THE ELECTRIC VEHICLE ACCELERATOR (EVA) GROUPED PROJECT

DOCUMENT PREPARED BY **CLIMATE RESOURCES EXCHANGE INTERNATIONAL PTE LTD ON BEHALF OF CRX CARBONBANK PTE LTD**

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1 PROJECT DETAILS

1.1 Summary Description of the Project

The Electric Vehicle Accelerator Grouped Project ("EVA") is an initiative undertaken by CRX CarbonBank Pte Ltd ("CRX") that focuses on Electric & Plug-In Hybrid Vehicle Technologies, so as to replace traditional internal combustion engines (ICE) which use emissive diesel and petrol fuel sources.[1]

An internal-combustion engine (ICE) is a heat engine that converts energy from the burning of gasoline or diesel in a combustion chamber into mechanical work, or torque. The engines have pistons that move up and down inside metal tubes called cylinders. There are two kinds of internal combustion engines currently in production: the spark ignition gasoline engine and the compression ignition diesel engine.

Electric Vehicle technologies have an electric motor instead of an internal combustion engine. The vehicle uses a large traction battery pack to power the electric motor and must be plugged in to a wall outlet or charging equipment. Because it runs on electricity, the vehicle emits no exhaust from a tailpipe and does not contain the typical liquid fuel components, such as a fuel pump, fuel line, or fuel tank.

The Grouped Project Activity (GPA) intends to generate Verified Carbon Units (VCUs) through the charging of electric vehicles (EVs) through EV charging systems, including their associated infrastructure, whose GHG emission reductions are achieved through the displacement of emissions from conventional fossil fuel vehicles used for passenger and freight transportation as a result of the electricity delivered by the project chargers. The usage of electricity powered cars instead of fossil fuel powered ones leads to lower GHG emissions per distance driven. This is proven in the respective ER calculations.

Under this GPA, multiple Project Activity Instances (PAIs) will be included as more charging point owners join the program. Under the GPA, all carbon credits accrue under the contractual jurisdiction of CRX.

To avoid double counting, the following steps will be applied:

- Each Charger will be given a Unique Identification Number[2] to make sure that the charger is not part of another project or part of a de-bundled program.

[1] https://www.energy.gov/eere/vehicles/articles/internal-combustion-engine-basics

[2] Full list of UIN will be shared with the validator.

- Carbon credits will only accrue to CRX from a charging point that is registered[3] under the EVA GPA.

- The Terms and Conditions at the point of sale at of the charging point will clearly indicate that carbon credits generated from the charging point accrue to the account of CRX.

- Based on the methodology AMS III.C Ver 15.0, Section 5.1.18.c and VCS methodology VM0038 Ver1.0, Section 5, Charging point and fleet owners will be briefed on the project boundaries.

The GPA will be submitted following CDM Methodology AMS-III.C, Emission reductions by electric and hybrid vehicles Ver. 15 and and VCS methodology VM0038, Methodology for Electric Vehicle Charging Systems Ver. 1, which describes the requirements for EV charging systems to issue credits across a range of potential charging systems and their applicable fleets[4]. Based on emission reduction calculation of applicable CDM methodology AMS III.C "Emission reductions by electric and hybrid vehicles" and VCS methodology VM0038 "Methodology for Electric Vehicle Charging Systems", overall emission reduction of project activity will not increase from 60,000 tCO2e/year for each instance.

Before the implementation of this GPA, the typical mode of transport within the boundary of the host countries would be petrol and diesel combustion vehicles, with the market penetration of EVs to be well below 5%[5].

Geographic location of vehicles and charging systems, and confirmation of eligibility from Methodology AMS III.C:

The first project instance is set to be developed within the boundary of Singapore but is envisioned to extend to the boundaries of Malaysia, Vietnam, Cambodia, the Philippines, Indonesia, Brunei, India, Nepal, Hong Kong, Taiwan South Korea and Japan.

The project reduces on average 7,801 tCO2 per annum.

Audit Type	Period	Program	VVB Name	Number of years
Validation/ Verification	-	VCS	TÜV SÜD South Asia Pvt. Ltd	-
Total	-	-	--	-

[3] Contract between CRX and charger owner will be shared with the validator during validation.

[4] Fleet is defined to be as a vehicle or a group of vehicles that are being charged at any charging point(s) registered under the GPA.

[5] The Influence on Energy and the Economy of Electrified Vehicles Penetration in ASEAN, https://think-asia.org/bitstream/handle/11540/12742/The-Influence-on-Energy-and-the-Economy-of-Electrified-Vehicle-Penetration-in-ASEAN.pdf?sequence=1

1.2 Sectoral Scope and Project Type

Sectoral Scope: 1&7, Energy industries (renewable/non-renewable sources) and Transport respectively

Category: AMS III.C: Emission reductions by electric and hybrid vehicles[6]

Version: 15.0

Category: VM0038: Methodology for Electric Vehicle Charging Systems[7]

Version: 1.0

Project Type: Grouped Project

1.3 Project Eligibility

This project activities undertaken are supported by the approved CDM methodology – AMS III C, Emission reductions by electric and hybrid vehicles version 15 and VM0038: Methodology for Electric Vehicle Charging Systems version 1. VCS standard accepted all active CDM methodology therefore project activity is eligible for registration under VCS standard version 4.4.

1.4 Project Design

☒ The project includes a single location or installation only

☐ The project includes multiple locations or project activity instances, but is not being developed as a grouped project

☒ The project is a grouped project

This project description is designed to be a Grouped Project and is structured to allow the expansion of multiple project activities after project validation.

Framework for the implementation of the proposed GPA

The (GPA) intends to generate VCUs through the charging of electric vehicles (EVs) through EV charging systems, including their associated infrastructure, whose GHG emission reductions are achieved through the displacement of emissions from conventional fossil fuel vehicles used for passenger and freight transportation as a result of the electricity delivered by the project

[6] https://cdm.unfccc.int/methodologies/DB/AWVYMI7E3FP9BDRQ6462030VPKFPQB

[7] https://verra.org/methodologies/vm0038-methodology-for-electric-vehicle-charging-systems-v1-0/

chargers. The usage of electricity powered cars instead of fossil fuel powered ones leads to lower GHG emissions per distance driven. This is proven in the respective ER calculations.

All Project Activity Instances (PAIs) will consist of only EV charging and utilization technologies, will not cover the combination of two or more technologies, and also use any one methodology.

To cater to both the publicly available and captive controlled charging points and their associated fleets within the host country, the following cases may be represented in the subsequent PAIs.

Table 1: Possible Scenarios for this GPA with respect to the selected methodology: AMS-III.C or VM0038

PAI Type	Vehicle Category	Baseline Fuel	Remarks
Case 1: Diesel Car Fleets	Cars Only	Diesel	Baseline scenario will take into consideration the average Specific Fuel Consumption (SFC) of the top 5 diesel/petrol cars and compare them against the average Specific Energy Consumption (SEC) of the top 5 Electric Vehicle (EV) equivalents, using the selected methodology formulas as reference.
Case 2: Petrol Car Fleets		Petrol	
Case 3: Diesel Bus Fleets	Buses Only	Diesel	Baseline scenario will take into consideration the average SFC of the top 5 diesel buses and compare them against the average SEC of the top 53 EV equivalents, using the selected methodology formulas as reference.
Case 4: Truck and Van Fleets	Trucks and Vans Only	Diesel	Baseline scenario will take into consideration the average SFC of the top 10 diesel trucks/vans and compare them against the average SEC of the top 10 EV equivalents, using the selected methodology formulas as reference.
Case 5: Diesel Motorbike Fleets	Motorbikes Only	Diesel	Baseline scenario will take into consideration the average SFC of the top 10 diesel/petrol motorbikes and compare them against the average SEC of the top 10 EV equivalents, using the selected methodology formulas as reference.
Case 6: Petrol Motorbike Fleets		Petrol	
Case 7: Host Country National Fleet	Combination of National Host Country Natural Fleet Only	Diesel and Petrol Combined	Baseline scenario will take into consideration the average mandated SFC of the host country and compare them against the average SEC of the top 10 EV equivalents, using the selected methodology formulas as reference.
Case 10: 3-Wheelers	3-Wheelers Only	Petrol	Baseline scenario will take into consideration the average SFC of the top 2 3-wheelers (or equivalent) and compare them against the

			average SEC of the EV equivalents, using the selected methodology formulas as reference.

These scenarios from the table above will be included and referenced to throughout this GPA document.

Eligibility Criteria

The eligibility criteria for new project instances to be introduced in project year to grouped projects will comprise:

- Applicability conditions as set out in methodology AMS III.C or VM0038

New project locations must be within the country referenced in section 3.5 (if new countries are being added, a PD deviation shall be submitted).

No	Eligibility Criterion	Compliance
1	Occur within one of the designated geographic areas specified in the project description.	**Applicable.** The first project instance is set to be developed within the boundary of Singapore but is envisioned to extend to the boundaries of Malaysia, Vietnam, Cambodia, the Philippines, Indonesia, Brunei, India, Nepal, Hong Kong, Taiwan South Korea and Japan.
2	Comply with at least one complete set of eligibility criteria for the inclusion of new project activity instances. Partial compliance with multiple sets of eligibility criteria is insufficient.	**Applicable.** Complete set of eligibility criteria will be demonstrated.
3	Be included in the monitoring report with sufficient technical, financial, geographic and other relevant information to demonstrate compliance with the applicable set of eligibility criteria and enable sampling by the validation/verification body.	**Applicable.** All supporting data for validation/verification purposes will be made visible in the monitoring report.
4	Be validated at the time of verification against the applicable set of eligibility criteria.	**Applicable.** A certifying body will be engaged to validate new project instances that are introduced to the project.

5	Have evidence of project ownership, in respect of each project activity instance, held by the project proponent from the respective start date of each project activity instance (i.e., the date upon which the project activity instance began reducing or removing GHG emissions).	**Applicable.** CRX will be the project proponent and will have a clear title and ownership of all VCUs generated from the EVA Programme as per the service agreement signed upon registration of fleet and charging point owners.
6	Have a start date that is the same as or later than the grouped project start date.	**Applicable.** The grouped project start date is determined by the implementation date of EV vehicles under the first PAI included into this GPA which is 14/10/2021. Any new PAIs introduced will be later than 14/10/2021.
7	Be eligible for crediting from the start date of the instance through to the end of the project crediting period (only). Note that where a new project activity instance starts in a previous verification period, no credit may be sought for GHG emission reductions or removals generated during a previous verification period (as set out in Section 3.4.4) and new instances are eligible for crediting from the start of the next verification period.	**Applicable.** Credits will be sought from the next verification period in this scenario
8	Not leave one VCS project and subsequently enroll in another VCS project.	**Applicable.** New PAIs will be enrolled under this VCS project with an exception to cases where the renewable energy source is connected to a charging station via national/regional grid. In such circumstances, project proponent will consider this as a separate project.

1.5 Project Proponent

Organization name	CRX CarbonBank Pte Ltd
Contact person	Vinod Kesava
Title	MD & CEO
Address	20 Malacca Street #07-00 Malacca Centre Singapore 048979
Telephone	+65 9384 0166
Email	v.kesava@climate-resources.com

1.6 Other Entities Involved in the Project

The contact details of both the project proponent (CRX CarbonBank Pte Ltd) and the other entity (Climate Resources Exchange International Pte Ltd) involved are the same.

Organization name	Climate Resources Exchange International Pte Ltd
Role in the project	Preparation of relevant project documents
Contact person	Vinod Kesava
Title	MD & CEO
Address	20 Malacca Street #07-00 Malacca Centre Singapore 048979
Telephone	+65 9384 0166
Email	v.kesava@climate-resources.com

Organization name	VITOL ASIA PTE LTD
Role in the project	Project Investor for Origination & VCU Off Taker
Contact person	Mr Prashan Patel
Title	Trader
Address	260 Orchard Road, #15-02 The Heeren, Singapore 238855
Telephone	+65 9785 6986
Email	ppp@vitol.com

1.7 Ownership

In accordance with VCS Standard version 4.4, section 3.6, the project vehicles are not owned by CRX, instead are owned by different entities that join the program through individual PAIs. But as per lease agreement carbon rights are with CRX.

The lease agreement will include and resent the legal right of the vehicle fleet owner or charging point owner to own, operate and maintain the EV cars across the locations where they have been implemented, only signing over the carbon rights to CRX and in turn the GPA.

1.8 Project Start Date

The project start date is determined by the implementation date of EV vehicles under the first PAI included into this GPA which is **14/10/2021.**

1.9 Project Crediting Period

The project crediting period for this project shall be 7 years, twice renewable for a total of 21 years.

