delivery trucks. For project regions to be admitted to the positive list, Equation 3 must be satisfied independently for each category z of such vehicles (that is separately for e-buses and e-trucks)
Purpose of Data	Calculation of HDV EV Market Share in Additionality
Comments	In the US, several such sources can be used including: IHS Markit subscriptions; American Public Transport Association (APTA) for transit bus databases. L