Project crediting period start date: 14/10/2021

Project crediting period end date: 13/10/2028

1.10 Project Scale and Estimated GHG Emission Reductions or Removals

The estimated annual GHG emission reductions/removals of the project are:

☒ <20,000 tCO_2e/year

☐ 20,000 – 100,000 tCO_2e/year

☐ 100,001 – 1,000,000 tCO_2e/year

☐ >1,000,000 tCO_2e/year

Project Scale	
Project	x
Large project	

Year	Estimated GHG emission reductions or removals (tCO_2e)

Year 1 Oct 2021 – Nov 2022	2,399
Year 2 Oct 2022– Nov 2023	4,199
Year 3 Oct 2023– Nov 2024	6,000
Year 4 Oct 2024– Nov 2025	7,801
Year 5 Oct 2025– Nov 2026	9,602
Year 6 Oct 2026– Nov 2027	11,402
Year 7 Oct 2027 – Nov 2028	13,203
Total estimated ERs	54,606
Total number of crediting years	7
Average annual ERs	7,801

The GHG emission reductions are estimated based on the number of vehicles projected for the seven years crediting period for one of the project activities instances (PAI). The emission reductions may vary from one project activity instance to another based on the number of vehicles however, it will not exceed the applicability criteria of 60,000 tCO2e per annum.

1.11 Description of the Project Activity

The project activity consists of electric vehicles (EV) and its charging system, inclusive of the charging point or battery swap station, which charge EV applicable fleets whose GHG emission reductions are achieved through the displacement of conventional (and emissive) fossil fuel vehicles (e.g., petrol and diesel) used for passenger and freight transportation because of the electricity delivered by the project charging stations and electrified fleets.

The GPA will be submitted following CDM Methodology AMS-III.C, Emission reductions by electric and hybrid vehicles Ver. 15 and VCS methodology VM0038, Methodology for Electric Vehicle Charging Systems Ver. 1*, which describes the requirements for EV charging systems to issue credits across a range of potential charging systems and their applicable fleets. Based on emission reduction calculation of applicable CDM methodology AMS III.C "Emission reductions*

by electric and hybrid vehicles" and VCS methodology VM0038 "Methodology for Electric Vehicle Charging Systems"*, overall emission reduction of project activity will not increase from 60,000 tCO2e/year.*

Under the first PAI of the project which will be taking place in Singapore, there is an estimated introduction of 600 electric vehicles with forecasted increased of up to 5000 electric vehicles over the course of the crediting period. As the GPA for introduction of electric vehicles will be registered under the small-scale methodology AMS-III.C, it will be ensured that the emissions reductions for each PAI shall not exceed 60,000 tCO2e/year.

Minimum Battery Specification

Parameter	Depth of discharge (DOD)	Battery cycle	Distance Travelled per charge	Lifetime
Value	80% [8]	1200 cycles [9]	132 km [6]	2-6 years [6]

The following table demonstrates project and baseline vehicle categories with comparable passenger/load capacity and power rating.

Category of vehicle	**Baseline**	**Project scenario**
Combined Car	Passenger capacity – 5 Average fuel consumption – 5.97L/100km	Passenger capacity – 5 Power consumption – 20kWh/100km
Diesel Car	Passenger capacity – 5 Average fuel consumption – 5.23L/100km	Passenger capacity – 5 Power consumption – 16.61kWh/100km
Petrol Car	Passenger capacity – 5 Average fuel consumption – 6.7L/100km	Passenger capacity – 5 Power consumption –17kWh/100km
Diesel Bus	Passenger capacity – up to 87 for single-deck, 132 for double-decker Average fuel consumption – 29L/100km	Passenger capacity – up to 87 for single- deck, 132 for double-decker Average fuel consumption – 133kWh/100km
Combined Van	Maximum Laden Weight (MLW) – up to 3.5 tonnes Average fuel consumption – 8.4L/100km	Maximum Laden Weight (MLW) – up to 3.5 tonnes Average fuel consumption – 16.72kWh/100km

[8] https://www.ntu.edu.sg/docs/librariesprovider60/publications/ess-technology-roadmap-singapore.pdf?sfvrsn/c91c9ae8_2

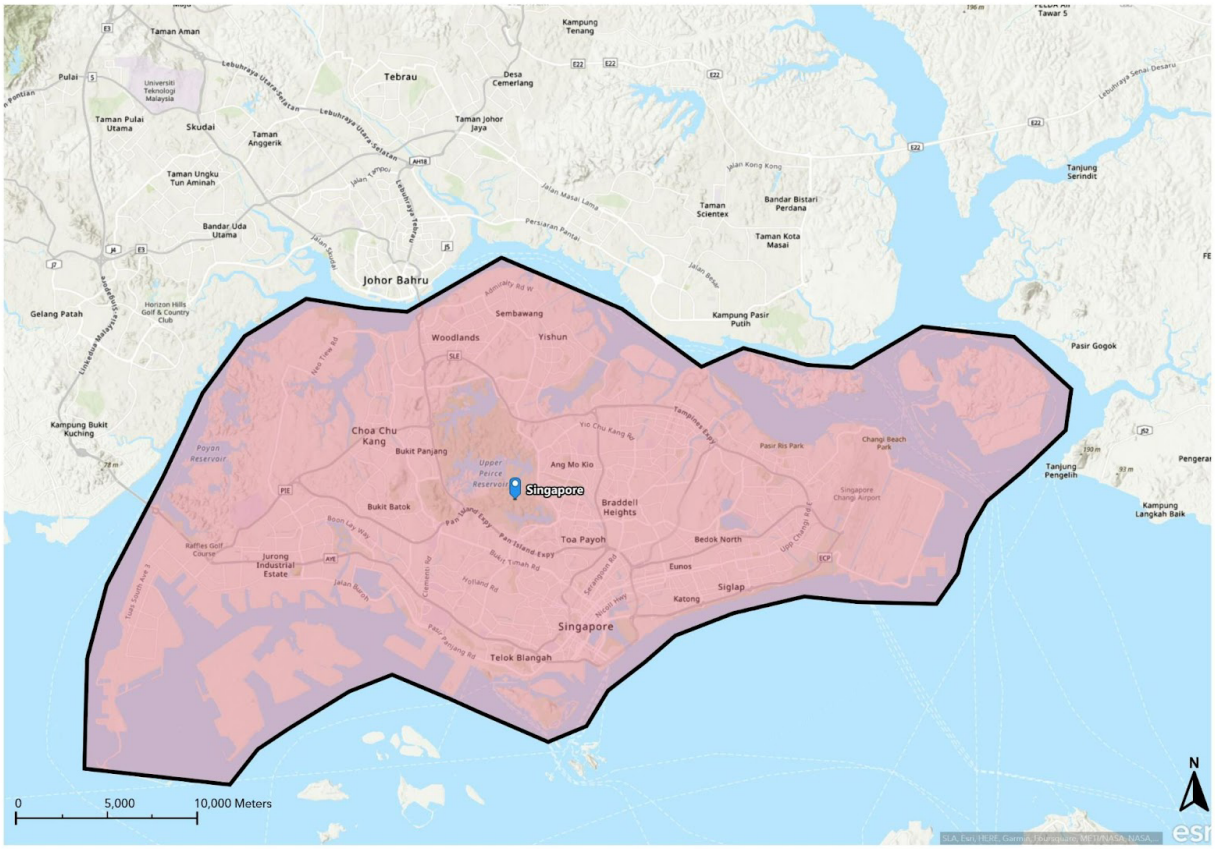
[9] https://www.nccs.gov.sg/files/docs/default-source/default-document-library/e-mobility-technology-roadmap.pdf

Diesel Van	Maximum Laden Weight (MLW) – up to 3.5 tonnes Average fuel consumption – 8.4L/100km	Maximum Laden Weight (MLW) – up to 3.5 tonnes Average fuel consumption –16.72kWh/100km
Petrol Van	Maximum Laden Weight (MLW) – up to 3.5 tonnes Average fuel consumption – 8.4L/100km	Maximum Laden Weight (MLW) – up to 3.5 tonnes Average fuel consumption –16.72kWh/100km
Diesel HGV	Maximum Laden Weight (MLW) – Between 3.5 to 16 tonnes Average fuel consumption – 14L/100km	Maximum Laden Weight (MLW) - Between 3.5 to 16 tonnes Average fuel consumption – 52kWh/100km
Diesel VHGV	Maximum Laden Weight (MLW) – Above 16 tonnes Average fuel consumption – 30L/100km	Maximum Laden Weight (MLW) – Above 16 tonnes Average fuel consumption – 118.15kWh/100km
Petrol Motorcycle	Passenger capacity – 2 Average fuel consumption – 2.8L/100km	Passenger capacity – 2 Average fuel consumption – 5.3kWh/100km
Petrol 3-wheeler	Passenger capacity – 1 Average fuel consumption – 3.8L/100km	Passenger capacity – 1 Average fuel consumption – 4.1kWh/100km

1.12 Project Location

EVA would like to replicate similar activities across the host countries as stated in Section 1.1.

The first project activity will be developed in Singapore, with the plan to expand into regional countries.



1.13 Conditions Prior to Project Initiation

Before EV charging was made easily available to the general community, EV owners had no ability to directly or indirectly impact the baseline emissions associated with their fossil fuel vehicles. As such, in the baseline scenario, EV owners would employ the use of diesel/petrol vehicles that utilize traditional ICE, in turn inducing higher GHG reductions.

In the project scenario, emission reductions will be generated when electricity kwh are supplied via the charger to an EV to result in EV-miles driven. This can be achieved when the EV-miles driven are converted to an equivalent set of fossil fuel vehicle miles driven by applying the comparable vehicle requirements laid out in the Applicability condition.

As a result, there is a neutralization of EV miles driven and fossil fuel miles driven, hard wired into the methodology's requirements. Artificially increasing this ratio to generate more fossil fuel miles driven is thus impossible.

1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks

Given that, the VCS Standard defines regulatory surplus as: "The project shall not be mandated by any law, statute or other regulatory framework" And that for additionality purposes, a carbon

credit project must not have been undertaken due to such regulatory surplus mandates, whilst nonetheless comprising measures which are still in compliance with applicable laws, permits, etc., as such each PAI that will be included into the GPA must adhere to the following eligibility criteria stated below:

Eligibility Criteria	Yes	No
Were the project's GHG reductions mandated or required by VCS Standard regulatory surplus measures?		X
Are the EV implementation nonetheless broadly in compliance with prevailing local, regional and national laws?	X	

1.15 Participation under Other GHG Programs

1.15.1 Projects Registered (or seeking registration) under Other GHG Program(s)

The project has not been registered or is seeking registration under any other GHG programs.

1.15.2 Projects Rejected by Other GHG Programs

The project has not been rejected by any other GHG programs.

1.16 Other Forms of Credit

1.16.1 Emissions Trading Programs and Other Binding Limits

Does the project reduce GHG emissions from activities that are included in an emissions trading program or any other mechanism that includes GHG allowance trading?

☐ Yes ☒ No

The project is not involved in an emissions trading program or any other mechanism that includes GHG allowance trading.

1.16.2 Other Forms of Environmental Credit

Has the project sought or received another form of GHG-related credit, including renewable energy certificates?

☐ Yes ☒ No

Supply Chain (Scope 3) Emissions

This section is not applicable as Supply Chain (Scope 3) emissions are assessed in line with the VCS Standard 4.4 and Corporate Value Chain (Scope 3) Accounting and Reporting Standard. According to these sources this section is not applicable since the project does not directly impact emissions associated with any good or services other than the displacement of more GHG intensive (ICE) vehicles to EVs which are already accounted for in Scope 1.

1.17 Sustainable Development Contributions

The project contributes directly to achieving SDG 8 and 9 in addition to SDG 13. The SDG contributions of the project are as follows:

Row number	Estimated Project Contribution by the End of Project Lifetime	SDG Target	SDG Indicator
Sequential row number	Brief description of the quantifiable impact of the project's activities related to the SDG indicator	SDG target number	SDG indicator number, where directly related to an indicator, and exact text of indicator
1)	The project would contribute towards increasing employment opportunities in businesses as they introduce EVs into their operations. The estimated increase employment would be between 3 to 5.	8.5	8.5 Increasing employment opportunities.
2)	By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities. The project is estimated to decrease participants' total carbon emissions from driving from 2.79 tons CO2e/year to 1.22 tons CO2e/year, for a total average reduction of 1.58 tons CO2e/year/vehicle.	9.4	9.4.1 CO2 emission per unit of value added.
3)	The project will decrease national greenhouse gas emissions in countries from driving, determined by the total number of ICE vehicles, of all vehicle types, i.e. motorcycles, buses, autos, trucks, that	13.2	13.2.2 Total greenhouse gas emissions per year

	are replaced with EVs. The estimated reduction of greenhouse gas emissions over the crediting period is on average 7,801tCO2 per annum.		

1.18 Additional Information Relevant to the Project

Leakage Management

As per methodology para 43 no leakage calculation required.

Commercially Sensitive Information

None of the project documents will be considered commercially sensitive information, and all the documentation is available to any stakeholders.

If certain information is deemed sensitive and confidential for public viewing, it will be supplied to the VVBs separately for reviewing.

Further Information

There is no further information.

2 SAFEGUARDS

2.1 No Net Harm

As project activity is implementation of EV transport system and replacing fossil fuel-based transport system, project activity doesn't have any negative environmental and socio-economic impacts.

2.2 Local Stakeholder Consultation

A national level online stakeholder consultation was held on 12/04/2022 between EV users and owners to ensure diverse stakeholder opinions are gathered throughout the deployment process. Invitations were made public and published on the Sustainable Energy Association of Singapore (SEAS) website[10] as well as sent out through a mailing letter to all members of the association on 11/04/2022. The list of attendee details will be attached as part appendix A of the PDD below.

[10] https://seas.glueup.com/event/launch-of-the-electric-vehicle-accelerator-eva-52107/

During the sharing session, the general consensus was a positive one, with most questions from company representatives revolving around:

- How they could join the GPA.
- What kind of documentation was needed for them to be onboarded as quickly as possible.
- The infrastructure around the EVA data monitoring app.

These questions were answered by CRX personnel as well as the app-development team during a panel discussion that was also held during the LSC. After the sharing session, all questions we resolved in an in-depth manner.

Apart from the above, CRX will periodically engage with stakeholders through its EV fleet owners through a bi-annual reporting of EV use and uptake. In addition, CRX through its EV Fleet owners, will also has a dedicated customer helpline through which grievances / communications are received and addressed in a timely manner. This will be done on the group project's official website[11].

[11] https://www.evacarbon.com/

2.3 Environmental Impact

CRX had taken reference first from the Urban Redevelopment Authority of Singapore (URA), where it was found that what was published was very open ended and non-project specific. As such, the list of categories listed by URA was cross referenced with PMF IAS's Environmental Impact Assessment (EIA) Process & Procedures[12].

During which it was concluded that the GPA did not fall within any project types that would require clearance from central government, and an EIA would not be needed.

2.4 Public Comments

The public comment period was open from 02/08/2022 to 01/09/2022[13], and during which there were no comments received.

2.5 AFOLU-Specific Safeguards

Not applicable as this is a non-AFOLU project.

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

The following Methodology and Tools have been applied:

- AMS-III.C: Emission reductions by electric and hybrid vehicles, Ver. 15
- VCS methodology VM0038: *Methodology for Electric Vehicle Charging Systems, Ver.1*
- Tool05 to calculate Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation, Ver. 3
- Tool07 to calculate the emission factor for an electricity system, Ver. 07
- Activity Method for Determining Additionality of Electricity Vehicle Charging Systems VMD0049

3.2 Applicability of Methodology

[12] https://www.pmfias.com/eia-environmental-impact-assessment/

[13] https://registry.verra.org/app/projectDetail/VCS/3364

The selected methodology AMS-III.C. (Ver 15.0) and WM0038. (Ver 1.0) applied in this project incorporates project activities introducing new electric vehicles that displace the use of fossil fuel vehicles in passenger and freight transportation.

The project fulfils the following applicability conditions of the methodology:

S/N	Applicability conditions for AMS III.C	Project applicability
1.	The methodology is not applicable for project activities that involve a switch from fossil fuels to biofuels in transportation; those project activities shall consider using another Type III methodology (e.g. "AMS-III.T.: Plant oil production and use for transport applications" and "AMS-III.AK.: Biodiesel production and use for transport applications").	**Not Applicable** No switch from fossil to biofuels are made by the project activity. The project activity is a switch from fossil fuels to electricity.
2.	In cases where the project vehicles use a replaceable, chargeable battery there must be documented measures in place to ensure that vehicle owners have access to replacement batteries of comparable quality.	**Applicable** The project activity uses chargeable batteries that will be charged at charging stations. After completion of the lifetime of batteries, it will get replaced by batteries with similar specification. There are document measures that car-makers provide warranty on the EV batteries thus allowing vehicle owners to have access to replacement of batteries with comparable quality.[14] Therefore, this criteria is applicable. Project activity includes replaceable, chargeable battery. Project activity directly charge at charging stations. After completion of the lifetime of batteries, it will get replaced by batteries with

[14] https://www.channelnewsasia.com/cna-insider/road-trips-battery-safety-and-competing-chargers-10-electric-car-queries-answered-2026871

		similar specification. Therefore, this criterion is applicable.
3.	The project design document (PDD) shall explain the proposed approach for introducing/distributing the electric/hybrid vehicles, which shall allow for tracking of the project vehicles	**Applicable** Electric vehicles included under this GPA will be introduced throughout the host country specified in the individual PAI. Under the first PAI, the electric vehicles will be introduced throughout Singapore via direct procurement from the manufacturers. The vehicles will operate on lease and lease agreement. The tracking of the project vehicles will be done through using the EVA data monitoring system. Electric vehicles included under this GPA will be introduced throughout the host country specified in the individual PAI. Vehicle fleet owners operatingthese electric vehicles on lease and/or lease agreement clearly provide carbon ownership to CRX.
4.	a) Demonstrate that the baseline vehicles being displaced are those consuming fossil fuels. This can be done, for example, through documentation of the market share per fuel type per vehicle category in the project region.	**Applicable** Before EV charging was made easily available to the general community, EV owners had no ability to directly or indirectly impact the baseline emissions associated with their fossil fuel vehicles. As such, in the baseline scenario, EV owners would employ the use of

		diesel/petrol vehicles that utilize traditional ICE, in turn inducing higher GHG reductions.
	b) Ensure compliance with prevailing regulations pertaining to battery use and disposal.	**Applicable** The EVA program does not own the electric vehicles in each of the PAIs. As such the responsibility for the disposal of the electric vehicle batteries rests with the EV partners to comply with the laws and regulations of the country that the respective PAI resides in. In Singapore, some cars with expired certificate of entitlement (COE) are exported to other countries where recycling of parts occur or as used cars for extended used. In these cases, the end destination user is responsible for the EV battery disposal. For electric vehicles with batteries that will be disposed of in Singapore, it will be done so in accordance with the regulated e-waste management system administered by Singapore's National Environment Agency (NEA) which is based on the Extended Producer Responsibility (EPR) approach. This ensures that measures for proper collection, handling and treatment of e-waste are in place to safeguard against any negative environmental impacts associated with the batteries. The NEA has awarded licences to entities to operate as a Producer Responsibility Scheme (PSR) operators who will provide sufficient avenues for the collection of regulated electrical and electronic waste including electric vehicle batteries on

		behalf of producers and consumers to be transported to NEA-licensed e-waste recyclers for proper treatment and recycling.[15] Each EVA partner will work closely with the licensed operators to facilitate the disposal and collection process of electric vehicle batteries for treatment and recycling. As the CME, CRX can and will advise each EVA partner of best practices for the "circular economy" that is possible with EV batteries.
5.	The PDD shall include minimum performance specifications for the batteries to be used such as: depth of discharge, battery cycles, distance travelled per charge, lifetime.	**Applicable** PP has included batteries performance details in section 1.10 of this PD.
6.	The project proponent shall demonstrate that double counting of emission reductions will not occur e.g. via a contractual agreement with the end-user(s), maintenance of comprehensive inventory of project vehicles or unique identification of the vehicles owned by end-user(s). The steps undertaken to avoid double counting shall be documented in the PDD.	**Applicable** Vehicle fleet owners operating these electric vehicles on lease and/or lease agreement will clearly provide and sign carbon ownership over to CRX. Only vehicles are counted where such an agreement has been signed.
7.	In cases where renewable energy source is used for charging the electric vehicles through a dedicated transmission/distribution line, the methodology should be combined with "AMS-I.F.: Renewable electricity generation for captive use and mini-grid" to claim emission reductions for the amount of electricity supplied from renewable electricity source to the charging station[16].	**Applicable** AMS I.F will be combined with AMS III C if electric vehicles will be charge through renewable energy source. If electric vehicles will be charge through grid power then amount of power

[15] https://www.nea.gov.sg/our-services/waste-management/3r-programmes-and-resources/e-waste-management/extended-producer-responsibility-(epr)-system-for-e-waste-management-system

[16] In case where renewable energy source is connected to charging station via national/regional grid, project proponent should consider this as a separate project and may explore using "AMS-I.D.: Grid connected renewable electricity generation".

		withdrawn from the grid will consider as project emission.
8.	In cases where this methodology is combined with "AMS-I.F.: Renewable electricity generation for captive use and mini-grid", the project proponent shall separately demonstrate the additionality of each of the component (i.e supply of renewable energy to charging station (Type I) and use of electric vehicles (Type III). Furthermore while combining the two components applicable requirements on the start date and prior clean development mechanism (CDM) consideration shall be met in accordance with the CDM project standard and CDM project cycle procedures.	**Not Applicable** Currently, renewable energy sources are not used for charging electric vehicles. Hence AMS-I.F methodology is used along with the methodology.
9.	Types of hybrid/electric vehicles to be introduced include but are not limited to cars, buses, trucks, jeepneys, commuter vans, taxis, motorcycles and tricycles.	**Applicable** Electric Vehicles introduced may include but are not limited to cars, buses, trucks, jeepneys, commuter vans, taxis, motorcycles and tricycles. This is evident in the list of scenarios shown in Section 1.4, as well as baseline scenario calculations submitted to the VVB.
10.	Project participants shall demonstrate that the project and baseline vehicles are comparable, using the following means: a) Project and baseline vehicles belong to the same vehicle category, e.g., motorcycle, bus, taxi, truck, tricycle; b) Project and baseline vehicle categories have comparable passenger/load capacity and power rating with a variation of no more than 20 per cent (comparing the baseline vehicle with the respective project vehicle of same category).	**Applicable** Vehicles referenced in both the project and baseline scenario will belong to the same vehicle category. Currently under the first PAI, the project vehicle introduced would belong to the same category as the baseline vehicle, which covers 4 wheeler cars with comparable passenger capacity of 4. The power rating of the current project vehicles are

		the Bollure Bluecar with a power rating of of 30 kW.[17] Power rating of the similar segment internal combustion engines cars ie.Opel Astra has a power rating of 78kW. However, vehicles powered by fossil fuels typically have a higher power rating.[18] Vehicles referenced in both the project and baseline scenario will belong to the same vehicle category, e.g. motorcycle, bus, taxi, truck, tricycle; So as to ensure that Project and baseline vehicle categories have comparable passenger/load capacity and power rating with a variation of no more than 20 per cent.
11.	Measures are limited to those that result in emission reductions of less than or equal to 60ktCO2 equivalent annually.	**Applicable** In no year are projected emission reductions over 60,000tCO2e. If the emission reductions exceed 60,000 tCO2e, a new PAI will be submitted under the GPA.

Applicability Conditions for VM0038	Project Applicability
1) The applicable fleets of projects applying this methodology are limited to all LDV BEVs	**Applicable.**

[17] https://autocatalogarchive.com/wp-content/uploads/2023/06/Bollore-Bluecar-2021-FR.pdf

[18] https://www.sgcarmart.com/new_cars/newcars_specs.php?CarCode=11904&Subcode=5218

and PHEVs, and HDV EVs. For LDV projects, these applicable fleets comprise BEVs and PHEVs for L1 and L2 chargers, and BEVs for DCFCs. For HDV projects, these applicable fleets comprise MDV/HDV electric buses and trucks, both BEV and PHEV, eligible to charge at the project's set of EV charging systems.	The fleets are serviced by at least one of the following EV Charging Systems: • LDV BEV/PHEV (L1/1L2) • LDV BEV (DCFC) • HDV EV e-bus • HDV EV e-truck Therefore, this criterion is met.
2) Project proponents must demonstrate that the EV models comprising the applicable fleet of the project are comparable to their… … conventional fossil fuel baseline vehicles using the following means[19]: • Project and baseline vehicles belong to the same vehicle category (e.g., car, motorcycle, bus, truck, LDV, MDV, HDV) • Project and baseline vehicles have comparable passenger/load capacities (comparing the baseline vehicle with the respective project vehicle).	**Applicable.** The project partner will establish in section 1.1 the comparability between EV's in the applicable fleets and their comparable fossil fuel baseline vehicles. Hence, this criterion is met.
3) In order to demonstrate that double counting of emission reduction will not occur, the project proponent must maintain an inventory of EV chargers included in the project, including their L1/L2/DCFC classifications and unique identifiers; other measures may include disclosure of credit ownership to EV drivers. Double counting relative to any issued GHG credits from projects that introduce EV fleets will be addressed using the emission reduction discount adjustments in Section 8.4 below.	**Applicable** The project partner will declare its inventory of EV chargers, whether it has already been supplied or not, and its respective type of EV charging system the inventory contains (L1/L2/DCFC/etc). After which, Geospatial coordinates or Unique identifiers such as NEMA codes, Customer codes, Equipment serial numbers, Charger ID codes will be supplied to the CME and VVB.

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

Where associated infrastructure and/or renewable power (on-site and/or direct transmission) are included in an EV charging system, this must be referenced and described in the charging system's inventory. Project documentation must also include the following for each EV charger: • Classification using the performance voltage, AC/DC basis and kw power specifications given for L1, L2 and DCFC 50/100/150/320/500 definitions. • Unique identifiers, including the geo-spatial coordinates and one other unique reference.. ..such as NEMA codes, customer codes, equipment serial numbers, charger ID codes, or AFDC ID codes	Where associated infrastructure and/or renewable power are included in an EV charging system, it will be referenced and described in the charging system's inventory. Hence, this criterion is met.
4) This methodology is applicable to EV charging systems utilizing AI to provide electricity to and from EVs, on-site batteries and renewables under the condition that the AI must include adequate metering systems (e.g., meters/sub-meters and/or associated measurement systems). These metering systems must measure and accurately trace all electricity deliveries and receipts from all such interrelated associated infrastructure sources. This includes electricity sourced from/returned to the grid, dedicated renewable energy generated on-site (including RE sourced from direct transmission lines), on-site storage batteries, and/or the EV's on-board battery.	**Applicable.** If the project partner's project activity utilizes AI to provide electricity to and from EVs, on-site batteries and renewables under the condition that the AI uses must include adequate metering systems. These metering systems will be elaborated upon and described briefly in an appendix, consistent with guidance found in VM0038. Hence, this criterion is met.
5) Projects with estimated annual emission reductions of over 60,000 tCO2e (large-scale) are permitted where project proponents can demonstrate that the project is located in a country with credible national data sources for GHG emission calculations.	**Applicable.** The project activity is set to take place in Singapore, which isn't included as part of Annex I or II countries and regions listed in the module VMD0049 Activity Method for Determining Additionality of Electric Vehicle

Otherwise, projects are limited to annual emission reductions equal to or under 60,000 tCO2e (small-scale). Projects located in Annex I and II countries, and countries referenced by EIA data sources, are automatically eligible to be of any scale. All regions listed in module VMD0049 Activity Method for Determining Additionality of Electric Vehicle Charging Systems meet these criteria and thus are not limited in scale.	Charging Systems, therefore all projects will be limited to an annual emission reductions equal to or under 60,000 tCO2e. Furthermore, since this project is to be registered as a GPA, If the annual emission reductions exceed 60,000tCO2e, a new PAI will be submitted under the GPA.
6) Project proponents must demonstrate proof of ownership of emission reductions which may be achieved through the following..: ..• With the charging system owners through contractual agreements, terms of service, utility program participation rules, or other means, and/or • With EV drivers through disclosure of credit ownership (e.g., through dispenser notices, screen displays, terms of service, etc.).	**Applicable.** The project proponent will demonstrate proof of ownership of emission reductions through one of the following methods/documents: With Charging System Owners: • Contractual agreements • Terms of Service contracts. • Utility program participation rules. With the EV drivers, disclosure of credit ownership via: • Dispenser notices • Screen displays • Terms of Service Therefore, this criterion is met.

The project fulfils the applicability of the following TOOLS

S/N	Applicability conditions for TOOL05 "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation"	Project applicability
1	If emissions are calculated for electricity consumption, the tool is only applicable if one out of the following three scenarios applies to the sources of electricity consumption: a) Scenario A: Electricity consumption from the grid. The electricity is purchased from the grid	**Applicable** Scenario A applies to the project activity as electricity consumption that is used to charge the electric vehicles is

	only, and either no captive power plant(s) is/are installed at the site of electricity consumption or, if any captive power plant exists on site, it is either not operating or it is not physically able to provide electricity to the electricity consumer; b) Scenario B: Electricity consumption from (an) off-grid fossil fuel fired captive power plant(s). One or more fossil fuel fired captive power plants are installed at the site of the electricity consumer and supply the consumer with electricity. The captive power plant(s) is/are not connected to the electricity grid; or c) Scenario C: Electricity consumption from the grid and (a) fossil fuel fired captive power plant(s). One or more fossil fuel fired captive power plants operate at the site of the electricity consumer. The captive power plant(s) can provide electricity to the electricity consumer. The captive power plant(s) is/are also connected to the electricity grid. Hence, the electricity consumer can be provided with electricity from the captive power plant(s) and the grid.	supplied from the grid, and there is no captive power plant installed at the site of electricity consumption.
2	This tool can be referred to in methodologies to provide procedures to monitor amount of electricity generated in the project scenario, only if one out of the following three project scenarios applies to the recipient of the electricity generated: a) Scenario I: Electricity is supplied to the grid; b) Scenario II: Electricity is supplied to consumers/electricity consuming facilities; or c) Scenario III: Electricity is supplied to the grid and consumers/electricity consuming facilities.	**Applicable** Scenario II is applicable as the electricity consumed in the project activity will be supplied to consumers (electric vehicles)/electricity consuming facilities (charging points).
3	This tool is not applicable in cases where captive renewable power generation technologies are installed to provide electricity in the project activity, in the baseline scenario or to sources of leakage. The tool only accounts for CO2 emissions.	**Applicable** No captive renewable power generation technologies are installed in the project activity.

S/N	**Applicability Conditions for TOOL07 "Tool to calculate the emission factor for an electricity system"**	**Project Applicability**
1	This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity that is where a project activity supplies electricity to a grid or	**NA** The project activity does not calculate for baseline

	a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects).	emissions for electricity consumption as the project activity does supply electricity nor substitute grid electricity.
2	Under this tool, the emission factor for the project electricity system can be calculated either for grid power plants only or, as an option, can include off-grid power plants. In the latter case, two sub-options under the step 2 of the tool are available to the project participants, i.e. option IIa and option IIb. If option IIa is chosen, the conditions specified in "Appendix 1: Procedures related to off-grid power generation" should be met. Namely, the total capacity of off-grid power plants (in MW) should be at least 10 per cent of the total capacity of grid power plants in the electricity system; or the total electricity generation by off-grid power plants (in MWh) should be at least 10 per cent of the total electricity generation by grid power plants in the electricity system; and that factors which negatively affect the reliability and stability of the grid are primarily due to constraints in generation and not to other aspects such as transmission capacity.	**Applicable** The emission factor for the project electricity system under the first PAI is calculated from grid power plants only.
3	In case of CDM projects the tool is not applicable if the project electricity system is located partially or totally in an Annex I country.	**Applicable** The project electricity system for the project activity is not located in an Annex I country
4	Under this tool, the value applied to the CO2 emission factor of biofuels is zero	NA Biofuels are not used in proje

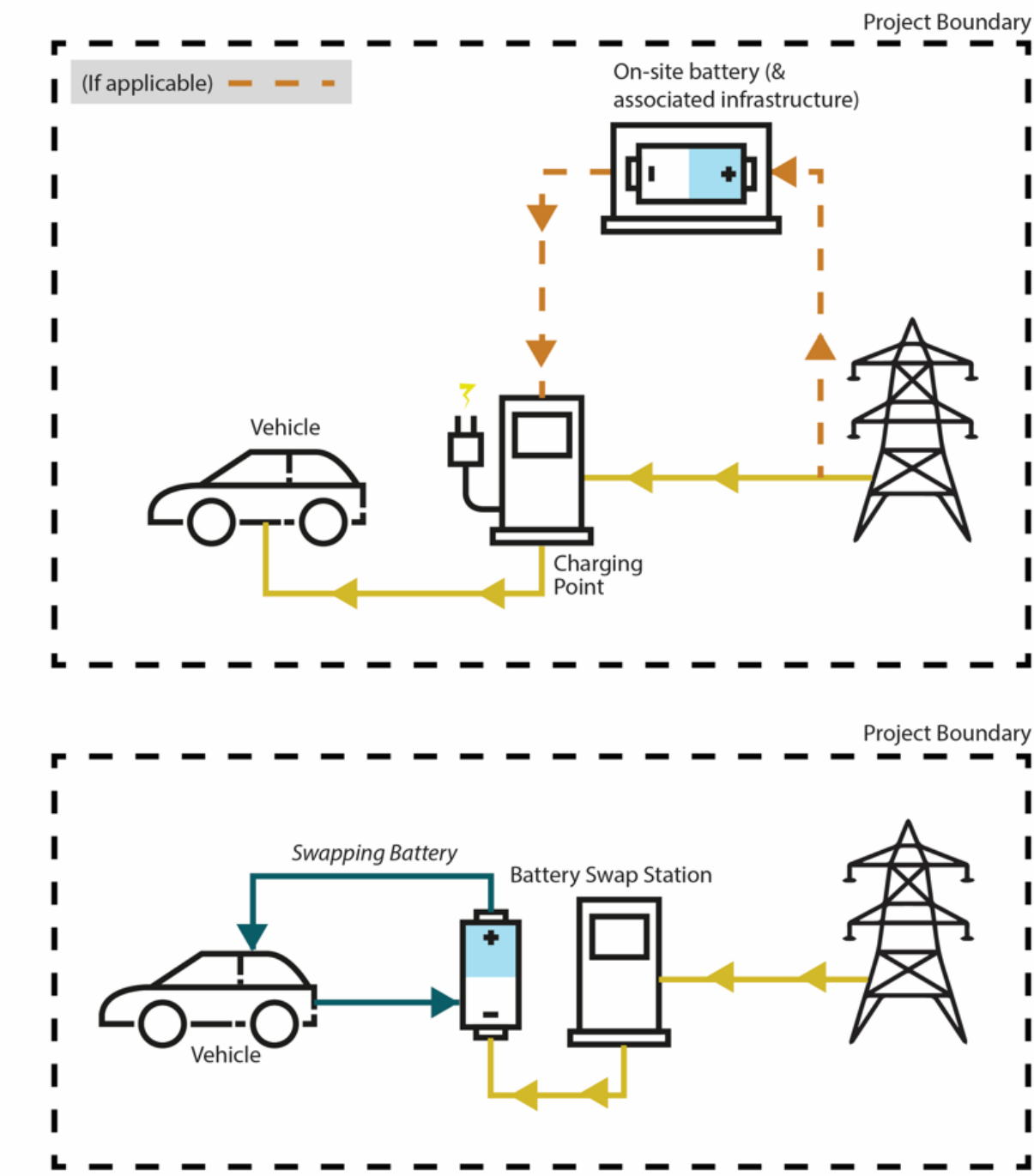
3.3 Project Boundary

The project boundary comprises of a fleet for EV chargers and geographical location of the host country where the chargers are installed.

The relevant gases included in calculation of emissions are shown in the table below:

Source		Gas	Included?	Justification/Explanation
Baseline	Fossil fuel combustion of vehicles displaced by project activities	CO_2	Yes	Included in the calculation of CO2e associated with fuel combustion.
		CH_4	N/A	N/A
		N_2O	N/A	N/A
		Other	N/A	N/A
Project	Electricity consumption via grid	CO_2	Yes	Main emission source
		CH_4	N/A	N/A
		N_2O	N/A	N/A
		Other	No	Not Applicable
	EV battery swap in vehicle	CO_2	Yes	Main emission source
		CH_4	N/A	N/A
		N_2O	N/A	N/A
		Other	No	Not Applicable

The project boundary includes the electric vehicles that are part of the project activity and the electricity supply source.



3.4 Baseline Scenario

As per the methodology AMS III.C Ver. 15 para 22 and VM0038 Ver.1 para 6, the project's baseline scenario is the operation of comparable vehicles (the comparability of baseline and project applicable fleet vehicles which has been demonstrated as per indicators described below in (a) and (b)), that would have been used to provide the same transportation service..

(a) Project and baseline vehicles belong to the same vehicle category, e.g. motorcycle, bus, taxi, truck, tricycle;

(b) Project and baseline vehicle categories have comparable passenger/load capacity and power rating with a variation of no more than 20 per cent (comparing the baseline vehicle with the respective project vehicle of same category).

3.5 Additionality

Methodology AMS III.C provides an option to demonstrate additionality with following 2 options:

Option 1:

Demonstrate that the project activity would otherwise not be implemented due to the existence of one or more barrier(s) listed in the "Methodological tool: Demonstration of additionality of small-scale project activities". The barrier(s) can be demonstrated for buyers/users and/or charging service providers of the electric vehicles even if the manufacturer or retailer of the electric vehicles is implementing the project.

Option 2:

Demonstrate ex ante that the market share of project electric/hybrid vehicles is equal to or smaller than 5 per cent of the vehicles of the same category (e.g. if project vehicles are electric scooters, market share of electric two wheelers is equal to or smaller than 5 per cent of all motorized two wheelers, irrespective of the manufacturer) in the region.

PP has opted option 2 to demonstrate additionality.

Singapore:

According to data presented by Singapore Land Transport Authority[20] (LTA), the table below depicts the numbers for different types of motor vehicles in Singapore as of 31st December 2021:

Vehicle Type	Fuel Type	Population
Cars	Petrol	568,391
	Diesel	23,087
	Petrol-Electric	64,437
	Petrol-Electric (Plug in)	692

[20] https://www.lta.gov.sg/content/dam/ltagov/who_we_are/statistics_and_publications/statistics/pdf/M09-Vehs_by_Fuel_Type.pdf?fireglass_rsn=true

	Petrol-CNG	164
	Electric	3,246
	Diesel-Electric	20
	Total	678,037

Taking into consideration the fully electric EV population in Singapore, the percentage of Electric Vehicles on the road in Singapore can be calculated as 0.48% market penetration, which is lower than the 5% threshold. Therefore, as per methodology option 2 project is additional.

According to section 7 of VM0038, project proponents applying the methodology must determine additionality using the procedure described below.

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.

Response: Regulatory surplus has been demonstrated by the absence of any systematically enforced law, statue, or other regulatory framework in Singapore which mandates the project activity consisting of installing EV charging systems and their associated infrastructure to charge applicable EV fleets, in order to displace the use of conventional fossil fuel-based vehicles used for passenger and freight transportation.

Step 2: Positive List

The applicability conditions of the latest version of VCS module VMD0049 Activity Method for Determining Additionality of Electric Vehicle Charging Systems represent the positive list. The positive list was established using the activity penetration option (Option A in the VCS Standard). Projects that meet all applicability conditions of this methodology and VCS module VMD0049 Activity Method for Determining Additionality of Electric Vehicle Charging Systems are deemed additional.

The project activity is set to take place in Singapore which isn't included in the regions stated with the latest VCS module VMD0049 Activity Method for Determining Additionality of Electric Vehicle Charging Systems. Therefore, Step 2 is not applicable.

Step 3: Project Method

Where the project is small-scale, the project proponent must demonstrate that the project activity would otherwise not be implemented due to the existence of one or more barrier(s) listed in the latest version of the CDM methodological tool Demonstration of additionality of small-scale project activities.

Where the project is large-scale, the project proponent must apply the latest version of the CDM Tool for the demonstration and assessment of additionality.

Response: This project will use the CDM methodological tool 'Demonstration of additionality of small-scale project activities' and have chosen the Technological barrier approach to demonstrate additionality.

According to the 2021 data presented by Singapore's Land Transport Authority (LTA), only 0.48% (3,246 EVs) of Singapore's vehicles are fully electric. This number is significantly lower than the composition of conventional fossil fuel-based vehicles and the associated infrastructure which dominates the market share of passenger and freight transportation vehicles in Singapore. This would support the technological barrier faced by EVs and the associated infrastructures due to the low market share. Therefore, it is demonstrated that the less technologically advanced alternative of conventional fossil fuel-based vehicles would involve lower risks and be a preferred alternative to be adopted, which would have led to higher emissions.

Therefore, having applied Step 1 and 3 according to the procedures as listed in the methodology, the project is deemed to be additional.

3.6 Methodology Deviations

There are no deviations from the methodology.

4 QUANTIFICATION OF GHG EMISSION REDUCYIONS AND REMOVALS

4.1 Baseline Emissions

The baseline emissions are calculated using two models depending on which methodology is applied for the project activity. For project activities that involve both charging point owners (CPO) and fleet owners or fleet owners only, baseline emissions will be calculated as per AMS-III.C. Project activities that involve CPOs only, baseline emissions will be calculated as per VM0038.

i) CPOs and fleet owners or fleet owners only

Baseline emissions calculated using Approach 2 as described in AMS-III.C methodology Ver. 15 section 5.4.

Approach 2: Using the electricity used to charge the vehicles

The baseline emissions are calculated as per the equation below by transforming the electricity charged to the vehicles at the charging stations/points into travelled distance and the emission factor for fossil fuels used by the baseline vehicles to travel the same distance.

$$BE_y = \sum_i EF_{BL,km,i} \times \frac{EC_{PJ,i,y}}{SEC_{PJ,km,i,y}} \times 10^{-6}$$ Equation (1)

Where:

BE_y = Total baseline emissions in year *y* (t CO_2)

$EC_{PJ,i,y}$ = The electricity consumed for charging project vehicles category i at the charging stations/points in year y (kWh)

$EF_{BL,km,i}$ = Emission factor for baseline vehicle category *i* (g CO_2/km)

$SEC_{PJ,km,i,y}$ = Specific electricity consumption per km per project vehicle category i in year y (kWh/km)

In which,

$$EF_{BL,km,i} = SFC_i \times NCV_{BL,i} \times EF_{BL,i} \times IR^t$$ Equation (2)

Where:

SFC_i = Specific fuel consumption of baseline vehicle category *i* (g/km)

$NCV_{BL,i}$ = Net calorific value of fossil fuel consumed by baseline vehicle category *I* (J/g)

$EF_{BL,i}$ = Emission factor of fossil fuel consumed by baseline vehicle category *i* (g CO_2/J)

IR^t = Technology improvement factor for baseline vehicle in year *t*. The improvement rate is applied to each calendar year. The default value of the technology improvement factor for all baseline vehicle categories is 0.99

T = Year counter for the annual improvement (dependent on age of data per vehicle category)

Option 2 (Top 20 per cent of the comparable vehicles used for public/private transportation) will be taken to determine the specific fuel consumption for vehicle category i (SFCi).

The specific fuel consumption for comparable vehicles is estimated by using the specific fuel consumption for highway driving obtained from manufacturer's specification of the top 20 per cent of vehicles operated/used for public/private transportation in the project region.

ii) CPOs only

Baseline emissions calculated using VM0038 methodology Ver. 1 Section 8.1.

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

$$BE_y = \sum_{i,f} ED_{iy} * EF_{ify} * 100 * IR_i^{y-1} / (AFEC_{iy} * MPG_{iy}) \quad \text{Equation (3)}$$

Where:

BE_y = Baseline emissions in year *y* (tCO_2e)
$ED_{i,y}$ = Electricity delivered by project charging systems serving applicable fleet *i* in project year *y* (kwh)
$EF_{j,f,y}$ = Emission factor for the fossil fuel *f* used by comparable fleet vehicles *j* in year *y* (tCO_2e/gallon)
$IR_{i,}$ = Technology improvement rate factor for applicable fleet *i*
$AFEC_{i,y}$ = Weighted average electricity consumption per 100 miles rating for EVs in applicable fleet *i* in project year *y* (kwh/100 miles)
$MPG_{i,y}$ = Weighted average miles per gallon rating for the fossil fuel vehicles comparable to each EV in applicable fleet *i*, in project year y (miles per gallon)

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

$$BE_y = \sum_{i,f} ED_{iy} * EF_{ify} * 100 * IR_i^{y-1} / (AFEC_{iy} * MPG_{iy}) \quad \text{Equation (4)}$$

Where:

BE_y = Baseline emissions in year *y* (tCO_2e)
$ED_{i,y}$ = Electricity delivered by project charging systems serving applicable fleet *i* in project year *y* (kwh)
$EF_{j,f,y}$ = Emission factor for the fossil fuel *f* used by comparable fleet vehicles *j* in year *y* (tCO_2e/gallon)
$IR_{i,}$ = Technology improvement rate factor for applicable fleet *i*
$AFEC_{i,y}$ = Weighted average electricity consumption per 100 miles rating for EVs in applicable fleet *i* in project year *y* (kwh/100 miles)
$MPG_{i,y}$ = Weighted average miles per gallon rating for the fossil fuel vehicles comparable to each EV in applicable fleet *i*, in project year y (miles per gallon)

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

$$MPG_{iy} = \sum_a (MGP_{aiy} * EVR_{aiy}) / \sum_a EVR_{aiy} \quad \text{Equation (5)}$$

Where:

$MPG_{i,y}$ = Weighted average miles per gallon rating for fossil fuel vehicles comparable to each EV in applicable fleet *i* in project year *y* (miles per gallon)

$MPG_{a,j,y}$ = Mile per gallon rating for the fossil fuel vehicle model deemed comparable to each EV model a from applicable fleet *i* in project year *y* (miles/gallon)

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

4.2 Project Emissions

The project emissions are calculated using two models depending on which methodology is applied for the project activity. For project activities that involve both charging point owners (CPO) and fleet owners or fleet owners only, project emissions will be calculated as per AMS-III.C. Project activities that involve CPOs only, project emissions will be calculated as per VM0038.

i) CPOs and fleet owners or fleet owners only

Project emissions include the electricity and fossil fuel consumption associated with the operation of project vehicles and shall be calculated as follows:

Approach 2 from AMS-III.C: Using the electricity used to charge the vehicles

$$PE_y = \sum_i EF_{PJ,km,i,y} \times \frac{EC_{PJ,i,y}}{SEC_{PJ,km,i,y}} \quad \text{Equation 6}$$

Where:

$EC_{PJ,i,yy}$ = Electricity consumed by the project vehicles of type i in year y (kWh)

$SEC_{PJ,km,i,y}$ = Specific electricity consumption by project vehicle category *i* per km in year *y* in urban conditions (kWh/km)

i Vehicle types of project activities

The emission factor of the project vehicles shall be established as follows:

$$EF_{PJ,km,i,y} = \sum_i SEC_{PJ,km,i,y} \times EF_{elect,y}/(1 - TDL_y) \times 10^{-3} + \sum_i SFC_{PJ,km,i,y} \times NCV_{PJ,i} \times EF_{PJ,i} \times 10^{-6}$$

Equation 7

Where:

$SEC_{PJ,km,i,y}$	=	Specific electricity consumption by project vehicle category *i* per km in year *y* in urban conditions (kWh/km)
$EF_{elect,y}$	=	CO_2 emission factor of electricity consumed by project vehicle category *i* in year *y* (kg CO_2/kWh)
$SFC_{PJ,km,i,y}$	=	Specific fossil fuel[3] consumption by project vehicle category *i* per km in year *y* in urban conditions (g/km)
$EF_{PJ,i}$	=	CO_2 emission factor of fossil fuel consumed by project vehicle category *i* in year *y* (g CO_2/J)
$NCV_{PJ,i}$	=	Net calorific value of the fossil fuel consumed by project vehicle category *i* in year *y* (J/g)
TDL_y	=	Average technical transmission and distribution losses for providing electricity in the year *y*

ii) CPOs only

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

$$PE_y = \sum_{ij} EC_{ijy} * EFkw_{ijy}$$ Equation 8

Where:

PE_y = Project emissions in year *y* (tCO_2e)

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

$EFkw_{i,j,y}$ = Emission factor (average) for the electricity sourced from region *j* consumed by project charging systems serving applicable fleet *i* in year *y* (tCO_2e/kwh)

Where the projects include associated infrastructure within their charging systems. Project emissions must be quantified for all such following Equation 9, which must replace Equation 8, where the follow applies:

1) The electricity emissions factor for the on-site battery must be calculated using the net weighted average of the grid and on-site renewable emission factors provided in Equation 10 below.
2) The charging system's metering system must adequately and accurately measure the trace such net electricity kwh provided to be the charging system (i.e., deliveries minus receipts) from all electricity sourced from/returned to grid and dedicated renewables. This includes, for example, electricity sourced from the grid, dedicated renewables (e.g., on site) and delivered to the EV directly and/or via on-site batteries, the net of kwh returned back to such sources from the EV batteries.

$$PE_y = \sum_{ijs} NEC_{ijsy} * EFkwAI_{ijsy} - \sum_{ij} LEC_{ijy} * EFkwonsitebatt_{ijy}$$ Equation 9

Where:

PE_y	= Total project emissions in year y (tCO_2e)
$NEC_{i,j,s,y}$	= Electricity consumed by EV charging systems supplied from associated infrastructure source *s* net of any kwh EV/charger returned to this same source within region *j* serving applicable fleet *i* in project year *y* (kwh/year)
$EFkwAI_{j,j,s,y}$	= Emission factor for the electricity from each associated infrastructure source *s* within region *j* consumed by project chargers serving applicable fleet *i* in year *y* (tCO_2e/kwh)
$LEC_{j,j,y}$	= Electricity provided to the grid and/or building from on-site storage battery within region *j* serving applicable fleet *i* in project year *y* (kwh/year)
$EFkwonsitebatt_{i,j,y}$	= Emission factor for the electricity from the on-site battery associated infrastructure source *s* within region *j* consumed by project charging systems serving applicable fleet *i* in year *y* (tCO_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:

$$EFkwonsitebatt_{ijy} = \sum_z ECB_{ijzy} * EFkwAIZ_{ijzy}$$ Equation 10

4.3 Leakage

As per the methodology para 43, no leakage calculation is required.

4.4 Net GHG Emission Reductions and Removals

Emissions reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y$$ Equation 11

Where:

ER_y = 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)

LE_y = Leakage emissions in year y (t CO_2e)

Example calculations will be done to provide an indicative estimated emission. Under the first project activity instance, the entity is a fleet owner, thus all associated baseline emission and project emission will be calculated using the AMS-III.C methodology.

As per equations 1 and 2, the baseline emissions are defined as:

(Equation 1) $BE_y = \sum EF_{BL,km,j} \times (EC_{PJ,I,y}/SEC_{PJ,km,I,y}) \times 10^{-6}$

- $EF_{BL,km,j}$ = 137.80 gCo2/KM
- $EC_{PJ,I,y}$ = 8994838 kwh
- $SEC_{PJ,km,I,y}$ = 0.2 kwh/km

(Equation 2) $EF_{BL,km,j} = SFC_i \times NCV_{BL,i} \times EF_{BL,i} \times IR^t$

- SFC_i = 44.47 g/km
- $NCV_{BL,i}$ = 43650 J/g
- $EF_{BL,i}$ = 0.0000717 gCo2/KM
- IR^t = 0.99

Therefore, the baseline emission BE_y ~ 6197 tCO2e

As per equations 6 and 7, the project emissions are defined as:

(Equation 6) $PE_y = \sum EF_{PJ,km,i,y} \times (EC_{PJ,i,y}/SEC_{PJ,km,i,y})$

- $EF_{PJ,km,i,y}$ = 0.0001 gCo2/KM
- $EC_{PJ,i,y}$ = 8994838 kwh
- $SEC_{PJ,km,i,y}$ = 0.2 kwh/km

(Equation 7) $EF_{PJ,km,i,y} = \sum SEC_{PJ,km,i,y} \times EF_{elect,y}/(1\text{-}TDL_y) \times 10^{-3} + \sum SFC_{PJ,km,i,y} \times NCV_{PJ,i} \times EF_{PJ,i} \times 10^{-6}$

- $SEC_{PJ,km,i,y}$ = 0.2 kwh/km
- $EF_{elect,y}$ = 0.408 kgCO2/kwh
- TDL_y = 0.034
- $SFC_{PJ,km,i,y}$ = 0 g/km
- $NCV_{PJ,i}$ = 43650 J/g

- $EF_{PJ,i}$ = 0.000071 Gco2/J

Therefore, the project emissions PE_y ~ 3799 tCO2e

The net emissions reduction well be calculated following Equation 11

(Equation 11)

- BE_y = 6197 tCO2e
- PE_y = 3799 tCO2e
- LE_y = N/A (No leakage calculation required)

Therefore, the net emission reductions ER_y ~ 2399 tCO2e

Year	Estimated baseline emissions or removals (tCO_2e)	Estimated project emissions or removals (tCO_2e)	Estimated leakage emissions (tCO_2e)	Estimated net GHG emission reductions or removals (tCO_2e)
Year 1 Oct 2021 – Nov 2022	6,197	3,799	0	2,399
Year 2 Oct 2022– Nov 2023	10,850	6,651	0	4,199
Year 3 Oct 2023– Nov 2024	15,502	9,502	0	6,000
Year 4 Oct 2024– Nov 2025	20,155	12,354	0	7,801
Year 5 Oct 2025– Nov 2026	24,808	15,206	0	9,602
Year 6 Oct 2026– Nov 2027	29,460	18,058	0	11,402
Year 7 Oct 2027 – Nov 2028	34,113	20,910	0	13,203
Total	141,085	86,480	0	54,606

5 MONITORING

5.1 Data and Parameters Available at Validation

Data / Parameter	$NCV_{BL, Petrol}$
Data unit	GJ/Ton
Description	Net calorific value of gasoline
Source of data	IPCC 2006 Volume 2 Energy, table 1.2
Value applied	44.3
Justification of choice of data or description of measurement methods and procedures applied	IPCC 2006 Volume 2 Energy https://www.ipccnggip. iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf
Purpose of Data	Calculation of baseline emissions
Comments	NCV is only used for the baseline and is thus not an annually monitored value but one which is known at the time of validation. (Applicable for equations used under AMS.III.C)

Data / Parameter	$NCV_{BL, Diesel}$
Data unit	GJ/Ton
Description	Net calorific value of Diesel
Source of data	IPCC 2006 Volume 2 Energy, table 1.2 https://www.ipcc-nggip. iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf
Value applied	43
Justification of choice of data or description of measurement methods and procedures applied	IPCC default value.
Purpose of Data	Calculation of baseline emissions

Comments	NCV is only used for the baseline and is thus not an annually monitored value but one which is known at the time of validation. (Applicable for equations used under AMS.III.C)

Data / Parameter	$NCV_{BL, Combined}$
Data unit	J/g
Description	Net calorific value of Diesel and Petrol
Source of data	Calculated; See ER Spreadsheet provided to Validator
Value applied	43,650
Justification of choice of data or description of measurement methods and procedures applied	Calculated value taking into consideration IPCC data.
Purpose of Data	Calculation of baseline emissions
Comments	NCV is only used for the baseline and is thus not an annually monitored value but one which is known at the time of validation. (Applicable for equations used under AMS.III.C)

Data / Parameter	$NCV_{BL, Aviation Gasoline}$
Data unit	J/g
Description	Net calorific value of Jet Fuel
Source of data	IPCC 2006, Volume 2: Energy, Chapter 1: Introduction Table 1.2
Value applied	44300
Justification of choice of data or description of measurement methods and procedures applied	Calculated value taking into consideration IPCC data.
Purpose of Data	Calculation of baseline emissions
Comments	NCV is only used for the baseline and is thus not an annually monitored value but one which is known at the time of validation. (Applicable for equations used under AMS.III.C)

Data / Parameter	$SFC_{,BL,Cars\text{-}Diesel}$
Data unit	g/km
Description	Specific fuel consumption of baseline Diesel Cars
Source of data	Calculated; See ER Spreadsheet provided to Validator
Value applied	43.5
Justification of choice of data or description of measurement methods and procedures applied	Calculation cross referencing Singapore Land & Transport Authority statistics, and averaging of most common diesel vehicles driven in Singapore.
Purpose of Data	Calculation of baseline emissions
Comments	Applicable for equations used under AMS.III.C

Data / Parameter	$SFC_{,BL,Cars\text{-}Petrol}$
Data unit	g/km
Description	Specific fuel consumption of baseline Petrol Cars
Source of data	Calculated; See ER Spreadsheet provided to Validator
Value applied	45.45
Justification of choice of data or description of measurement methods and procedures applied	Calculation cross referencing Singapore Land & Transport Authority statistics, and averaging of most common petrol vehicles driven in Singapore.
Purpose of Data	Calculation of baseline emissions
Comments	Applicable for equations used under AMS.III.C

Data / Parameter	$SFC_{,BL,Buses\text{-}Diesel}$
Data unit	*g/km*
Description	*Specific fuel consumption of baseline Diesel Buses*
Source of data	*Calculated; See ER Spreadsheet provided to Validator*
Value applied	271.12

Justification of choice of data or description of measurement methods and procedures applied	Calculation cross referencing Singapore Land & Transport Authority statistics, and averaging of most common diesel buses driven in Singapore.
Purpose of Data	*Calculation of baseline emissions*
Comments	*Applicable for equations used under AMS.III.C*

Data / Parameter	$SFC_{,BL,Vans(LGV)\text{-}Diesel}$
Data unit	g/km
Description	Specific fuel consumption of baseline Diesel Trucks and Vans
Source of data	Calculated; See ER Spreadsheet provided to Validator
Value applied	69.97
Justification of choice of data or description of measurement methods and procedures applied	Calculation cross referencing Singapore Land & Transport Authority statistics, and averaging of most common diesel LGV-Vans driven in Singapore.
Purpose of Data	Calculation of baseline emissions
Comments	Applicable for equations used under AMS.III.C

Data / Parameter	$SFC_{,BL,Vans(LGV)\text{-}Petrol}$
Data unit	g/km
Description	Specific fuel consumption of baseline Diesel Trucks and Vans
Source of data	Calculated; See ER Spreadsheet provided to Validator
Value applied	132
Justification of choice of data or description of measurement methods and procedures applied	Calculation cross referencing Singapore Land & Transport Authority statistics, and averaging of most common petrol LGV-Vans driven in Singapore.
Purpose of Data	Calculation of baseline emissions
Comments	Applicable for equations used under AMS.III.C

Data / Parameter	$SFC_{,BL,HGV\text{-}Diesel}$
Data unit	g/km
Description	Specific fuel consumption of baseline Diesel Trucks and Vans
Source of data	Calculated; See ER Spreadsheet provided to Validator
Value applied	102.48
Justification of choice of data or description of measurement methods and procedures applied	Calculation cross referencing Singapore Land & Transport Authority statistics, and averaging of most common diesel HGV driven in Singapore.
Purpose of Data	Calculation of baseline emissions
Comments	Applicable for equations used under AMS.III.C

Data / Parameter	$SFC_{,BL,VHGV\text{-}Diesel}$
Data unit	g/km
Description	Specific fuel consumption of baseline Diesel Trucks and Vans
Source of data	Calculated; See ER Spreadsheet provided to Validator
Value applied	245.74
Justification of choice of data or description of measurement methods and procedures applied	Calculation cross referencing Singapore Land & Transport Authority statistics, and averaging of most common diesel VHGV driven in Singapore.
Purpose of Data	Calculation of baseline emissions
Comments	Applicable for equations used under AMS.III.C

Data / Parameter	$SFC_{,BL,Motorbikes\text{-}Petrol}$
Data unit	g/km
Description	Specific fuel consumption of baseline Diesel Motorbikes
Source of data	Calculated; See ER Spreadsheet provided to Validator
Value applied	19.26

Justification of choice of data or description of measurement methods and procedures applied	Averaging of most common petrol motorbikes driven in Singapore
Purpose of Data	Calculation of baseline emissions
Comments	Applicable for equations used under AMS.III.C

Data / Parameter	$SFC_{,BL,3wheeler\text{-}Petrol}$
Data unit	g/km
Description	Specific fuel consumption of baseline Petrol Motorbikes
Source of data	Calculated; See ER Spreadsheet provided to Validator
Value applied	25.69
Justification of choice of data or description of measurement methods and procedures applied	Averaging of known petrol 3-wheelers driven in Singapore
Purpose of Data	Calculation of baseline emissions
Comments	Applicable for equations used under AMS.III.C

Data / Parameter	$SFC_{,BL,SGNational\text{-}Combined}$
Data unit	g/km
Description	Specific fuel consumption of baseline Petrol and Diesel Vehicles in Singapore
Source of data	Calculated; See ER Spreadsheet provided to Validator
Value applied	44.47
Justification of choice of data or description of measurement methods and procedures applied	Averaging of diesel and petrol cars driven in Singapore
Purpose of Data	Calculation of baseline emissions
Comments	N/A

Data / Parameter	$EF_{BL,Diesel} = EF_{PJ,Diesel}$
Data unit	gCO2/J
Description	CO2 emission factor of Diesel
Source of data	IPCC 2006, Volume 2: Energy, Chapter 3: Mobile Combustion Table 3.2.1 https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_3_Ch3_Mobile_Combustion.pdf
Value applied	0.0000741
Justification of choice of data or description of measurement methods and procedures applied	IPCC default value
Purpose of Data	Calculation of baseline emissions
Comments	EFCO2 is only used for the baseline and is thus not an annually monitored value but one which is known at the time of validation (Applicable for equations used under AMS.III.C)

Data / Parameter	$EF_{BL,Petrol} = EF_{PJ,Petrol}$
Data unit	gCO2/J
Description	CO2 emission factor of Petrol
Source of data	IPCC 2006, Volume 2: Energy, Chapter 3: Mobile Combustion Table 3.2.1 https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_3_Ch3_Mobile_Combustion.pdf
Value applied	0.0000693
Justification of choice of data or description of measurement methods and procedures applied	IPCC default value
Purpose of Data	Calculation of baseline emissions

Comments	EFCO2 is only used for the baseline and is thus not an annually monitored value but one which is known at the time of validation(Applicable for equations used under AMS.III.C)

Data / Parameter	$EF_{BL,Combined} = EF_{PJ,Combined}$
Data unit	gCO2/J
Description	CO2 emission factor of Petrol and Diesel
Source of data	Calculated; See ER Spreadsheet provided to Validator
Value applied	
Justification of choice of data or description of measurement methods and procedures applied	Calculated value taking into consideration IPCC data.
Purpose of Data	Calculation of baseline emissions
Comments	EFCO2 is only used for the baseline and is thus not an annually monitored value but one which is known at the time of validation (Applicable for equations used under AMS.III.C)

Data / Parameter	$EF_{BL,AviationGasoline} = EF_{PJ,AviationGasoline}$
Data unit	gCO2/J
Description	CO2 emission factor of Jet Fuel
Source of data	IPCC 2006, Volume 2: Energy, Chapter 1: Introduction Table 1.4 https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf
Value applied	0.00007
Justification of choice of data or description of measurement methods and procedures applied	Calculated value taking into consideration IPCC data.
Purpose of Data	Calculation of baseline emissions

Comments	EFCO2 is only used for the baseline and is thus not an annually monitored value but one which is known at the time of validation (Applicable for equations used under AMS.III.C)

Data / Parameter	IR^t
Data unit	-
Description	Technological improvement factor for baseline vehicle in year t.
Source of data	As per the methodology AMS III.C Ver 15.0
Value applied	0.99
Justification of choice of data or description of measurement methods and procedures applied	As per the methodology AMS III.C Ver 15.0
Purpose of Data	Calculation of baseline emissions
Comments	Applicable for equations used under AMS.III.C & VM0038

Data / Parameter	$EF_{elect,CM}$
Data unit	kgCO2/kWh
Description	Grid emission factor
Source of data	Energy Market Authority Singapore (EMA)
Value applied	0.408
Description of measurement methods and procedures to be applied	EMA is publishing the grid emission factor on an annual basis. Therefore, EMA data will be updated on an annual basis based on published data by EMA or any other relevant literature or source.
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of project emissions
Calculation method	N/A
Comments	Applicable for equations used under AMS.III.C

Data / Parameter	$EF_{BL,Diesel}$
Data unit	tCO_2e/gallon
Description	CO_2 emission factor of Diesel
Source of data	IPCC 2006, Volume 2: Energy, Chapter 3: Mobile Combustion Table 3.2.1 https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_3_Ch3_Mobile_Combustion.pdf
Value applied	0.013039
Justification of choice of data or description of measurement methods and procedures applied	IPCC default value
Purpose of Data	Calculation of baseline emissions
Comments	EFCO2 is only used for the baseline and is thus not an annually monitored value but one which is known at the time of validation. (Applicable for equations used under VM0038)

Data / Parameter	$EF_{BL,Petrol}$
Data unit	tCO_2e/gallon
Description	CO2 emission factor of Petrol
Source of data	IPCC 2006, Volume 2: Energy, Chapter 3: Mobile Combustion Table 3.2.1 https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_3_Ch3_Mobile_Combustion.pdf
Value applied	0.008406
Justification of choice of data or description of measurement methods and procedures applied	IPCC default value
Purpose of Data	Calculation of baseline emissions

Comments	EFCO2 is only used for the baseline and is thus not an annually monitored value but one which is known at the time of validation (Applicable for equations used under VM0038)

Data / Parameter	$EF_{BL,Combined}$
Data unit	tCO_2e/gallon
Description	CO2 emission factor of Petrol and Diesel
Source of data	Calculated; See ER Spreadsheet provided to Validator
Value applied	0.0107225
Justification of choice of data or description of measurement methods and procedures applied	Calculated value taking into consideration IPCC data.
Purpose of Data	Calculation of baseline emissions
Comments	EFCO2 is only used for the baseline and is thus not an annually monitored value but one which is known at the time of validation (Applicable for equations used under VM0038)

5.2 Data and Parameters Monitored

Data / Parameter	EC(PJ,I,y)
Data unit	kWh
Description	Electricity consumed by the project vehicles of type i in year y
Source of data	Invoiced bills and/or EVA Data Monitoring System and Platform and/or manual data collection through electricity utility bills
Description of measurement methods and procedures to be applied	Data will be collected from project partners in the form of invoiced bills and/or what has been directly recorded on the EVA Data Monitoring System and Platform.
Frequency of monitoring/recording	Continuously and daily recording
Value applied	XX

Monitoring equipment	Electricity supplier metering, CPO Data Monitoring receipts
QA/QC procedures to be applied	Electricity supplier metering, crosschecked against CPO Data Monitoring receipts
Purpose of data	Baseline emission calculation
Calculation method	N/A
Comments	Applicable for equations used under AMS.III.C and VM0038

Data / Parameter	$SEC_{(PJ,i,j,k,l,m,n,o,p,)}$
Data unit	*kWh/km*
Description	*Specific electricity consumption per km per project vehicle category Type i per year y* *i: Cars* *j: Buses* *k: LGV Van* *l: HGV* *m: VHGV* *n: Motorcycle* *o: 3-wheelers*
Source of data	*Purchase orders, procurement documents*
Description of measurement methods and procedures to be applied	Calculated based on electricity consumption to charge the vehicle. *Data will be collected from project partners in the form of electricity charging bills.*
Frequency of monitoring/recording	*Yearly*
Value applied	*XX*
Monitoring equipment	*N/A*
QA/QC procedures to be applied	*Purchase orders or procurement documents with third party validated specifications for the specific vehicle type.*
Purpose of data	*Baseline emission calculation*
Calculation method	*N/A*

Comments	*Applicable for equations used under AMS.III.C*

Data / Parameter	$SFC_{(PJ,i,j,k,l,m,n,o,p)}$
Data unit	g/km
Description	Specific fossil fuel consumption by project vehicle category Type i per km in year y in urban conditions i: Cars j: Buses k: LGV Van l: HGV m: VHGV n: Motorcycle o: 3-wheelers
Source of data	Value applied in accordance to the methodology AMS.III.C
Description of measurement methods and procedures to be applied	Data will be collected from project partners in the form of purchase orders or procurement documents at inclusion of the PAI into the GPA and during each monitoring period.
Frequency of monitoring/recording	Yearly
Value applied	0
Monitoring equipment	N/A
QA/QC procedures to be applied	Purchase orders or procurement documents with third party validated specifications for the specific vehicle type.
Purpose of data	Project emission calculation
Calculation method	N/A
Comments	Applicable for equations used under AMS.III.C

Data / Parameter	AFECiy
Data unit	kwh/100 miles
Description	Weighted electricity consumption per 100 miles rating for EVs of type i in project year y
Source of data	Calculated in ER Sheet (Applicable to project activities that involve only charging infrastructure)
Description of measurement methods and procedures to be applied	N/A
Frequency of monitoring/recording	Yearly
Value applied	XX
Monitoring equipment	Company procurement records or purchased sales information
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of baseline emissions
Calculation method	$AFECiy$=Σa($EVaiya$∗$EVRaiy$)/Σa$EVRaiy$ Where: $EVaiya$ = Electricity consumption per 100 miles rating for model a EV in applicable fleet i in project year y (kwh/100 miles) $EVRaiy$ = Total number of model a EVs in applicable fleet i on the road by project year y (cumulative number of EVs)
Comments	Applicable for equations used under VM0038

Data / Parameter	MPGiy
Data unit	Miles per gallon
Description	Weighted average miles per gallon rating for fossil fuel vehicles deemed comparable to each EV in applicable fleet i in project year y
Source of data	Calculated in ER Sheet
Description of measurement methods	*N/A*

and procedures to be applied	
Frequency of monitoring/recording	*Yearly*
Value applied	*XX*
Monitoring equipment	Company procurement records or purchased sales information
QA/QC procedures to be applied	*N/A*
Purpose of data	Calculation of baseline emissions
Calculation method	$MPGiy$=Σ($MGPaiy$∗$EVRaiya$)/Σ$EVRaiy$ Where: $MPGiy$ = Weighted average miles per gallon rating for fossil fuel vehicles comparable to each EV in applicable fleet i in project year y (miles per gallon) MPGaiy = Mile per gallon rating for the fossil fuel vehicle model deemed comparable to each EV model a from applicable fleet i in project year y (miles/gallon) $EVRaiy$ = Total number of EV models within applicable fleet i on the road by project year y (cumulative number of EVs)
Comments	*Applicable for equations used under VM0038*

Data / Parameter	NECi,j,s,y
Data unit	kWh/year
Description	Electricity consumed by project chargers supplied from associated infrastructure source s net of any kwh EV/charger returned to this same source within region j serving applicable fleet i in project year y
Source of data	Calculated in ER Sheet (if project activity includes charging infrastructure)
Description of measurement methods and procedures to be applied	N/A
Frequency of monitoring/recording	Yearly

Value applied	XX
Monitoring equipment	Calibrated electricity meter.
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of project emissions
Calculation method	NA
Comments	Applicable for equations used under VM0038

Data / Parameter	EFkwAI-Zi,j,z,y
Data unit	tCO2e/kwh
Description	Emission factor for the net electricity from each associated infrastructure source s within region j consumed by project chargers serving applicable fleet i in year y
Source of data	Each of associated infrastructure source, s, must have a well-documented emissions factor for the electricity it supplies and/or dispatches as follows: – Grid-connected electricity from region j must follow the same procedures as for parameter EFkwi,j,y in Equation 4 (see above) – Dedicated renewable energy generated on-site, including renewable energy sourced via direct transmission lines, must set emission factors at zero – On-site storage batteries must assume the weighted average emission factor based upon the proportionate net consumption of grid and dedicated renewable energy at the charging system
Description of measurement methods and procedures to be applied	N/A
Frequency of monitoring/recording	Yearly
Value applied	XX
Monitoring equipment	N/A

QA/QC procedures to be applied	N/A
Purpose of data	Calculation of project emissions
Calculation method	In accordance with equation 10
Comments	Applicable for equations used under VM0038

Data / Parameter	LECi,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 (kwh/year).
Source of data	From on-site battery/charging system's adequate measurement systems
Description of measurement methods and procedures to be applied	*N/A*
Frequency of monitoring/recording	*Yearly*
Value applied	*XX*
Monitoring equipment	Calibrated electricity meter.
QA/QC procedures to be applied	*N/A*
Purpose of data	Calculation of project emissions
Calculation method	*NA*
Comments	*Applicable for equations used under VM0038*

Data / Parameter	EFkwonsitebatti,j,s,y
Data unit	tCO2e/kwh
Description	Emission factor for the electricity from the on-site batteries as associated infrastructure sources s within region j consumed by project chargers serving applicable fleet i in year y
Source of data	Calculated value
Description of measurement methods and procedures to be applied	N/A
Frequency of monitoring/recording	Yearly
Value applied	XX
Monitoring equipment	Calibrated electricity meter.
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of project emissions
Calculation method	In accordance with equation 10
Comments	Battery storage may not be applicable in all charger instances and this information will only be captured where relevant. Applicable for equations used under VM0038

Data / Parameter	ECBi,j,z,y
Data unit	kWh/year
Description	Electricity consumed by on-site battery from associated infrastructure sources z, which comprise only the grid-connected and dedicated renewable sources, within region j serving applicable fleet i in project year y
Source of data	ER Sheet
Description of measurement methods and procedures to be applied	N/A

Frequency of monitoring/recording	Yearly
Value applied	XX
Monitoring equipment	Calibrated electricity meter.
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of project emissions
Calculation method	N/A
Comments	Battery storage may not be applicable in all charger instances and this information will only be captured where relevant. Applicable for equations used under VM0038

5.3 Monitoring Plan

The monitoring plan provides procedures related to following components:

1) Organisational structure, responsibilities, and competencies of personnel carrying out monitoring activities.
2) The methods for measuring recording, storing, aggregating, collating and reporting data and parameters.
3) The procedures for internal auditing and QA/QC
4) The procedures for handling non-conformances with the validated monitoring plan
5) Sampling approaches, sizes, locations, frequencies, and QA/QC procedures
6) The policies for oversight and accountability of monitoring activities

Component 1: Organisational structure, responsibilities, and competencies of personnel carrying out monitoring activities.

As part of the monitoring plan, the project proponent will work closely with the partners in ensuring that the responsibilities are clearly delineated whereby the partners would collect the required frequency of all data for the monitoring of the project from the CPO database. They are also responsible for performing data and information quality control, along with the maintenance of data on the monitoring platform.

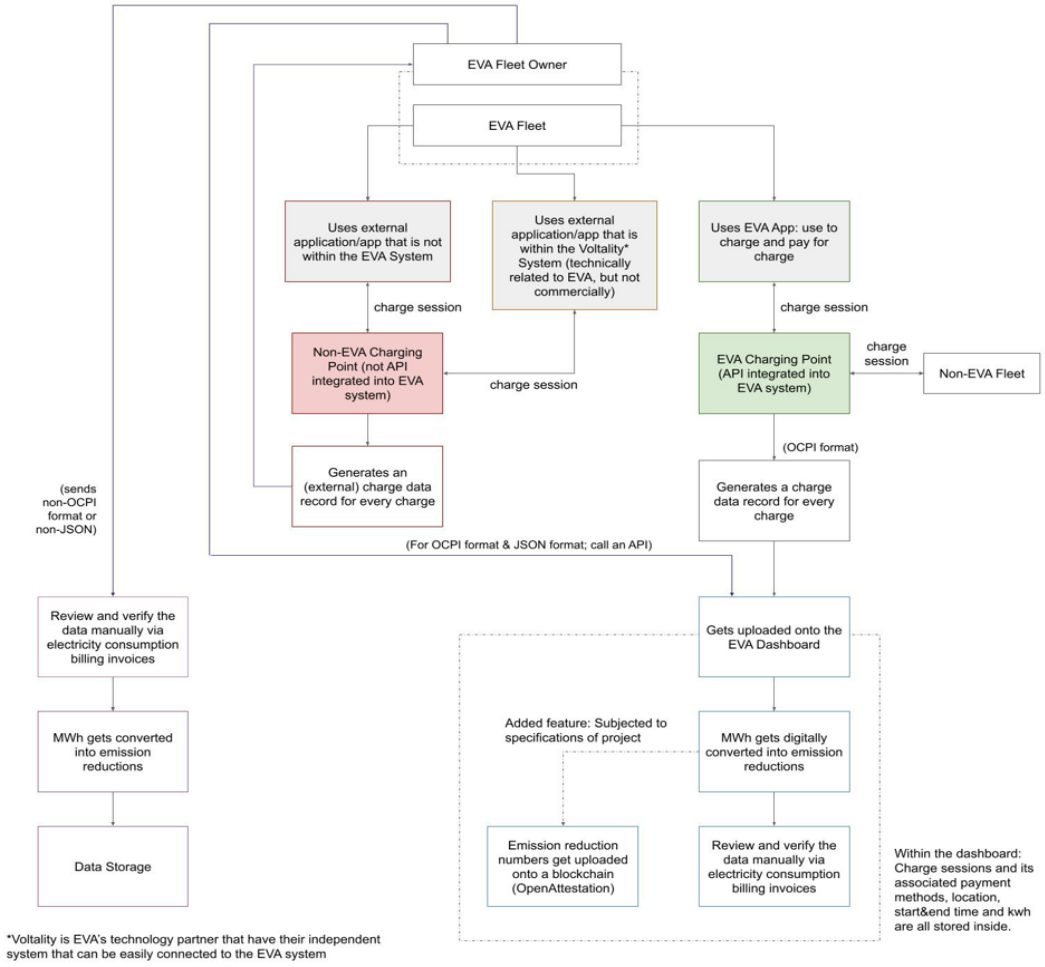
While the project proponent will be responsible for the monitoring reports for the entire crediting period which includes core responsibilities such as, ensuring that the quality of the collected data are checked,

filing of all documents and data in a timely manner, producing the annual monitoring report, and answering all inquiries and additionally information requested by the VVBs and registry.

The project proponent and partners will ensure that their respective staffs are familiar with the requirements of the respective systems and procedures to ensure the collection of most accurate results possible.

Component 2: The methods for measuring recording, storing, aggregating, collating and reporting data and parameters.

The various methods for data collection are depicted through the flow diagram of data monitoring below.



Component 3: The procedures for internal auditing and QA/QC.

Initial internal audit and QA/QC procedure involves the cross referencing of data supplied by the project activity partners. This includes verifying electricity consumption data with billing invoices. All of the verified electricity data will then be compiled and used to develop a comprehensive Excel document which includes all required methodology used for GHG emissions calculation at the time of verification. The

Excel document will undergo several quality checks (includes comparison of data collected with data of previous years) across the team before submission for verification. All data will be compiled and stored in an appropriate manner with the proper labels. All data stored will be kept throughout the crediting period with an additional 2 years after.

Component 4: The procedures for handling non-conformances with the validated monitoring plan.

Internally, the project proponent will conduct annual review of monitoring data and GHG emission reduction calculations to ensure compliance with the validated project plan and conformity to its QA/QC processes so that creditable GHG emission reductions can be validated. Any periods of non-conformance with the validated monitoring plan will be excluded in the GHG emission reduction calculations.

Component 5: Sampling approaches, sizes, locations, frequencies, and QA/QC procedures.

As mentioned in the above sections, the project proponent and partners have various methods for data collection and calculation to determine GHG emission reductions. Therefore, no sampling approach is used. The QA/QC procedures are described as above.

Component 6: The policies for oversight and accountability of monitoring activities.

The policies for oversight and accountability of monitoring activities are as following:

- Outlining roles and responsibilities of individuals involved in monitoring activities to specify clear lines of accountability.
- Establishing procedures for data collection, analysis, and reporting, emphasizing the importance of accurate and reliable information.
- Incorporating regular audits and evaluations are conducted to assess the effectiveness of monitoring procedures and to identify any potential gaps or areas for improvement.
- Prioritising transparency and communication between stakeholders to be informed about the monitoring process and its outcomes.
- Developing appropriate corrective actions and measures to prevent recurrence in the cases of non-compliance or deviations.

APPENDIX

Appendix A: LSC Attendees Details

First Name	Last Name	Company	Title/Position	Mode
Karen	Liow	AECO Energy	Snr Consultant - Energy and Renewables	
Joel	Chan	Aeqon Pte Ltd	VP Sales and Business Development	
spring	chua	Aeqon Pte Ltd	Executive Director	
Kang Wee	Lee	Affinidi	Business Development	
Kwong Ki	Chong	Affinidi	Solutions Architect Lead	
Stacey-Ann	Pearson	Affinidi	Business Development & Innovation	
Shiva	Subramanian	AGC Asia Pacific Pte Ltd	Consultant PV/BIPV	
Daniel	Chow	Arthur D. Little	Principal	Virtual
Kristoffer Jacek	Soh Zhi Wei	Beep Technologies Pte Ltd	CEO	
Benjamin	Long Wei Ming	Beep Technologies Pte Ltd		
Keenan	Kuah	Beep Technologies Pte Ltd	Product Manager	
Phobus	Sng	Beep Technologies Pte Ltd		
Sean	Tan Rui An	Beep Technologies Pte Ltd		
Senrui	Li	Beep Technologies Pte Ltd		
Shi Ying	Tan	Beep Technologies Pte Ltd		
Terence	Tann	Beep Technologies Pte Ltd	Head of Growth & eMobility	
Sherman	Lee	Beep Technologies Pte Ltd		
Xander	Pierik	Borouge PTE ltd	Application Marketing Manager	
Kok Leong	Ong	C2R	COO	Virtual
Bryan	Lim	Catsys	Sales and Business Development	
Howe Chien	Yeo	CERTIS Integrated Facilities Management	General Manager, Strategy and Ops Dev	
Goh	Chee Kiong	Charge+	CEO	
Kenny	Chua	Chubb Singapore Pte Ltd	Operation Manager	
Kes	Shotam	Climate Resources Exchange International Pte Ltd	Co-Founder/Direcor	
Cherie	Sim	Climate Resources Exchange International Pte Ltd	Head of Carbon Commodities	
Donald	Eubank	Climate Resources Exchange International Pte Ltd		
Eric	Bea	Climate Resources Exchange International Pte Ltd	Carbon Credit Development Executive	
Peter	Smith	Climate Resources Exchange International Pte Ltd		
Preeya	Unadirekkul	Climate Resources Exchange International Pte Ltd	Net-Zero Carbon Coordinator	
Sanjana	Somani	Climate Resources Exchange International Pte Ltd	Head, climate markets	
Viknesh	S	Climate Resources Exchange International Pte Ltd	Marcoms	
Vinod	Kesava	Climate Resources Exchange International Pte Ltd	CEO	
Yan Cheng, Simonn	Ng	Climate Resources Exchange International Pte Ltd	Executive Chairman	
Venn	Loo	Climate Resources Exchange International Pte Ltd	Senior HR/ Accounts & Admin Executive	
Henry	Teo	Cycle & Carriage Industries Pte Ltd	Business Consultant	
Jasmine	Chon	Cycle & Carriage Industries Pte Ltd	Sales Specialist	Virtual
Kevin	Ang	Cycle & Carriage Industries Pte Ltd	Sales/Engineering	Virtual
Patrick	Tan	Cycle & Carriage Industries Pte Ltd	Sales Manager Commercial vehicles	
Sebastian	Sim	Cycle & Carriage Industries Pte Ltd	Senior Manager	
Benjamin	Wu	Danfoss	Manager	
Jimmy	Wan	Delta Electronics Int’l (Singapore) Pte Ltd	Country Sales Director	
Anurag	Chatterjee	DNV Singapore Pte Ltd	Head of Sales, Power & Renewables, APAC	
Aravind	Muthiah	Durapower Holdings Pte. Ltd	Strategic Product Specialist	
Kenneth	Lew	Durapowergroup		
Ke	Fan	Eastern Green Power Pte Ltd	Managing Director	
Edouard	Lavillonniere	Edf Lab Singapore	Managing Director	
Joseph	Tan	Energreen Technologies Pte Ltd	Director	
Hans	van Mameren	Energy-Renewed Pte Ltd	Founder	
Stephan	Demmel	Engie	Consultant	Virtual
Syed Mubarak	Abdul Razaak	EPS (S) Pte Ltd	Vice President- Sustainability & Technology	
ww	Ho	EV Charging Technology Pte Ltd	Project Manager	Virtual
Alfred	Ang	EV Charging Technology Pte Ltd	CTO	Virtual
elosn	toh	EVOne Charging Pte Ltd	director	
Sanjay	Kuttan	Global Centre for Maritime Decarbonisation	Chief Technology Officer	
Brighton	Yam	Gojek	Head of Fleet Management (Strategy & Operations)	
Kelvin	Tay	Goldbell Corporation Pte Ltd	Managing Director, Future Mobility	
jingru	woh	Hendricks		Virtual
Manfred	Chew	HY M&E Consultancy Services Pte Ltd	LEW	Virtual
Hui Ying	Yap	Hyundai Motor Group Innovation Centre		Virtual
Noel	Yeo	IHH Healthcare Singapore	Chief Operating Officer	
Peter	Chow	IHH Healthcare Singapore	Ceo mount Elizabeth novena	Virtual
Michael	Brouwer	Impiro	CFO	Virtual
Paul	Singh Gill	Iota Omega Ventures Pte Ltd	Managing Partner - Asia	
Ruyin	Liu	JE Green Solutions Pte Ltd	Lab Analyst	
Chong Peng	Chew	Keppel Volt	Head	Virtual
Charles C.G	TAN	LEXBUILD Motors Pte Ltd	CEO	Virtual
Danny	Teo	Lim Kim Hai Electric Co. (S) Pte Ltd	BDM	

Francis	Pan	Lim Kim Hai Electric Co. (S) Pte Ltd		
Wenrui	Ho	LYS ENERGY SOLUTIONS PTE LTD	PV Finance Engineer	Virtual
Myo	Thwin	Myanmar Power Pte Ltd	GM	
Aman	Ullah	Narada Asia Pacific Pte Ltd		
Peter	Ng	Narada Asia Pacific Pte Ltd	Business Advisor	
Xinwei	Chen	National Research Foundation Singapore	Head	
Jia Hau	SIN	Schneider Electric Singapore Pte Ltd	eMobility Product Application leader	
Chee Kang	Liow	Sembcorp Solar Singapore Pte Ltd	Manager	
Jiayi	Chen	Sembcorp Solar Singapore Pte Ltd	Manager, Business Development	
Shining	Peh	Senoko Energy Pte Ltd	Manager new energy solutions	
Jormas	Fong	Shell (Singapore)	Account Manager	Virtual
Yang Zhi	Lim	Shopee	QA Engineer	
Edna	Seah	Siemens		
Charles	Chan	Singapore Management University	Graduate	
Chester	Tan	Sobono Greenland Pte Ltd	General Manager	
Wen Yang	Neo	Sobono Greenland Pte Ltd	Engineer	Virtual
Rene	Tan	ST Engineering	Sales Director	
Benjamin	Tan	STACS	ESG BD Intern	
Don	Choi	STACS	BD Associate	
Kimberly	Lee	STACS	Strategy & BD manager	
Aymeric	Salley	StraitsX	Head of StraitsX	
Tianwei	Liu	StraitsX	CEO	
Victor	Tan	StraitsX	Head of Marketing	
Zac	Wong	StraitsX	BD Manager	
EZHILI	SUSAI	Techsource Asia	Senior Account Manager	Virtual
Vincent	Wiguna	Tesla	Regional lead - Singapore, Charging	
Kelly	Ng	The Business Times		
Yufeng	Kok	The Straits Times	Correspondent	
Joshua	Wu	Toyota Tsusho Asia Pacific	Senior Business Development Manager	
Prashan	Patel	Vitol		Virtual
Wei Keong	Voo	Woodlands Transport	Manager	
Keith Tan	Yew Meng	Z-Power Automation	Director	